RADIATION PROTECTION OF WORKERS
Diagnostic Radiology

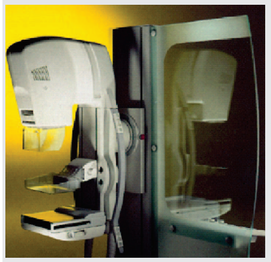
IAEA

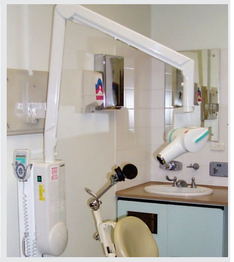
TYPES OF DIAGNOSTIC EXAMINATION

- **Mammography:** Detection of lesions in breast tissue using X rays.
- **Computed tomography (CT):** Imaging techniques that generate cross-sectional images of the body using X rays.
- **Dental radiology:** Imaging of the teeth using X rays.

Conventional techniques:

- Radiography static (radiographic images) e.g. a chest X ray.
- Fluoroscopy dynamic (real time) imaging e.g. fitting a pacemaker.



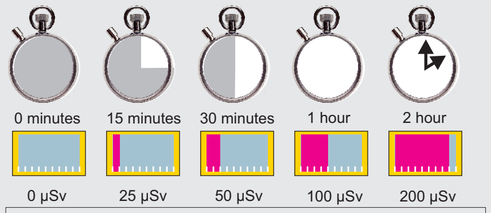


OCCUPATIONAL EXPOSURE

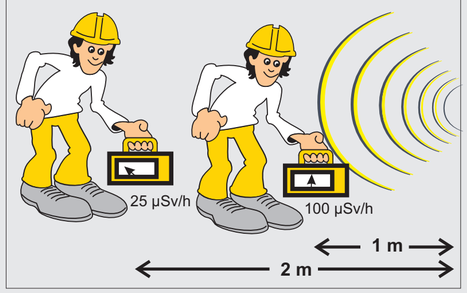
Exposure to X rays can be controlled by consideration of time, distance and shielding:

Time

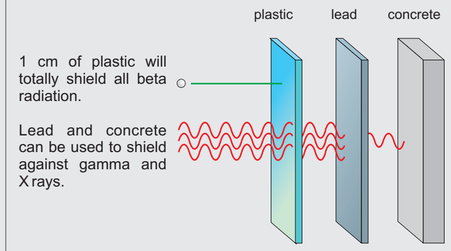
To reduce radiation doses, the time spent in radiation areas must be kept as short as possible. The longer the time spent in an area, the higher the dose received.



Distance If the dose rate at 1 m from a source is 100 µSv/h, the dose rate at 2 m will be 25 µSv/h.



Shielding Shielding material must be appropriate for the type of radiation. For example:



PERSONAL MONITORING

Occupational exposure to ionizing radiation can be assessed through the wearing of personal dosimeters and by keeping records of work patterns.

More than one dosimeter might be recommended (e.g. for interventional radiology a dosimeter worn under the apron and an additional one worn outside the apron at the neck). They have to be worn strictly according to the dispositions and information provided by the person responsible for radiation protection.

Dosimeters do not provide protection from exposure to ionizing radiation, they are a means of assessing the dose that the wearer has received.

An additional dosimeter worn outside the apron.

Radiation doses to staff and patients must be kept As Low As Reasonably Achievable: ALARA

Whenever a patient, particularly a child, requires comforting, this should be done by the patient's attendant rather than the staff. The attendant should be protected with lead aprons.

Interventional radiology

Any attempt to lower radiation dose to the patient will also lower staff dose.

This can be achieved by careful planning of the work and the use of appropriate equipment and exposure parameters.

Operator training is essential.

Lead aprons and dosimeters must be worn, as appropriate.

PROTECTIVE EQUIPMENT

Protective clothing

Personal protective equipment can be worn to provide protection against exposure to X rays, e.g. gown, aprons and thyroid protectors made of a material (such as vinyl) which contains lead.

A lead apron for the body.

A thyroid protector.

The thyroid dose can be reduced by over 90% by the use of a thyroid collar and the whole body dose by more than half by a lead apron.

Protective devices

Protective devices have to be available in fluoroscopy and interventional radiology rooms and include:

- ☑ Ceiling suspended protective screens.
- ☑ Protective lead curtain mounted on the patient table.

Protective lead curtain mounted on the patient table.

☑ REMEMBER

- ☑ Always wear the assigned dosimeters according to the instructions.
- ☑ Use properly the protective clothing and tools provided.
- ☑ A female worker should, on becoming aware that she is pregnant, notify the employer in order that her working conditions may be modified if necessary.
- ☑ Special protection is needed for staff in interventional radiology.

DOSE AND EFFECTS

Units of dose

The unit of absorbed dose is the gray (Gy).

The unit used to quantify the dose in radiation protection is the sievert (Sv).

One millisievert (mSv) is 1/1000 of a sievert.

- ▶ Annual doses from natural background radiation vary on an average between 1 mSv and 5 mSv worldwide.

One microsievert (µSv) is 1/1000 of a millisievert.

- ▶ The typical dose from a chest X ray is 20 µSv.

Dose rate

Dose rate is the dose received in a given time.
The unit used is the microsieverts per hour (µSv/h).

- ▶ If a person spends two hours in an area where the dose rate is 10 µSv/h, then they will receive a dose of 20 µSv.

Health effects of radiation exposure

Typically, the likelihood of deterministic effects arising among staff who use X ray machines is very small, unless a staff member's hand or body part inadvertently comes into contact with the primary beam.

In interventional radiology, skin injuries are possible if a person's hand comes into contact with the primary beam. Hair loss on the legs for an area not covered by a lead apron and cataracts have been documented from radiation exposure.

AS LOW AS REASONABLY ACHIEVABLE (ALARA)

Adherence to the ALARA principle and regular monitoring of personal doses can minimize the risk of stochastic effects.