



Safety Services

UNDERGRADUATE WORK INVOLVING SEALED SOURCES

Introduction

With sealed sources we are concerned with the external hazard that they produce. The potential magnitude of the external hazard can most simply be described in terms of the dose rates to be found in an area, and by doing this it is possible to recognise three types of area:

- i) non-designated area where the instantaneous dose rate is $<2.5\mu\text{Svh}^{-1}$ to the body and $<25\mu\text{Svh}^{-1}$ to the hands.
- ii) supervised area where the instantaneous dose rate is $>2.5\mu\text{Svh}^{-1}$ $<7.5\mu\text{Svh}^{-1}$ to the body and $>25\mu\text{Svh}^{-1}$ $<75\mu\text{Svh}^{-1}$ to the hands.
- iii) controlled area where the instantaneous dose rate is $>7.5\mu\text{Svh}^{-1}$ to the body and $>75\mu\text{Svh}^{-1}$ to the hands.

The limit for the non-designated area is equivalent (at the maximum permitted dose-rate) for somebody working 8 hours a week 50 weeks a year, to an annual dose of 1mSv, i.e. the maximum recommended level for a member of the general public. These guidelines have been drawn up in order to ensure that doses to undergraduates are kept AS LOW AS REASONABLY ACHIEVABLE (ALARA) and below this level. This can be achieved by either restricting the work to a non-designated area or, where a supervised area is required, restricting the time spent in that area.

General Guidelines

The minimum source strength necessary should be used. This should be below 0.5 MBq/source where students are 'handling' the sources. All sources should either be fitted with integral handles not less than 15 cms long or handled with forceps or remote handling tools. It should be remembered that under Regulation 6.5 the employer **shall ensure** that:

"No radioactive substance in the form of a sealed source is held in the hand or manipulated directly by hand unless the instantaneous dose rate to the skin of the hand does not exceed $75\mu\text{Svh}^{-1}$."

Even small gamma reference sources can have surface dose-rates as high as 13.5mSvh^{-1} for a 0.5MBq source.

Where sources with an activity greater than 0.5MBq are used then the undergraduates should not have access to the source or any area in which the instantaneous dose rate exceeds $7.5\mu\text{Sv h}^{-1}$. Any handling of the source, installing in equipment etc. should be performed by a registered radiation worker who is familiar with the hazards associated with the particular isotope in use and the precautions that need to be taken when handling it.

A suitable lockable store should be provided for each laboratory where teaching sources are used and stored. It should be adequately shielded such that the dose rate at the surface of the store is less than $2.5\mu\text{Sv h}^{-1}$ wherever reasonably practicable. The store should be marked with the radiation warning symbol.

A responsible person (senior technician) should be put in charge of: the store; an inventory of contents; and the issue and return to stock of the sources. The responsible person should also check, at least once a month, that all the sources are present and correct and an entry to that effect shall be made in a record book kept in the laboratory.

Prior to any demonstration or experiment involving radiations the students should be given

- a) instructions in the basic aspects of radiation protection appropriate to their work, with the importance of keeping doses as low as reasonably achievable (ALARA) being stressed
- b) reassurance with regard to the possible health hazards
- c) in the case of an experiment, written instructions as to its conduct - and these should have been approved by the appropriate Departmental Radiation Protection Supervisor.

The provision of information, instruction and training is a specific requirement of Regulation 14 of the Ionising Radiations Regulations 1999.

If the work is performed in a Supervised Area then the department would have a responsibility under Regulation 8(2) of the Ionising Radiations Regulations 1999 to provide the student with 'suitable personal protective equipment' when necessary.

Class experiments

For many experiments it may not be possible to keep down to non-designated levels, i.e. below the levels specified in Table 1 below, and with instantaneous dose rates below $2.5\mu\text{Sv h}^{-1}$. It is likely therefore that some supervised areas will be required.

Table 1

Radionuclide	Non-designated area limit in relation to external hazard (MBq)*
Sr-90	1.7
Cs-137	1.7
Cs-137 (betas shielded)	28
Ra-226	1.7
Na-22	7.6
Co-57	133
Co-60	1.7
Co-60 (betas shielded)	6.7
Fe-55	10,000
Am-241	514

**The above activity levels were based upon Schedule 6 of IRR85 and have been retained .*

It is hoped, however, that undergraduates will not require registration as individual radiation workers provided it can be demonstrated that they are unlikely to receive doses in excess of the general public limit of 1mSv per year. In order to do this a list should be drawn up each academic year for each class of student listing all the practicals they may perform during the year involving all types of ionising radiations. A form has been prepared to facilitate this ([ugworkreg.doc](#)). As long as the students are not likely to spend more than 120 hours/annum in a Supervised Area for Sealed Sources or X-rays then it should be a simple matter to demonstrate that the 1mSv dose limit will not be exceeded.

The students should be under supervision at all times whilst radioactive work is in progress.

Project Work

The use of amounts in excess of 0.5MBq per source will not be permitted for any student who is not registered as a radiation worker unless the source is installed in a piece of equipment and the student does not have access to a radiation field where the dose rate exceeds $7.5\mu\text{Sv h}^{-1}$.

Where the dose rates exceed $7.5\mu\text{Sv h}^{-1}$ or where the student is required to gain 'hands on' experience with sources of strength greater than 0.5MBq then he/she should be registered as a radiation worker and the work will have to be performed under a work certificate/scheme of work issued by Safety Services. If the work is with penetrating radiations then the student will be issued with a body monitoring badge.