# Radiation risk assessment (unsealed sources)

Before commencing a new activity involving work with ionising radiation in respect of which no risk assessment has been made, Regulation 8 of the Ionising Radiations Regulations 2017 (IRR17) requires that the University must make a suitable and sufficient assessment of the risk to any employee and other person. The purpose is to identify the measures the University needs to take to restrict the exposure of that employee or other person to ionising radiation.

Guidance on carrying out a radiation risk assessment can be found in the generic radiation risk assessments in the appendices of the University’s management system document (Management of work with ionising radiation at the University of Nottingham).

The IRR17 Approved Code of Practice (ACoP) can be viewed here: <http://www.hse.gov.uk/pUbns/priced/l121.pdf>.

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| **Project title** | | | **Project Reference** |
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| **Author (Project Proposer)** | | | |
| Name & position | Date | Signature | |
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| **Reviewer (Radiation Protection Supervisor (RPS), Academic Supervisor or Principal Investigator)** | | | |
| Name & position | Date | Signature | |
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| **Approver\* (Senior Radiation Protection Supervisor, or Head of Department)** *\*This is the approver of the proposal before submission to the H&S Dept. (not the authorisation for work to proceed)* | | | |
| Name & position: | Date: | Signature: | |
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Where the University is required to carry out a radiation risk assessment, the following matters should be considered, where they are relevant. These are stated in Paragraph 70 of the IRR17 ACoP. Basic guidance is included in italics. Information that is the same for all of this type of radiation risk assessment is shown in bold; bold text should remain in the assessment.

1. Risk Assessment (Sec 70)

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| **Nature of the source(s)** |
| **Unsealed source**  *Radioisotopes, maximum activity in Bq, types of radiation (x-ray, gamma-ray, alpha, beta, neutron), energies of principal emissions in keV or MeV.* |
| **Estimated dose rates (and dose) to which anyone can be exposed** |
| *Estimate external dose rate under normal conditions (units: µSv/h or mSv/h).*  *Estimate the annual external whole-body effective dose under normal conditions to all people who may be affected by the work and members of the public (units: µSv or mSv).*  *It may be necessary to estimate equivalent skin and / or lens of eye dose to those directly involved with the work (units: µSv or mSv).*  *Assume 10 % of the maximum source activity is accidentally ingested, injected or inhaled (choose the most relevant) and estimate the internal committed effective dose (units: µSv or mSv). Use dose coefficients in* [*ICRP Publication 119*](http://www.icrp.org/docs/P%20119%20JAICRP%2041(s)%20Compendium%20of%20Dose%20Coefficients%20based%20on%20ICRP%20Publication%2060.pdf)*.*  *Include your reasoning and method of calculation* |
| **Likelihood of contamination arising and being spread** |
| *High likelihood when using unsealed sources.* |
| **Results of previous personal dosimetry and area monitoring** |
| *Include any previous dose information from approved dosimetry service (e.g. personal or environmental TLD badge results) and previous area monitoring results (e.g. dose rate monitoring at a controlled area boundary using a suitable dose rate meter).*  *Not applicable if no prior dosimetry or monitoring has been carried out.* |
| **Advice from manufacturers or suppliers about equipment about its safe use and maintenance** |
| *Include manufacturer’s or supplier’s information relevant to ionising radiation safety* |
| **Engineering control measures or design features already in place or planned** |
| *See Regulation 9 in the IRR17 ACoP for guidance* |
| **Planned systems of work** |
| *Local rules, written arrangements, method statements and other procedures can be referenced or described here.* |
| **Estimated airborne and surface contamination levels** |
| *In most cases significant levels of airborne and surface contamination are not considered reasonably foreseeable outside of accident scenarios.*  *Surface contamination levels can be estimated based on the spillage of 10 % of a main stock solution*  *Airborne contamination levels can be estimated by considering the volatility of the particular compound and assuming a worst-case scenario (10 %)* |
| **Effectiveness and suitability of PPE** |
| *As a minimum, unsealed sources work will require nitriles gloves, safety glasses & laboratory coat*  *Consider the potential requirement for respiratory protective equipment (RPE).* |
| **Unrestricted access to significant dose rates** |
| *Detail the security and access arrangements that will ensure only trained and approved persons are able to access sources of ionising radiation.* |

| **Possible accident situation** | **Severity & potential likelihood** | **Consequences of failure of control measures** | **Steps taken to prevent accidents, or limit their consequences** | **Risk** |
| --- | --- | --- | --- | --- |
| *Consider potential radiation accidents* | *Harmless, slightly harmful, harmful or extremely harmful. How likely is it? (use guide below)* | *Consequences if the control measures fail* | *Arrangements in place to limit the consequences of the accident* | *No risk, trivial, tolerable, moderate, substantial or intolerable (use guide below)* |
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### Severity, likelihood and risk level guide

1. The risk rating is assessed for each identified task hazard. The risk rating is the product of the likelihood and severity defined below. Proposed actions are identified, which mitigate each task hazard. The risk rating is then re-evaluated, assuming implementation of the control measure.
2. The risk assessment uses a 4 x 4 matrix of severity and likelihood. The combinations of the four levels of severity and four levels of likelihood give rise to six levels of risk.
3. The four levels of severity are defined as:

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| **Harmless** | Not known to cause any harm.  Dose of ionising radiation: 10 µSv or less whole body; or 100 μSv or less extremity |
| **Slightly Harmful** | Superficial injuries, dust irritation, temporary discomfort.  Dose of ionising radiation: 10 μSv to 0.3 mSv whole body; or 100 μSv to 3 mSv extremity |
| **Harmful** | Lacerations, burns, concussion, sprains, RIDDOR reportable.  Dose of ionising radiation: 0.3 mSv to 20 mSv whole body; or 3 mSv to 200 mSv extremity |
| **Extremely Harmful** | Amputations, major fractures, fatal injuries.  Dose of ionising radiation: 20 mSv or more whole body; or 200 mSv or more extremity |

1. The four levels of likelihood are:

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| **Extremely Unlikely** | Not known to have happened at work. The frequency of occurrence is much less than once every ten years. |
| **Highly Unlikely** | The frequency of occurrence is less than once every ten years. |
| **Unlikely** | Has happened before and/or is likely to occur within the next ten years. |
| **Likely** | Event to be expected within the next twelve months. |

1. The matrix of severity and likelihood to determine the risk is:

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|  | **Extremely Unlikely** | **Highly Unlikely** | **Unlikely** | **Likely** |
| **Harmless** | No Risk | Trivial | Trivial | Tolerable |
| **Slightly Harmful** | Trivial | Trivial | Tolerable | Moderate |
| **Harmful** | Trivial | Tolerable | Moderate | Substantial |
| **Extremely Harmful** | Tolerable | Moderate | Substantial | Intolerable |

1. The definitions for the risk ratings are:

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| **No Risk** | No action required and no documentary records need to be kept other than risk assessments. |
| **Trivial** | No action required and no documentary records need to be kept other than risk assessments. |
| **Tolerable** | No additional controls are required. Consideration may be given to a more cost-effective solution or improvement that imposes no additional cost burden. Monitoring is required to ensure that the controls are maintained. |
| **Moderate** | Efforts should be made to reduce the risk, but costs of prevention should be carefully measured and limited. Risk reduction measures should be implemented within a defined time period. Where the moderate risk is associated with extremely harmful consequences, further assessment may be necessary to establish more precisely the likelihood of harm as a basis for determining the need for improved control measures. |
| **Substantial** | Work should not be started until the risk has been reduced. Considerable resources may have to be allocated to reduce the risk. Where the risk involves work in progress, urgent action should be taken. |
| **Intolerable** | Work should not be started or continued until the risk has been reduced. If it is not possible to reduce the risk even with unlimited resources, work has to remain prohibited. |

This radiation risk assessment should help the University decide on the following matters: These are stated in Paragraph 71 of the IRR17 Approved Code of Practice. Guidance is included in italics.

1. Risk Assessment (Sec 71)

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| **Actions needed to keep exposures As Low As Reasonably Practicable (ALARP)** |
| *What further actions are required to achieve ALARP?* |
| **What engineering controls, warning signals, other safety systems are necessary** |
| *What further engineering controls, warning signals etc. are required to achieve ALARP?*  *E.g. is a fume cupboard required? further shielding?* |
| **Whether PPE is appropriate and if so, what type is adequate and suitable** |
| *Is any other PPE required on top of nitriles gloves, safety glasses & laboratory coat?* |
| **Dose constraints** |
| *Applicable to new facilities or novel work with ionising radiation.*  *Where necessary in the planning of new facilities for work with ionising radiation, the University will specify a design constraint of 1 millisievert on the annual effective dose of any radiation worker and 0.3 millisieverts on the annual effective dose of any other person. This means that the design must ensure that projected exposures of any person during future use of the facility should not exceed these figures.* |
| **Protection of those who declare themselves pregnant and / or breastfeeding** |
| *Departments must make female workers aware of both the potential risk to the foetus caused by exposure of the mother to ionising radiation during pregnancy and subsequently, specifically where unsealed radioactive materials are used, the risk to the nursing infant.*  *Departments are required to implement all necessary measures to ensure that the foetal exposures could not exceed 1 millisievert as a result of routine work and reasonably foreseeable incidents.* |
| **Dose investigation level** |
| **The University has set a dose investigation level of 1 millisievert effective dose for anyone working with radiation within a calendar year (0.25 millisievert per quarter).**   * **Eye dose investigation level: 1 mSv/yr (0.25 mSv per quarter)** * **Finger dose investigation level: 50 mSv/yr (12.5 mSv per quarter)** |
| **Maintenance and testing schedules** |
| *Equipment designed to restrict exposure e.g. Fume cupboards should be regularly maintained*  *Routine contamination monitoring procedure should be in place* |
| **Contingency plans** |
| *Having identified the possible accident situations, detail the corresponding contingency plan* |
| **Training needs** |
| *Safety office unsealed source module is mandatory.*  *Detail the necessary departmental technical/user training required.* |
| **Designation of areas and local rules** |
| *Should the area be designated as a controlled or supervised area? (see University’s management system document for guidance).*  *Local rules are required for all designated areas.*  *Areas not requiring formal designation or local rules will be defined as ‘registered areas’.* |
| **Access restrictions and other precautions for designated areas** |
| *Are further restriction or precautions required for the designated area?*  *See Regulation 19 of the IRR17 ACoP for guidance on the additional requirements for designated areas.* |
| **Classified persons** |
| *A classified person anyone who might receive an effective dose greater than 6 millisieverts, or an equivalent dose greater than 15 millisieverts to the lens of the eye or 150 millisieverts to the skin or extremities, during routine work or reasonably foreseeable incidents. The work with ionising radiation carried out by the University should not ordinarily warrant designation of classified persons but specific cases may arise from time to time and these should be referred to the RPO.* |
| **Dose assessment programme** |
| *This will be determined by the RPO.* |
| **Requirements for leak testing** |
| **Not applicable to unsealed sources** |
| **Responsibilities of managers and workers** |
| *Include specifics and reference the University’s management system (Management of work with ionising radiation at the University of Nottingham).* |
| **Monitoring and auditing programme** |
| **It is recommended that this risk assessment, as well as any local rules, are reviewed at least annually to ensure that conditions have not changed significantly.** |