Te Kāwanatanga o Aotearoa
New Zealand Government

MINISTRY OF HEALTH
MANATŪ HAUORA

Code of Practice for Dental Radiology

ORS C4

2024

Issued 1 December 2024 **health.govt.nz**

Citation: Ministry of Health. 2024. *Code of Practice for Dental Radiology: ORS C4*. Wellington: Ministry of Health.

Published in December 2024 by the Ministry of Health
PO Box 5013, Wellington 6140, New Zealand

ISBN 978-1-991075-89-5 (online)
HP 9089

This document is available at health.govt.nz

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Introduction

Purpose and commencement

The Code of Practice for Dental Radiology (this code) is issued by the Director for Radiation Safety (the Director) under section 86 of the Radiation Safety Act 2016 (the Act). It specifies technical requirements necessary to comply with the fundamental requirements in sections 9 to 12 of the Act. The requirements in this code do not limit the general nature of the fundamental requirements.

This code comes into force on 1 December 2024.

This code replaces the Code of Practice for Dental Radiology which was issued on 28 June 2018 and revoked on 1 December 2024.

Scope

This code applies to all activities and practices associated with radiological equipment used for intraoral, panoramic and cephalometric dental procedures. Activities associated with cone beam computed tomography equipment are dealt with in the *Code of Practice for Diagnostic and Interventional Radiology: ORS C1*. Activities or practices can include manufacturing, possessing, controlling, managing, using, transporting, storing, exporting, importing, selling, supplying or disposing of a radiation source.

This code does not absolve the holder of a source licence from the obligation to comply with the fundamental requirements in sections 9 to 12 of the Act, which apply to every person who deals with a radiation source.

Compliance with this code does not imply compliance in related areas such as health practitioners' clinical competence, occupational safety, hazards in the workplace, resource management and transport of hazardous substances.

Interpretation

Defined terms are identified in **bold** and have the following meanings.

Accident — any **unintended medical exposure** or other unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of **protection and safety**.

Ancillary equipment — equipment other than **radiological equipment** or **protective equipment** that has an impact on the successful outcome of a **radiological procedure**, such as automatic film processors, image receptors, view boxes and equipment used for digital image display.

Carer and comforter — a person who voluntarily (rather than occupationally) helps in caring for, supporting and comforting a **patient** undergoing a **radiological procedure**.

Dental practitioner — a health practitioner with education and training in the dental uses of radiation who is competent to perform independently and oversee dental radiological procedures. This could be, for example, a dentist, dental specialist, dental therapist, dental hygienist or orthodontic auxiliary.

Diagnostic reference level — a level that is used to indicate whether, in routine conditions, the dose to the **patient** in a specified radiological procedure is unusually high or unusually low for that procedure. National diagnostic reference levels, if established, will be published for the purpose of comparison in a compliance guide issued under this code.

Director for Radiation Safety — a person appointed under section 76 of the Act to carry out the functions and duties and exercise the powers conferred or imposed by the Act, including the power to issue this code.

Dose limit — the value of **effective dose** or **equivalent dose** set out in Schedule 3 of the Act.

Effective dose — the tissue-weighted sum of **equivalent doses** in all specified tissues and organs of the body.

Employer — the legal entity that employs **workers**. A self-employed person is regarded as being both an **employer** and a **worker**.

Equivalent dose — the radiation-weighted **absorbed dose** in a tissue or organ of the body.

Ethics committee — a committee that approves programmes of biomedical research, including, in particular, the justification of medical exposure of volunteers.

Facility — any place where **radiological** and **ancillary equipment** is installed, used, handled or stored.

Health practitioner — defined in regulation 3 of the Radiation Safety Regulations 2016 as having 'the same meaning as in section 5(1) of the Health Practitioners Competence Assurance Act 2003': that is, a person who is, or is deemed to be, registered with an authority as a practitioner of a particular health profession.

Health screening programme — a programme for asymptomatic populations that is approved and justified by the Ministry of Health in conjunction with appropriate professional bodies).

Holder of a source licence —as in section 20 of the Act, the person responsible at all times for the management and control of each radiation source to which the licence applies.

In-room protective device — a device or equipment to reduce exposure to radiation but not worn by a person, such as ceiling-suspended protective screens, protective lead curtains, mobile shields and disposable protective drapes.

Justify — to determine that the expected benefits to individuals and society from introducing or continuing a practice outweigh the harm, including the radiation detriment, resulting from the practice. In respect of individual **radiological procedures**, this involves the weighing of expected benefits against the radiation detriment that might be caused with account taken of the benefits and risks of available alternative techniques that do not involve **medical exposure**. The words 'justifies', 'justified' and 'justification' have corresponding meanings.

Manufacturer/supplier — the person or organisation that designs, manufactures, produces, constructs, assembles, installs, distributes, sells, exports or imports radiological equipment or develops software that could influence the delivery of a medical exposure.

Medical exposure — exposure to ionising radiation experienced by **patients** for the purpose of dental diagnosis, by **carers and comforters** while caring for, supporting or comforting **patients** undergoing **radiological procedures**, and by **volunteers** in a programme of biomedical research.

Member of the public — for purposes of **protection and safety**, any individual in the population except when subject to **occupational exposure** or **medical exposure**.

Occupational exposure — as set out in section 5 of the Act, exposure to ionising radiation experienced by **workers** during the course of their work.

Optimise — to implement a level of **protection and safety** that results in the magnitude of individual doses, the number of individuals (**workers** and **members of the public**) subject to exposure and the likelihood of exposure being as low as reasonably achievable, after taking economic and social factors into account. For **medical exposures** of **patients** this requires the management of the radiation dose to the **patient** commensurate with the medical purpose. The words 'optimises', 'optimised' and 'optimisation' have corresponding meanings.

Overexposure of a person — when:

a) a **dose limit** has been exceeded

b) a person has received a dose and no dose was intended

c) the total **effective dose** to a **patient** (this includes any intended and necessary repeat components) is equal to, or greater than, 20 times the intended dose:

Patient — a person who is subject to **medical exposure** for their own medical benefit.

Person — includes a corporation sole, a body corporate and an unincorporated body (as defined in section 13 of the Legislation Act 2019) unless the context otherwise requires.

Personal protective equipment — equipment a person wears to reduce their exposure to radiation, such as protective aprons, organ shields, protective eyewear and protective gloves.

Place — as in section 5 of the Act, any dwelling, premises, vehicle, ship, craft or aircraft; a building or a structure; or part of a place.

Potential exposure — possible future exposure that may result from an anticipated operational occurrence or **accident** at a source or due to an event or sequence of events of a probabilistic nature, including equipment faults and operating errors.

Protection and safety — the protection of people against exposure to ionising radiation, and the safety of **radiological equipment**, including the means for achieving this, and the means for preventing **accidents** and for mitigating the consequences of **accidents** if they do occur.

Protective equipment — **personal protective equipment** and **in-room protective devices**.

Public exposure — exposure to ionising radiation that a **member of the public** experiences but excluding any **occupational exposure** or **medical exposure**.

Radiation safety officer — a person who is competent in radiation protection and safety and is designated by the holder of a source licence to oversee the application of regulatory requirements for radiation protection and safety.

Radiological equipment — equipment, including its associated software, used to produce X-rays.

Radiological procedure — a procedure involving the use of **radiological equipment** for intraoral, panoramic and cephalometric dental procedures.

Referring practitioner — a health practitioner who is approved by the holder of a source licence to refer individuals to a dental practitioner for a medical exposure.

Risk assessment — the process of systematically identifying, estimating, analysing and evaluating risk for the purpose of informing priorities, developing, or comparing courses of action, and informing decision-making.

Servicing engineer — a person who has expertise in installing, servicing and maintaining radiological equipment.

Unintended medical exposure —exposure of the wrong individual, tissue or organ; exposure that is substantially greater than intended; inadvertent exposure of an embryo or fetus; failure of **radiological equipment**, software or systems; or error, mishap or other unusual occurrence with the potential for subjecting the **patient** or a

volunteer in biomedical research to a **medical exposure** that is substantially different from what was intended.

Volunteer — an individual other than a **carer and comforter** who may be subjected to **medical exposure** as part of a programme of medical or dental research. .

Worker — an individual who works, full time, part time or temporarily, for the holder of a source licence or another **employer** and who has recognised rights and duties in relation to occupational radiation protection. A self-employed person is regarded as being both an employer and a worker.

The holder of a source licence

General

1. Section 20(1) of the Act states that 'The holder of a source licence is responsible at all times for the management and control of each radiation source to which the licence applies.' Therefore, the holder of a source licence must take prime responsibility for protection and safety of each radiation source. The holder of a source licence must:

   (a) establish a management system to enhance protection and safety that:

      (i) effectively integrates protection and safety into the overall management system of the organisation

      (ii) makes a commitment to protection and safety from the highest level of management at the facility and provides all required resources

      (iii) includes procedures to promote continuous improvement and a safety culture

      (iv) ensures that a dental practitioner has the role of planning and delivering medical exposures

      (v) ensures that an appointed radiation safety officer or other suitably qualified people have delegated roles and tasks as appropriate

      (vi) requires consulting with and engaging the services of experts and other interested parties as necessary

      (vii) maintains and enforces procedures and local rules as appropriate

   (b) carry out and maintain a risk assessment for each radiation source and all aspects of a practice that are relevant to protection and safety. The risk assessment is for the purpose of ensuring the adequacy of the protection and safety provisions

   (c) appoint a radiation safety officer who has the training required in clause 4(a)

   (d) for all roles under clause sub-clauses (iv) and (v) of 1(a):

      (i) fully document the roles

      (ii) ensure that people are notified of their duties in relation to protection and safety and that they carry out those duties

   (e) ensure that all activities associated with radiological equipment are justified and optimised for protection and safety

(f) apply the requirements set out in Schedule 3 of the Act and ensure that any radiation exposure that results from planned operations or activities does not exceed applicable dose limits. This sub-clause relates to the requirements of section 9(3) of the Act, which states that 'a person who deals with a radiation source must ensure that any ionising radiation exposure that results from a planned operation or activity does not exceed the applicable dose limits set out in Schedule 3'.

Facilities

2. The holder of a source licence must:

(a) provide facilities that:

(i) are sited, located, designed, manufactured, constructed, assembled, commissioned, operated, maintained and decommissioned in accordance with good engineering practice, and minimise the need to rely on administrative controls and personal protective equipment for protection and safety

(ii) enable the person conducting a radiological procedure that uses fixed units to perform duties either (A) further than 2 metres from the X-ray tube head and the patient or (B) behind shielding equivalent to at least 18-millimetre gypsum plasterboard

(iii) enable the person conducting a radiological procedure to clearly observe and communicate with the patient at all times during the radiological procedure

(iv) provide ways for properly displaying and interpreting radiographs and, if film radiography is performed, for properly processing films

(v) if cephalometry is performed with an image receptor that does not fully intercept the primary X-ray beam, are shielded with at least 2-millimetre lead equivalence to intercept the beam before it reaches regularly occupied areas to which the dental practitioner does not control access

(b) verify and document the adequacy of the structural shielding of facilities before:

(i) the facility is used for clinical purposes

(ii) the intended use of a room or space changes

(iii) radiological equipment is upgraded

(iv) underlying procedures change or patient workload changes

(v) surrounding room occupancy or access to space is altered.

Equipment

3. The holder of a source licence must:

   (a) provide, maintain, test and regularly service radiological equipment, protective equipment and ancillary equipment so that it:

      (i) is fit for its intended purpose

      (ii) fulfils its design requirements for protection, safety and optimisation

      (iii) meets the requirements in Appendix 1 of this code.

   (b) ensure that a servicing engineer measures the physical parameters of radiological equipment, including calibration of output in terms of appropriate quantities using internationally accepted protocols, and generating diagnostic reference levels on all of the following occasions:

      (i) at the time of commissioning equipment and before using it clinically

      (ii) periodically after that commission, but at least every three years

      (iii) after any maintenance that could affect protection and safety

      (iv) after installing any new software or modifying any existing software that could affect protection and safety

   (c) maintain a record of maintenance for each item of radiological equipment, including a log of faults and remedial actions taken (interim and subsequent repairs), the results of testing before reintroducing an item to clinical use and any reports from servicing engineers

   (d) maintain an accurate inventory of all radiological equipment, including its location, details and unique identifying information

   (e) take all reasonable steps to prevent damage or unauthorised access to or loss of radiological equipment

   (f) transfer management and control of radiological equipment only to people who are authorised to assume management and control under the Act

   (g) dispose of radiological equipment only if:

      (i) the equipment has been rendered permanently inoperative

      (ii) all radiation warning signs have been removed.

Training and authorisation

4. The holder of a source licence must ensure that all people with roles for protection and safety are:

   (a) qualified, educated and trained in protection and safety so that they understand their duties and can perform them competently. This includes ensuring that a radiation safety officer has training that meets that specified in Appendix 2 of this code. A health practitioner registered with the Dental

Council in a vocational scope of practice that is set out in Schedule 3 of the Radiation Safety Regulations 2016 does not necessarily need to undergo additional training to satisfy the requirements of this clause

(b) named in a current list with details of their qualifications, education and training

(c) authorised to assume their roles and responsibilities.

Radiological procedures

5. The holder of a source licence must prevent:

   (a) anyone from conducting radiological procedures for any purpose other than dental diagnosis

   (b) radiological equipment designed for intraoral procedures from being used for cephalometry

   (c) the use of handheld portable radiological equipment without a stand unless it is impractical or medically unacceptable to do so.

6. For each radiological procedure, the holder of a source licence must ensure that:

   (a) sufficient personnel are available to successfully perform the procedure

   (b) patients are subject to a medical exposure only if:

      (i) the procedure has been requested by a referring practitioner and information on the clinical context has been provided, or it is part of a health screening programme

      (ii) the procedure has been justified by the dental practitioner in consultation as appropriate with the referring practitioner, or it is part of a health screening programme

      (iii) the patient or the patient's legal representative has been informed of the expected diagnostic benefits as well as the risks

   (c) volunteers are subject to medical exposure only if:

      (i) the medical exposure has been approved by an ethics committee

      (ii) dose constraints and other conditions imposed by the ethics committee are satisfied

   (d) carers and comforters are subject to medical exposure only if they have received, and indicated they understand, relevant information on radiation protection and risks

   (e) for occupational and public exposures, the radiological procedure is expected to give benefits to the individuals who undergo the procedure and

to society that outweigh the harm resulting from the procedure. This must be done in consultation with the dental practitioner.

Accident prevention and mitigation

7. Section 20(3) of the Act sets out what the holder of a source licence must do if they believe an incident has occurred that has resulted in a overexposure of a person to radiation. As well as complying with those requirements, the holder of a source licence must:

   (a) take all practicable steps to minimise the likelihood of accidents by implementing a multilevel system of sequential, independent provisions for protection and safety that is commensurate with the likelihood and magnitude of potential exposures

   (b) take immediate action to mitigate the consequences of any accident that does occur

   (c) promptly investigate any accident, including by:

      (i) calculating or estimating the doses a person has received and, if applicable, the dose distribution within them

      (ii) identifying corrective actions required to prevent a recurrence of the incident

      (iii) implement all corrective actions identified in clause 7(c)(ii)

   (d) keep a written record of the accident, noting the:

      (i) cause

      (ii) calculations made under clause 7(c)(i)

      (iii) corrective actions identified under clause 7(c)(ii)

      (iv) details of corrective actions implemented under clause 7(c)(iii)

   (e) as soon as practicable notify the Director if the accident either:

      (i) results in a significant unintended or accidental exposure, or

      (ii) is caused by equipment failure.

Records

8. Section 35(1)(a) of the Act states that 'a person who has management or control of a radiation source must keep records that contain sufficient information to enable the Director to ascertain whether the person is complying with the radiation safety requirements'. To meet this requirement, the holder of a source licence must maintain records that verify compliance with this code and retain those records for no less than six years.

Dental practitioner

General

9. The dental practitioner must:
   (a) direct the planning and delivery of medical exposures
   (b) only use radiological equipment that is fit for its purpose, the most appropriate available and designed for its purpose
   (c) stop using equipment if it has a fault that reduces protection and safety
   (d) report any faults or other irregularities to the holder of a source licence
   (e) comply with local rules and protocols
   (f) report accidents to the holder of a source licence.

Justification

10. Before starting a radiological procedure, the dental practitioner must, in consultation as appropriate with the referring practitioner, justify the medical exposure for the individual involved considering, in particular for paediatric or possibly pregnant patients:
   (a) the appropriateness of the request
   (b) the urgency of the radiological procedure
   (c) the characteristics of the medical exposure
   (d) the characteristics of the individual patient
   (e) relevant information from the patient's previous radiological procedures and clinical history
   (f) relevant national or international referral guidelines.

11. Clause 10 does not apply to radiological procedures that an ethics committee has justified or that are part of an approved health screening programme.

12. If the procedure involves an asymptomatic individual for early detection of disease (but not as part of an approved health screening programme), the dental practitioner must, in addition to satisfying the justification requirements above:
   (a) justify the procedure for that individual in accordance with guidelines of relevant professional bodies
   (b) in advance of the procedure, inform the individual or the individual's legal guardian of the expected benefits, risks and limitations of the procedure.

13. For any radiological procedure involving a carer and comforter, the dental practitioner must:

    (a) fully inform the carer and comforter of the radiation risks and check that the carer and comforter understands

    (b) ensure no part of the carer and comforter is exposed to the primary X-ray beam

    (c) ensure that a carer and comforter wears a lead apron.

Optimisation of protection and safety

14. To ensure that the operational aspects of optimisation of protection and safety for patients undergoing radiological procedures are in place, the dental practitioner must:

    (a) select radiological equipment that is fit for its purpose, the most appropriate available and designed for its purpose

    (b) correctly identify the patient and the procedure

    (c) strictly limit patient exposure to the area of clinical interest by collimating the beam and, for intraoral radiography, by positioning the end of the cone as close as possible to the patient's skin, and shielding radiosensitive organs that may be exposed when appropriate

    (d) minimise the need for repeat procedures

    (e) adopt equipment settings and features for the procedure that the holder of a source licence has set or, if the holder of a source licence has set no such requirements, apply settings and features that keep the dose to the patient as low as reasonably achievable to get the desired diagnostic information that the procedure was undertaken to obtain

    (f) optimise the processing and display of images.

15. To keep doses arising from occupational exposure as low as reasonably achievable, the dental practitioner must:

    (a) establish a controlled area no less than 2 metres from the patient and the tube head during radiological procedures involving fixed units

    (b) restrict access to the controlled area to only those who need to be there

    (c) ask a worker to act as a carer and comforter only where needed

    (d) ensure that no worker is exposed to the primary radiation beam

    (e) ensure that no worker holds the tube head (except for procedures using handheld intraoral radiological equipment) or image receptor during the exposure

(f) use protective equipment if a worker must be within 2 metres of the patient and is not adequately shielded by a barrier

(g) maintain barriers and shielded doors in a closed or protected position during exposures.

16. The dental practitioner must keep doses arising from public exposure as low as reasonably achievable by preventing members of the public from entering controlled areas during a radiological procedure unless they need to be present as a carer and comforter.

Other parties

Manufacturer/supplier

17. The manufacturer/supplier of radiological equipment must:

    (a) supply well-designed, well-manufactured and well-constructed radiological equipment that:

        (i) provides for protection and safety in line with the requirements of this code

        (ii) meets engineering, performance and functional specifications

        (iii) meets quality standards appropriate to the significance of systems and components, including software, for protection and safety

        (iv) provides clear displays, gauges and instructions on operating consoles in appropriate languages

    (b) provide information in appropriate languages on how to properly install and use the radiological equipment and on its associated radiation risks, including performance specifications, instructions for operating and maintenance, and instructions for protection and safety

    (c) supply all radiological equipment with all appropriate radiation protection tools as a default, rather than as optional extras.

18. The manufacturer/supplier must make suitable arrangements with the holder of the source licence to share information on use and operating experience that may be important for protection and safety.

Servicing engineer

19. The servicing engineer must:

    (a) install and service radiological equipment competently so that it complies with the requirements in clause 3

    (b) for newly installed, serviced or modified radiological equipment, ensure that the setting of the image receptor sensitivity matches the sensitivity of the image receptor being used, and compare diagnostic reference levels with national levels, if any, or appropriate international levels

    (c) ensure that radiological equipment fitted with an object programmed exposure control is adjusted to match the speed of the image receptor in use

(d) ensure that all dosemeters used for dosimetry of patients and to measure the physical parameters of radiological equipment are calibrated at least every two years and that such calibrations are traceable to a standards dosimetry laboratory

(e) cooperate with the holder of a source licence to ensure that radiological equipment cannot be used clinically while it is being installed or serviced

(f) collaborate with the holder of a source licence after installation or servicing to ensure necessary quality control tests are completed successfully and confirming that all radiation protection and safety features are in place and operating correctly before equipment is returned to clinical use

(g) after installing or servicing equipment, provide a written report to the holder of a source licence that:

  (i) clearly identifies the equipment

  (ii) describes the equipment fault (if any), work done, parts replaced, adjustments made and any changes that may affect protection and safety

  (iii) certifies that the radiological equipment complies with the relevant requirements in clause 3

  (iv) for installation of new equipment, certifies that the installation enables the facilities to comply with clause 2(a)

  (v) certifies that all radiation protection and safety features are in place and operating correctly.

Appendix 1:
Equipment

Part 1: Radiological equipment

General

These requirements apply to all radiological equipment used for intraoral, panoramic and cephalometric dental radiography. The radiological equipment must have:

1. hardware and software controls that minimise the likelihood of unintended or accidental medical exposures
2. devices that automatically terminate the irradiation after a pre-set time, tube current–exposure time product or dose to the automatic exposure control detector, or when the 'dead man' hand switch is released
3. radiation beam control mechanisms, including devices that indicate clearly (visually and/or audibly) and in a fail-safe manner when the beam is 'on'
4. when pre-set protocols are provided, technique factors that adequately trained personnel can readily access and modify
5. operating parameters for radiation generators, such as the generating tube potential, filtration, focal spot position and size, source-image receptor distance, field size indication and either tube current and time or their product, that are clearly and accurately shown
6. total filtration in the incident primary X-ray beam greater than 1.5-millimetre aluminium equivalence for equipment designed to be operated at tube potentials up to and including 70 peak kilovoltage (kVp), and greater than 2.5-millimetre aluminium equivalence above 70 kVp
7. leakage radiation that is less than 1 milligray per hour at every rating specified by the manufacturer for that tube in that housing when measured at 1 metre from the focus of the X-ray tube
8. X-ray tube output coefficient of variation less than 0.1 for five or more consecutive exposures at the same setting
9. for radiological equipment where the exposure time can be selected, X-ray tube output that is linear within 10% between two exposure time settings that do not differ by more than a factor of four, with peak kilovoltage and milliamperage kept constant.

Intraoral radiography

These requirements apply to all radiological equipment used in intraoral radiography. The radiological equipment must have:

1. a minimum tube potential of 60 kVp
2. radiation output sufficient to obtain radiographs with exposure times of one second or less
3. an open-ended collimator providing a focus-to-skin distance of at least 20 centimetres and a field size at the collimator end of no more than 4 centimetres by 5 centimetres if rectangular, or 6 centimetres in diameter if cylindrical
4. for fixed intraoral units, manoeuvrability at short focal distances around the head of the patient, and the tube head supported so that it remains stationary when positioned for radiography
5. for handheld portable units, an integral backscatter shield protecting the operator's entire body
6. for handheld portable units, a durable label in a prominent position with wording to the following effect: 'Danger — equipment produces X-rays when energised.'

Cephalometric radiography

These requirements apply to all radiological equipment used for cephalometric radiography. The radiological equipment must have:

1. devices to precisely align the patient, image receptor and X-ray field
2. limitation of field size to the dimensions of the image receptor
3. the field size at each focus-to-image distance for which it is used marked on the housing.

Panoramic radiography

These requirements apply to all radiological equipment used for panoramic radiography. The radiological equipment must have:

1. a permanent primary barrier equivalent to 2 millimetres of lead or more
2. the capability to select suitable exposure protocols for different sized patients, including paediatric patients
3. the ability to limit the field size to:
   (a) the dimensions of the receptor slit (if present) and the image receptor
   (b) the area required for diagnosis, by means of programmed field size trimming and 'child-imaging mode'.

Part 2: Ancillary equipment

These requirements apply to all ancillary equipment used for dental radiography. The ancillary equipment must:

1. produce digital images that are free of visual artefacts produced from ghosting of previous images or the loss of visually detectable pixels or any artefact that could be reasonably misinterpreted as a clinical feature
2. to the extent practicable, use E or F speed intraoral imaging films
3. to the extent practicable, use the fastest combination of film speed and cassette screens
4. comprise intensifying screens, digital receptors and cassettes that are maintained in clean condition, free of blemishes and monitored by regular quality control checks
5. for digital imaging, ensure a means of displaying images at a diagnostic quality, including at a relevant resolution and contrast.

Appendix 2:
Training requirements for radiation safety officers

The following table sets out the levels of knowledge a radiation safety officer must have on specified topics. In the 'Level of knowledge' column, '1' indicates a general awareness and understanding of the topic and '2' indicates an ability to use radiation safety knowledge to assess situations, predict outcomes and apply plans or actions based on those assessments and predictions

Subject area	Level of knowledge
X-ray production, interaction and detection	
X-ray production and interaction of X-rays with matter (to include attenuation and scatter)	1
Methods of detecting X-rays	1
Radiation effects, risks, dose units and typical doses	
Biological effects of radiation	1
Risks of stochastic effects (including from fetal and paediatric exposures)	2
Causes and consequences of deterministic effects (also referred to as harmful tissue reactions)	1
Risk and benefits of radiation exposures	2
Radiation quantities and units (absorbed dose, equivalent dose and effective dose)	2
Factors affecting radiation dose	1
Typical doses from dental diagnostic procedures (including diagnostic reference levels)	2
Safety of irradiating apparatus used in dental radiology and protection	
Physical characteristics	2
Time, distance and shielding	2
Specific hazards, including factors affecting radiation doses (where applicable to include handheld portable irradiating apparatus for intraoral dental radiological procedures)	2
Regulatory requirements	
The radiation safety requirements as interpreted in the Radiation Safety Act 2016	2
Radiation protection of patients, carers and comforters, and volunteers in biomedical research	2
Radiation protection of workers and the public (including individual dose monitoring for the assessment of occupational exposure)	2
Quality control and quality assurance applied to dental radiology	2