

Ionising Radiation - Medical Exposure Regulations(IR(MER)) Study Guide

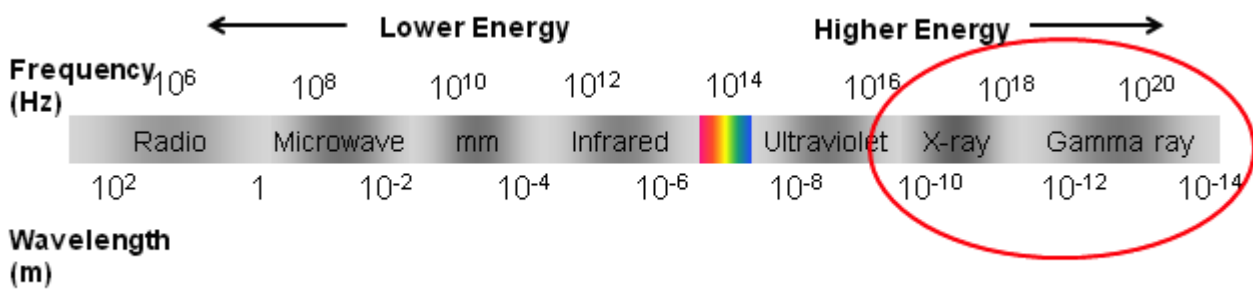
Part 1: Introduction to Ionising Radiation

What is Ionising radiation?

Radiation is a form of energy carried by particles called photons.

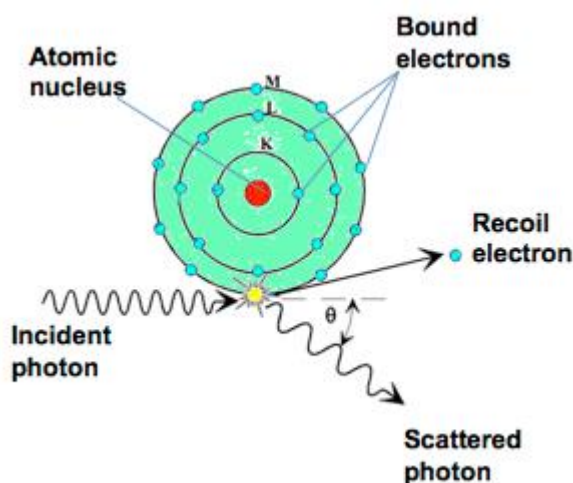
Visible light is composed of such photons.

X-rays and Gamma rays are beams of photons with much higher energies than visible light.



Each X-ray or Gamma ray photon has so much energy it can knock part of an atom (an electron) off.

This process is known as ionisation and thus X-rays and Gamma rays are both known as **Ionising Radiation**.

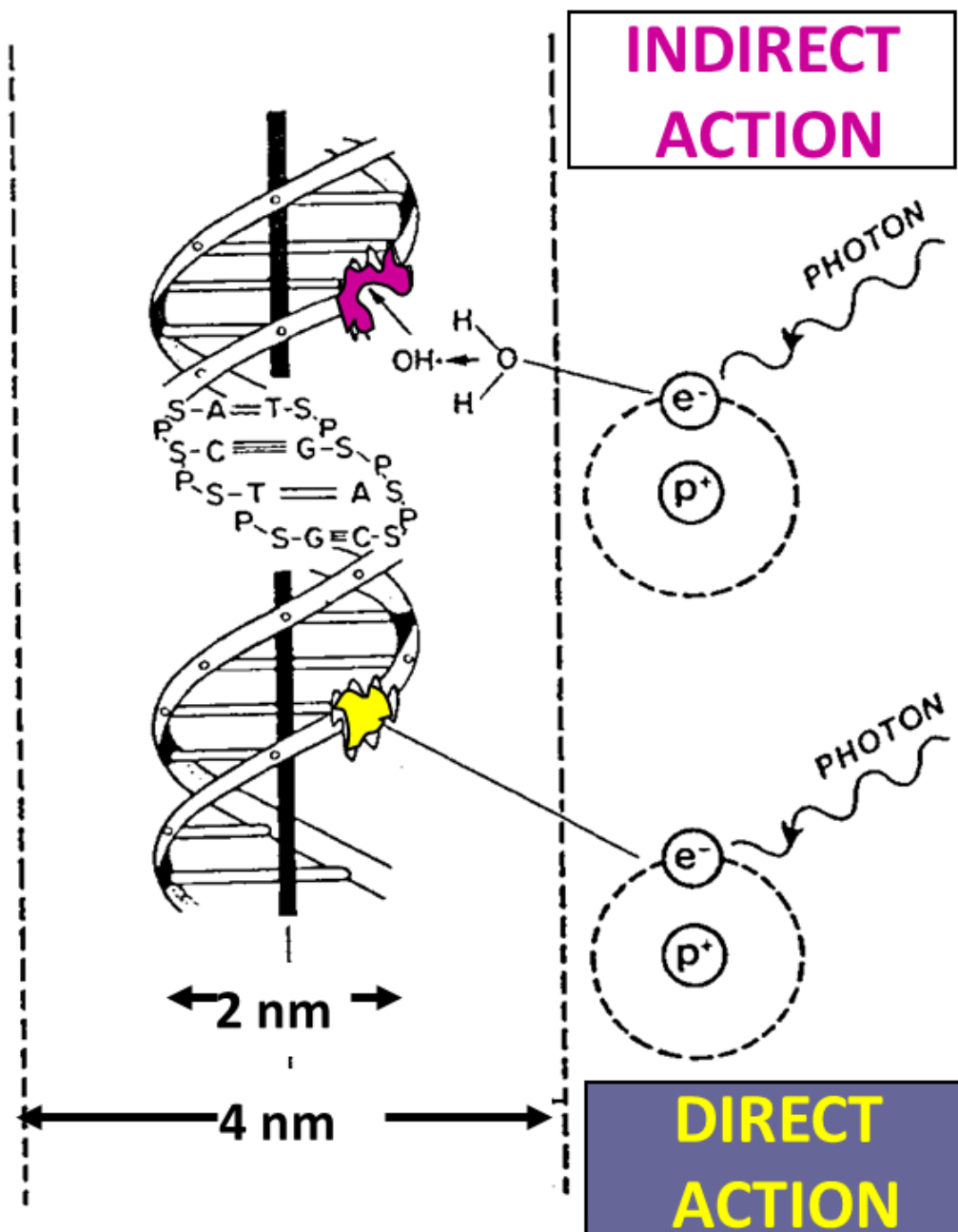


What does it do to us?

Ionisation events can "directly" damage the DNA in our cells.

In addition, the atom that had an electron knocked off is sometimes called "a free radical" and it is very chemically reactive.

Free radicals are actually much more likely to cause damage to the DNA in our cells than the initial photon interaction and such damage is known as "indirect".



What does it do to us?

When the DNA in a cell is damaged it can often be repaired by our body with no harmful consequences

If the damage is too great then the cell involved will die.

If many cells are killed in this way then, depending on the level of exposure, effects like skin reddening, ulceration, cataract formation, and hair loss can occur these are known as "deterministic effects".

If a very high level of exposure occurs then immune suppression, radiation sickness and even death of the individual may occur.

At any level of exposure our body will attempt to repair the DNA in any cells that have been non-fatally damaged.

Sometimes this repair is not quite correct and the cell is said to be mutated.

In this case the cell concerned will often either die or exhibit no harmful effects. However, if the cell concerned is in the gonads then the mutation may be passed on to any subsequent offspring.

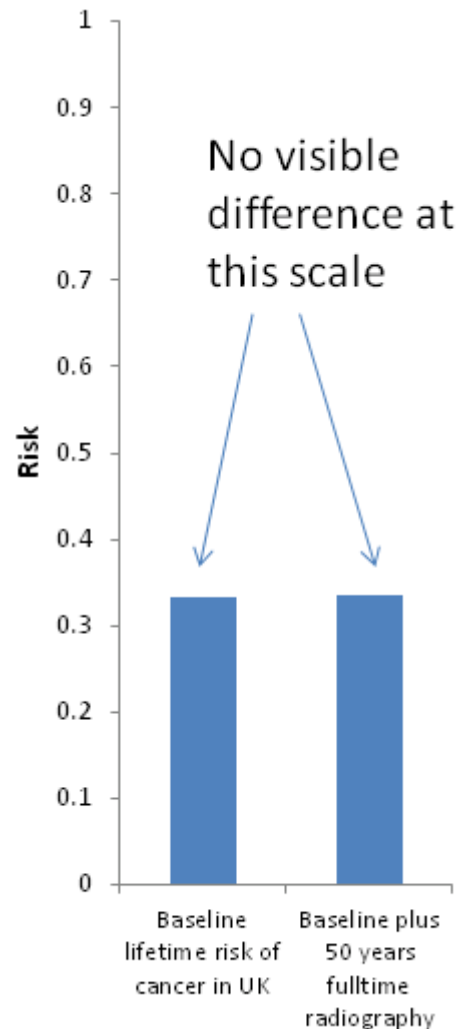
Very occasionally an incorrect repair may cause a cell to turn cancerous. The likelihood of this happening is dependent on the amount of radiation the body was exposed to and increases as the exposure increases. This is known as a "stochastic" effect.

Should I be scared?

Although any exposure to Ionising Radiation may thus increase the risk of cancer later in life the additional risk is very small for the typical levels of exposure.

Ionising radiation is a natural phenomenon and we are exposed to it in our daily lives at all times.

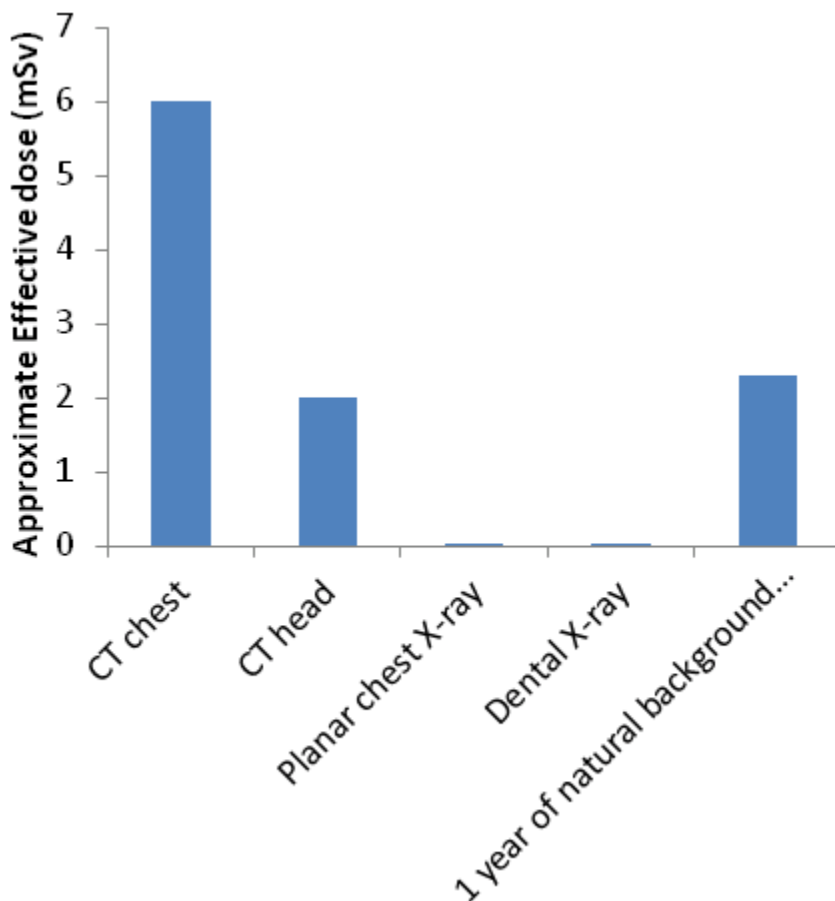
If good practices are followed then the level of exposure most staff will receive from their work will be much less than that received from natural sources in our daily life.



Typical radiation doses to patients

A CT chest delivers ~300 times as much radiation to the patient as a planar chest X-ray.

Examination	Amount of radiation (Effective dose)
CT chest	~6mSv
CT head	~2mSv
Planar chest X-ray	~0.02mSv
Dental X-ray	~0.001mSv
1 year of natural background radiation	~2.3mSv



The legal framework

We already know that without proper safety controls and practices Ionising radiation has the potential to be extremely dangerous but that with good practice the risks can be kept very low.

Two significant pieces of legislation have therefore been introduced into UK law to help to ensure our safety from Ionising Radiation.

Compliance with all aspects of these laws is required to ensure the safety of staff, patients and members of the public.

Ionising Radiation Regulations 2017 [IRR 17]

Mainly staff safety



Ionising Radiation (Medical Exposure) Regulations 2017 [IR(ME)R 17]

Mainly patient safety



Part 2: Ionising Radiation (Medical Exposure Regulations) (IR(MER)) for Referrers

IRMER For Referrers: The legal framework Ionising Radiation Regulations 2017 [IRR 17]

Mainly staff safety



Ionising Radiation (Medical Exposure) Regulations 2017 [IR(ME)R 17]

Mainly patient safety



Since we know that ionising radiation (e.g. X-rays and gamma rays) can be dangerous IR(ME)R 17 aims to ensure that radiation exposure to patients is As Low As Reasonably Practicable.

More radiation leads to more risk to the patient but also insufficient radiation will cause poor image quality or inadequate treatment. There are risks to be considered from both too little and too much radiation.

IR(ME)R 17: Duty holders

IRMER lays out key roles (known as "Duty Holders") and their associated responsibilities to minimise these risks.

This means they are **personally** responsible under law.

Some of these roles may be held by the same person.



- Employer (Trust)
- **Referrer (You)**
- Practitioner
- Operator

The duty holders under the employer should be appointed in writing confirming their scope of practice.

IR(ME)R 17: Employer

In most circumstances within the NHS, a Trust will be considered to be the employer. The employer is generally responsible for the operation, equipment and training. For example:

- Providing a framework of written procedures (Standard operating procedures)
- Ensuring a procedure for positive identification of patients is produced
- Carrying out a Clinical audit as appropriate
- Keeping records of equipment
- Implementing and maintaining a Quality Assurance (QA) programme for radiological equipment
- Keeping documentation of Staff Entitlements e.g. who is entitled to act as a referrer, operator, or practitioner and the scope of their practice
- Records of Referrers, Practitioners & Operators & their dates and nature of training
- Ensuring all staff training is appropriate to their scope and kept up-to-date (every 3 years)
- Formally investigating exposures much greater than intended (as advised by the MPE)
- Notifying the Care Quality Commission (CQC) of exposures much greater than intended (as advised by the MPE)

IR(ME)R 17: Training

It is crucial that you are suitably trained in referral process and understand the Trust referral procedures

This helps to reduce the incidences of referral errors and thus improves patient safety.

Please note this includes being able to use the relevant software appropriately (e.g. CERNER).

If you need further training or guidance on relevant software more information can be found on the Source.

IR(ME)R 17: Practitioner



The primary responsibility of the practitioner is to justify medical exposures.

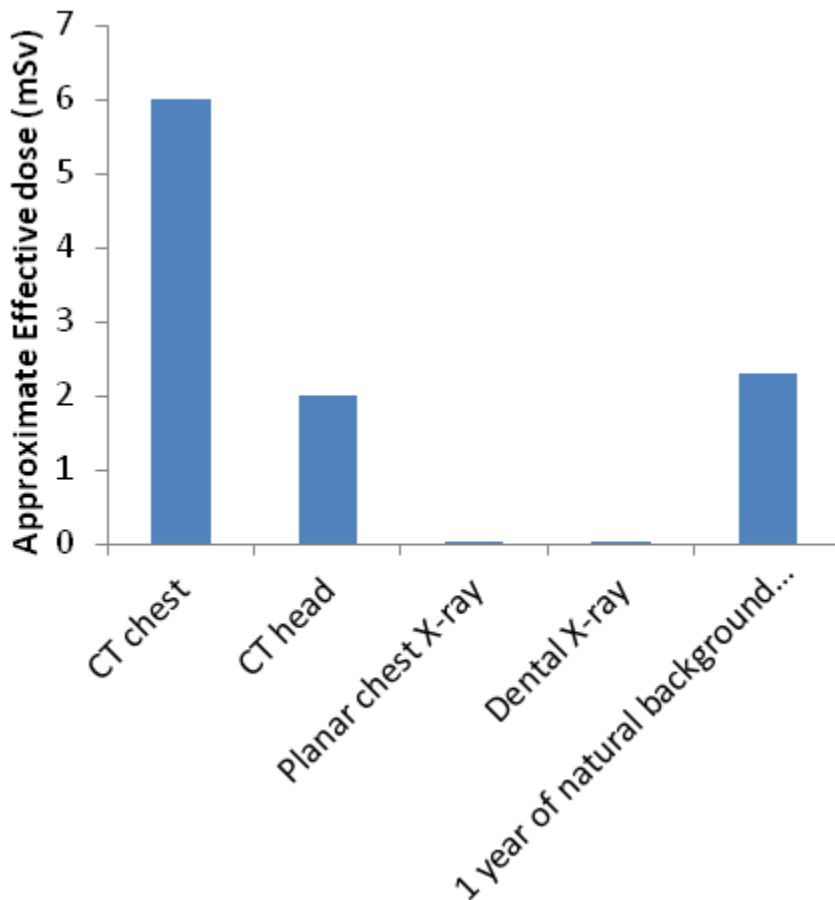
This requires the practitioner to have a full knowledge of the potential benefit and detriment associated with the procedure under consideration. Clearly all practitioners need to be adequately trained to undertake this function.

Typical radiation doses to patients

The amount of radiation a person receives is usually measured through a quantity known as the Effective dose. The units of effective dose are known as Sieverts and typical diagnostic doses are in milliSieverts (mSv) which are a thousand times smaller.

A CT chest delivers ~300 times as much radiation to the patient as a planar chest X-ray.

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IR(ME)R 17: Referrer (you)

The referrer must:

- Provide sufficient clinical information to enable the Practitioner to Justify the radiation exposure (including signing and dating the request clearly)

Practical Notes

Think of an X-ray request as a prescription for radiation

- Provide a contact number in case there are any queries about the request
- Check what relevant imaging the patient already has or is already referred for
- You can only refer within your scope of practice

The Imaging Department is not legally entitled to proceed with an incomplete or inaccurate request.

Note that for a RADIOLOGY ORDER CANCELLATION, the referrer MUST contact the imaging department directly by telephone.

IR(ME)R 17: Referrer (you)

As a 'referrer' you MUST follow the employer's procedures for referring patients.

You MUST request the medical exposure using a protocol which will include the following as a minimum:

- Unique patient ID
- Sufficient clinical information to enable the Practitioner to justify and then authorise the exposure on the basis of net benefit to the patient.
- Information(where relevant) on:
 - Last menstrual period (LMP), Pregnancy, Breast Feeding
- Unique signature (hardcopy or electronic)

Here is what to avoid:

- Selecting the wrong patient (electronic/hardcopy)
- Repeating investigations
- Investigating when results are unlikely to change management
- Investigating too early
- Doing the wrong investigation
- Failing to provide appropriate clinical information and questions that need to be answered
- Over-investigating

IR(ME)R 17: Referrer (you)

Practical advice for requesting X-Rays

Before requesting an X-Ray consider:

- Why do I need an X-Ray?
- Will it change the management?
- Does the patient fulfill indication?

N.B: Remember you are prescribing radiation!



Requesting X-Ray - the vital information that is needed is:

- Patient name
- Hospital number
- DOB
- Pregnant? Last Menstrual Period
- Clinical details
- Clinical Question
- Mode of transport
- Department / Consultant

Your Accountability is:

- Responsibility for referring
- Responsibility for results
- You must have knowledge of the local agreement and risk/safety mechanisms

Paused and checked

IR(ME)R requires all duty holders to comply with their local employer's procedures. This 'pause and check' poster does not replace these procedures but represents a shortened summary of the main checks. You must adhere to your local procedures at all times.

Diagnostic Radiology Referral

Have you “Paused & Checked”?

An IR(ME)R Referrers checklist for referring a patient for a diagnostic imaging examination

P	Patient	Ensure correct patient (3-point ID) Ensure it is physically possible for the patient to undergo the examination (e.g. any mobility issues) Ensure patient understands and agrees to examination
A	Anatomy	Ensure correct body part/laterality specified
U	User Checks	Confirm most appropriate investigation and consider non ionising radiation alternative (use of iRefer/local referral guidelines) Check previous investigations Confirm timing of examination (is date required clear?) Ensure pregnancy/breastfeeding status is verified Ensure any special needs/interpreter/disabilities/mobility documented (eg hoist required?) Ensure implantable cardiac defibrillator devices documented Ensure allergies documented and appropriate pathology results are available where requested
S	System & Settings	Confirm correct examination (code) requested Confirm correct imaging modality selection Confirm relevant clinical information is adequate to enable the Practitioner to justify the examination Confirm relevant clinical information will assist in the evaluation of the study
E	End	Confirm entitled Referrer against IR(ME)R procedures – eg unique identifier/correct user login Final check that this is the CORRECT patient Confirm the above and submit request
D	Draw to a Close	Ensure you have received an evaluation of the examination Ensure the results are discussed with the patient Confirm whether further investigation is required

iRefer

Imperial College NHS uses iRefer (www.irefer.org.uk) for imaging referrals
iRefer is a tool promoting evidence-based imaging.

It will be available via the Trust Intranet from September 2019

How iRefer will help you

- Helps you quickly select safe and effective investigations for your individual patients
- Ensures that the most appropriate imaging test is conducted at the right time
- Promotes uniform and best care for patients
- Reduces the number of unhelpful or repeat investigations
- Supports rapid diagnosis, which can shorten patient management pathways
- Protects the patient by avoiding unnecessary ionising radiation



IR(ME)R 17: Operator

An operator is anyone who carries out a practical aspect of the examination. They must:

- Accurately identify the patient to be exposed
- Ensure that the examination has been Justified
- Carry out the examination in accordance with the Employer's protocol
- Ensure that the patient's radiation dose is as low as reasonably practicable (ALARP)

If you are an operator this is the wrong course for you. You must instead complete the full IR(ME)R 17 training.

IR(ME)R 17: Duty holders

In addition to the duty holders, IRMER also defines a role called a **Medical Physics Expert (MPE)**, whose job it is to advise on patient dosimetry, development and use of new and/or complex techniques, as well as other matters related to radiation protection concerning medical exposures. In addition they are involved in any high dose procedures such as complex interventional cases or CT scans as well as assisting with procurement of X-ray equipment. You can always contact the MPE if you want advice on an IRMER matter or help understanding IRMER.

Imperial College MPE Contact Details:

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