

Management of Ionising Radiation Incidents within the Patient Safety Incident Response Framework (PSIRF)

The PSIRF provides a structured, learning-focused approach to managing ionising radiation incidents, promoting transparency and continuous improvement. Compliance with statutory radiation legislations¹⁻⁴ and guidance⁵ is crucial to maintaining safety standards. PSIRF encourages organisations to focus on system-wide learning and improvement rather than individual blame, ensuring that all incidents are reviewed with the aim of strengthening processes, training, and overall safety culture.

Radiation Incidents

An ionising radiation incident refers to any near miss, unexpected or unintended exposure to radiation that could impact patients, staff, or the public. These incidents can occur due to errors in procedure, equipment, or breaches of safety protocols. Radiation incidents can include but are not limited to:

- **Patient-related:** Over/under-exposure during diagnostic/therapeutic procedures.
- **Staff/Public:** Accidental exposure or breaches of protection limits.
- **Equipment-related:** Malfunctions or failures of radiation-emitting devices.
- **Radioactive source issues:** Loss, contamination, or unauthorised use.
- **Unintended foetal exposure** even with correct procedures.
- **Administrative errors:** Incorrect patient ID, procedure selection, or documentation errors.

Responsibilities

Employers have a legal duty to ensure the safe use of ionising radiation in healthcare¹⁻⁴. This responsibility includes implementing safety measures, conducting risk assessments, and thoroughly investigating incidents to prevent recurrence.

Managers must oversee incident reporting and investigation in accordance with organisational PSIRF policies, ensuring that lessons learned are shared to improve safety practices. Appointed radiation protection specialists (e.g. Radiation Protection Advisors and Medical Physics Experts) are to provide expert guidance on incident classification and response.

All employees working with radiation must comply with safety protocols, report incidents promptly, and engage in continuous training to maintain high safety standards and a strong safety culture.

Classifying & Reporting Radiation Incidents

Step	Key Actions
Step 1: Classification	Non-notifiable incidents: Managed internally under PSIRF pathways. Notifiable incidents: Managed internally but reported externally to relevant regulators and authorities. (e.g. Care Quality Commission, Health and Safety Executive, Environment Agency, Office for Nuclear Regulation, Medicines and Healthcare products Regulatory Agency).
Step 2: Reporting	Seek radiation protection specialist guidance if uncertain on classification. Calculate effective dose where required to assess level of harm. Report internally within organisational governance structure and externally following the guidance provided by the respective authority.
Step 3: Investigation	Follow organisational PSIRF investigation processes as per level of harm. Conduct fact-finding, document evidence, and consult all parties involved. Examine contributing factors and opportunities for improvement. Conduct debriefing sessions to reinforce learning.

Step 4: Communication & Closure	<p>Notify governance teams, internal and external stakeholders as required by organisational processes.</p> <p>Ensure Duty of Candour is undertaken.</p> <p>Implement corrective actions, update training, and share key learnings.</p>
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Level of Harm

Levels of harm that can be applied to radiation incidents are as defined by the radiological society guidance^{6 & 7}.

Harm Level	Definition
Low Harm	Minimal clinical impact with a radiation dose below the moderate harm threshold.
Moderate Harm	Demonstrable moderate clinical harm, an accidental or unintended exposure to ionising radiation that results in a 0.1% (1 in 1,000) or greater lifetime radiation-induced cancer risk.
Severe Harm	Severe clinical harm with an additional tissue dose causing permanent deterministic effects.

Learning from Incidents

PSIRF promotes a no-blame culture, encouraging transparent reporting and fostering a learning environment. Healthcare organisations should review all radiation incidents, whether minor or significant, to enhance safety measures.

Staff must feel supported to report radiation incidents without fear, allowing lessons to be learned and preventative measures implemented.

Regular audits and reviews of ionising radiation incidents helps identify trends, strengthen protocols, and align with best practices. Using a standard taxonomy for incidents can help in this process⁸.

Using case studies in training reinforces safety awareness, while human factors analysis highlights systemic vulnerabilities, ensuring informed improvements in patient and staff protection.

Keys to Successful Implementation of PSIRF in Ionising Radiation Incident Management

Develop **structured processes** for identifying, investigating, and managing radiation incidents in line with regulations. Ensure **staff are well-trained** in radiation safety, incident management, and PSIRF processes. Using simulation exercises to test and refine incident response procedures.

Foster **an open reporting culture** promoting transparency and encouraging staff to report incidents without fear of blame.

Adopt **integrated incident management** with quality initiatives and risk management frameworks to enhance patient safety.

[1] Gov.UK, 'The Environmental Permitting (England and Wales) Regulations 2016' (*Legislation.gov.uk*2016)

<https://www.legislation.gov.uk/ukxi/2016/1154/contents>

[2] Gov.uk, 'The Ionising Radiations Regulations 2017' (*www.legislation.gov.uk*2017) <https://www.legislation.gov.uk/ukxi/2017/1075/contents>

[3] legislation.gov.uk, 'The Ionising Radiation (Medical Exposure) Regulations 2017' (*Legislation.gov.uk*2017)

<https://www.legislation.gov.uk/ukxi/2017/1322/contents>

[4] Gov.uk, 'Radiation - Radiation (Emergency Preparedness and Public Inf...)' (*www.hse.gov.uk*)

<https://www.hse.gov.uk/radiation/ionising/reppir.htm>

[5] CQC, 'Criteria for Making a Notification - Care Quality Commission' (*Cqc.org.uk*2024) <https://www.cqc.org.uk/guidance-providers/ionising-radiation/ionising-radiation-medical-exposure-regulations-irmer/criteria-making-notification>

[6] Working party, Strickland, N., Public Health England, Care Quality Commission, Murray, M., National Reporting and Learning System, Patient Safety in Radiotherapy Steering Group, Webb, S., & Tooley, M. (2019). Learning from ionising radiation dose errors, adverse events and near misses in UK clinical imaging departments. In The Royal College of Radiologists, The Society and College of Radiographers, & The Institute of Physics and Engineering in Medicine, Working Party Report to Clinical Imaging Board. <https://www.rcr.ac.uk/media/zdhdhlp/rc5491-1.pdf>

[7] The Royal College of Radiologists (2020). *IR(ME)R Implications for clinical practice in diagnostic imaging, interventional radiology and diagnostic nuclear medicine*. [online] Available at: https://www.rcr.ac.uk/media/mab2tga/rcr-publications_ir-me-r-implications-for-clinical-practice-in-diagnostic-imaging-interventional-radiology-and-diagnostic-nuclear-medicine_june-2020.pdf.

[8] Royal College of Radiologists, 'Learning from Ionising Radiation Dose Errors, Adverse Events and near Misses in UK Clinical Imaging Departments Working Party Report to Clinical Imaging Board Contents' (2019) <https://www.rcr.ac.uk/media/zdhdhlp/rc5491-1.pdf>