**RADIATION PROTECTION OF WORKERS**

### Diagnostic Radiology

#### 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**

<table>
<thead>
<tr>
<th></th>
<th>0 m</th>
<th>0.5 m</th>
<th>1 m</th>
<th>2 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic</td>
<td>100 µSv/h</td>
<td>25 µSv/h</td>
<td>10 µSv/h</td>
<td>&gt; 1 µSv/h</td>
</tr>
<tr>
<td>Lead</td>
<td>10 µSv/h</td>
<td>5 µSv/h</td>
<td>2.5 µSv/h</td>
<td>1 µSv/h</td>
</tr>
<tr>
<td>Concrete</td>
<td>&gt; 1 µSv/h</td>
<td>&gt; 1 µSv/h</td>
<td>&gt; 1 µSv/h</td>
<td>&gt; 1 µSv/h</td>
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#### Protective Equipment

- A lead apron for the body.
- A thyroid protector.
- A protective lead curtain mounted on the patient table.
- An additional dosimeter worn outside the apron.

#### Personal Monitoring

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

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

#### 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.

#### 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.

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.