

Guide to Radiation Personal Protective Equipment (PPE)

For more detailed information, including a helpful eBook, posters and free videos, see British Institute of Radiology [Personal Protective Equipment for Diagnostic X-ray Use¹](#).

Employer's responsibilities

The Health and Safety at Work Act 1974² places a general duty on employers to ensure so far as is reasonably practicable (SFARP), the health and safety of their employees. This duty includes the provision of safe equipment, systems of work and a safe working environment through a hierarchy of control that culminates in the provision of adequate and suitable PPE. For work activity in the presence of ionising radiation, this is enforced by the Ionising Radiations Regulations 2017³ (IRR17), which tasks the employer to take all necessary steps to restrict SFARP the exposure of employees to ionising radiation and ensuring all PPE complies with the Personal Protective Equipment Regulations 2002⁴, meets Basic Safety Standards (BS EN) 61331-3⁵, and through adequate provision of storage for PPE.

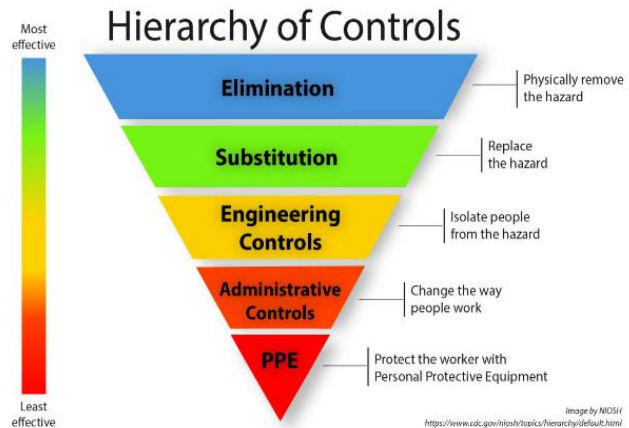


Figure 1 Hierarchy of safety controls (adapted from ref 7)

Organs at risk from ionising radiation?

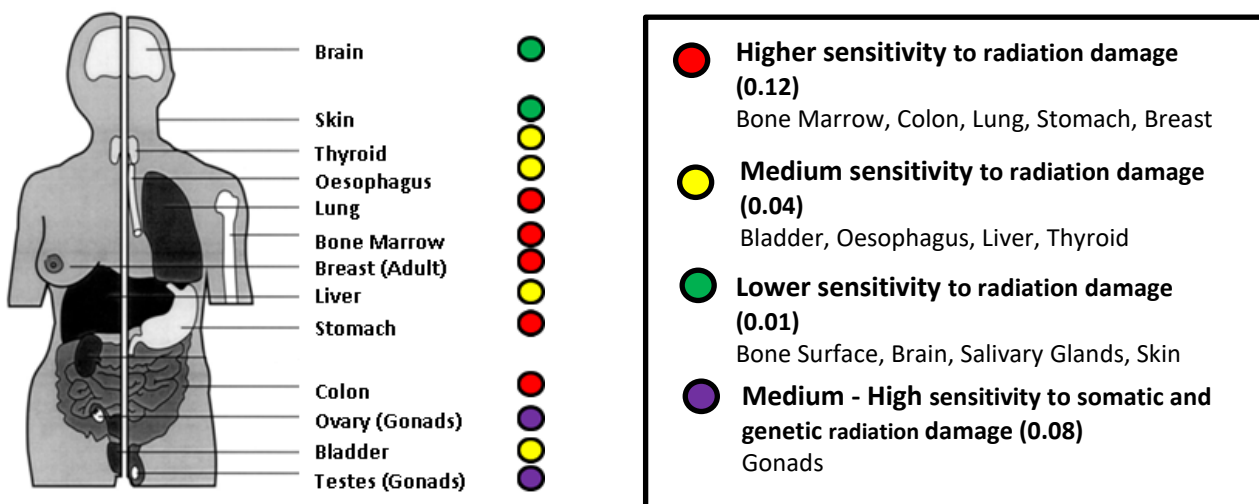


Figure 2 Organs at risk from ionising radiation (and tissue weighting factors) based on ICRP Report 103 (Ref 6)

Selection of Equipment

For any radiation work activity an IRR17³ radiation risk assessment, should be completed with the advice of a Radiation Protection Adviser. This assessment should outline the necessary PPE, including the required lead equivalence (LE) and the specific type of PPE needed. Types of protective clothing for the operator can include aprons, Thyroid collars, gloves, mittens and eyewear.

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Manufacturer testing of Lead equivalence

PPE aprons and thyroid collars are designed to safeguard against scattered radiation, where the material undergoes manufacturer testing under broad-beam conditions for a range of radiation beam qualities⁸. Equipment tested according to this standard can provide protection from scattered radiation originating from primary x-ray beams with tube voltages ranging from 60 kVp to 120 kVp due to the energy of the scattered radiation being compatible with primary beams 10 kVp lower.

When PPE is required for practices involving exposure to radiation exceeding 125 kVp, they must meet or surpass the lead equivalent (LE) values for radiation quality at 150 kVp.

LE of PPE should be appropriately marked or labelled to ensure correct use.

Wearing Your PPE (reproduced from BIR poster)

Length
Your apron should cover you from neck to knee.

Size
Too large: results in gaps and inadequate protection.
Too small: could result in discomfort and damage to PPE.

Lumbar support
The belt should be pulled snugly round the waist without creasing the apron and is essential for distributing weight.

Overlap
The PPE should fasten easily and overlap completely at the front.

Front edge
It should be parallel with the line of the body with no gaps showing.

Thyroid collar
It should be close fitting without being too tight, high enough to cover the thyroid and overlap your PPE at the front.

The deepest part should be at the front.

Arm holes
Too large: leaves a gap and provides inadequate breast protection.

Too small: could result in discomfort and damage from creasing.

1. <http://www.birpublications.org/page/ppe>
2. Health and Safety at Work etc. Act 1974. <https://www.legislation.gov.uk/ukpga/1974/37/contents>.
3. The Ionising Radiations Regulations 2017. <https://www.legislation.gov.uk/uksi/2017/1075/contents/made>.
4. The Personal Protective Equipment Regulations 2002. http://www.legislation.gov.uk/uksi/2002/1144/pdfs/uksi_20021144_en.pdf
5. British Standard BS EN 61331-3 (2014). Protective devices against diagnostic medical X-radiation-Part 3: Protective clothing, eye wear and protective patient shields.
6. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP publication 103. Ann ICRP. 2007;37(2-4):1-332. doi: 10.1016/j.icrp.2007.10.003. PMID: 18082557.
7. CDC - Hierarchy of Controls - NIOSH Workplace Safety and Health Topic. <https://www.cdc.gov/niosh/topics/hierarchy/>.
8. British Standard BS EN 61331-1 (2014). Protective devices against diagnostic medical X-radiation. Part 1: Determination of attenuation properties of materials.

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