Ionizing Radiation Protection Regulation in Canada

The Role of the Federal Provincial Territorial Radiation Protection Committee

Christopher H. Clement*

Canadian Nuclear Safety Commission, 280 Slater Street, Ottawa, Ontario, Canada

Abstract. Canada has one of the broadest and most mature nuclear industries in the world, and is a world leader in uranium mining, and in the production of medical radioisotopes. The Canadian nuclear industry also includes: uranium milling, refining, and fuel fabrication facilities; nuclear generating stations; research reactors and related facilities; waste management facilities; and the use of radioactive materials in medicine and industry. Regulation of this broad and dynamic industry is a complex and challenging task. Canada has a cooperative system for the regulation of ionizing radiation protection covering federal, provincial, territorial, and military jurisdictions. A Federal/Provincial/Territorial Radiation Protection Committee (FPTRPC) exists to aid in cooperation between the various agencies. Their mandate encompasses regulation and guidance on all aspects of radiation protection: federal and provincial; NORM and anthropogenic; ionizing and non-ionizing. The Canadian Nuclear Safety Commission (CNSC) is the federal nuclear regulator whose mandate includes radiation protection regulation of most occupational and public exposures. The CNSC does not regulate medical (patient) exposures, some aspects of NORM, or military applications. Provincial authorities are the primary regulators with respect to doses to patients and occupational doses arising from x-rays. Health Canada plays a role in x-ray device certification, development of national guidance (e.g. on radon) and direct regulation of certain federal facilities. NORM is regulated provincially, with varying regulatory mechanisms across the provinces and territories. Radiation protection regulation for National Defence and the Canadian Armed Forces is performed by the Director General Nuclear Safety. This paper gives an overview of the structure of the regulation of ionizing radiation protection in Canada, and shares lessons learned, particularly with respect to the usefulness of the FPTRPC in helping coordinate and harmonize radiation protection regulation nationally.

KEYWORDS: Ionizing; Radiation; Canada; Regulation.

1. Canada's Nuclear Industry

The scope of Canada's nuclear industry is world-leading, both in terms of variety, and in some sectors in terms of magnitude. For example, approximately two-thirds of the world's medical radioisotopes are produced in Canada, and Canada is the world leader in uranium mining producing about 28% of worldwide production [1]. The nuclear industry in Canada also has a long history. The world's first uranium mine, the Port Radium mine (producing radium and then uranium from 1932 to 1960) is located in northern Canada.

Today, the Canadian nuclear industry covers essentially every peaceful use of radioactive materials, including:

- Nuclear generating stations;
- Research reactors;
- Nuclear substances and radiation devices (radiography, industrial gauges, exploration, nuclear medicine, education, etc.);
- Uranium mines and mills;
- Uranium processing and fuel fabrication facilities;
- Medical particle accelerators;
- Non-medical particle accelerators;
- Waste management facilities;
- Irradiator facilities (in veterinary hospitals, research, medical and industrial institutions, etc.);
- Brachytherapy and teletherapy facilities;

* Presenting author, E-mail: Christopher.Clement@cnsc-ccsn.gc.ca

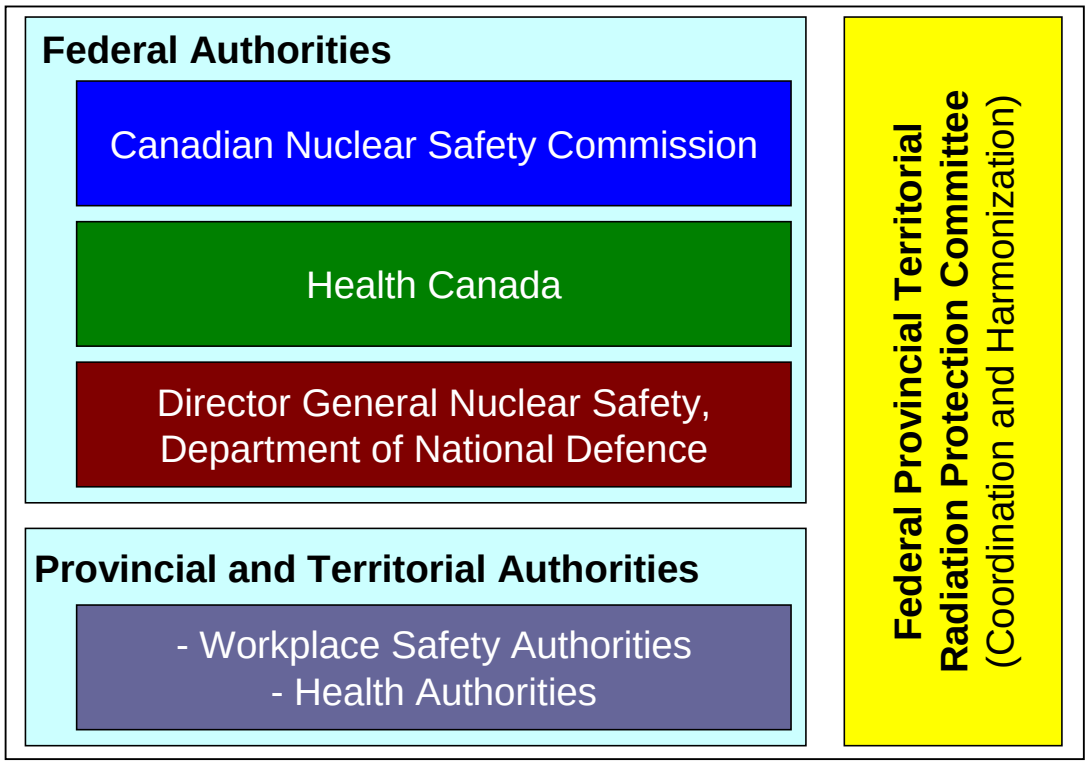
- Nuclear substance processing facilities;
- Nuclear research and test establishments;
- Packaging and transport of nuclear substances;
- Dosimetry services; and,
- Import and export of nuclear substances.

2. Canada's Radiation Protection Regulatory Environment

In Canada, responsibilities are divided between federal and provincial/territorial authorities. For example, the federal government has primary responsibility for natural resources (including uranium mining) and the development, production, and use of nuclear energy. Health care (including radiation doses to patients) is within the scope of each of the provincial governments.

Given the breadth and depth of the nuclear industry in Canada, and the various levels of governments having different areas of responsibility, some aspects of radiation protection regulation in Canada can be complex. Fig. 1 shows the various federal, provincial and territorial agencies involved along with the Federal Provincial Territorial Radiation Protection Committee which plays a supporting role.

Figure 1: Federal, Provincial and Territorial Radiation Protection Regulatory Authorities



Three federal agencies play key roles in radiation protection regulation.

The **Canadian Nuclear Safety Commission** (CNSC) [2] is Canada's federal nuclear regulator. Radiation protection regulation is an integral part of the CNSC's mandate to regulate the use of nuclear energy and materials to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.

Health Canada [3] is the federal department responsible for helping Canadians maintain and improve their health, while respecting individual choices and circumstances. Part of this mandate, carried out

by the Radiation Protection Bureau, is to promote and protect the health of Canadians by assessing and managing the risks posed by radiation exposure in living, working and recreational environments.

The **Director General Nuclear Safety** [4] is accountable for the development, co-ordination, and assurance of the implementation of a comprehensive nuclear safety program for the Department of National Defence and the Canadian Forces. Radiation protection is a significant part of this nuclear safety program.

In addition, several **provincial and territorial bodies** play key roles, particularly with respect to health care and naturally occurring radioactive material (NORM). The organization of these bodies differs among the ten provinces and three territories, but radiation protection regulation tends to reside within health and labour (occupational safety) agencies.

To support the federal, provincial and territorial radiation protection agencies, the **Federal Provincial Territorial Radiation Protection Committee** (FPTRPC) [5] advances the development and harmonization of practices and standards for radiation protection across these jurisdictions.

These agencies are described in further detail below.

2.1 The Canadian Nuclear Safety Commission

2.1.1 Mandate

The Canadian Nuclear Safety Commission (CNSC) regulates the use of nuclear energy and materials to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy. Created in 1946 as the Atomic Energy Control Board, the name of the agency changed in 2000 with the enactment of the Nuclear Safety and Control Act (NSCA). Its vision is to be one of the best nuclear regulators in the world by being effective, efficient, transparent, and an employer of choice.

Since 1946, the CNSC has worked to ensure Canada's nuclear exports are used for their intended peaceful purposes and has fulfilled Canada's international obligations not to manufacture or otherwise acquire nuclear weapons. It has also been ensuring that the production of nuclear energy does not pose an unreasonable risk to the public and the environment.

2.1.2 Organization

The CNSC is an independent federal government agency, and is composed of two components: a decision-making Commission tribunal that makes legally binding decisions based on laws and regulations, and a staff organization with technical experts in various disciplines of nuclear safety and control. The CNSC is accountable to the Parliament of Canada through the Minister of Natural Resources Canada.

The Commission functions as a quasi-judicial tribunal. It sets regulatory policy direction and establishes legally binding regulations on matters relating to health, safety, security and environment issues affecting the Canadian nuclear industry, and respects Canada's international commitments on the peaceful use of nuclear energy. The Commission is responsible for making licensing decisions on nuclear activities in Canada.

The CNSC staff organization is comprised of more than 600 employees. It develops regulatory frameworks, makes recommendations on licensing activities to the Commission and conducts compliance activities in support of an effective and efficient regulatory regime. The work of the staff organization includes the review of licence applications and renewals, promotion and verification of compliance with the NSCA, regulations and licence conditions, and enforcement activities. To support these activities, the CNSC maintains a comprehensive and publicly accessible regulatory document program including regulatory policies, standards, guides, and notices.

Neither the Commission nor the CNSC staff organization has a role in promoting the use of nuclear energy or in the development of nuclear technology. The CNSC's concerns always remain regulation and safety, not commercial development or promotion.

2.1.3 Radiation Protection Regulation

The CNSC considers radiation protection to be a central and integral part of effective nuclear safety regulation. Radiation protection issues are considered throughout the lifecycle of a facility or use of nuclear substances. For major facilities this includes everything from the design stage, to construction, operation, and finally, decommissioning. This process can identify potential radiation protection issues early in the process when they are more easily resolved, rather than having to retrofit facilities or relying more heavily on administrative controls. It also promotes a safety culture in which radiation protection is a fundamental component, fostering the idea that what is important is the overall safety of workers and the public from all hazards.

Radiation protection aspects of nuclear regulation in Canada are consistent with the current recommendations of the International Commission on Radiological Protection, whose fundamentals are embodied in publication ICRP-60.

The CNSC participates in a number of international activities related to radiation protection and other aspects of nuclear regulation in order to contribute to the harmonization of international nuclear safety and security regulatory standards and to ensure that the CNSC's activities are consistent with international best practices. These activities involve organizations such as the International Nuclear Regulators Association, the International Atomic Energy Agency, the Nuclear Energy Agency of the Organization for Economic Co-operation and Development, the International Commission on Radiological Protection, and the United Nations Scientific Committee on the Effects of Atomic Radiation. The CNSC is also actively involved in the bilateral exchange of regulatory information and collaboration with foreign nuclear regulators.

2.2 Health Canada

2.2.1 Mandate

Health Canada is the federal department responsible for helping Canadians maintain and improve their health, while respecting individual choices and circumstances.

Health Canada's goal is for Canada to be among the countries with the healthiest people in the world. To achieve this goal, Health Canada:

- Relies on high-quality scientific research as the basis for our work.
- Conducts ongoing consultations with Canadians to determine how to best meet their long-term health care needs.
- Communicates information about disease prevention to protect Canadians from avoidable risks.
- Encourages Canadians to take an active role in their health, such as increasing their level of physical activity and eating well.

2.2.2 Radiation Protection

The Radiation Protection Bureau's mandate is to promote and protect the health of Canadians by assessing and managing the risks posed by radiation exposure in living, working and recreational environments.

Specifically, Health Canada's Radiation Protection Bureau is responsible for:

- Supporting Canada's role in the Comprehensive Nuclear-Test-Ban Treaty by operating the Canadian portion of the International Monitoring System for radionuclides and providing one of 16 national radionuclide laboratories specified under the Treaty
- Conducting assessments under the Canadian Environmental Assessment Act
- Leading the coordination of federal nuclear emergency preparedness and providing Health Canada's technical support to the Federal Nuclear Emergency Plan (FNEP)
- Developing guidance to protect Canadians from the effects of nuclear accidents, radioactivity in water and food, radon in indoor air, and naturally occurring radioactive materials from non-nuclear industries
- Operating the Canadian Radioactivity Monitoring Network and laboratory to provide health assessments regarding existing levels of radioactivity and effects of nuclear/radiological accidents from a national perspective
- Conducting research on the health effects of radionuclides in the environment, especially sensitive Arctic environments and food chains, and on global air and radionuclide movements
- Providing intercomparison programs for internal radiation exposure measurements, internal dosimetry services and research on internal dosimetry and measurements through the National Calibration Reference Centre for Bioassay and In-Vivo Monitoring
- Managing the National Dose Registry, that contains the occupational radiation dose records of all monitored radiation workers in Canada. and conducts research on exposure trends and on the health outcomes of occupational exposures
- Conducting research on exposure trends for radiation workers and on the health outcomes of occupational exposures to radiation
- Providing advice to federal departments and agencies, other levels of government, industry, universities, hospitals, workers and the public on health issues related to radiation exposure

2.3 The Director General Nuclear Safety

Director General Nuclear Safety (DGNS) is accountable for the development, co-ordination, and assurance of the implementation of a comprehensive nuclear safety program for the Department of National Defence and the Canadian Forces (DND/CF). This responsibility encompasses the many radioactive materials and other sources of ionizing radiation in use within the DND/CF with a view to assuring overall design, development and operational safety. DGNS is responsible for auditing compliance with the nuclear safety program which includes technical safety analyses of the adequacy of design and behaviour of equipment and activities initiated by or including DND/CF personnel.

2.4 The Role of Provincial and Territorial Authorities

Responsibility for workplace health and safety is under the jurisdiction of the provinces and territories, typically through their Worker Compensation Boards or Departments of Health or Labour. The exception is where this is explicitly a federal domain, such as in federal departments, agencies and corporations, the armed forces, national research organizations and those industries involved in inter-provincial land transportation, air and maritime services and telecommunications. The Canadian Nuclear Safety Commission is the federal agency responsible for the control of nuclear substances and facilities, as well as the resulting radiation exposure, except within the Canadian armed forces. Naturally occurring radioactive materials (NORM) however are not regulated by the CNSC except when these materials are being transported or imported/exported. NORM remains the responsibility of the provinces and territories, except where this is explicitly in a federal setting. Radiation emitting devices, other than those using nuclear substances, are subject to federal requirements at the point of sale or importation regarding standards for design, construction and functioning. Otherwise, for installation and use the jurisdiction is again provincial or territorial, except for those devices installed and used in federal facilities or in federally regulated industries. The Canada Labour Code prevails in federal jurisdictions, and for radiation protection the standards developed by Health Canada, as specified in its series of radiation protection safety codes, are applicable.

At the provincial and territorial levels, radiation protection is administered either through designated radiation protection programs or as part of the broader duties of occupational health and safety officers from the Workers Compensation Board or similar organization. For the provinces, radiation protection programs are based in various ministries or agencies. Some of the programs have regulatory authorities, while for others their functions are restricted to advisory and service roles and supporting the regulatory programs of other environmental, occupational and public health bodies. A full listing of the member organizations and their representatives on the FPTRPC is given in Appendix 1. One key area of responsibility for the provinces and territories is the delivery of healthcare, which is a major user of medical x-ray equipment. Protection of patients is a trade off in the optimization of exposure to achieve an acceptable level of diagnostic information. The introduction of computerized imaging modalities is leading to larger doses to the population. The advent of digital imaging requires renewed attention on the means for controlling exposures. Protection of healthcare workers is important as this group accounts for the largest number of occupationally exposed persons, at around 70% of all persons currently monitored routinely for occupational radiation exposure in Canada.

3. The Federal/Provincial/Territorial Radiation Protection Committee

3.1 Mission and Mandate

The mission of the Federal/Provincial/Territorial Radiation Protection Committee (FPTRPC) is to advance the development and harmonization of practices and standards for radiation protection within Federal, Provincial and Territorial jurisdictions.

The FPTRPC is an intergovernmental Committee established to support Federal, Provincial and Territorial radiation protection agencies in their respective mandates by:

- providing a national focus for government radiation protection agencies;
- promoting the harmonization of radiation health and safety programs;
- identifying emerging issues in radiation protection and recommending actions to the appropriate jurisdictions;
- developing and harmonizing radiation protection standards, guidelines and input for legislation;
- providing a forum for representatives of the provinces and territories, the Canadian Nuclear Safety Commission, Department of National Defence, Health Canada and other federal departments/agencies;
- considering requests from other governmental committees and agencies concerned with health, safety and environmental issues and liaising regularly with such committees and agencies.

3.2 Committee Composition

Committee membership consists of delegates from the CNSC, Health Canada, the Department of National Defence, and from each Province and Territory. Delegates are individuals directly responsible for radiation protection within their respective jurisdictions.

3.3 Background

The FPTRPC was created in 1993, as a result of the termination of its predecessor - the Federal Provincial Sub-committee on Radiation Surveillance (FPSRS). The FPSRS was a Sub-committee of the Federal Provincial Committee on Environmental and Occupational Health, which in turn reported to the Council of Deputy Ministers of Health. The FPSRS operated for a period of some ten years, until a restructuring took place in the early 1990s by the federal government to reduce the number of Committees, Sub-committees and Working Groups.

The members of the FPSRS had recognized that the meetings were very beneficial for the coordination and development of radiation protection programs across Canada and for addressing issues of national importance. International incidents such as the Chernobyl nuclear accident and domestic issues, such

as the concern for radon gas in homes and other buildings, hi-lighted the importance of coordinating the limited resources nationally to address these matters. Therefore a proposal was made by the membership to reform the FPSRS as an independent Committee (FPTRPC) which would have its reporting relationship through the member jurisdiction departments that were to be represented on the new Committee. Formal support for the Committee was requested of and received from each of the jurisdictions of the former FPSPS. The Territories were also invited to participate, even though they had no identified radiation protections departments. The costs for holding an annual meeting would be shared amongst the members. The FPTRPC held its first formal meeting in October 1993.

Since that time, the FPTRPC has held regular annual meetings, has developed its Terms of Reference and established a number of Sub-committees and Working Groups to address the detailed technical aspects of the Committee's work. The FPTRPC continues to liaise with the Federal-Provincial Committee on Environmental and Occupational Health, concerning matters of mutual interest (e.g. drinking water quality guidelines). Expansion of the FPTRPC is a key initiative to achieving effective representation of appropriate federal government agencies. In 1999 the Department of National Defence (specifically, DGNS) formally joined the FPTRPC to become the third federal organization, along with the Canadian Nuclear Safety Commission and Health Canada. Communication with other domestic organizations and with international bodies is actively being pursued. In particular the Canadian radiation protection community has been informed of its work through articles published in the bulletins of the Canadian Radiation Protection Association and the Canadian Organization of Medical Physicists.

3.4 The Business of the FPTRPC

The work of the FPTRPC can be categorized into the following twelve broad areas:

- **Diagnostic Radiology** - medical x-ray practices, reference doses, new technology (digital), mammography & other standards, radiological exposure trends

- **Dose Limits and Worker Issues** - harmonization of limits (workers; general public; pregnant worker); worker suspension, return to work, injury claims and compensation

- **Dosimetry Services and Dose Records** - approval of commercial services, wearing of dosimeters, changes to doses records, accessing the National Dose Registry

- **FPTRPC Administration** - membership/representation, terms of reference, work plans, meetings, minutes & reports, sub-committees and working groups, communication/liaison

- **Standards and Guidelines** - International standards (ICRP, IAEA, ICNIRP, WHO), national guidelines (e.g. drinking water, radon in homes), other agencies (DND, HRDC)

- **Naturally Occurring Radioactive Materials** - jurisdiction, national NORM guidelines, identification, regulatory controls, waste management, worker protection, transportation

- **Non-ionizing Radiation** - sunlamps and sun awareness, lasers, microwave and RF devices, cell phones and towers, radio transmitters, VDTs, 60Hz- ELF, ultrasound items

- **Nuclear Medicine and Radiotherapy** - quality assurance, patient doses, accident reporting

- **Nuclear Emergency Preparedness** - preparedness/response planning, intervention levels and protective action guidelines, support services (environmental, laboratory & human testing)

- **Radiation Emitting Devices** - legislation, Safety Codes, development/updating process

- **Radiation Safety and Control Issues** - legislation, licensing, inspections, evaluations

- **Resources in Canada** - government programs/ staffing, private services, advisory bodies, instrumentation & equipment, calibration/testing laboratories, research/education programs

3.5 Working Methods

The FPTRPC is lead by three co-chairs, one each from the CNSC and Health Canada, and one provincial/territorial co-chair. Secretariat services are provided by the CNSC and Health Canada as necessary.

Face-to-face meetings of the entire FPTRPC are held on an annual basis, although more frequent meetings of the whole are possible within the FPTRPC terms of reference. At a minimum, each meeting includes a session chaired by each of the three co-chairs.

Most of the work of the FPTRPC is carried out by the following sub-committees or working groups:

- Business Plan Working Group
- Canadian NORM Working Group
- Communications Working Group
- EMF Working Group
- Emergency Planning Working Group
- Guidelines for Canadian Drinking Water Quality - Radionuclides
- Health Canada Mammography Working Group
- Industrial Radiography Regulations Harmonization Working Group
- Joint Documents Working Group
- Medical Utilization Working Group
- Provincial Radiation Dosimetry Review Sub-committee
- Radiation Standards Working Group
- Radon Action Level Working Group
- Survey Instrument Calibration Working Group

3.6 Recent FPTRPC Accomplishments

The FPTRPC has proven to be an excellent forum to discuss developments in radiation protection regulation across Canada, and to aid in harmonization of practices and regulatory approaches. A survey of radiation protection requirements across all Canadian jurisdictions, comparing them to international standards, was recently prepared as an aid to national harmonization. The FPTRPC has also played an important role in helping establish a new residential radon guideline, and in assisting Health Canada with their campaign to raise awareness of residential radon. In addition, some of the accomplishments of the FPTRPC include producing or contributing to reports on:

- Health Effects and Exposure Guidelines Related to Extremely Low Frequency 50/60 Hz Electric and Magnetic Fields
- Solar and Artificial Ultraviolet Radiation: Health Effects and Protective Measures
- Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials
- Guidelines for Tanning Salon Owners, Operators and Users
- Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency
- Canadian Mammography Quality Guidelines
- Guidelines for Interventions in Nuclear Emergencies
- Making Changes to Dose-related Information Filed with the National Dose Registry
- Keeping Radiation Exposures and Doses "As Low AS Reasonably Achievable - ALARA"
- Guidelines for Canadian Drinking Water Quality - Radiological Characteristics

4. Summary and Concluding Remarks

In Canada, radiation protection regulation is within the mandate of several federal, provincial and territorial authorities. The Federal Provincial Territorial Radiation Protection Committee plays an important role in advancing the development and harmonization of practices and standards for radiation protection across these jurisdictions.

Acknowledgements

The author wishes to thank current and past members of the FPTRPC who contributed to the FPTRPC business plan, from which substantial sections of this document were drawn.

REFERENCES

[1] NATURAL RESOURCES CANADA, Mineral and Metal Commodity Reviews (Uranium), 2006, http://www.nrcan.gc.ca/mms/cmy/content/2006/64.pdf.

[2] CANADIAN NUCLEAR SAFETY COMMISSION
http://www.nuclearsafety.gc.ca/.

[3] HEALTH CANADA
http://www.hc-sc.gc.ca/.

[4] DIRECTOR GENERAL NUCLEAR SAFETY
http://www.nuclearsafety.forces.gc.ca/.

[5] FEDERAL PROVINCIAL TERRITORIAL RADIATION PROTECTION COMMITTEE
http://www.hc-sc.gc.ca/ewh-semt/radiation/fpt-radprotect/index-eng.php.