Radiation Protection Regulations

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Radiation Protection Regulations

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NUCLEAR SAFETY AND CONTROL ACT

Radiation Protection Regulations

P.C. 2000-783 May 31, 2000

Her Excellency the Governor General in Council, on the recommendation of the Minister of Natural Resources, pursuant to section 44 of the *Nuclear Safety and Control Act*[a], hereby approves the annexed *Radiation Protection Regulations* made by the Canadian Nuclear Safety Commission on May 31, 2000.[a] S.C. 1997, c. 9

RADIATION PROTECTION REGULATIONS

INTERPRETATION AND APPLICATION

Interpretation – 1

1. (1) The definitions in this subsection apply in these Regulations.

"absorbed dose" means the quotient, in gray, obtained by dividing the energy absorbed through exposure to radiation by the mass of the body or part of the body that absorbs the radiation. (*dose absorbée*)

"Act" means the *Nuclear Safety and Control Act*. (*Loi*)

"balance of the pregnancy" means the period from the moment a licensee is informed, in writing, of the pregnancy to the end of the pregnancy. (*reste de la grossesse*)

"committed" means, in respect of a dose of radiation, received by an organ or tissue from a

nuclear substance during the 50 years after the substance is taken into the body of a person 18 years old or older or during the period beginning at intake and ending at age 70, after it is taken into the body of a person less than 18 years old. (*engagée*)

"dosimeter" means a device for measuring a dose of radiation that is worn or carried by an individual. (*dosimètre*)

"effective dose" means the sum of the products, in sievert, obtained by multiplying the equivalent dose of radiation received by and committed to each organ or tissue set out in column 1 of an item of Schedule 1 by the weighting factor set out in column 2 of that item. (*dose efficace*)

"equivalent dose" means the product, in sievert, obtained by multiplying the absorbed dose of radiation of the type set out in column 1 of an item of Schedule 2 by the weighting factor set out in column 2 of that item. (*dose équivalente*)

"exemption quantity" has the same meaning as in section 1 of the *Nuclear Substances and Radiation Devices Regulations*. (*quantité d'exemption*)

"five-year dosimetry period" means the period of five calendar years beginning on January 1 of the year following the year in which these Regulations come into force, and every period of five calendar years after that period. (*période de dosimétrie de cinq ans*)

"licensed activity" means an activity described in any of paragraphs 26(*a*) to (*f*) of the Act that a licence authorizes the licensee to carry on. (*activité autorisée*)

"licensee" means a person who is licensed to carry on an activity described in any of paragraphs 26(*a*) to (*f*) of the Act. (*titulaire de permis*)

"one-year dosimetry period" means the period of one calendar year beginning on January 1 of the year following the year in which these Regulations come into force, and every period of one calendar year after that period. (*période de dosimétrie d'un an*)

"radon progeny" means the following radioactive decay products of radon 222: bismuth 214, lead 214, polonium 214 and polonium 218. (*produit de filiation du radon*)

"skin" means the layer of cells within the skin that are 7 mg/cm^2 below the surface. (*peau*)

"worker" means a person who performs work that is referred to in a licence. (*travailleur*)

"working level" means the concentration of radon progeny in l m^3 of air that has a potential alpha energy of 2.08×10^{-5} J. (*unité alpha*)

"working level month" means the exposure that results from the inhalation of air containing one working level for 170 hours. (*unité alpha-mois*)

(2) For the purpose of the definition “dosimetry service” in section 2 of the Act, a facility for the measurement and monitoring of doses of radiation received by or committed to nuclear energy workers who have a reasonable probability of receiving an effective dose greater than 5 mSv in a one-year dosimetry period is prescribed as a dosimetry service.

(3) For the purpose of the definition “nuclear energy worker” in section 2 of the Act, the prescribed limit for the general public is 1 mSv per calendar year.

Application - 2

2. (1) Subject to subsection (2), these Regulations apply generally for the purposes of the Act.

(2) Only section 3 of these Regulations applies to a licensee in respect of a dose of radiation received by or committed to a person

(*a*) in the course of the person’s examination, diagnosis or treatment, as directed by a medical practitioner who is qualified to examine, diagnose or treat the person under the applicable provincial legislation; or

(*b*) [Repealed, SOR/2007-208, s. 5]

(*c*) as a result of the person’s voluntary participation in a biomedical research study supervised by a medical practitioner who is qualified to provide such supervision under the applicable provincial legislation.

SOR/2007-208, s. 5.

OBLIGATIONS OF LICENSEES AND NUCLEAR ENERGY WORKERS

Administration of Nuclear Substance for Medical Purposes - 3

3. When a nuclear substance is administered to a person for therapeutic purposes, the licensee shall, before the person leaves the place where the substance is administered, inform the person of methods for reducing the exposure of others — including anyone providing care and assistance — to radiation from the person.

SOR/2007-208, s. 6.

Radiation Protection Program - 4

4. Every licensee shall implement a radiation protection program and shall, as part of that program,

(*a*) keep the amount of exposure to radon progeny and the effective dose and equivalent dose received by and committed to persons as low as is reasonably achievable, social and economic factors being taken into account, through the implementation of

(i) management control over work practices,

(ii) personnel qualification and training,

(iii) control of occupational and public exposure to radiation, and

(iv) planning for unusual situations; and

(*b*) ascertain the quantity and concentration of any nuclear substance released as a result of the licensed activity

(i) by direct measurement as a result of monitoring, or

(ii) if the time and resources required for direct measurement as a result of monitoring outweigh the usefulness of ascertaining the quantity and concentration using that method, by estimating them.

Ascertainment and Recording of Doses - 5

5. (1) For the purpose of keeping a record of doses of radiation in accordance with section 27 of the Act, every licensee shall ascertain and record the magnitude of exposure to radon progeny of each person referred to in that section, as well as the effective dose and equivalent dose received by and committed to that person.

(2) A licensee shall ascertain the magnitude of exposure to radon progeny and the effective dose and equivalent dose

(*a*) by direct measurement as a result of monitoring; or

(*b*) if the time and resources required for direct measurement as a result of monitoring outweigh the usefulness of ascertaining the amount of exposure and doses using that method, by estimating them.

Action Levels - 6

6. (1) In this section, “action level” means a specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee’s radiation protection program and triggers a requirement for specific action to be taken.

(2) When a licensee becomes aware that an action level referred to in the licence for the purpose of this subsection has been reached, the licensee shall

(*a*) conduct an investigation to establish the cause for reaching the action level;

(*b*) identify and take action to restore the effectiveness of the radiation protection program implemented in accordance with section 4; and

(*c*) notify the Commission within the period specified in the licence.

Provision of Information - 7

7. (1) Every licensee shall inform each nuclear energy worker, in writing,

(*a*) that he or she is a nuclear energy worker;

(*b*) of the risks associated with radiation to which the worker may be exposed in the course of his or her work, including the risks associated with the exposure of embryos and foetuses to radiation;

(*c*) of the applicable effective dose limits and equivalent dose limits prescribed by sections 13, 14 and 15; and

(*d*) of the worker's radiation dose levels.

(2) Every licensee shall inform each female nuclear energy worker, in writing, of the rights and obligations of a pregnant nuclear energy worker under section 11 and of the applicable effective dose limits prescribed by section 13.

(3) Every licensee shall obtain from each nuclear energy worker who is informed of the matters referred to in paragraphs (1)(*a*) and (*b*) and subsection (2) a written acknowledgement that the worker has received the information.

Requirement to Use Licensed Dosimetry Service - 8

8. Every licensee shall use a licensed dosimetry service to measure and monitor the doses of radiation received by and committed to nuclear energy workers who have a reasonable probability of receiving an effective dose greater than 5 mSv in a one-year dosimetry period.

Collection of Personal Information - 9

9. When, for purposes related to the administration of the Act and these Regulations, a licensee collects personal information, as defined in section 3 of the *Privacy Act*, that may

be required to be disclosed to the Commission, another government institution or a dosimetry service, the licensee shall inform the person to whom the information relates of the purpose for which it is being collected.

Nuclear Energy Workers - 10

10. Every nuclear energy worker shall, on request by the licensee, inform the licensee of the worker's

(*a*) given names, surname and any previous surname;

(*b*) Social Insurance Number;

(*c*) sex;

(*d*) date, province and country of birth; and

(*e*) dose record for the current one-year and five-year dosimetry periods.

SOR/2007-208, s. 7(E).

Pregnant Nuclear Energy Workers - 11

11. (1) Every nuclear energy worker who becomes aware that she is pregnant shall immediately inform the licensee in writing.

(2) On being informed by a nuclear energy worker that she is pregnant, the licensee shall, in order to comply with section 13, make any accommodation that will not occasion costs or business inconvenience constituting undue hardship to the licensee.

SOR/2007-208, s. 8(F).

RADIATION DOSE LIMITS

Interpretation - 12

12. (1) The definitions in this subsection apply in section 13.

"ALI" or "annual limit on intake" means the activity, in becquerel, of a radionuclide that will deliver an effective dose of 20 mSv during the 50-year period after the radionuclide is taken into the body of a person 18 years old or older or during the period beginning at

intake and ending at age 70 after it is taken into the body of a person less than 18 years old. (*LAI ou limite annuelle d'incorporation*)

"E" means the portion of the effective dose, in millisievert

(*a*) received by a person from sources outside the body; and

(*b*) received by and committed to the person from sources inside the body, measured directly or from excreta. (*E*)

"I" means the activity, in becquerel, of any radionuclide that is taken into the body, excluding the radon progeny and the activity of other radionuclides accounted for in the determination of E. (*I*)

"Rn" means the average annual concentration in the air, in Bq per m^3, of radon 222 that is attributable to a licensed activity. (*Rn*)

"RnP" means the exposure to radon progeny in working level months. (*RnP*)

"Σ I/ALI" means the sum of the ratios of I to the corresponding ALI. (*Σ I/LAI*)

(2) For the purposes of sections 13 and 14, doses of radiation include those received from X-rays or other man-made sources of radiation.

Effective Dose Limits - 13

13. (1) Every licensee shall ensure that the effective dose received by and committed to a person described in column 1 of an item of the table to this subsection, during the period set out in column 2 of that item, does not exceed the effective dose set out in column 3 of that item.

TABLE

Item	Column 1 Person	Column 2 Period	Column 3 Effective Dose (mSv)
1.	Nuclear energy worker, including a pregnant nuclear energy worker	(*a*) One-year dosimetry period	50
		(*b*) Five-year dosimetry period	100
2.	Pregnant nuclear energy worker	Balance of the pregnancy	4

3.	A person who is not a nuclear energy worker	One calendar year	1

(2) For the purpose of item 1 of the table to subsection (1), the effective dose shall be calculated using the following formula and expressed in millisievert:

$$E + 5RnP + 20 \Sigma {}^{I}/_{ALI}$$

(3) For the purpose of item 2 of the table to subsection (1), the effective dose shall be calculated using the following formula and expressed in millisievert:

$$E + 20 \Sigma {}^{I}/_{ALI}$$

(4) For the purpose of item 3 of the table to subsection (1), the effective dose shall be calculated using either of the following formulas and expressed in millisievert:

$$E + {}^{Rn}/_{60} + 20 \Sigma {}^{I}/_{ALI}$$

$$E + 4RnP + 20 \Sigma {}^{I}/_{ALI}$$

(5) For the purpose of subsection (1), where the end of a dosimeter-wearing period or a bioassay-sampling period does not coincide with the end of a dosimetry period set out in column 2 of the table to that subsection, the licensee may extend or reduce the dosimetry period to a maximum of two weeks so that the end of the dosimetry period coincides with the end of the dosimeter-wearing period or biossay-sampling period, as the case may be.

Equivalent Dose Limits - 14

14. (1) Every licensee shall ensure that the equivalent dose received by and committed to an organ or tissue set out in column 1 of an item of the table to this subsection, of a person described in column 2 of that item, during the period set out in column 3 of that item, does not exceed the equivalent dose set out in column 4 of that item.

TABLE

Item	Column 1 Organ or Tissue	Column 2 Person	Column 3 Period	Column 4 Equivalent Dose (mSv)
1.	Lens of an eye	(*a*) Nuclear energy worker	One-year dosimetry period	150
		(*b*) Any other person	One calendar year	15
2.	Skin	(*a*) Nuclear energy worker	One-year dosimetry period	500
		(*b*) Any other person	One calendar year	50
3.	Hands and feet	(*a*) Nuclear energy worker	One-year dosimetry period	500
		(*b*) Any other person	One calendar year	50

(2) For the purpose of subsection (1), where a dosimeter-wearing period or a bioassay-sampling period extends beyond the end of a dosimetry period set out in column 3 of the table to that subsection, the period is extended to the end of the dosimeter-wearing or bioassay-sampling period or by two weeks, whichever extension is shorter.

(3) When skin is unevenly irradiated, the equivalent dose received by the skin is the average equivalent dose over the 1 cm^2 area that received the highest equivalent dose.

Emergencies - 15

15. (1) During the control of an emergency and the consequent immediate and urgent remedial work, the effective dose and the equivalent dose may exceed the applicable dose limits prescribed by sections 13 and 14, but the effective dose shall not exceed 500 mSv and the equivalent dose received by the skin shall not exceed 5 000 mSv.

(2) Subsection (1) does not apply in respect of pregnant nuclear energy workers who have informed the licensee in accordance with subsection 11(1).

(3) The dose limits prescribed by sections 13 and 14 and subsection (1) may be exceeded by a person who acts voluntarily to save or protect human life.

When Dose Limit Exceeded - 16

16. When a licensee becomes aware that a dose of radiation received by and committed to a person or an organ or tissue may have exceeded an applicable dose limit prescribed by section 13, 14 or 15, the licensee shall

(*a*) immediately notify the person and the Commission of the dose;

(*b*) require the person to leave any work that is likely to add to the dose;

(*c*) conduct an investigation to determine the magnitude of the dose and to establish the causes of the exposure;

(*d*) identify and take any action required to prevent the occurrence of a similar incident; and

(*e*) within 21 days after becoming aware that the dose limit has been exceeded, report to the Commission the results of the investigation or on the progress that has been made in conducting the investigation.

Authorization of Return to Work - 17

17. (1) When the Commission or a designated officer authorized under paragraph 37(2)(*h*) of the Act authorizes the return to work of a person referred to in section 16, the authorization may specify conditions and prorated dose limits.

(2) For the purpose of this section, a prorated effective dose limit is the product obtained by multiplying the applicable dose limit prescribed by section 13 or 15 by the ratio of the number of months remaining in the dosimetry period to the total number of months in the dosimetry period.

(3) If an equivalent dose that exceeds the applicable equivalent dose limit prescribed by section 14 or 15 is received by or committed to a person and the Commission or a designated officer authorized under paragraph 37(2)(*h*) of the Act authorizes the return to work of that person, the equivalent dose limit for the dosimetry period is the sum of the equivalent dose limit that was exceeded and the equivalent dose that was received by and committed to the person up to the time that the person was required to leave work in accordance with paragraph 16(*b*).

DOSIMETRY SERVICES

Application for Licence to Operate - 18

18. An application for a licence to operate a dosimetry service shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*:

(*a*) a description of the proposed operation of the dosimetry service;

(*b*) the proposed quality assurance program;

(*c*) the types of dosimetry services proposed to be provided, including the types of radiation that will be monitored and their respective energy ranges;

(*d*) the precision, accuracy and reliability of the dosimetry services to be provided; and

(*e*) the proposed qualification requirements and training program for workers.

Obligations of Licensees - 19

19. Every licensee who operates a dosimetry service shall file with the National Dose Registry of the Department of Health, at a frequency specified in the licence and in a form compatible with the Registry, the following information with respect to each nuclear energy worker for whom it has measured and monitored a dose of radiation:

(*a*) the worker's given names, surname and any previous surname;

(*b*) the worker's Social Insurance Number;

(*c*) the worker's sex;

(*d*) the worker's job category;

(*e*) the date, province and country of birth of the worker;

(*f*) the amount of exposure of the worker to radon progeny; and

(*g*) the effective dose and equivalent dose received by and committed to the worker.

LABELLING AND SIGNS

Labelling of Containers and Devices - 20

20. (1) No person shall possess a container or device that contains a radioactive nuclear substance unless the container or device is labelled with

(*a*) the radiation warning symbol set out in Schedule 3 and the words "RAYONNEMENT — DANGER — RADIATION"; and

(*b*) the name, quantity, date of measurement and form of the nuclear substance in the container or device.

(2) Subsection (1) does not apply in respect of a container or device

(*a*) that is an essential component for the operation of the nuclear facility at which it is located;

(*b*) that is used to hold radioactive nuclear substances for current or immediate use and is under the continuous direct observation of the licensee;

(*c*) in which the quantity of radioactive nuclear substances is less than or equal to the exemption quantity; or

(*d*) that is used exclusively for transporting radioactive nuclear substances and labelled in accordance with the *Packaging and Transport of Nuclear Substances Regulations*.

Posting of Signs at Boundaries and Points of Access - 21

21. Every licensee shall post and keep posted, at the boundary of and at every point of access to an area, room or enclosure, a durable and legible sign that bears the radiation warning symbol set out in Schedule 3 and the words “RAYONNEMENT-DANGER-RADIATION”, if

(*a*) there is a radioactive nuclear substance in a quantity greater than 100 times its exemption quantity in the area, room or enclosure; or

(*b*) there is a reasonable probability that a person in the area, room or enclosure will be exposed to an effective dose rate greater than 25 µSv/h.

SOR/2007-208, s. 9.

Use of Radiation Warning Symbol - 22

22. Whenever the radiation warning symbol set out in Schedule 3 is used,

(*a*) it shall be

(i) fully visible,

(ii) of a size appropriate for the size of the container or device to which it is affixed or attached, or the area, room or enclosure in respect of which it is posted,

(iii) in the proportions depicted in Schedule 3, and

(iv) oriented with one blade pointed downward and centred on the vertical axis; and

(*b*) no wording shall be superimposed on it.

SOR/2007-208, s. 10.

Frivolous Posting of Signs - 23

23. No person shall post or keep posted a sign that indicates the presence of radiation, a nuclear substance or prescribed equipment at a place where the radiation, nuclear substance or prescribed equipment indicated on the sign is not present.

RECORDS TO BE KEPT BY LICENSEES - 24

24. Every licensee shall keep a record of the name and job category of each nuclear energy worker.

TRANSITIONAL PROVISION - 25

25. During the period before the beginning of the first one-year dosimetry period

(*a*) "one-year dosimetry period" means the period beginning on the day these Regulations come into force and ending on December 31, 2000; and

(*b*) each effective dose limit set out in these Regulations for a one-year dosimetry period is equal to the product obtained by multiplying the applicable dose limit by the ratio of the number of days in the one-year dosimetry period to 365.

COMING INTO FORCE - 26

26. These Regulations come into force on the day on which they are approved by the Governor in Council.

SCHEDULE 1
(Subsection 1(1))

ORGAN OR TISSUE WEIGHTING FACTORS

Item	Column 1 Organ or Tissue	Column 2 Weighting Factor
1.	Gonads (testes or ovaries)	0.20
2.	Red bone marrow	0.12
3.	Colon	0.12
4.	Lung	0.12
5.	Stomach	0.12
6.	Bladder	0.05
7.	Breast	0.05
8.	Liver	0.05
9.	Oesophagus	0.05
10.	Thyroid gland	0.05
11.	Skin[1]	0.01
12.	Bone surfaces	0.01
13.	All organs and tissues not listed in items 1 to 12 (remainder organs and tissues) collectively, including the adrenal gland, brain, extra-thoracic airway, small intestine, kidney, muscles, pancreas, spleen, thymus and uterus[2,3]	0.05
14.	Whole body	1.00

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

[2] When the equivalent dose received by and committed to one of these remainder organs and tissues exceeds the equivalent dose received by and committed to any one of the organs and tissues listed in items 1 to 12, a weighting factor of 0.025 shall be applied to that remainder organ or tissue and a weighting factor of 0.025 shall be applied to the average equivalent dose received by and committed to the rest of the remainder organs and tissues.

[3] Hands, feet and the lens of an eye have no weighting factor.

SCHEDULE 2
(Subsection 1(1))

RADIATION WEIGHTING FACTORS

Item	Column 1 Type of Radiation and Energy Range	Column 2 Weighting Factor
1.	Photons, all energies	1
2.	Electrons and muons, all energies[1]	1
3.	Neutrons[2] of energy < 10 keV	5
4.	Neutrons[2] of energy 10 keV to 100 keV	10
5.	Neutrons[2] of energy > 100 keV to 2 MeV	20
6.	Neutrons[2] of energy > 2 MeV to 20 MeV	10
7.	Neutrons[2] of energy > 20 MeV	5
8.	Protons, other than recoil protons, of energy > 2 MeV	5
9.	Alpha particles, fission fragments and heavy nuclei	20

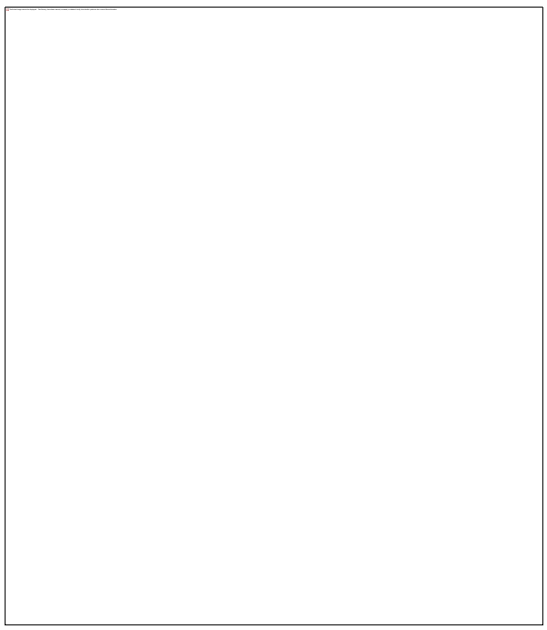
[1] Excluding Auger electrons emitted from nuclei bound to DNA.

[2] Radiation weighting factors for these neutrons may also be obtained by referring to the continuous curve shown in Figure 1 on page 7 of the *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, published in 1991.

SCHEDULE 3

(Sections 20, 21 and 22)

RADIATION WARNING SYMBOL



NOTE:

The three blades and the central disk of the symbol shall be

(*a*) magenta or black; and

(*b*) located on a yellow background.