Ionising Radiations Regulations 1999

- Came into force on 1st January 2000
- Replace the Ionising Radiations Regulations 1985

Essential legal requirements

- Notification - HSE
- Prior risk assessment
- Restriction of exposure (Limitation)
- Maintenance of equipment
- Contingency plans
- Radiation Protection Adviser (RPA)
- Information, instruction and training of all staff
- Designation of 'controlled area'
- Local Rules
- Radiation Protection Supervisor
- Quality assurance programme
- Duties of employees

Dose limits

	Old	New
Classified workers	50 mSv	20 mSv
Non-classified workers	15 mSv	6 mSv
General public	5 mSv	1 mSv

Ionising Radiation (Medical Exposure) Regulations 2000

- Came into force on 13th May 2000
- Replace the Ionising (Protection of Persons Undergoing Medical Examination or Treatment) Regulations 1988

Essential legal requirements

- Duties of Practitioner, Operator and Referrer
- Justification of all medical exposures
- All doses kept as low as reasonably practicable (Optimisation)
- 'Written procedures' for medical exposures
- Clinical audit
- Equipment inventory
- Operators and Practitioners MUST have received adequate training
- Operators and Practitioners MUST undertake continuing education

Defines new positions of responsibility:

- The Employer (Legal Person)
- The Referrer
- The Practitioner
- The Operator

The Employer (Legal Person)

Who? Person or body corporate with natural or legal responsibility for a radiological installation

Role? Responsible for providing the overall safety and radiation protection framework and for ensuring that staff and procedures conform with the regulations

The Referrer

Who? A medical, dental or other health professional entitled to refer a patient to a *practitioner* for a medical exposure

Role? Responsible for supplying the *practitioner* with sufficient information to justify an appropriate exposure

The Practitioner

Who? Medical, dental or other health professional entitled take responsibility for a medical exposure

Role? *Adequately trained* to take decisions and responsibility for medical exposures
Must justify an exposure on grounds of
Specific objectives of the exposure
Total potential benefit to the patient
Anticipated detriment to the patient
Efficacy, benefits and risks of alternative techniques

The Operator

Who? A person conducting any practical aspect of a medical exposure including exposing the radiograph and processing the film

Role? Must be *adequately trained* for the role played in the exposure

Practitioner Adequate Training

Undergraduate degree conforming to the requirements for the undergraduate dental curriculum in dental radiology and imaging as specified by GDC. Also to conform with the *Core Curriculum in dental radiography and radiology* as specified by the BSDMFR in 2008.

Operator Adequate Training

1. Operators involved in radiographing patients
   - Dentists - practitioner training
   - Dental nurses - possess Certificate in Dental Radiography
   - Dental hygienists/therapists - equivalent training to nurses

2. Operators involved in processing/QA
   - Dental nurses and other DCPs should possess the Certificate in Dental Nursing or have received adequate and documented training specific to the tasks that they undertake

Continued Professional Development

- CPD mandatory for all *practitioners* and *operators* involved in radiographing patients
- Within the GDC CPD cycle, it is recommended that dental *practitioners* should carry out 5 hours verifiable CPD in radiography and radiation protection.
- *Operators* should attend a continuing education course every 5 years

Practitioner Courses:

- Principles of radiation physics
- Risks of ionising radiation
- Radiation doses in dental radiography
- Factors affecting doses in dental radiography
- Principles of radiation protection
- Statutory requirements
- Selection criteria
- Quality assurance

Operator Courses:

- Principles of radiation physics
- Risks of ionising radiation doses in dental radiography
- Radiation doses in dental radiography
- Factors affecting dose in dental radiography
- Principles of radiation protection
- Statutory requirements
- Quality assurance

'Radiation Protection File' contents:

- Local Rules - as required under IRR99
- 'Written procedures' - as required under IR(ME)R2000

Local Rules (as required under IRR99)

- Name of RPS
- Identification and description of 'controlled area'
- Summary of working instructions
- Contingency arrangements
- Dose investigation level
- Name of 'legal person'
- Name and contact details of RPA
- Arrangements for personal dosimetry
- Arrangements for pregnant staff

'Written procedures' (as required under IR(ME)R2000)

- Identification of patients
- Identification of referrer, practitioner, operators
- Identification of pregnant patients
- QA programmes
- Assessment of patient dose
- Use of diagnostic reference levels
- Authorisation and justification of all exposures
- Clinical evaluation of the outcome of all exposures
- Referral criteria
- Protocols (guideline exposure settings) for all projections

NOTES ON RADIOGRAPHY AND RADIOLOGY IN RELATION TO DENTISTRY

X-RAY SET VARIABLES

1. Kilovoltage (kV, kVp)

kV refers to the potential difference applied across an x-ray tube and determines the speed at which electrons travel across the x-ray tube and impact on the tungsten target.
Traditional x-ray sets work at around 50kV, but most modern x-ray sets now produce a 65-70kV potential difference across the tube.
This determines the energy of the x-ray photons produced at the target, which in turn determines the penetrating power or *quality* of the x-ray beam.

2. Milliamperage (mA)
mA refers to the current flowing through the x-ray tube. Most dental sets operate between 7 – 12 mA. The current determines the number of electrons flowing from the filament to the target which in turn determines the nu ber or *quantity* of x-ray photons in the beam.

3. Time (secs)
The length of time of the exposure also determines the number or *quantity* of x-ray photons in the beam.

KV essentially controls CONTRAST
Lower kV x-ray tubes create images with greater contrast (the visible difference between the dark soft tissues and the paler bones & teeth).
Higher kV tubes produce x-ray beams which penetrate bone & teeth better, causing these tissues to appear slightly darker on film, and showing less contrast with the darker soft tissues. kV is inversely proportional to radiographic contrast

mA and time together (mAs) essentially control DEGREE OF BLACKENING
An over-exposed film is too black, while an under-exposed film is too pale.

INTERACTIONS OF X-RAYS WITH MATTER

1. Pure Absorption
2. Absorption & Scatter
(3. Pure Scatter)
4. Transmitted unchanged

Energy absorbed from the x-ray beam by the tissues may lead to harm.

MECHANISMS OF TISSUE DAMAGE

X-rays cause damage by ionisation. Mechanisms for harm m include:

1. Direct damage to DNA or RNA
This may lead to (a) Cell death
(b) Abnormal replication
(c) Failure of transfer of information

If SOMATIC cells are affected → radiation induced malignancy
If GENETIC cells are affected → congenital abnormality

2. Indirect damage
Ionisation of water may occur with the release of free adicals;

(a) $H_20 \rightarrow H_20^+ + e^-$
$H_20^+ \rightarrow H^+ +$ OH (free radical)

(b) $H_20 + e^- \rightarrow H_20^-$
$H_20^- \rightarrow$ H (free radical) + OH^-

(c) $H + H \rightarrow H_2$ (Hydrogen gas)
$OH + OH \rightarrow H_2O_2$ (Hydrogen peroxide)
Release of H_2 and H_2O_2 → tissue damage

CLASSIFICATION OF RADIATION-INDUCED HARM

1.Somatic Deterministic (Certainty Effects)
(a) Early
- Mucositis
- Radiation sickness 2-10 Sv whole body irradiation
- Death >10 Sv whole body irradiation

(b) Late
- Cataracts
- Sterility
- Obliterative endarteritis

The severity of these effects is proportional to the a nt of radiation received.
These effects are usually associated with high levels of radiation exposure and each has a THRESHOLD beneath which this effect will not occur. Ra ection measures are designed to limit diagnostic radiation exposure so that these effects are prevented.

2. Somatic Stochastic Effects (cancer development)
Radiation induced malignancies
These events are governed by the rules of probability - every exposure to radiation MAY induce a malignancy, but when exposed to low levels of radiation the chance of

this occurring is very small. There is NO THRESHOLD beneath which a malignancy will definitely not occur. There is no link between the amount of radiation received and the severity of the harm caused, only the likelihood of causing harm.
(Somatic tissues = cells within the body of the patient irradiated other than the cells of the reproductive organs.)

3. Genetic Stochastic Effects (Heritable disease)
These effects refer to the chance of inducing a congenital abnormality within the future offspring of the patient undergoing examination through irradiation of their reproductive organs.

RISKS FROM DENTAL RADIOGRAPHY

Dental radiography uses very low levels of radiation. There is however a small chance of
(a) a somatic stochastic effect (an induced malignancy)
(b) a genetic stochastic effect (an induced congenital abnormality)

Risks of inducing a fatal malignancy from radiographic xaminations:

X-ray examination	Estimated risk of fatal cancer
Dental intra-oral	1 in 10 000 000
Panoramic	1 in 1 000 000
Cephalometric radiograph	1 in 10 000 000 – 1 in 3 500 000
Chest	1 in 1 000 000
MSCT chest	1 in 1400- 1 in 700

Risk of inducing a congenital abnormality = 1 every 3 ears within the UK given current levels of radiography

INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION'S (ICRP) GENERAL PRINCIPLES OF DOSE LIMITATION

1.No practice shall be adopted unless its introduction produces a net positive benefit JUSTIFICATION

2.All exposures shall be kept As Low As Reasonably Achievable (ALARA), taking social and economic factors into account - OPTIMISATION

3.The dose equivalent to individuals shall not exceed limits recommended by the Commission - LIMITATION

RECOMMENDED PHYSICAL METHODS OF DOSE LIMITATION

Intra-oral Radiography:
- Dental x-ray machines; 60-70kV
  DC generators
  200mm open-ended 'long' spacer cone
- Rectangular collimation
- Film holders incorporating beam-aiming devices
- F speed film

Extra-oral Radiography:
- Constant potential generators
- Effective patient positioning aids
- Rare earth intensifying screens
- Use of field limitation techniques

- Efficient processing to minimise errors
- Quality Assurance programme in place to regulate all aspects of radiography

DOSE UNITS AND DOSIMETRY

1. Radiation Absorbed Dose (D)

Measure of amount of energy absorbed from x-ray beam by soft tissues.
Measured in joules / kg of soft tissues

SI unit = Gray (Gy)

2. Equivalent Dose (H))

A measure of radiation dose that takes into account the radiobiological effectiveness or ability to do damage of different types of radiation. Each type of radiation is allocated a different *radiation weighting factor* W_R, examples include:

X-rays, gamma rays	$W_R = 1$
Protons	$W_R=2$
Alpha particles	$W_R = 20$

Radiation weighted dose (H) = Radiation Absorbed Dose(D) x W_R

SI unit = Sievert (Sv)

3. Effective Dose(E)

A measure which allows doses from investigations of different parts of the body to be compared, by converting all doses into an equivalent whole body dose. The most radiosensitive organs and tissues in the body are given *tissue weighting factors*, W_T. When an exposure involves one of these tissues the Radiation Weighted Dose (H) is multiplied by the appropriate tissue weighting factor (W_T) to give an effective dose. This

dose can be used to compare with doses from other investigations of other parts of the body. Some examples of tissue weighting factors set by ICRP (publication 103) include:

Red Bone Marrow, breast, colon, Lung, stomach	W_T=0.12 each
Gonads	W_T=0.08
Thyroid, Bladder, Oesophagus, Liver	W_T=0.04 each
Salivary glands Bone Surface, Brain, Skin	W_T=0.01
Remainder Tissues (14 named tissues including the oral ucosa)	W_T=0.12 total
TOTAL	1.00

Effective Dose (E) = Radiation Weighted Dose (H) x SW_T

SI unit = Sievert (Sv)

TYPICAL DOSES FROM VIEWS USED IN DENTAL RADIOGRAPHY

Intraoral film	= 0.3-22µSv (best practice 2 µSv)
Panoramic radiograph	= 2.7-38µSv (most around 20 µSv)
Cephalometric radiograph	= 2.2-5.6 µSv
Chest	= 18 µSv
MSCT chest	= 14-28mSv

Natural Background radiation = 2.2 mSv annually

A 'best practice' periapical is equivalent to 8 hours of natural background radiation

A modern panoramic film is equivalent to 3 days of natural background radiation, or to the extra radiation received from cosmic sources during a return flight to Spain.

DOSE LIMITATION

1. Patients
There are no formal dose limits for patients receiving radiographs as part of the diagnosis and treatment of their condition. The guidance from the ICRP detailed earlier applies.

2. Occupationally exposed workers
These may be divided into;
(a) Classified workers
(b) Non-classified workers

3. General public
Dentists are categorised as non-classified workers since they work with low levels of radiation exposure. Their annual dose limit is 6mSv, 3/10 of that of classified workers

limit of 20mSv. Personal monitoring is not compulsory for non-classified workers, although it is recommended to establish that dose limits are not being exceeded. Annual health checks are not required.

ANNUAL DOSE LIMITS

	Classified Workers	Non-Classified Workers	Any Other Persons
Old Whole Body Dose Limits	50mSv	15mSv	5mSv
New Whole Body Dose Limits	20mSv	6mSv	1mSv

SELECTION CRITERIA

'Descriptions of clinical conditions derived from patient signs, symptoms and history that identify patients who are likely to benefit from particular radiographic technique.'

SUMMARY OF RECOMMENDATIONS

'Guidelines are NOT a rigid constraint on clinical practice, but a concept of good practice against the needs of the individual patient can be considered'

Levels of evidence supporting recommendations.

	Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendations.
	Requires availability of well-conducted clinical studies but no randomised clinical trials on the topic of recommendation.
	Requires evidence obtained from expert committee reports or opinions an/or clinical experiences of respected authorities. Indicates absence of directly applicable clinical studies of good quality.

Panoramic radiography

All patients must have a history taken and must be exa ed clinically prior to panoramic radiography.
Where radiographs are clinically indicated, intra-oral radiographs should be considered first because of better detail and lower radiation dose.

Suggested Selection Criteria for panoramic radiology

- Where a bony lesion or unerupted tooth cannot be demonstrated on intraoral radiographs
- In a patient with a neglected dentition where clinically there are multiple carious teeth and there is a concurrent generalised periodontal disease
- As part of an orthodontic assessment where there is a inical need to know the state of the dentition and the presence or absence of unerupted teeth
- In the assessment of third molars prior to surgical extraction

Caries Diagnosis

Caries risk factors

- Social history
- Medical history
- Dietary habits
- Use of fluoride
- Plaque control
- Saliva
- Clinical evidence

Individuals categorised as high, moderate or low risk according to risk factors.

Children

- It is recommended that all children designated as high caries risk have six-monthly posterior bitewing radiographs taken until no or active lesions are apparent and the individual has entered another risk category

- It is recommended that all children designated as moderate caries risk have annual posterior bitewing radiographs taken until no new or active lesions are apparent and the individual has entered another risk category

- It is recommended that all children designated as low caries risk have posterior bitewing radiographs taken at approximately 12 to 18 month intervals in the primary dentition, and at approximately two-year intervals in the permanent dentition. More extended radiographic recall intervals may be employed if there is explicit evidence of continuing low caries risk.

Adults

- It is recommended that all adults designated as high caries risk have six-monthly posterior bitewing radiographs taken until no new or active lesions are apparent and the individual has entered another risk category
- It is recommended that all adults designated as moderate caries risk have annual posterior bitewing radiographs taken until no new or active lesions are apparent and the individual has entered another risk category
- It is recommended that all adults designated as low caries risk have posterior bitewing radiographs taken at approximately two-year intervals. More extended radiographic recall intervals may be employed if there is explicit evidence o continuing low caries risk.

Radiographs in Periodontal Assessment

- If a patient has uniform pocketing <6mm and little or recession- horizontal bitewing radiographs are recommended
- If a patient has pocketing >6mm-vertical bitewings are recommended, supplemented by intraoral periapical views using the paralleling technique at sites where alveolar bone image is not included
- If a patient has irregular pocketing, bitewing radiographs (horizontal or vertical depending on pocket depth), supplemented if necessary
  taken using the paralleling technique are recommended
- An intraoral radiograph using a paralleling technique indicated if a periodontal/endodontic lesion is suspected
- A panoramic radiograph of optimal quality may offer a dose advantage over large numbers of intraoral radiographs and may be considered as an alternative if available. This maybe the case when there are concurrent problems for which radiography is indicted e.g. symptomatic third molars, multiple existing crowns/heavily restored and/or multiple endodontically treated teeth in a patient new to the practice. However, in view of the l tations in fine detail on panoramic radiographs taken on older machines, supplementary intraoral radiographs may be necessary for selected sites

Radiographs in Endodontics

- A good quality, pre-operative radiograph will reveal possible complicating factors, and therefore a radiograph will be an essential aid to treatment planning.

- At least one good quality radiograph is necessary to determine working length(s)
- If there is any doubt about the integrity of the apical constriction, a further radiograph should be taken to confirm that the master nes are at the correct length within the canals before final condensation is carried out

- At least one post-operative radiograph is necessary to assess the success of the obturation and to act as a baseline for assessment of apical pathology or healing
- A further follow-up radiographs should be taken at one year after completion of treatment, even for asymptomatic teeth. Large periapical radiolucencies should be monitored more frequently.

RADIOGRAPHIC IMAGE QUALITY AND QUALITY ASSURANCE

PRACTICAL FACTORS INFLUENCING IMAGE QUALITY

These include:

- The X-ray equipment
- The image receptor - film or film/screen combination
- Processing
- The patient
- The operator and radiographic technique

QUALITY ASSURANCE IN DENTAL RADIOLOGY

The World Health Organisation has defined radiographic quality assurance (QA) programmes as '...an organised effort by the staff operating a facility to ensure that the diagnostic images produced by the facility are of high quality so that they consistently provide adequate diagnostic information at the lowest possible cost and with the least possible exposure of the patient to radiation'.

TERMINOLOGY

The main terms in quality procedures include:

- *Quality control* - the specific measures for ensuring and verifying the quality of the radiographs produced
- *Quality assurance* - the arrangements to ensure that the quality control procedures are effective and that they lead to relevant change and improvement
- *Quality audit* - the process of external reassurance and assessment that quality control and quality assurance mechanisms are satisfactory and that they work effectively

QUALITY ASSURANCE PROGRAMME

A basic principle of quality assurance is that, within the overall QA programme, all necessary procedures should be laid down in writing and in particular:

- Implementation must be the responsibility of a named person
- Frequency of implementation must be defined
- The content of the essential supporting records must be defined
- The frequency for formal audits of these records must be defined

AIMS OF QA PROGRAMMES AND QUALITY CONTROLS

- To produce diagnostic radiographs of consistently high standard
- To reduce the number of repeat radiographs
- To determine all sources of error to allow their correction
- To increase efficiency
- To reduce costs
- To reduce the radiation dose to patients and staff

QUALITY CONTROL MEASURES

The essential quality control measures relate to:

- Staff training and updating
- Image quality and film reject analysis
- Working procedures
- X-ray equipment
- Darkroom, image receptors and processing
- Audits

Staff training and updating

Staff register should include:

- Name
- Responsibility (e.g. referrer, practitioner, operator, Radiation Protection Supervisor (RPS) duties)
- Date and form of training received
- Recommended date for a review of training needs, (every 5 years)

Image quality and film reject analysis

This assessment should include:

- Comparison of the quality of every radiograph to a high standard reference film positioned permanently on the viewing screen
- Investigation of any significant deterioration in quality and instigation of appropriate corrective action
- Recording all investigations together with the identified cause of deterioration and the action taken
- Regular annotation (approx. every 3 months) of the image quality record to indicate that the day-to-day checks have been carried out and, where appropriate, that no significant deterioration in image quality has been observed
- Subjective assessment of the quality of each radiograph. The NRPB 2001 guidelines recommend the following simple three point scale:

Rating	Quality	Basis
1	Excellent	No errors of patient preparation, exposure, positioning, processing or film handling
2	Diagnostically acceptable	Some errors of patient preparation, exposure, positioning, processing or film handling, but which do not detract from the diagnostic utility of the radiograph
3	Unacceptable	Errors of patient preparation, exposure, positioning, processing or film handling which render the radiograph unacceptable

All films should be assessed in this way and the results recorded so that the overall quality of radiography can be evaluated and measured against appropriate *targets*. The NRPB/RCR's minimum *targets* are:

Rating	*Percentage of radiographs taken*
1	Not less than 70%
2	Not greater than 20%
3	Not greater than 10%

Film reject analysis

Collect all rejected radiographs and record:

- Date
- Nature of the film fault/error, as shown earlier, e.g.:
    a) Film too dark
    b) Film too pale
    c) Low or poor contrast
    d) Unsharp image
    e) Poor positioning
- Known or suspected cause of the error or fault and corrective action taken
- Number of repeat radiographs (if taken)
- Total number of radiographs taken during the same time period. This allows the percentage of faulty films to be calculated

Working procedures

These include:

- Local Rules - the provision of Local Rules and Employers procedures are a legal requirement in the UK under the Ionising Radiations Regulations 1999. These can be combined into a single document known as the Radiation Protection File. It should contain the procedural and operational elements that are essential to the safe use of X-ray equipment, including guidance on exposure times, and as such should contain much of what is relevant to the maintenance of good standards in QA
- Operational procedures or systems of work - these include written procedures that provide for all actions that indirectly affect radiation safety and diagnostic quality, e.g. procedures for the correct preparation and subsequent use of processing chemicals
- Procedures log - this is a record of the existence of appropriate local rules and employers procedures, together with a record of when they were reviewed (not exceeding 12 months)

X-ray equipment

The appropriate physical checks of all relevant aspects of equipment performance that are required include:

- The *critical examination* - carried out before any new X-ray equipment is brought into routine use and is the legal responsibility of the installer

- The *acceptance test* - carried out before the equipment is put into clinical and is the legal responsibility of the legal person. This determines whether the equipment is working correctly and includes an assessment of a typical patient dose. The RPA needs to be consulted.
- A *Routine test* at least every 3 years or after any major maintenance edure. This is the responsibility of the legal person. It is similar to the acceptance test and checks include: voltage (size and constancy), fil ion, timer accuracy, leakage of radiation and beam diameter
- Day-to-day checks of important features that could affect radiation protection including:
    - correct functioning of warning lights and audible alarms
    - correct operation of safety devices
    - satisfactory performance of the counterbalance for maintaining the correct position of the tube head

Written records and equipment log should be maintained and include:

- All installers formal written reports describing the checks made, the results obtained and action taken
- Results of all equipment checks in chronological order
- Details of all routine or special maintenance

Darkroom, image receptors and processing

Darkroom

Regular checks, with all results recorded in a log, should be made of the following:

- General cleanliness, but particularly of work surfaces and film hangers (if used)
- Light-tightness, by standing in the darkroom in total darkness with the door closed and safelights switched off and visually inspecting for light leakage
- Safelights, to ensure that these do not cause fogging of films, require checks on:
    - Type of filter - this should be compatible with the colour sensitivity of film used - i.e. blue, green or ultraviolet
    - Condition of filters - scratched filters should be replaced
    - Wattage of the bulb - ideally it should be no more than 25 W
    - Their distance from the work surface - ideally they should be at least 4ft (1.2m) away
    - Overall safety - the simple quality control measure for doing this is known as the *coin test*

Image receptors

X-ray film. This requires:

- Ideal storage conditions - cool, dry and away from all sources of ionising radiation - as recommended by the manufacturers
- Strict stock control with records to ensure usage before the expiry date
- Careful handling

Cassettes. These require:

- Regular cleaning of intensifying screens with a propriety cleaner
- Regular checks for light tightness
- Regular checks for film/screen contact
- A simple method of identification of films taken in similar looking cassettes e.g. a Letraset letter on one screen

Processing

Chemical solutions. These should be:

- Always made up to the manufacturers' instructions
- Always at the correct temperature
- Changed or replenished regularly - ideally every 2 weeks and records should be kept to control and validate these changes
- Monitored for deterioration. This can be done easily radiographs of a *step-wedge phantom*

Processing equipment

- Manual processing requires the use of accurate timers, thermometers and immersion heaters
- Automatic processors require regular replenishment of mical solutions and regular cleaning especially of the rollers
- Records of all cleaning procedures are required to be kept

Audit

The final requirement for demonstrating effective implementation of the programme is a quality audit. Every year, the person with overall lity for the QA programme should check the full QA programme. This is an essential feature of demonstrating effective implementation of the programme.

QUALITY ASSURANCE IN GENERAL DENTAL PRACTICE

TIMETABLE FOR QUALITY CONTROL TESTS

DAILY

X-ray Equipment:

- Check audible & visible exposure warning indicators

Processing:

Manual

- Check levels of developer & fixer solutions; replenish with fresh solutions if necessary to maintain normal volume
- Change water in wash tank
- Check temperature and adjust using water bath or heater to 21°C

Automatic

- Check solution levels; replenish with fresh solutions if necessary
- Pass 'cleaning films' through at beginning of day to remove roller/transport residues
- Change water in wash tank

Reference Film:

- View each radiograph to compare it with a standard goo quality radiograph kept on the viewing box

Reject Analysis:

- Record any faults occurring on films classed as Grade 2 or Grade 3
- Record total numbers of films taken per day

WEEKLY

X-ray Equipment:

- Visually inspect mains connections and support arm

Processing:

Automatic –

- Wash rollers or transport mechanism
- Perform sensitometry/densitometry tests to assess processor functions

Reference Film:

- Using a standard reference object and a standard expos e, take a test film and process it in the normal way. Compare this film for density and contrast with the *Standard Reference Film* taken this way and processed previously with new chemicals. Record any differences and replace the developer solution if any are detected.

MONTHLY

X-ray Equipment:

Films and Cassettes:

- Check film stocks - rotate in order to use oldest stocks first
- Take out of circulation all out-of-date films - use as cleaning films
- Clean intensifying screens with commercial screen cleaner
- Check hinges and clasps of cassettes, and visually inspect screens for damage and evenness of sponge support

Processing:

Manual

- Change all solutions and thoroughly clean all tanks and hangers

Automatic

- Change all solutions and thoroughly clean all tanks an rollers/transport system

Reject Analysis:

- Analyse all recorded Grade 2 & 3 films to detect frequ occurring faults
- Calculate reject rate as a % of all films taken in this period
- Targets: >70% Grade 1
  <20% Grade 2
  <10% Grade 3

SIX MONTHLY

X-ray Equipment:

- Check collimation

Films and Cassettes:

- Test for light leakage into cassette
- Perform *film-screen contact test* to ensure good contact between film and screen within cassette

Dark Room:

- Perform visual inspection for light leakage

- Perform *coin test* to assess degree of fogging from light leakage and safe lights

Automatic Processors:

- In those with a daylight loading system, perform a coin test within the handling area of the processor

3 YEARLY

X-ray Equipment:

- Service and perform safety check