- Protective eyewear should be worn by the operator and any staff within 1m of the patient during interventional radiology. This is not necessary for other members of staff as the deterministic effects such as cataract formation have a relatively high threshold. Protective eyewear should be wraparound to prevent side scatter into the eye, with a lead equivalence of 0.7mm at the lenses.

- Leaded gloves should be worn by the operator at their discretion, due to the loss of sensitivity and sterility involved with using them. Unshielded hands or other body parts should not be placed in the direct beam.

- Lead aprons and other protective equipment should be checked at least once a year for damage. Any obvious damage should be reported to the Superintendent Radiographer. Aprons with defects larger than $15mm^2$ should not be used unless the apron is proven safe due to the location of the hole.

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THE RADIOLOGICAL PROTECTION CENTRE
Incorporating The John Perry Laboratory

Fluoroscopy: Radiation Protection of Staff

Advice on Best Practice

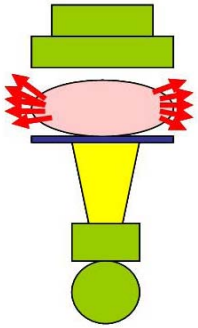
GENERAL ADVICE

- Only staff who are necessary to the procedure should be in the room whilst fluoroscopy is being carried out.

- All operators should be trained in radiation protection and use of the x-ray equipment.

- Fluoroscopy only contributes around 40% of the total dose whereas acquiring digital frames (i.e. fluorography) contributes 60%. Therefore, if possible step back during image acquisition.

- All staff who are not required at the couch should stand a few paces back where possible. This significantly reduces dose. For example, doubling the distance between you and the patient cuts your exposure by a factor of about four.

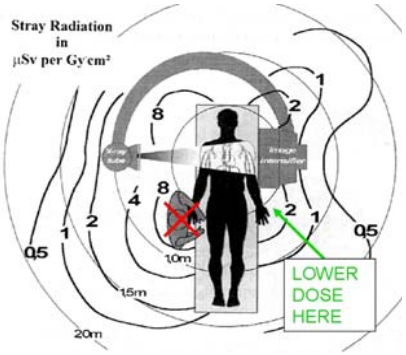


- If supplied, dosemeters should be worn underneath the lead apron at waist or chest height. Finger badges should be worn by Interventional Radiologists operating near the primary beam.

- Minimising the dose to the patient will effectively minimise the dose to staff as well. Therefore:
  - collimate the beam as much as possible
  - maximise the distance between the X-ray tube and the patient and
  - minimise the distance from the patient to the image intensifier.
  - remove the grid when possible to further reduce dose.

- If the beam is vertical, keep the tube under the patient to avoid stray primary beam.

- If the beam is horizontal the operator should stand on the **image intensifier** side of the patient to reduce their dose, as scattered radiation will be more intense on the tube side.



PROTECTIVE EQUIPMENT

- Two-piece lead aprons are recommended as these reduce back strain. The top should overlap the skirt by 10cm.

- 0.25mm lead aprons are recommended for most procedures, for example, those that use beam energies up to 100kVp.

- 0.35mm lead aprons should be used for beam energies above 100kVp. Operators and staff required to stand next to the couch should wear at least 0.35mm thick lead equivalent aprons if their total workload exceeds one hour of screening a month or if performing a high dose procedures such as interventional radiology.

- Any additional shielding such as lead skirts around the undercouch fluoroscopy unit should always be used.

- Thyroid shields should always be worn by staff standing within 2m of the couch during fluoroscopy as these considerably reduce effective dose to staff.