

INIS-mf--12755

**Code of Practice for Radiological
Protection in Dentistry**

Department of Health 1988

**Code of Practice for Radiological
Protection in Dentistry**

Department of Health 1988

Foreword

Following consultations with the Medical Radiation Advisory Committee of the Nuclear Energy Board and other interested groups a Code of Practice for Radiological Protection in Dentistry has been drawn up by my Department. The Code applies to all those involved in the practice of dentistry and is designed to minimise radiation doses to patients, dental staff and the public from the use of dental radiographic equipment.

The adoption of this Code will help to ensure that the radiological techniques and protection measures which are applied in the practice of dentistry are adequate and I fully endorse the procedures outlined.

I would like to take this opportunity to thank all of those who contributed to this Code, in particular the Medical Radiation Advisory Committee, the staff of the Dental Schools in Trinity College, Dublin and University College Cork and Dr John Clarkson, Deputy Chief Dental Officer, Department of Health.

A handwritten signature in black ink, reading "Rory O'Hanlon", written over a horizontal line.

Rory O'Hanlon
Minister for Health

CONTENTS

PART 1	INTRODUCTION	PAGE
1.	Need for Radiation Protection	5
2.	E.C. Directives	6
3.	Statutory Controls	6
4.	Implications for the practice of dentistry	6
PART 2	CODE OF PRACTICE FOR RADIOLOGICAL PROTECTION IN DENTISTRY	
1.	Responsibility for Radiation Protection	9
2.	Radiographic equipment	9
3.	Location of equipment	10
4.	Film processing	11
5.	Procedures to minimise doses to patients	11
6.	Operator and staff protection	12
7.	Protection of the public	13
8.	Additional information	14
Appendix		14

PART I

1. Need for Radiation Protection

The ionizing radiation used by the dental profession is mainly limited to x-rays and this document deals with that subject. There are two kinds of biological consequences which result from the radiation exposure of humans;

- (1) somatic effects - affecting the individual exposed;
- (2) genetic effects — affecting the progeny of irradiated persons.

1. Somatic effects can be further divided into two types:

(A) Non-Stochastic Effects

These are effects which include, among others, the induction of cataract of the lens of the eye and skin erythema. They would not be expected to occur for exposures below a certain threshold value. The severity of the effect is assumed to be proportional to the dose received.

(B) Stochastic Effects

These are effects which include the induction of leukaemia and some other cancers. The probability of occurrence is assumed to be proportional to the dose received with no threshold value below which no effects will be observed. Dental radiography can give rise to a significant dose of radiation to the bone marrow in the skull and cervical spine, the oral mucosa, the thyroid and the eye as well as to any part of any person exposed to the primary beam.

The utilisation of badly adjusted equipment, and/or a poor technique (e.g. holding an x-ray film in the hand) may unnecessarily increase the incidence of stochastic effects and could in some extreme cases give rise to the induction of a non-stochastic effect.

2. Genetic Effects

Owing to the rapid growth in the use of dental x-rays and the increasing number of persons undergoing dental examinations the genetic effects of ionizing radiation from dental radiography may also be of concern.

It is important to remember that the number and variety of radiation sources contributing to the total exposure of the public is increasing. No user or group of users of ionizing radiation has the right to defend its position on the basis that, in comparison with others, it is producing only a small population exposure. The largest single contributor of man-made

radiation exposure to the population is medical and dental diagnostic radiology. It is assumed that, for the purpose of establishing acceptable standards of protection from ionizing radiation, any exposure, no matter how small, carries some risk. The magnitude of this risk is also assumed to be proportional to the magnitude of the dose received. Radiographic procedures which minimise the dose to patients and at the same time yield the required diagnostic information must, therefore, be utilised. All users of radiation must take every practical step to minimise the exposures for which they are responsible.

2. E.C. Directives

E.C. Directives (European Council Directives 80/836/Euratom and 84/467/Euratom) laying down the basic safety standards for the health protection of the general public and workers against the dangers of ionizing radiation are being implemented.

Another E.C. Directive (84/466/Euratom) laying down the basic measures for the radiation protection of persons undergoing medical examination or treatment is also being implemented.

A summary of the main points of these E.C. Directives is given in the Appendix.

3. Statutory Controls

The Minister for Health has powers under the Health Act, 1953 (No. 26 of 1953) to make regulations for the control of the use etc. of radioactive substances and irradiating apparatus in the medical and dental area.

The Nuclear Energy (General Control of Fissile Fuels, Radioactive Substances and Irradiating Apparatus) Order, 1977 (S.I. No. 166 of 1977) made by the Minister for Energy under the Nuclear Energy Act, 1971 (No. 12 of 1971) provides for the control by licence to be obtained from the Nuclear Energy Board of the custody, importation, disposal etc. of radioactive substances and irradiating apparatus generally. The European Communities (Medical Ionizing Radiation) Regulations, 1988 (S.I. No. 189 of 1988) made by the Minister for Health under the European Communities Act, 1972 (No. 27 of 1972) gives statutory effect to provisions contained in E.C. Directive 84/466/Euratom on the protection of persons undergoing medical examination or treatment.

4. Implications for the Practice of Dentistry

The following are the major implications of this Code and of the E.C. Directives for the practice of dentistry in this country:

- (i) A licence for the custody of dental radiographic equipment must be obtained from the Nuclear Energy Board. In future this should be done 28 days before starting work with equipment. The Dental Council will inform all new entrants to the Dental Register of these requirements. Any change in the type and use of equipment, ownership or address at which it is used must be notified to the Nuclear Energy Board.
- (ii) All radiographic exposures must be clinically justified and kept as low as reasonably achievable and should have regard to the Code in Part 2 of this document.
- (iii) Radiographic equipment may only be used under the direction and supervision of dentists. Undergraduate training will take account of radiation protection requirements and a process of continuing education will be initiated for dentists already in practice. Dentists who have obtained a recognised qualification including training in radiographic techniques and protection measures may operate dental radiographic equipment. Persons other than dentists may operate radiographic equipment only if they have received recognised training in radiation protection and radiographic techniques and if they operate under the direction and supervision of a dentist. Any persons, such as dental surgery assistants, who assist in carrying out dental radiographic procedures must have received instruction and training in radiological protection measures.
- (iv) In each practice a named person who is appropriately trained is required to take day-to-day responsibility for radiation protection. Normally this will be one of the dentists in the practice. It will be this person's responsibility to see that the attached Code is adhered to; that any staff who are involved in work with radiographic equipment are properly trained and any female staff employed in the practice are made aware of the possible hazards of ionizing radiation during pregnancy.
- (v) The dentist must ensure that all radiographic equipment under his/her responsibility conforms to the standards outlined in the attached Code. If this is not so then advice should be sought from the Nuclear Energy Board.
- (vi) All the radiological protection measures relating to patients, staff and the public and the quality control procedures in the attached Code should be adhered to. The inspection of dental surgeries may be necessary to ascertain if adequate radiological protection measures are being taken.

- (vii) If an exposure to ionizing radiation occurs accidentally, for example from malfunctioning radiographic equipment, then it must be reported immediately by the dentist or employer to the Nuclear Energy Board and the Department of Health. Radiation Safety Committees should also be informed in the case of health boards and other institutions.
- (viii) If the workload is high i.e. over 350 periapical or 40 panoramic films per week, or when using cephalometric techniques then the use of protective barriers and structural shielding of installations may be necessary.
- (ix) In order to carry out an inventory of dental radiographic equipment in Ireland a Postal Survey organised by the Personnel Dosimetry Service of the Nuclear Energy Board has been carried out.
- (x) A more detailed assessment of the performance — characteristics of x-ray equipment will be undertaken periodically by the Personnel Dosimetry Service of the Nuclear Energy Board. Dentists will have to cooperate with these monitoring procedures.
- (xi) Non-compliance with the code may mean that Controlled Areas within an operating area may have to be introduced or Radiation Protection Advisors appointed to individual surgeries.

PART 2

Code of Practice for Radiological Protection in Dentistry

1. Responsibility for Radiation Protection

The dentist is the person responsible for all aspects of radiation protection in general dental practice. Where more than one dentist is in the practice then a particular dentist should be given this responsibility.

It is the dentist's responsibility to ensure that the dental facility complies with the safety requirements outlined, that radiographic equipment works satisfactorily and is operated only by trained personnel. The dentist should establish procedures so that this Code is operated by the staff and the dentist must hold a licence from the Nuclear Energy Board for the custody of radiographic equipment.

Ultimate responsibility for ensuring the licensing of radiographic equipment and for radiological protection in Health Board facilities, in hospitals and other institutions rests with the employing authority. Radiation Safety Committees in such institutions should take full account of dental radiological protection requirements.

Radiographic equipment may only be used under the direction and supervision of dentists who have had adequate training in radiation protection and radiographic techniques as approved by the Dental Council. Persons other than dentists may operate dental radiographic equipment only under the direction and supervision of a dentist, as described above, and if they have followed a course of training in radiation protection and techniques approved by the Dental Council. Persons, other than dentists, assisting in carrying out dental radiographic procedures must have received instruction and training in radiological protection measures as appropriate to their work.

Any accident involving an exposure to ionizing radiation must be reported immediately by the dentist or employing authority to the Nuclear Energy Board and the Department of Health. The Radiation Safety Committee should also be informed where one exists in a health board or institution.

2. Radiographic Equipment

- (i) All x-ray apparatus should be well maintained and serviced and have its performance checked regularly. Particular attention should be paid to old equipment. Any deterioration in quality and repeatability of radiographs should indicate an immediate check.

- (ii) The Kilovoltage must not be less than 50 kVp (normally in the range 60 - 75 kVp).
- (iii) Filtration should be at least equivalent to 1.5 mm of aluminium (2.5 mm if > 70 kVp).
- (iv) There should be adequate shielding to decrease leakage, and leakage radiation should not exceed 1mSv (100 mR) in 1 hour at 1 metre from the tube when operated at maximum rating.
- (v) Beam width should be limited to the minimum necessary to cover the area under examination (intra-oral radiography 6 - 7 cm at cone end).
- (vi) A director cone should be used with a minimum focus — skin distance not less than 18 cm up to 60 kVp and not less than 20 cm above 60 kVp. Open ended cones are preferable to the “pointer” type of cone.
- (vii) An exposure switch of the electronic type should be fitted and it should be of a type which is able to terminate an exposure at a pre-set time (max time 5 sec). The switch should have to be depressed throughout the whole of the exposure. A mechanical switch should not be used.
The switch must be mounted at the end of a cable at least two metres in length.
- (viii) The x-ray machine should be equipped with a warning light to indicate that the machine is turned on, and a second prominent light indicating when x-radiation is being generated.
- (ix) Panoramic units
 - (i) A localising cone or other device must be provided which limits the minimum focus to skin distance to not less than 15 cm.
 - (ii) The primary beam must be collimated such that the size of the useful beam at the image receptor does not exceed, by more than 2% of the source-to-image receptor distance, each dimension of the scanning slit.

3. Location of Equipment

The equipment may be stored in the dental surgery or a separate room. There must be sufficient space to allow staff to maintain a distance of at least two metres from the tube head. In the case of pantomographic or

cephalometric equipment it should be possible to operate the unit from behind a protective screen or wall. Access to the room should be limited during a radiographic exposure.

4. Film Processing

It is essential that there is meticulous attention to processing techniques, and the proper use of developing and fixing solutions in order that repeat x-ray examinations are not necessary. Manufacturer's recommendations with respect to strength of solutions, temperature and time must be followed to ensure optimum development. Solutions should be replenished or replaced as necessary. Even unused developer deteriorates with time.

Cleanliness is important to reduce film artefacts for both manual and automatic film processing. Automatic film processors should be cleaned, serviced regularly and quality of performance assessed.

A dark room must be well blacked out to prevent fogging of films and the safe light equipped with an appropriate filter. If adjacent to the radiography room, the film storage container must be adequately shielded to prevent exposure of films.

5. Procedures to minimise doses to patients

- (i) Only those x-rays which, after a clinical examination and a careful consideration of both the dental and general health needs of the patient, are found to be necessary for patient care should be carried out. The routine use of x-rays without a specific dental or associated need is not warranted. It should be determined if there are any previous x-ray examinations which would make further examination unnecessary.
- (ii) The operator should use the minimum exposure time consistent with obtaining a good quality film. This includes using the fastest film which will give the necessary contrast and detail and with extra-oral films the use of cassettes with intensifying screens.
- (iii) Unnecessary repeat films should be avoided by using a proper technique and reliable and consistent processing.
- (iv) Film holders and bite-wing films should be used to save the patient having to hold the film.
- (v) As it is difficult to differentiate between categories of patient at particular risk from radiation, a protective lead apron should be worn by all patients having x-ray examinations. When taking vertex

occlusal films a lead apron must be worn by patients. In panoramic radiography, since the source of the radiation is coming from the back of the patient, dual (front and back) lead aprons should be used.

- (vi) Particular care should be taken with women who may be or are pregnant. A protective apron must be provided to protect the foetus.
- (vii) Clinical records should include details of all x-ray examinations carried out.

6. Operator and staff protection

- (i) The operator or other staff must not stand in the direct beam during exposure nor must they hold the tube housing or the cone.
- (ii) The dental film, wherever possible, should be fixed in position; otherwise it should be held by the patient. The dental practitioner or other personnel must not hold the film in place during exposure.
- (iii) The operator or staff must stand at least two metres away from the tube head during exposure.
- (iv) The operator or staff should stand behind a protective barrier with a lead equivalent of not less than 0.5 mm if the workload is high e.g. above 350 periapical or 40 panoramic films per week.
- (v) If persons are needed to assist children or weak patients they must avoid the direct beam and must be provided with a lead apron. The same person must not regularly perform these duties.
- (vi) Checks should be made of dose received by staff. Monitoring badges should be worn continuously by all staff involved in work with ionizing radiation. Badges should be worn on the trunk between the level of the shoulders and the hips. For the first 24 weeks badges should be changed every four weeks. If the doses recorded are not significant, (i.e. below the threshold of measurement of 0.1 mSv per month for film badges) or extremely variable, then the frequency at which badges are changed may be decreased, subject to the agreement of the Personnel Dosimetry Service of the Nuclear Energy Board. The above arrangement shall not apply to pregnant staff who should wear the badges over the abdomen and have them changed fortnightly during the 8-15 week period and monthly for the remainder of their pregnancy. Alternatively, it may prove more convenient to change the badge fortnightly from the date of

declaration of pregnancy until the woman goes on maternity leave.

All monitoring badges should be obtained from the Personnel Dosimetry Service of the Nuclear Energy Board, or another laboratory approved by the Board and returned thereto for examination. Records of doses received by staff should be kept.

The licences issued to dentists, as referred to earlier, include conditions specifying dose limits for both exposed workers and members of the public which shall not be exceeded.

- (vii) It is the dentist's responsibility to see that all members of staff involved in work with ionizing radiation receive information and training in the radiological protection measures outlined here. Special attention should be applied to the protection of women of childbearing age and of pregnant women. It is the duty of the dentist to inform any such employee in his or her practice of the possible hazards to the foetus from ionizing radiation. A protective lead apron must be worn by pregnant women operating or assisting in radiographic procedures. The Medical Radiation Advisory Committee of the Nuclear Energy Board recently recommended that the total dose to the abdomen in pregnancy should be less than 1 mSv between weeks 8-15 inclusive or 5 mSv during the gestation period. It is not expected however that compliance with this recommendation should present problems in dental radiology if the standard radiation protection measures outlined in this Code are implemented.
- (viii) Only those people whose presence is essential should remain in the x-ray room during exposure.
- (ix) An x-ray room must not be used simultaneously for more than one radiological investigation.
- (x) An area within the primary beam, before it is sufficiently attenuated, or within 2 metres of the tube head, or the patient in any direction when a radiographic exposure is occurring is designated a Controlled Area (See Appendix vii). Appropriate protection measures have to be taken after consultation with the Nuclear Energy Board if persons operate in a Controlled Area.

7. Protection of the Public

- (i) The direct beam should not be directed through doors or windows or wooden floors where persons may be situated. Normally the direct beam will be restricted to certain main directions and these

locations should have an adequate thickness of absorbing materials — i.e. brick or concrete, in order to protect persons working or living in adjacent areas.

- (ii) Normally only small levels of scattered radiation are detectable on the inner walls of dental surgeries. There is therefore usually no need for heavy structural shielding to protect from scattered radiation. However, if the workload is high, i.e. more than 350 periapicals or 40 panoramic films per week or when using cephalometric techniques, and depending on factors such as the maximum voltage of the machine and the distance from the source of radiation, the installation of structural shielding may be necessary. Advice should be obtained from the Nuclear Energy Board or the Radiation Safety Committee where appropriate.

8 Additional information

Further advice and information on Radiation Protection can be had from the Nuclear Energy Board, 3 Clonskeagh Square, Clonskeagh Road, Dublin 14.

Details of film monitoring services are available from The Personnel Dosimetry Service, Nuclear Energy Board, 3 Clonskeagh Sq, Clonskeagh Road, Dublin 14.

Copies of E.C. Directives 80/836/Euratom, 84/466/Euratom and 84/467/Euratom are available from the Government Publications Sales Office.

Copies of the European Communities (Medical Ionizing Radiation) Regulations 1988 are available from the Government Publication Sales Office.

Appendix

Summary of E.E.C. Directives 80/836/Euratom, 84/466/Euratom and 84/467/Euratom.

- (i) The reporting of activities involving radiation will be compulsory and, in some cases, a system of prior authorisation will be necessary.
- (ii) The Directives outline the fundamental principles governing radiation protection involving patients and the public. All medical exposures must be clinically justified and the need to keep such exposures as low as is reasonably achievable is emphasised. Strict limits on doses to workers and members of the public are laid down.

- (iii) Ionizing radiation used in medical procedures will have to be carried out under the responsibility of qualified doctors or dental practitioners who have acquired competence in radiation protection and have been trained in diagnostic radiology techniques.
- (iv) An inventory of all medical and dental radiological equipment will have to be carried out in each country and criteria of acceptability for such equipment set out, as in the attached Code of Practice. Equipment which no longer meets the criteria specified must be taken out of service or replaced.
- (v) All radiographic equipment which is in use will be kept under strict surveillance with regard to radiological protection and quality control of the appliance.
- (vi) Each Member State must take all necessary measures to ensure effective radiation protection.
- (vii) Certain working areas are defined for radiation protection purposes;

(a) controlled areas

“Any area in which doses are liable to exceed threetenths of the annual dose limits laid down for exposed workers shall constitute or be included in a controlled area.”

(b) supervised areas

“Any area which is not considered as a controlled area and in which doses are liable to exceed one-tenth of the annual dose limits laid down for exposed workers shall be considered as a supervised area.”

A “controlled area” is an “area subject to special rules for the purposes of protection against ionizing radiation and to which access is controlled”. If certain dose limits are exceeded or persons operate too close to the primary beam (see 6. x of the Code of Practice) then additional more stringent protection measures apply in such areas. A “supervised area” is “an area subject to appropriate supervision for the purpose of protection against ionizing radiation”. Dental surgeries generally fall into the category of “supervised” areas.