University of Manchester

School of Physics and Astronomy

Local Rules for the Management of Radioactive Materials

These Local Rules are drawn up in compliance with the Ionizing Radiations Regulations 1999.

This document supplements the Radiation Protection Management System of the University of Manchester (Chapter 25 of the University Health and Safety Arrangements).

Issued 05/01/2017 by P.Campbell with the Authority of the Head of School.

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1 REGULATIONS

The School of Physics and Astronomy holds radioactive material for teaching, training and research.

1.1 Objectives

- To ensure that all activities in the School are carried out in such a way as to ensure the safety of all the people concerned, other members of the School, and the public at large.
- To ensure that the Head of School can demonstrate compliance with Statutory Requirements and University Regulations relating to the control of radioactive substances and ionising radiation.
- To ensure that teaching and research activities can be conducted safely, legally and efficiently.

1.2 Principles

1. No radioactive material may be brought into or sent out of the School without prior authorisation, and all such transactions must be recorded.
2. No radioactive material may be used within the School until a detailed plan of operation has been approved.
3. No person shall work with a radioactive substance within the School until they have received suitable training and been formally approved for such work.
4. Responsibility for a radioactive material extends to all aspects of its

security, storage, and use including the actions of all individuals who handle or use the material.

1.3 Underpinning Legislation

All work activities with radioactive materials is regulated by two pieces of legislation: the Environmental Permitting Regulations (2011), and the Ionising Radiations Regulations, 1999. The former controls the acquisition, storage and disposal of radioactive materials, while the latter determines the way work involving such substances may be carried out.

1.4 Responsibilities and Local Rules

Within the School of Physics and Astronomy, the Head of School is ultimately responsible for compliance with Statutory Requirements and University Regulations, and exercises control through these Local Rules. For practical and administrative purposes, direct responsibility for the formulation and application of Local Rules within the School is delegated to the Radiation Protection Supervisor (RPS), who reports to and advises the Head of School. The functions of the School RPS are as defined in IRR99. The Radiation Protection Adviser (RPA) for the university South Campus is Public Health England, and the Radiation Protection Officer (RPO) from October 1st 2014 is Dr Ian Haslam. . All radioactive materials within the School are directly under the supervision and control of a specified member of staff, who is responsible to the Head of School for compliance with all regulations relating to their security, accounting, use and disposal.

The Local Rules of the School of Physics and Astronomy are issued with the authority of the Head of School, and control all operations involving radioactive materials within the School. The Local Rules are intended to supplement and interpret the various external regulations, taking account of local conditions (e.g. constraints of space, the presence of undergraduate students within the building, etc.). Thus, the Local Rules may be more restrictive than the University Rules and/or Statutory Regulations. In such cases, the more restrictive local regulation shall be taken to apply.

1.5 Definitions

- Definition of a Radioactive Substance

1.6 Table 2.3 of the government guidance to EPR2011 lists values for which a radionuclide is considered to be 'out of scope' of EPR2011; this value is radionuclide-specific and can range from 10 mBq/g to 10 kBq/g depending upon the radionuclide.

Responsible Person- A specified member of staff must take responsibility for each radioactive source and all operations involving that source within the School, The responsible person must be a permanent member of the academic, experimental or technical staff, or a research fellow, but will normally be an academic supervisor.

2 SCHOOL PROCEDURES

2.1 **Key Personnel**

2.1.1 Radiation Safety Management

School Radiation Protection Supervisor (Radioactive Materials)

Dr Paul Campbell — Room: 4.11, Schuster Building
Tel ext 54157

Should the RPS be unavailable, the Deputy RPS is**:**

Dr A.G. Smith — Room 4.12, Schuster Building
Tel ext. 54156

University Radiation Safety Unit (RSU)

Dr Ian Haslam — Radiation Protection Officer and
Head of The Radiation Safety Unit:
7th Floor Williamson Building
Tel. ext 56983

2.1.2 Radiation workers

No individual may work with radioactive substances in the School of Physics and Astronomy unless specifically authorised to do so. In order to be given permission to work, workers must be suitably trained and competent to perform their duties. All workers must keep formal records of training and

competence.

Classified Radiation Workers- This term is a nationally recognised classification and is defined under IRR99. Designation as a Classified Radiation Worker is subject to an annual medical review by an Appointed Doctor. Classification will usually only be necessary for, and will normally be restricted to, individuals required to undertake work outside of the University (e.g. at a Licensed Nuclear Site).

2.1.3 Training

All members of staff and research students who are participating in projects which involve working in an unsupervised capacity with a source of ionizing radiation must have (a) attended EITHER the course in Radiation Safety Awareness organized by the university RSU, or the equivalent internal course provided by the School of Physics and Astronomy, and (b) demonstrated practical competence by completing the university's RW1 form and submitting this to the university Radiation Safety Unit or internal equivalent.

Prior to submitting an RW1 form, each worker will be required to provide proof of attendance of the course in Radiation Safety Awareness organized by the Radiation Safety Unit, and must be deemed to be "competent" by their Project Leader and RPS. In general, radiation workers in the School of Physics and Astronomy will not be classified.

Attendance at the course in Radiation Safety Awareness organized by the RSU should be arranged through the School RPS. Undergraduate and short-term project students are exempt from this requirement, as long as they are supervised by a registered radiation worker.

Formal records of training and competence must be kept for all persons authorised to work with radioactive substances.

2.1.4 Dosimetric monitoring

Any radiation worker requiring to be "Classified" under IRR99 **must** be monitored with a personal dosimeter, and maintenance of dosimetry records is a statutory requirement. Dosimetric monitoring is provided by Christie Medical Physics and Engineering , and is organised directly through the School RPS. Records of received radiation doses are maintained by Christie Medical Physics and Engineering, with duplicate records held by the university RPO, and the School RPS.

While, in general, radiation workers in the School of Physics and Astronomy will not be classified, any such individuals who also work at sites other than the School of Physics and Astronomy may need to be Classified, and will require

special arrangements to be made for integration of dose records.

Non-classified radiation workers within the School may be required to wear a thermoluminescent dosimeter (TLD). Dose records will be similarly maintained by the School for all radiation workers, and may be inspected by individuals on request to the School RPS.

2.1.5 Undergraduate student coursework

Undergraduate students may undertake experiments that involve small sealed sources of radioactivity, but they must be supervised by a trained radiation worker. The practical procedure must be designed such that the dose received by the student is shown to be trivial, even in the worst foreseeable circumstances. All such work must be approved by the School RPS. Personal dosimetry should not be necessary in procedures involving undergraduate students, as the experimental design MUST have precluded the necessity for such monitoring.

The following criteria will apply:

(1) Regardless of whether the work takes place in a Controlled area, Supervised area, normal research lab or teaching lab, all student exercises must be undertaken in accordance with the experimental protocol outlined in the laboratory script and risk assessment;

(2) On no account may undergraduate students work with any radioactive substances in an unsupervised capacity;

(3) The individual responsible for the Health and Safety of the students is the member of academic staff responsible for devising and maintaining the experiment;

(4) Any graduate assistants demonstrating the experiment must be fully briefed and trained by the person responsible for the experiment;

2.2 Radiation Areas

Work with radioactive substances or sources of ionising radiation may normally only take place within a designated area. There are two categories of designation recognised under the Ionising Radiation Regulations 1999, namely *Controlled* and *Supervised* Areas

The academic member of staff responsible for a radiation area is responsible for ensuring good practice within that area, which includes high standards of cleanliness and housekeeping, appropriate monitoring and record keeping.

2.2.1 Controlled Areas

Areas of high potential risk (specifically, where the instantaneous dose rate is likely to exceed 6mSv per year or where relatively large quantities of radioisotopes are present) are designated as Controlled Areas. An appropriate sign must be displayed at all entrances, and the boundaries of the area must be clearly defined.

All operations within Controlled Areas must be in accordance with an Experimental Protocol, which forms a **Written System of Work** under the terms of IRR99.

2.2.2 Supervised Areas

Within the School of Physics and Astronomy, any area in which routine work with radioactive materials is to be carried out, and which is not a Controlled Area, will be designated a Supervised Area. An appropriate sign must be displayed on the door of the laboratory, and the boundaries of the area within the laboratory must be clearly defined. Under normal circumstances, unless obvious separation of areas can be achieved, a Supervised Area should include the whole of the laboratory involved.

Entry to a Supervised Area by persons not authorized to work with radioactive materials should be limited as far as is practicable. However, all experimental work within a Supervised Area must be performed under the terms of the experimental protocol outlined in the laboratory script and risk assessment.

2.3 EXPERIMENTAL PROTOCOLS

No work involving radioactive substances is allowed in the School of Physics and Astronomy unless carried out in accordance with an approved Experimental Protocol.

The Experimental Protocol must define all operations which a trained radiation worker would be able to interpret unambiguously. For procedures that do not directly involve radioactive substances, workers should still consider any radiological hazards or exposures which may arise from other work taking place in the same area.

The work protocol must, at the minimum, define procedures for the following activities and operations:

(a) *Normal working procedures in the laboratory*: This specification must include a definition of the laboratory area to be used in project operations; details of the source(s) to be used and the manner of their use.

(b) *Documentation and record keeping*: details of what records are to be kept,

and in what form, must be specified.

(c) *Contingency plans*: detailed risk assessment and plans for the most likely accident (or accidents); this plan must include a plan of action in case of fire in either the laboratory or elsewhere in the building.

2.3.1. Generic Risk Assessments

Where a research project involves a risk of exposure to ionizing radiation, a risk assessment must be prepared in accordance with Regulation 7(2) of IRR99. Generic risk assessments have been performed for the following activities:

- Use of sealed sources of activity less than 3.7 MBq,100 μCi (RASS-1).
- Use of sources of activity greater than 3.7 MBq, 100 μCi (RASS-2).
- Use of unsealed alpha-emitting sources (RAUS-1).
- Maintenance of the neutron tank (RANT-1).
- Use of Compton Scattering apparatus (RACS-1)

These risk assessments are available on request from either the RPS or the technician responsible for the local area and must be read and understood before any of the above procedures are undertaken.

2.3.2 Risk Assessments for Research Projects

When the proposed work with a radioactive source is not covered by one of the School's generic risk assessments, it will be the duty of the Project Leader to provide such an assessment. Where work is undertaken off site, it will be the duty of the Project Leader to verify that a risk assessment has been made by the host institution. Guidance on the preparation of a risk assessment may be obtained from the RPS.

2.4 RADIOACTIVE SOURCES

The School of Physics and Astronomy uses sealed sources, typically with activities less than 3.7 MBq, in both teaching and research laboratories for calibration and demonstration. A large neutron source of 370 GBq Pu/Be is housed in the teaching laboratory. In addition there are several unsealed alpha/fission-fragment sources which are normally stored in rooms 5-27 and 4-17a, but which may be housed temporarily in equipment in rooms 4-20 and 5-17/20 for the purposes of equipment calibration. For each store of radioactive materials the accounting procedures detailed below must be followed.

2.4.1 Source Accounting Procedures

The School of Physics and Astronomy holds small sealed and unsealed sources in storage locations listed under section 2.4.2 of this document. Each store must be used exclusively for the storage of radioactive materials. Each storage location must display, in a prominent position, a log sheet where each source in the store is identified. Sources removed from the store must be signed out by the user and signed in (preferably by another person) when returned. Wherever possible, the source should be returned to the store at the end of each working day. Sources removed for longer periods must have their location recorded in the log and have that location verified each day by the person signing out the source. For each store there is an appointed person who will verify the contents of the store on a monthly basis. The stock records for unsealed radioactive materials will be completed on a monthly basis.

2.4.2 Areas in the School where radioactive sources are stored or used:

Room 5-27 (Radiochemical Laboratory)
Isotopes are stored securely in several safes located in this room. Please read the Rules for working in this laboratory, as shown in Appendix 1 to this document.

Room 5-17/20 (Clean Laboratory)
Isotopes from Room 5-27 on long term transfer (longer than 1 week) are stored securely in one safe and used in labeled apparatus.

Room 4-17a
Isotopes are stored securely in one safe.

Room 4-20
Calibration sources are stored in a safe in a locked cupboard (4.20b). Sources may be present in labeled apparatus.

Teaching Laboratories
2^{nd} floor nuclear lab: Sealed sources up to 3.7 MBq are stored securely in a safe when not in used. These sources are used for the purpose of laboratory demonstration.

The large sealed Pu/Be (370 GBq) source is kept either in the neutron tank, or in the event of maintenance work on the tank, in the original transport container adjacent to the tank.

The security and accountability of all radioactive sources must be responsibility of a member of staff, who is responsible for ensuring that its use and storage

comply with conditions laid down in the Local Rules, University regulations and Statutory Controls.

Sealed sources of radioactive material are subject to specific conditions of storage and labeling, as follows:

(i) Sealed sources must be clearly identified, with a unique code number.

(ii) Responsibility for the control of a sealed source must be clearly defined and accepted. The location and status of any particular sealed source must be known, to the academic supervisor in whose charge the source is kept, at all times.

(iii) It is a requirement that any person(s) responsible for a sealed source must know, on a daily basis, its location.

(iv) Sealed sources must be securely stored under conditions of locked containment, and access restricted to authorised personnel.

(v) The withdrawal of a sealed source from its storage location, and its subsequent return, must be indicated using the appropriate laboratory system.

(vi) The integrity of a sealed source is required to be tested as specified in IRR99. Leak testing of each source will be carried out by the RSU, who will issue a Certificate.

(vii) The RPS will keep an up to date register of all sealed sources held within the School.

2.4.3 Monitoring of the Working Environment.

For all storage locations for radioactive sources, the RPS or delegated technician will undertake systematic monitoring at monthly intervals, in order to determine the absorbed gamma dose rate at the external surface of each store.

For the above monitoring purposes, the School will maintain a calibrated gamma-ray dose meter as well as a Geiger contamination monitor and a neutron monitor.

2.4.4 Designation of Working Areas and systems of work

Supervised Areas

The 2nd floor teaching lab, rooms 4.20, and room 4.17a are both designated as supervised areas.

Radiochemical Lab 5.27
Room 5.27 houses several sources in three safes. The maximum dose rate in this room is 25 μSv/hr. No radiation worker should be present in this room for more than 200 hours per annum.

Clean Lab 5.17-20
Sources from Room 5.27 may be housed in a safe and used in apparatus. The maximum dose rate in this room is less than 7.5 μSv/hr controlled by the RPS limiting the number and types of sources on extended loan. The transfer of sources is only performed by the RPS.

Neutron Tank
When the neutron tank is drained of water the 2nd floor teaching lab becomes a controlled area due to the fast-neutron dose. This procedure occurs on an annual basis for cleaning of the tank under the conditions described in a System of Work. Only registered radiation workers wearing dosimeters should be involved in the removal of the source to temporary housing in the transport container. The transfer of the source takes of the order of a minute.

Compton Scattering 2nd Floor Nuclear Teaching Lab
The Compton scattering experiment in the 2nd floor teaching lab produces a collimated beam capable of giving dose rates of up to 400 μSv/hr. The beam from this experiment passes clear of the working area for students. Outside of the direct path of the beam the dose rates are less that 7.5 μSv/hr. The Perspex sheet prevents students from leaning into the beam.

Additional
Any experiment temporarily housing a source becomes a Supervised Area and should be appropriately labeled.

2.5 ACCIDENTS AND INCIDENTS

2.5.1 Prevention and Contingency Plans

A major purpose of the formulation of a detailed protocol in advance of starting an experiment is for the prevention of accidents, the avoidance of incidents which might lead to the irradiation of individuals, and to facilitate the formulation of rapid plans of action in an emergency with full knowledge of the facts. As a general principle, radioactive material should not be removed if a laboratory is evacuated.

Actions to limit the spread of contamination must be taken in the event of all incidents. The measures, as outlined in the Risk Assessments, include limiting the movement of workers from and to Controlled or Supervised area following

an incident, the secondary containment of any leakage or fractured sealed source (using strengthened containment bags) and steps outlined in the Site Security plan.

2.5.2 Reporting and investigation

In the event of a spillage of unsealed radioactive material, the RPS must be informed In the event of an accident, immediate action must be taken by those people on hand to contain the accident and limit damage. The health and safety of individuals is to be given absolute priority.

If not present or involved, the academic supervisor must be informed as soon as possible when an accident occurs, and if practicable must attend the site of the accident as soon as possible.

It is the responsibility of the academic supervisor to report any accident or incident involving a radioactive substance to the School RPS. The University RSU must also be informed of any such occurrence. A brief interim report (or reports) should be prepared as soon as possible after the incident and the subsequent action to be taken will be decided following discussion between the supervisor, the School RPS, the School Safety Advisor, the Head of School and the University RPA.

Depending on the circumstances and the nature of the incident, external regulatory bodies (e.g. The Health and Safety Executive, The Environment Agency) will be contacted by the RSU.

At the earliest possible opportunity, a full written report must be submitted to the University authorities and the University RSU.

In response to foreseeable events outlined in the Risk Assessments the following contingencies exist:

- in the event of fire, sources in use in Room 4-20 and in the 2nd floor teaching laboratory are to be “dropped” into the emergency source repositories (and the area evacuated). All other sealed sources must be located in their safes or mounting equipment. The RPS, or deputy, will confirm the inventory and integrity of the inventory (below) as soon as reasonably practicable.

- in the event of loss or theft, an area search is to be undertaken and the loss confirmed. The Head of School, Head of Safety, RSU and appropriate external bodies (e.g. GMP) to then be immediately informed.

- If there are reasonable grounds for believing that any radioactive materials or accumulated radioactive waste has been lost or stolen, or theft has been attempted or there are reasonable ground to believe such an event has occurred:

  - the Police and the Environment Agency shall be notified immediately;

- every effort must be made to recover the source;
- the circumstances, including actions taken, must be reported to the Environment Agency, in writing, as soon as practicable.

- Written confirmation of the above must be sent to the Environment Agency within 24 hours of its discovery.

- In the event of unauthorised use, the nature of the use is to be determined and the degree of loss of control assessed in a written report to the University authorities.

Following any event outlined above (including recovery of a stolen source) a leak test will be performed by the RSU and the results compared to existing records. In the event of leak test failure, or source casing damage likely to result in failure, the source will be condemned and scheduled for immediate disposal.

2.5.3 Dose Investigation Level

Under IRR99 (Regulation 8), it is necessary to specify a dose investigation level. For the purpose of the procedures undertaken in Supervised areas by non-classified workers, and as recorded by dose-rate monitoring of work areas or personal dosimetry, this level is set at a whole body (effective) dose of 2mSv/annum (i.e. 1/3 of the level which would require radiation workers to be Classified).

Appendix 1: Radiochemical Laboratory Rules.

1. Laboratory coats are to be worn at all times.
2. Eating, drinking, smoking and the application of cosmetics are forbidden.
3. Mouth operations are not allowed under any circumstances.
4. Radioisotopes are to be kept within one of the approved locked stores when not in use.
5. Solid radioactive wastes and inflammable liquids are to be placed only in the marked containers.
6. Gloves, laboratory coats, fume cupboards and bench surfaces are to be monitored after work.
7. Hands are to be washed and monitored before leaving the laboratory.
8. In the event of a spill of active material:
   Put on disposable gloves.
   Mop up the spill with absorbent paper.

Bag all contaminated material for disposal.
Report the incident immediately to the RPS.
Monitor the surface when dry.

Assessor(s)	
Signature(s)	
Date	
Date for review	