



THE COLLEGE OF
VETERINARIANS
OF ONTARIO

INFO SHEET

RADIATION PROTECTION AND MONITORING For Veterinarians, Veterinary Clinic Employees and Clients

INTRODUCTION

Diagnostic x-rays are an essential part of modern veterinary practice. Radiation protection, in the form of monitoring devices, personal protective equipment, facility design and construction, and appropriate usage precautions, is required to monitor and prevent exposure that could result in somatic and genetic changes to individuals or their descendants.

The following is intended for information purposes only. For questions concerning specific situations and circumstances, please contact the relevant government agency.

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Somatic effects are changes that may occur in the body organs of an exposed worker, which may appear from a few hours, to years later, depending on the amount and degree of exposure of the individual. Genetic effects include the possibility of chromosomal damage to the germ cells, which could result in mutations that could later lead to genetic defects in the worker's descendants. In the relatively low dosages used in veterinary medicine, the likelihood of genetic changes is greater than that of somatic changes.

Radiation protection and monitoring for veterinary clinic employees is governed by the federal government, the provincial government and the provincial regulatory body, CVO.

Dosimeters are devices which are used to monitor radiation exposure of persons who work with radiation devices. Personal dosimeters (also called "monitors" or "badges") are used to monitor the x-ray dose received by an individual whose work may result in exposure to x-rays. Dosimetry services are available for measuring personal, occupational exposures to x-ray, gamma, neutron and beta radiation. Dosimeters are devices used to measure an individual's accumulated exposure to these types of harmful radiation. Dosimeters, consisting of plaques enclosed in special holders, or ring dosimeters, are used for specific "wearing periods", depending upon the service to which the user subscribes. Established criteria are used in placing new applicants on the appropriate service and wearing schedule.

There are several reasons to monitor this dose:

1. To verify that legal dose limits are not exceeded. The probability of this happening in veterinary radiology is extremely low, based on dose statistics for past years.
2. To detect significant changes in personal exposure due to faults in x-ray equipment, poor operating procedures or increased workload. Even though doses may remain below the legal limits, increases in the reported values may be indicative of a problem leading to unnecessary exposure. A generally accepted principle in radiation protection is that doses should be As Low As Reasonably Achievable (ALARA).
3. To relieve or prevent anxiety of staff members who may be concerned about their exposure to x-rays.

Every staff member who is required to be present in an x-ray room while an x-ray is taken must wear a personal dosimeter. For portable x-ray units, every staff member who regularly assists in radiology should wear a dosimeter.

There are two commercial dosimetry services in Canada, which can supply suitable dosimeters:

1. Health Canada, Radiation Protection Bureau, National Dosimetry Services₁
2. Landauer Inc.₂

Annual permissible radiation exposure limits for Xradiation are set in accordance with the International Commission on Radiological Protection recommendations. The current exposure limits for radiation workers and other workers and members of the public are as follows:

PART OF BODY IRRADIATED	EXPOSURE CONDITIONS AND COMMENTS	DOSE EQUIVALENT ANNUAL LIMIT (MILLISIEVERTS)	
		X-ray Workers	Other Workers
Column 1	Column 2	Column 3	Column 4
Whole body or trunk of body	Uniform irradiation	50	5
Partial or non-uniform irradiation of body	The limit applies to the EFFECTIVE DOSE EQUIVALENT defined in Note (a)	50	5
Lens of eye	Irradiated either alone or with other organs or tissues	150	50
Skin	The limit applies to the mean dose equivalent to the basal cell layer of the epidermis for any area of skin of 1 square centimetre or more	500	50
Individual organs or tissues other than lens of eye or skin	The limit on effective dose equivalent applies, with an overriding limit on the dose equivalent to the individual organ or tissue	500	50

Note (a)

The EFFECTIVE DOSE EQUIVALENT, H_E , is determined by the following formula:

$$H_E = S_T W_T H_T$$

where:

- (i) T is an index for tissue type;
- (ii) H_T is the annual dose equivalent in tissue T;
- (iii) W_T is a weighting factor which has the following values:

0.25 for the gonads, 0.15 for the breast, 0.12 for the red bone marrow, 0.12 for the lungs, 0.03 for the bone surfaces, 0.03 for the thyroid, 0.06 for each of the five other organs or tissues receiving the highest dose equivalents, but excluding the skin, extremities and eye lenses. The exposure of all other remaining tissues can be neglected. When the gastro-intestinal tract is irradiated, the stomach, small intestine, upper large intestine and lower large intestine shall be considered as four separate organs; and

- (iv) $S_T W_T H_T$ is the sum of the $W_T H_T$ values for all irradiated tissues which receive more than 1 millisievert in a given year.

The National Dose Registry (NDR) is a centralized radiation dose record system, operated by the Radiation Protection Bureau. It contains the occupational radiation dose records of all monitored radiation workers in Canada.

The registry includes over 80 different occupations (e.g., veterinarians, veterinary technicians, dentists, radiologists, laboratory technicians, uranium miners, nuclear power workers), working at 14 categories of organizations (e.g., hospitals, private clinics, universities).

The NDR publishes annual reports on occupational radiation exposures. Each report contains dose information on the two calendar years prior to the year of issue, preliminary information on the more recent year, and more comprehensive information, including dose distributions by occupation, on the earlier year.

The Radiation Protection Bureau of Health Canada also publishes fact sheets for the public and workers. Among these is: **Safety Code 28. Radiation Protection in Veterinary Medicine, 1991**, a 38 page guide on the recommended safety procedures for installation and use of veterinary xray equipment. Safety Code 28 is a guideline and does not have any legislative authority in Ontario.

The Radiation Protection Service of the Ontario Ministry of Labour, registers employers in possession of an x-ray source(s), approves x-ray plan location drawings and conducts safety inspections to ensure compliance with the Occupational Health and Safety Act and the X-ray Regulation.

Information required for the Form 2 - Application for Review of Permanent X-ray Location, includes the make, model and serial number of the x-ray machine, a description of the maximum rated tube voltage, maximum rated tube current and anticipated maximum workload, as well as the description of the permanent location of the machine, complete with drawings and specifications. In the case of portable x-ray machines which are not used regularly in one location, the address where the x-ray machine(s) are normally stored shall be submitted on the Form 1 - Application for Registration.

An x-ray safety inspection may include: a review of the plan location drawing(s), a technical evaluation of the x-ray machine, a review of dosimetry and radiographic exposure records, examination of protective radiation shielding accessories, a review of clinical films and an interview with the x-ray workers to discuss any radiation safety concerns.

An inspector has the authority to enter any workplace without a warrant or notice. Unannounced inspections are Ministry of Labour policy.

Under the *Occupational Health and Safety Act*, an inspector has the authority to issue an order to ensure compliance with the Act. In addition, the penalty for violating the Act is a maximum fine of \$25,000 and/or 12 months in jail for an individual and a maximum fine of \$500,000 for a corporation.

Under the College's *Minimum Standards for Veterinary Facilities in Ontario*, certain types of veterinary facilities are required to have x-ray machines. The minimum standards set out requirements for protective equipment that correlates with the federal requirements. In addition, the minimum standards set out the minimum protective equipment that is required in the facility, as well as a radiology log. Finally, the *Minimum Standards for Veterinary Facilities in Ontario* requires any veterinary facility which must contain an x-ray machine to have made an application under the *Occupational Health and Safety Act* and that application has been reviewed and accepted by an inspector under that Act.

- 1 Health Canada, Radiation Protection Bureau, National Dosimetry Services, Ottawa, Ontario
Phone: 613-954-6689 or 800-261-6689 Fax: 613-957-8698 or 800-252-6272
- 2 Landauer Inc., Glenwood, Illinois, USA
Phone: 708-755-7000 or 800-323-8830 Fax: 708-755-7126 or email custserv@landauerinc.com
- 3 Ontario Ministry of Labour, Radiation Protection Service, 81A Resources Road, Weston, Ontario
Phone: 416-235-5922 Fax: 416-235-5926

INFO SHEETS of the College of Veterinarians of Ontario provide veterinarians and the public with information about the governance of veterinarians in Ontario or contain practice parameters and standards that should be considered by all Ontario veterinarians in the care of their patients, dealings with their clients and the welfare of their staff.

It is important to note that these INFO SHEETS may be used by the College or other bodies in determining whether appropriate standards of practice and professional activities have been maintained.

The College of Veterinarians of Ontario regulates veterinarians in Ontario in the public interest.