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1) Introduction
At our meetings with the Commissioners, the question of legislation to protect workers from radiation hazards was raised. This subject was identified as a potential area to consider for consolidation under a new OHS statute.

Since that time, we have had an opportunity to explore the legislative foundation for worker protection from radiation hazards, and can report as follows.

2) The legislative situation
We have spoken to the senior staff at the Radiation Protection Services section of the BC Ministry of Health, in Burnaby. From those conversations we have ascertained that the Board is not reluctant to call upon the Service’s scientists to assist in investigations and enforcement of the Board’s radiation protection regulations. Indeed, the Service’s purpose is stated: “As key facilitator of preventive action on radiation matters, [the Service] assures the protection of the people of British Columbia from radiation hazards and from inappropriate uses or exposures to radiation emitting devices and other sources.”

The Service also sees as one of its mandates the “protection of workers and the public from hazards of radiation sources.”

Despite these laudable claims, the Service has no authority to enforce any provincial legislation which specifically protects workers from sources of ionizing and non-ionizing radiation. It does, however, exercise some influence in this area, albeit indirectly, through its authority to inspect and investigate health facilities under public health legislation.

It is the Service’s view that, if a radiation problem for workers arises at a workplace (e.g. a hospital, a clinic or an industrial setting), it would be the Board that would hold the legislative authority to take remedial or other corrective actions under the WCAmt.

At the moment, the IH&S Regulations contain a limited number of provisions dealing with radiation health matters. An extract from this regulation is set out in Appendix A to this report.

We were advised that the Service has assisted the Board in significantly updating these provisions. The new OHS Regulation contains almost three times more provisions and
that much more detailed guidance to employers, workers and others in relation to radiation protection measures. The new provisions extracted from the proposed regulation are set out in Appendix B.

3) Conclusions
The Ministry of Health does not administer any legislation that could be applied to protect workers from radiation hazards. However, the Board administers current provisions which address this issue. Given this state of affairs, and in particular the more detailed and comprehensive provisions in the proposed new OHS Regulation, we do not believe there is a need for the Commission to comment on this subject in its final report.
Appendix A

EXTRACT FROM THE IH&S REGULATIONS

GLOSSARY OF TERMS
"ionizing" in respect to radiation means the capacity to convert materials subjected to the radiation to a reactive or ionized electron state; "nonionizing" radiation which does not have the above stated capacity;

RADIATION HAZARDS

Application of regulations
13.61 All employers and workers, concerned with the use, storage, handling, transportation or disposal of radioactive substances, shall comply with:
(a) the Atomic Energy Control Regulations of Canada, and
(b) regulations made under applicable Federal or Provincial legislation, and
(c) additional requirements that the Board may prescribe.

Control measures
13.63 The employer shall ensure that all equipment capable of producing ionizing radiation, such as produced by X-ray machines and radioactive substances, or non-ionizing radiation, such as microwaves, lasers, ultra violet, infra red, is located, shielded, and operated so that no worker is exposed either directly or indirectly to radiation which, in the opinion of the Board, is in excess of safe quantities.

Equipment requirements
13.65 Equipment used for the generation and use of microwave radiation shall be:
(a) provided with adequate safety interlocks and shielding, and
(b) so located as to provide the least possible hazard to workers in the vicinity of the equipment, and
(c) maintained to prevent radiation leakage and minimize exposure to workers, and
(d) labelled after inspection so that the inspection status of the equipment is immediately apparent.

Exposure limit
13.67 No worker shall be exposed to microwave radiation in excess of 10 milliwats/cm² (645 mW/in²) measured at a distance of 2 inches (5 cm) from any external surface of the equipment or apparatus generating or using microwave radiation.

Repairing equipment
13.69 Workers repairing microwave generating equipment shall be provided with and shall use suitable protective screens and shields.
**Worker training**

13.71 The employer shall ensure that all workers exposed to ionizing and hazardous non-ionizing radiation shall receive pre-job instruction and training in the safe usage of the equipment generating or using such radiation.

**Use of lasers**

13.73 Where lasers are used in any work area, including research and teaching, the work premises and procedures shall be designed, maintained and operated in accordance with standards and procedures acceptable to the Board.*

Appendix B

EXTRACT FROM THE NEW OHS REGULATON
RE: IONIZING AND NON-IONIZING RADIATION

Definitions 7.32 In sections 7.33 to 7.49

"action level, ionizing radiation" means an effective dose of 1 milliSievert (mSv) per year;

"action level, non-ionizing radiation" means the exposure limits for the general public listed in the codes and standards identified in this Part, or if no public limit is specified in an applicable standard, it means the maximum exposure limit for workers as specified in the standard;

"effective dose" means the amount of ionizing radiation (in mSv) absorbed by the worker's whole body, adjusted for the energy level and type of radiation and the differing susceptibilities of the organs and tissues irradiated, and if only part of the body is exposed, the effective dose is the sum of the weighted equivalent doses in all irradiated tissues and organs;

"equivalent dose" means the amount of ionizing radiation (in mSv) absorbed by a specific body part and adjusted for the energy level and type of radiation.

Note: Radiation and tissue weighting factors for determining effective and equivalent doses are found in ICRP Publication 60, 1990 Recommendations of the International Commission on Radiological Protection.

Application 7.33 Sections 7.34 to 7.49 apply to all sources of ultrasonic energy, non-ionizing and ionizing radiation, including radiation sources governed by the Atomic Energy Control Act (Canada), or any successor legislation, and the regulations under that Act, but excluding natural background radiation, except as specified by the board, and medical or dental radiation received as a patient.

General Requirements

Exposure control plan 7.34 If a worker exceeds, or may exceed, an applicable action level for ionizing or non-ionizing radiation the employer must develop and implement an exposure control plan meeting the requirements of section 5.54.

Operation of equipment 7.35 Equipment producing ionizing or non-ionizing radiation must be installed, operated and maintained in accordance with the applicable standard from the following list, or other standard acceptable to the board:
Ionizing:
(b) latest edition of Safety Code 27, Health and Welfare Canada, Requirements for Industrial X-Ray Equipment - Use and Installation;
(c) latest edition of Safety Code 28, Health and Welfare Canada, Radiation Protection in Veterinary Medicine - Recommended Safety Procedures for Installation and Use of Veterinary X-ray Equipment;
(d) latest edition of Safety Code 29, Health Canada, Requirements for the Safe Use of Baggage X-ray Inspection Systems;
(g) latest edition of Safety Code 32, Health Canada, Safety Requirements & Guidance for Analytical X-ray Equipment;
(h) latest edition of Safety Code 33, Health Canada, Radiation Protection in Mammography;

Note: Safe operating requirements for radioactive materials are specified under the licensing requirements of the Atomic Energy Control Board, or any successor agency.

Radiofrequency:
(j) latest edition of Safety Code 6, Health and Welfare Canada, Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz to 300 GHz;

Lasers:
(l) ANSI Standard Z136.1-1993, Safe Use of Lasers;
(m)ANSI Standard Z136.2-1988, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources;
(n) ANSI Standard Z136.3-1988, Safe Use of Lasers in Health Care Facilities;
Infrared and ultraviolet:
(o) CSA Standard CAN/CSA-C22.2 No. 224-M89 (R1994), Radiant Heaters and Infrared and Ultraviolet Lamp Assemblies for Cosmetic or Hygienic Purposes in Nonmedical Applications.

Personal protective equipment 7.36 If required in a standard acceptable to the board, personal protective equipment must be provided by the employer and properly used by the worker.

Education and training 7.37 If a worker exceeds, or may exceed, an applicable action level for ionizing or non-ionizing radiation, the employer must ensure that the worker is adequately educated and trained in the hazards and safe use of the equipment or materials causing the exposure.

Ionizing Radiation

General responsibility 7.38 The employer must ensure that the exposure of workers to ionizing radiation is kept as low as reasonably achievable below the exposure limits.

Exposure limits 7.39 (1) A worker’s exposure to ionizing radiation must be limited to

(a) an annual effective dose of 20 mSv, and
(b) an annual equivalent dose of
   (i) 150 mSv to the lens of the eye,
   (ii) 500 mSv to the skin, averaged over any 1 cm² area at a nominal depth of 7 mg/cm², regardless of the area exposed, and
   (iii) 500 mSv to the hands and feet.
(2) Once a worker has declared her pregnancy, her effective dose, for the remainder of the pregnancy, from external and internal sources, must be limited to the lesser of
(a) 4 mSv, or
(b) the dose limit specified for pregnant workers under the Atomic Energy Control Act, or any successor legislation, and the regulations under that Act.

Note: The external dose referenced in subsection (2) is measured at the abdomen.

Instructions 7.40 (1) Before a worker uses or approaches equipment or materials whereby the worker exceeds, or may exceed the action level, the employer must prepare written instructions for
(a) the safe operation of the equipment,
(b) the boundaries of the hazard area,
(c) the work procedures to be followed,
(d) the correct use of any required personal protective equipment,
(e) procedures to be followed in an emergency.

(2) The instructions required by subsection (1) must be posted or otherwise available in the work area, or near the equipment controls.

**Monitoring exposure**

- **7.41**
  - (1) Unless specifically exempted by the board, if a worker exceeds or may exceed the action level, the employer must ensure that the worker is provided with and properly uses an acceptable personal dosimeter.
  - (2) Personal dosimetry data must be submitted to the National Dose Registry of Health Canada, and if requested, a copy must be submitted to the board.

**Radiation survey**

- **7.42**
  - (1) If a worker exceeds, or may exceed, the action level, the employer must conduct a radiation survey which measures radiation levels in the occupied work areas that may be influenced by the radiation-producing equipment or material.
  - (2) A radiation survey must include leak testing to determine any unusual source of emission of ionizing radiation or any source of escape of a radioisotope.
  - (3) The radiation survey must be conducted at least every 2 years, and when
    - (a) the equipment has been damaged or modified,
    - (b) a radioisotope or a radioactive sample has been spilled or accidentally released,
    - (c) there is an indication of an unusually high exposure of a worker to ionizing radiation, or
    - (d) specified in the equipment manufacturer's instructions.

**Records**

- **7.43**
  - (1) The employer must maintain records of radiation surveys for at least 10 years, and of exposure monitoring and personal dosimetry data for the period of employment plus 10 years.
  - (2) The records referenced in subsection (1) must be available to workers.

**Reviewing exposure information**

- **7.44**
  - (1) In assessing the adequacy of control measures for ionizing radiation, the employer must use all available exposure information to measure the effectiveness of the controls in comparison with similar industry and occupation groups.
  - (2) If there is a significantly higher dose profile than industry averages indicate is achievable, the employer must examine the work practices and conditions of exposure at the workplace, and alter them to reduce the unusually high doses as required by section 7.38.

**Note:** Data from the National Dose Registry is compiled and published by Health Canada and is available for the purpose of review of exposure information.
Reproductive hazards 7.45

(1) The employer must ensure that every worker who exceeds, or may exceed, the action level is fully informed of any potential reproductive hazards associated with the worker’s exposure to ionizing radiation.

(2) When requested by a pregnant worker or by a worker intending to conceive a child, the employer must make counselling available with respect to the reproductive hazards.

Non-ionizing Radiation

(1) Exposure to radiofrequency electromagnetic fields from short-wave diathermy devices must be limited to the maximum exposure levels in the latest edition of *Safety Code 25, Health and Welfare Canada, Short-Wave Diathermy Guidelines for Limiting Radiofrequency Exposure*.

(2) Exposure to electromagnetic fields from magnetic resonance clinical systems must be limited to the maximum exposure levels in the latest edition of *Safety Code 26, Health and Welfare Canada, Guideline on Exposure to Electromagnetic Fields from Magnetic Resonance Clinical Systems*.

(3) Except as identified in subsections (1) and (2), exposure to non-ionizing radiation and contact currents from radiofrequency electromagnetic fields must not exceed the limits in the latest edition of *Safety Code 6, Health and Welfare Canada, Limits of Exposure to Radiofrequency Fields at Frequencies from 10 kHz to 300 GHz*.

Note: Table 7-1 lists the exposure limits for workers from *Safety Code 6*. The sum of all fractions of all frequency bands must not exceed unity when time and spatially averaged.

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<th>Magnetic field strength rms, (A/m)</th>
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</table>

MHz = megahertz  
W/m² = watts per square metre  
rms, (V/m) = root mean square, volts per metre  
f = frequency in MHz  
rms, (A/m) = root mean square, amperes per metre
Lasers 7.47 Exposure to non-ionizing radiation from lasers must be limited to the exposure limits identified in the following standards, where applicable, or other standard acceptable to the board:

(a) ANSI Standard Z136.1-1993, Safe Use of Lasers;
(b) ANSI Standard Z136.2-1988, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources;
(c) ANSI Standard Z136.3-1988, Safe Use of Lasers in Health Care Facilities.

Ultraviolet radiation 7.48
(1) For welding, burning and allied processes, the employer must ensure that the requirements for radiation protection in Part 12 (Tools, Machinery and Equipment) are met.

(2) Exposure to ultraviolet radiation produced by equipment or industrial processes must be limited to levels in Threshold Limit Values for Chemical Substances and Physical Agents, 1995-1996, published by the ACGIH.

Note: Ultraviolet radiation from the sun is not included within the scope of these requirements. Nevertheless, workers and employers need to be aware of the hazard associated with solar radiation. Workers need to take effective means to limit exposure, such as appropriate dress and the use of sun-block creams.

Ultrasound 7.49
The operation of equipment which emits ultrasonic energy must be in accordance with the practices and procedures identified in the following codes or standards, where applicable, or other standard acceptable to the board:
