CONTROL OF NON-IONIZING RADIATION EMITTING DEVICES IN CANADA

Michael H. Repacholi, S.K. Ghosh
D.A. Benwell and G.C. Dutt

Radiation Protection Bureau, Environmental Health Directorate
Health Protection Branch, Health and Welfare Canada
Ottawa, Canada K1A 1C1

During the past ten (10) years there has been a tremendous increase in the use of non-ionizing radiation (NIR) emitting devices. As such there has been an increasing need for controls on these NIR devices to ensure that they do not present a hazard to the users or the general public.

In Canada there is a fundamental division of responsibility in the health field. The Federal Government under the Radiation Emitting Devices (RED) Act draft regulations on design, construction and performance standards for new devices that are sold or imported into Canada. The Food and Drugs Act Medical Devices Regulations can also be used to draft performance standards for medical radiation emitting devices. Most of the Provinces of Canada have their own radiation safety acts that control the facility and the use of the NIR devices once they have been sold. Use of NIR devices in Federal establishments are controlled under the Canada Labour Code and Treasury Board Standards.

The Radiation Protection Bureau has been given the responsibility of determining potential hazards from NIR devices, proposing regulatory action as necessary, carrying out research into bioeffects of these radiations and developing radiation measurement techniques.

Control of NIR devices is divided up into three (3) general areas:
(i) microwaves, RF and electromagnetic fields
(ii) ultrasound and noise, and
(iii) lasers, ultraviolet and other electro-optical radiations.
In each of these areas, surveys of NIR emitting devices are made. If potential hazards to device operators or risks to the general public are found, it is determined whether regulations will significantly reduce this potential hazard. If so, a detailed study of the design, construction and functioning of the device is carried out. With this information and other available standards and data from within and outside Canada, a draft standard is proposed in the Canada Gazette Part I.

Comments and criticisms are then solicited from manufacturers, users, professional associations, national and international standards organizations and other interested persons. These comments are then taken into account when drafting the final standard in the Canada Gazette Part II. Meetings with professional associations, manufacturer's organizations, technical experts and other Government Departments are held before the final regulations are published. After an appropriate lead-in time, all manufacturers must then construct their devices in accordance with the standards specified in the regulations.

Regulations for microwave ovens have been in effect since October 1974 and the responsibility for compliance to this regulation also rests with the Radiation Protection Bureau. To date over 130 models of microwave ovens have been tested and at present all of the ovens sold in Canada comply with the microwave leakage radiation requirements.

Extensive studies have been carried out on a number of other NIR devices, including demonstration lasers and laser scanners. A survey in Ottawa area schools indicated that some demonstration lasers were sufficiently powerful to produce eye damage quicker than the "blink" reflex to students who might inadvertently view the direct beam. Laser scanners are now becoming accepted by the big supermarket chains in Canada and our preliminary surveys indicated that potentially hazardous exposure to laser light of large fractions of the general public could exist if these devices were to proliferate without complying with appropriate safety standards. The final form regulations on these two types of lasers is expected to be published shortly.

Over sixty (60) NIR devices have been drawn up for possible regulatory control, so priorities for studying the hazard of these devices are assigned depending on the severity of their effect and the number of people exposed. Higher priorities have been given to the following devices:

Ultrasound -: diathermy, diagnostic and industrial cleaning devices
Microwaves -: diathermy, bloodwarmers, commercial communications devices and active metal detectors
Ultraviolet -: sun (health) lamps, dental polymerizers, mercury lamps and industrial sterilizers

Draft regulations on the above devices are at various preliminary stages.

In addition to drafting performance standards the Radiation Protection Bureau has compiled a number of safety codes under the Canada Labour Code and Treasury Board Standards. These safety codes basically outline how to use the devices in a safe manner, and what installation precautions are necessary to ensure that personnel exposures are kept within acceptable levels. Final form safety codes have been completed on:

(i) open beam microwave devices
(ii) closed cavity microwave devices
(iii) active metal detectors, and
(iv) demonstration lasers.

The safety code on active metal detectors was written in response to the tremendous increase in air-highjacking and the need to detect weapons on airline passengers. However there was the fear that passengers wearing cardiac pacemakers could suffer adverse effects when passing through these metal detectors. Setting up procedures to obtain the correct electric and magnetic field strength for these devices was written into the safety codes to minimize potential hazards to passengers wearing cardiac pacemakers.

General safety codes on open and closed microwave devices were developed to provide safety information on the increasing number of devices using microwave radiation. Radar control equipment at airports, communications devices, diathermy, door openers and bloodwarmers are among the current device applications of microwaves where these safety codes can be utilized.

Where possible, it has been the aim of the Radiation Protection Bureau to provide a safety code on use and installation together with a design, construction and functioning regulation on the NIR device. In this way a package of information covering all aspects of health and safety for the device are presented.

Since the non-ionizing radiation field is relatively young, bioeffect data pertinent to setting safe exposure levels is scarce. Part of the problem stems from the fact that the measuring instrument technology has not kept pace with demand. There is a great need for good portable survey instruments, especially in the ultrasound field. Since there are very few commercially available ultrasound measuring instruments, an ultrasound float radiometer, a balance radiometer and hydrophones have been developed at the Radiation Protection Bureau to assist in the surveys of ultrasound diathermy and diagnosis devices.

The Radiation Protection Bureau is presently involved in an ultrasound intercomparison study between a number of laboratories around the world, which hopefully will provide the basis for an internationally acceptable standard.

Investigations made at the Radiation Protection Bureau of ultrasound or microwave radiation on blood enzyme activity showed that no effect could be found when the temperature was held constant (1), (2) and (3). Criteria documents on the health effects of microwave radiation, noise and ultraviolet radiation are also being prepared. These documents are used as a basis for determining permissible exposure levels.

For the present, control of NIR devices must continue using maximum exposure levels determined from the best available data. Safety factors to these exposure levels may be necessary depending on the quantity and quality of data available. There is obviously a great need in the NIR field for internationally accepted maximum exposure levels similar to those produced for ionizing radiations by the International Commission on Radiological Protection (ICRP). Perhaps a similar organization for non-ionizing radiations should be formed to provide the same standard setting leadership as the ICRP.

Reference

(1) M.L. Belkode, A.M. Muc and D.L. Johnson
"Thermal and Athermal Effects of 2.8 GHz Microwaves on Three Human Serum Enzymes", J. Microwave Power 9 (1) (1974) 23

(2) M.L. Belkode, D.L. Johnson and A.M. Muc
"Thermal and Athermal Effects of Microwave Radiation on the Activity of Glucose - 6 - Phosphate Dehydrogenase in Human Blood", Health Physics 26 (1974) 45

(3) M.L. Belkode, D.L. Johnson, J.W. Conner and R.G. Hussey
"Effect of 3.6 MHz Ultrasound on Human Serum Proteins and Enzymes", Health and Welfare Canada, Radiation Protection Bureau Report IR-149 (November 1974)