THE RADIATION PROTECTION NOTE 8: RADIATION PROTECTION IN THE UNIVERSITY OF GLASGOW

This note, read in conjunction with Departmental Radiation Rules, forms the "Local Rules" required by Regulation 18 of the Ionising Radiations Regulations 2017.

RADIATION PROTECTION – ORGANISATION

The University Court carries the ultimate responsibility for the safety of its employees and visitors to the University. Heads of School/College are responsible for implementing safety arrangements within their area. Court is advised on safety matters by the Health Safety & Wellbeing Committee (HSWC). The HSWC oversees the work of the Radiation Protection Service (RPS) and receives the annual report of the RPS from the Radiation Protection Adviser. The remit of the Radiation Protection Service is to provide advice on ionising radiation, laser safety, microwave radiation, ultra violet radiation and RF radiation including mobile phones and mobile phone transmitting stations. The RPS also provides specialist services, including the provision of personal radiation dosimeters, monitoring equipment, laboratory contamination surveys and the disposal of radioactive waste.

The Radiation Protection Service is overseen by the Radiation Protection Adviser (RPA) and his/her deputy, the Radiation Protection Officer (RPO). There is a full-time technician and a part-time secretary.

The University Medical Officer is responsible for the medical examination of "classified" radiation workers.

The head of each area using ionising radiation is required by the Ionising Radiations Regulations 2017 (IRR17) to appoint a suitable Radiation Protection Supervisor who is responsible for writing departmental local rules and ensuring that personnel within the department abide by these rules. Other duties include registering new radiation workers with the Radiation Protection Service, organising routine medicals for 'classified' workers, keeping records of the receipt, use and disposal of radioactive material.

When first registering with the Radiation Protection Service, a radiation worker must sign the registration form stating that he/she has read and understood the local rules and systems of work applicable to their area.

RADIATION PROTECTION – LEGISLATION

<u>Environmental Authorisations (Scotland) Regulations 2018</u>

This Act protects the public and the environment from unauthorised use and disposal of radioactive materials.

Before using radioactive materials, an application for the registration of radioactive materials must be made to the Scottish Environmental Agency (SEPA). At the same time, application must be made for an authorisation to dispose of radioactivity once it becomes radioactive waste. These applications are complicated and time-consuming as full justification and hazard assessments are required before SEPA will issue certificates.

At Glasgow University there are two 'single-site' open source licences covering the Gilmorehill and Garscube campuses respectively as well as other licences for sealed sources. The University is inspected frequently by a SEPA inspector who specialises in radioactivity. Contravention of these licences, whether by exceeding registration limits, losing a source, inaccurate record keeping or exceeding disposal limits may lead to a substantial fine. It is a requirement of the Regulations that a copy of certificates of registration and authorisation shall be kept posted on the premises to which they relate in such a way as to be conveniently read by persons whose duties on the premises may be affected by their requirements.

The RPS is responsible for issuing and controlling sub-limits for each area which utilises radioactive materials.

The Ionising Radiations Regulations 2017

These regulations are made in conjunction with the Health and Safety at Work Act 1974 and are mainly concerned with dose constraints as detailed in Radiation Protection Note No 2. IRR17 is accompanied by an Approved Code of Practice called “Work with Ionising Radiation” that gives guidance on the implementation of the regulations.

Classified Radiation Workers

IRR17 requires that any worker who is likely to receive a radiation dose greater than three tenths of the annual dose limit (ie >6 mSv) should be designated as a “Classified Radiation Worker”. Once registered, the classified worker is given a radiation medical and dose assessments must be made for all lost radiation dosimeters. These assessments are sent to an approved dosimetry service approved by the Health and Safety Executive (HSE) which is also responsible for dose record keeping. Only personnel who handle significant amounts of gamma emitters are designated as “classified” workers, but occasionally workers who regularly exceed the laboratory handling limit for beta emitters can be classified on the advice of the RPA. Workers who may be at risk of an internal exposure may also be classified on the advice of the RPA. Any “classified” worker who travels to an institution other than his employer and enters a “controlled” radiation area is considered to be an “outside worker”. Glasgow University staff who may come under this category should contact the RPS before visiting an outside employer so that arrangements can be made for dose assessments. At Glasgow University staff are mainly designated as “unclassified” workers.

Unclassified Radiation Workers

The great majority of staff at Glasgow University who work with ionising radiation are registered as “unclassified” radiation workers. “Unclassified” radiation workers are treated in the same way as “classified” workers except they do not receive a radiation medical. There is no requirement under IRR17 to provide “unclassified” workers with a dosimeter or to keep a record of their radiation dose, but all radiation workers are given this facility. Providing that the handling limits for “supervised” radiation areas and the “systems of work” on the entrances to “controlled radiation areas" are followed the chances of over-exposure are negligible. The vast majority of radiation dose reports over the last twenty years have recorded “minimum” doses confirming that departmental local rules and systems of work within the University are adequate protection from over-exposure.

Controlled Radiation Areas

These are areas where radiation dose levels may exceed the adequate shielding level of 7.5 $\mu Sv h^{-1}$. At Glasgow University, the door of each “controlled” area carries an 8" x 12" yellow warning sign bearing the legend "Controlled Radiation Area" ; 'No Entry to Unauthorised Personnel' and also the black propeller symbol denoting a radiation hazard. Doors to the entrance of "Controlled" areas, using unsealed sources, must display a "System of Work" that admits unclassified radiation workers to the area. A copy of a typical system of work is displayed on the following page.

Controlled Radiation Areas are required to have a much higher standard of finish than ordinary radiation areas ("Supervised Radiation Areas"). They should contain a stainless steel aero-dynamic fume cupboard with an air flow rate better than 0.5 ms^{-1}, good quality furniture, sealed laminated benches and coved, welded PVC flooring. There should be a handwash basin by the door with elbow taps. Aqueous radioactive waste should be disposed down a sink designated for this purpose only and log books should be readily available to record the date of arrival, usage and disposal of radioisotopes.

One of the main reasons for having controlled radiation areas is that restrictions are lifted on the normal storage and handling limits encountered in other areas, but it is important for all workers to use the shielding and instrumentation available to reduce the risk of over exposure.

IONISING RADIATIONS REGULATIONS 2017

Regulation 19(3c) permits an employee who is not a classified radiation worker to enter and remain in a "controlled" area provided that person abides by the terms of a written system of work which ensures that they cannot be exposed to radiation to an extent exceeding the relevant dose limit.

SYSTEM OF WORK

This "controlled" radiation area may be used by unclassified radiation workers for dispensing radioisotopes and for other manipulations of radioactive material subject to the following conditions:

1 On entry, a preliminary radiation survey must be carried out to verify that the radiation dose rate is less than 7.5 $\mu Sv h^{-1}$ averaged over a minute (10 cps on a standard one inch GM minimonitor) and to check that there is no unfixed contamination of the working surfaces.

2 All manipulations must be carried out in accordance with the Local Rules.

3 For each radioisotope, the maximum activity of stock solution which may be dispensed and the maximum activity of the aliquot which may be manipulated by an unclassified worker is given in the table below.

Radioisotope	^{3}H	^{14}C	^{35}S	^{33}P	^{32}P	^{125}I	^{131}I
Stock Solution Maximum Activity (MBq)	500	250	250	250	50	5	5
Dispensed Aliquot Maximum Activity (MBq)	500	50	50	50	5	5	5

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University Radiation Protection Officer

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Supervised Radiation Areas

These areas are demarcated by an 8" x 5" yellow sign with the legend "Supervised Radiation Area: In the event of a fire, there is no significant hazard from radioactive materials to anyone entering this laboratory for fire-fighting or rescue purposes". The National Radiological Protection Board (now the Public Health England) document M443 recommends that all areas, where the dose constraint for the internal hazard is greater than 1 mSv, should be designated as controlled areas.

1) For gamma and hard beta emitting radioisotopes, the handling limit is 5 MBq

2) For soft beta emitters the handling limit is 50 MBq

Although there has been some relaxation in handling limits in IRR17 and ICRP68, the limits listed below have been adopted at Glasgow University since 1979 and have been retained.

The Storage & Handling Limits for Supervised Radiation Areas

RADIOISOTOPE	*STORAGE LIMIT (MBq)*	*HANDLING LIMIT (MBq)*
^{3}H	*500*	*500*
^{14}C	*250*	*50*
^{35}S	*250*	*50*
^{32}P	*50*	*5*
^{36}Cl	*50*	*5*
^{45}Ca	*50*	*5*
^{51}Cr	*100*	*50*
^{59}Fe	*5*	*5*
^{64}Zn	*5*	*5*
^{75}Se	*5*	*5*
^{125}I	*5*	*5*
^{131}I	*5*	*5*

Supervised radiation areas are general purpose laboratories with good surface finishes. Floors should be made of welded PVC and all wooden surfaces should be covered. Where a sink has been designated for the disposal of aqueous radioactive waste, the Radiation Protection Supervisor should allocate limits so that, overall, the monthly departmental total is not exceeded. All disposals must be logged, and stock record cards amended accordingly.

The Ordering of Radioactive Material

All orders for radioactive material must initially be checked by the Local Radiation Supervisor to ensure that registration schedule limits are not exceeded. All consignments of radioactive material are delivered directly to the Radiation Protection Service who log them, check them against departmental registrations and then deliver them to respective radiation areas.

Storage of Radioactive Material

Anyone wishing to order radioactive materials from the Western Dispensary must first telephone the RPS to receive a unique order number. The names of personnel authorised to order radioactive materials from the Western Dispensary must be sent in advance and orders will only be issued on production of a University ID card.

Storage of radioactive material must comply with the requirements stipulated in the EASR 18 registration certificate. Only authorised personnel should have access to radioactive materials and these persons are responsible for ensuring that these materials are stored in secure locations. Restrictions on storage limits for supervised areas mean that most stock solutions are stored in a controlled radiation area and some of these stock solutions can be for multi-use.

Security is of the utmost importance and fridges; freezers and radioisotope safes should be labelled and be lockable or there should be lockable containers within. All stock solutions must be labelled, and all aliquots should also be labelled identifying them back to the original stock solution. All this information should be entered onto a record stock card or equivalent system.

SEPA inspectors visit the University on a regular basis and randomly inspect record keeping systems within departments. The Inspector may visit your fridge and ask you to produce the record card for a radioisotope stored within, or alternatively, ask to see the radioisotope corresponding to a record card they have selected. Either way, failure to satisfy their requirements would result in the issuing of an improvement notice or worse: a fine not exceeding £20,000 for the loss of a stock solution.

Disposal of Radioactive Waste

Solid Radioactive Waste

This waste must **not** be disposed along with ordinary laboratory waste but articles that have been used during a radioactive experiment (benchkote, gloves, tissues etc) and when monitored are found to be free from contamination, may be disposed via this route. There should be a dedicated radioactive waste bin in each laboratory and all disposals must be logged. There is an absolute limit of 10 MBq per bin for radionuclides having a half-life < 365 days except ^{32}P, tritium and ^{14}C. The Radiation Protection Service provides waterproof labels which must be completed with details from the radioactive waste log prior to disposal. It is important to work out half-life corrections before completing the label as "guesstimates" can be very misleading. The label must be fully completed to show the department, laboratory of origin, date of disposal, isotopes present and their estimated activity on the date off disposal. All sharps should be shrouded and placed in rigid containers which must be sent separately to the RPS and must not be included in normal radioactive waste. It is important to remember that RPS personnel handle this waste therefore all waste disposed should be made biologically safe and high toxicity and carcinogenic components should be noted on the label. ^{32}P is now store-decayed by the RPS prior to disposal and should be segregated from other radioactive waste.

Radioactive animal or putrescible waste will be accepted at the RPS by special arrangement. Large animal carcasses are disposed separately, again by special arrangement.

As mentioned in Radiation Protection Note No:7, it is most important to reduce the volume of radioactive waste by monitoring prior to disposal especially now that all radioactive waste is incinerated rather than going to landfill.

Liquid Radioactive Waste

The disposal of aqueous radioactive waste has already been discussed but radioactive solvent waste is difficult to dispose of and its use must be carefully considered. Solvent waste must not be put down any sink, especially radioactive solvents. Radioactive solvent waste is incinerated by an industrial contractor and the considerable costs will be met by the school/college concerned. The RPS will only accept radioactive solvent waste in standard black metal, three-gallon drums by prior arrangement. Vials containing "Ecoscint" or other safe liquid scintillation cocktails should be packed into five-gallon plastic drums or into heavy grade polythene bags to prevent leakage. There is a section on the stock record card, which should be completed if disposal is via this route.

Radiation Surveys

The Radiation Protection Service conducts three contamination surveys per year in all areas where radioisotopes are used. Written reports are submitted to Local Radiation Supervisors stating whether or not the survey was satisfactory. At periodic intervals, the RPS also conducts radiochemical audits to ensure that departments are keeping accurate records. It is also the responsibility of the units to conduct their own surveys to back up those of the RPS.

Thyroid Monitoring

All workers handling radioiodine should have their thyroids monitored on a regular basis by the Local Radiation Supervisor. The Radiation Protection Service has modified a scaler-timer with a scintillation probe (Minimonitor type 42) for this purpose. For ^{125}I a count rate of 10 cps above background at the "Adam's Apple" relates to a dose commitment to the thyroid of 1.2 mSv. For ^{131}I, 10 cps relates to a thyroid dose commitment of 15 mSv. The RPS should be informed of all thyroid measurements that exceed background levels.

The Use of Ionising Radiation in Undergraduate Teaching

Following the implementation of the Ionising Radiations Regulations on January 1st 2018, the following guidance notes are for schools/colleges who are involved in the use of ionising radiation in undergraduate teaching.

There are two aspects of this situation:

(1) the radiation exposure of undergraduate 'volunteers' who agree to some predetermined radiation exposure as part of an experiment where X-rays or radioisotopes are administered directly to the 'volunteer' and

(2) the more usual situation where there is a small radiation exposure, or risk of such exposure, in the course of a teaching or demonstration experiment.

The Health Safety & Wellbeing Committee prohibits the use of experiments of type 1 and, for type 2 teaching experiments, recommends that the radiation protection standards laid down for the use of ionising radiation in schools should be adhered to in general, with a small number of exceptions permitted in the case of honours students whose work is directly supervised by a member of staff.

Work with ionising radiation in schools is governed by the Department of Education and Science Administration Memorandum AM/1/92 which in turn follows the International Commission for Radiological Protection (ICRP) recommendations on this subject.

The whole body (stochastic) dose limit for pupils and undergraduates is 0.5 $mSvy^{-1}$ (excluding natural background radiation and medical procedures) and the single organ dose limit is set at 5 $mSvy^{-1}$. In addition, it is recommended that the dose equivalent from each teaching exercise should not exceed one-tenth of the annual values. These limits are quite low and may be compared with the natural background dose rate of approximately 1 $mSvy^{-1}$ excluding the radon contribution and the IRR17 recommended radiation worker annual dose limit of 20 $mSvy^{-1}$.

In following these recommendations, the University is not required to register undergraduates as radiation workers or to provide radiation dosemeters. Where honours students are engaged in project work under the close supervision of a member of staff, they may handle larger activities of unsealed radioactive material than those listed in Table II below and are required to register with the Radiation Protection Service. The RPS will issue radiation dosimeters and dose records will be held with an approved record keeping service.

To achieve the standards laid down, all experiments and demonstrations involving the use of ionising radiation should be carefully prepared with a view to minimising radiation exposure at all times. Adequate supervision of undergraduates must be provided and instruction in correct handling techniques, with a brief explanation of the hazards involved, should precede the actual experiment.

A summary of the main ICRP recommendations is given below.

X-RAY APPARATUS (non-diagnostic)

X-ray apparatus should be completely enclosed (including the useful beam) in protective shielding such that the dose rate dose not exceed 5 μSvh^{-1} at a distance of 5 cm from the shielding at the maximum operating conditions of the set. Interlocks should be provided to shut off the useful beam if the shielding is moved.

DISCHARGE TUBES

These are potential sources of high radiation dose rates and should be checked by the University RPS under the actual working conditions before use in demonstration lectures, etc.

CLOSED (SEALED) RADIOACTIVE SOURCES

For sources causing external radiation, the activity is restricted according to the dose rate they cause when fully exposed. Table I overleaf gives the maximum permitted dose rate at 0.1 m and the typical maximum activity for different types of source.

Source	*Maximum Dose Rate* μSvh^{-1}	*Typical Maximum Source Activity*
Beta-particle	50	50 kBq
Gamma-ray	10	500 kBq
Neutron	10	5000 ns^{-1}

Table I: ICRP 36 Recommended Maximum Dose Rate at 0.1m

Sources that do not satisfy these requirements should be shielded so that the dose rate does not exceed that given above for X-ray apparatus. The University RPS should monitor them before they are used in teaching. The shielding should carry a warning notice to the effect that a radioactive source is present and the radioisotope and activity involved should be clearly marked.

All sources used in a teaching laboratory **must** be returned to secure storage at the end of the teaching period and a check made that none are missing.

UNSEALED RADIOACTIVE MATERIAL (OPEN SOURCE)

The attention of the student should be drawn to the necessity of avoiding contamination of the laboratory or themselves and the usual precautions for the use of open source material should be employed, ie benchkote, spill trays, disposable gloves, etc. The pamphlet 'Health Physics - A Short Account for Undergraduates' produced by the RPS in June 2004 may be helpful in this respect. To reduce to an absolute minimum the risk from inadvertent inhalation or ingestion of unsealed radioactive material, ICRP recommend that the maximum activity in use during an experiment should not exceed one-tenth of the Annual Limit of Intake (ALI) for a radiation worker of the radioisotope involved. Table II lists the value of this quantity for the radioisotopes most commonly used in the University.

Radionuclide	^{3}H	^{14}C	^{35}S	^{32}P	^{45}Ca	^{59}Fe	^{125}I	^{131}I
One-tenth ALI (MBq)	100	4	3	0.5	1	0.5	0.1	0.08

TABLE II Maximum Permissible Activity per Experiment

Most undergraduate experiments can be carried out with activities much smaller than those listed above.

Experiments using natural uranium and thorium compounds require particular care. Table III gives the maximum quantity of these materials that may be used in teaching experiments. The value quoted for uranium takes account of both chemical toxicity and radiation protection requirements.

Element	*Activity (Bq)*	*Mass (Milligram)*
Thorium	5	1
Uranium	50	5

TABLE III Maximum Activity of Thorium or Uranium per Experiment

OTHER SOURCES OF IONISING RADIATION ENCOUNTERED BY UNIVERSITY PERSONNEL

Diagnostic X-ray Equipment

All radiographers are "classified" radiation workers. All other personnel involved with radiography should follow the instructions in written systems of work to keep their radiation dose to a minimum.

X-ray Crystallography

Engineering controls and written systems of work allow workers in these areas to be designated "unclassified". It is very important to follow the step by step operating procedures for these devices and to ensure that shielding, especially a beam stop, is in place.

Electron Microscopes

No significant radiation hazard has ever been detected from one of these devices but occasionally low level radiation leakage is discovered after a service or overhaul. The RPS should be contacted whenever maintenance has taken place to ensure the continued safety of personnel. There is no requirement to register EM personnel or to issue them with dosimeters.

Accelerators and Reactors

There are two accelerators currently in operation in the University. One is stationed at SUERC, East Kilbride and is a research device. The other is in the SAH, Garscube Campus and is used for therapeutic treatments.

OTHER CATEGORIES OF WORKERS

University Personnel working in NH Trust Premises

The owner of a property is responsible for the health and safety of personnel within that property therefore the local NH Trust looks after University personnel working on hospital premises. However the University RPS liaises very closely with the Trust RPS and personnel from both areas attend the annual radiation protection course run by the University RPS. It is imperative for University staff to notify the RPS prior to working with radioactive materials or apparatus in an NH Trust premises.

Technicians aged 16 to 18

Technicians under the age of 18 may work within a supervised radiation area but must not be put into a position whereby they are required to become "classified".

Pregnant Radiation Workers

The Ionising Radiations Regulations 2017 came into force on January 1 2018. Part of these regulations state that every employer shall ensure that:

*"Those female employees of that employer who are engaged in work with ionising radiation are informed of the possible risk arising from ionising radiation to the foetus and to a nursing infant and of the importance of those employees informing the employer (*in your case, the Radiation Protection Adviser) *in writing as soon as possible:-*

1. *after becoming aware of their pregnancy; or*
2. *if they are breast-feeding."*

The annual effective dose for any employee of 18 years of age or above has been reduced from 50 mSv to 20 mSv in any calendar year but for women of reproductive capacity, the limit on equivalent dose for the abdomen shall be 13 mSv in any consecutive period of three months.

Once a pregnancy has been confirmed, all efforts will be made to ensure that the dose to the foetus is < 1 mSv for the remainder of the pregnancy. For women who are breast-feeding, extra precautions should be taken in the workplace to ensure that radiation contamination levels are minimal.

Exposure of the embryo in the first three weeks following conception is not likely to result in deterministic or stochastic effects in the live born child. Diagnostic and therapeutic procedures causing exposure of the abdomen of women who suspect they are pregnant should be avoided unless there are strong clinical indications.

At Glasgow University we have followed the recommendations as laid down in the International Commission on Radiological Protection publication 60 since 1990. These limits are almost identical to the new limits and no radiation worker at Glasgow University has come anywhere near to a reporting level.

It must be stressed that any information you give to the Radiation Protection Service will be treated with the utmost confidence and details will not be passed to schools/colleges without your explicit instruction. If you require any further information, or clarification, please do not hesitate to contact The Radiation Protection Adviser on extension 4471.

Visitors to the University

The University is responsible for all personnel on its premises irrespective of whether they are employees. When visitors wish to work with ionising radiation they will be treated as if they are employees and will be asked to register as a radiation worker even if they are here for only a few weeks. The reason we can provide this service is that "spare" radiation dosimeters are always available at the RPS and the registering of personnel with Landauer, our approved dosimetry service, is straightforward and cost free. Any visitor who is a "classified" radiation worker and wishes to enter a "controlled" radiation area at Glasgow should carry a radiation passbook and have details of any radiation dose received here filled in by the RPA.

Maintenance Staff

Estates personnel require access to all areas for maintenance purposes. Whenever they enter a "controlled" or "supervised" radiation area they must do so only after the RPS has issued a permit to work stating that the area has been monitored and is safe to carry out maintenance. Certain occasions require the presence of a member of the RPS to monitor the procedure ie when breaking into radioactive drains or the repair of leaks from designated sinks.

Outside contractors are accorded the same facilities as University personnel but they must make contact with the Radiation Protection Service prior to commencement of work so that safety procedures may be put in place for their workmen. In the case of outside contractors a ‘handover’ arrangement is in place, this effectively hands over control of the radiation area to the contractor until the work is completed.

Cleaning Staff

Cleaning staff may enter "supervised" radiation areas without requiring a permit to work. It is the duty of radiation workers in these areas to ensure that the laboratory is left in a tidy and contamination free state at the end of each working day. Cleaners must not be asked to tidy benches where radioactivity or other hazardous chemicals are used. Cleaners are not permitted to enter "controlled" radiation areas unless the area is radiation free and a permit to work has been issued by the Radiation Protection Service. In special circumstances, cleaners are issued with radiation dosimeters because of historical reasons, but these personnel should never be put into a position whereby they come into contact with ionising radiation.

RADIATION DOSIMETERS

Luxel Optically Stimulated Luminescence (OSL)

Under IRR17 only “classified” radiation workers are required to wear a dosimeter from an approved dosimetry and record keeping service. However, all radiation workers in the University are issued with a dosimeter to record any external ionising radiation. The dosimeter should be worn at the level of the top pocket of a laboratory coat as exposure of the eyes to beta radiation is the principal external radiation hazard in most laboratories.

The badge holder contains filters that enables the dosimeter to determine whether the exposure is to beta or penetrating radiation such as low energy X-radiation or gamma radiation.

It is important to avoid splashing the dosimeter with radioactive solutions because even very small traces of radioactive contamination will result in erroneous doses being recorded. OSL dosimeters are ten times more sensitive than film or TLD dosimeters and have a threshold level of 0.01 mSv (10 μSv).

It is most important to return dosimeters promptly at the end of a wearing period as any delay may result in the badge being returned to the approved dosimetry service without a "control" badge that normally cancels out doses received to both. The control badge is kept within a radiation free area in the RPS office until all badges are returned. It then travels with the returned badges back to America and any dose received during the flight is automatically removed so that the only dose recorded is that received by the worker in the laboratory.

Thermoluminescent Finger Dosimeters

These dosimeters are designed to record the dose received to the fingers during the dispensing of radioactive materials. Any worker who regularly exceeds the handling limit or is performing a new technique should wear one of these badges.

Fast Neutron Nuclear Track Emulsion Dosimeters

These dosimeters are supplied to personnel who are exposed to fast neutrons produced by unshielded neutron sources or accelerators.

Reporting of Radiation Doses

Local Radiation Supervisors are informed of all doses exceeding 0.3 mSv. If, on processing, a dosimeter records a dose greater than 30% of the maximum permitted dose for that period, the record keeping service informs the University immediately and the RPA conducts an investigation. At the end of the year, each worker is sent a copy of the annual dose received.

Transport of Radioactive Materials

The rules and regulations involving the transport of radioactive materials are complex and the RPS should be consulted whenever these materials leave University premises. Transport of radioactive materials within the UK is governed by the 'Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations SI 2009 No.1348 (CDG2009)' a summarised version can be obtained via email from the RPS office. Anyone receiving a significant quantity of radioactive material from the EEC is required to complete form number 1493/93, again available from the RPS.

Public transport and taxis must not be used for the transport of radioactive material; University transport should be used at all times. Private cars may be used for the transport of excepted packages provided the insurer is informed beforehand.

EMERGENCY PROCEDURES

Where a radiation accident is accompanied by serious personal injury, treatment of the injury takes precedence over decontamination and containment of contamination. Immediate medical assistance should be obtained from the Occupational Health Unit on extension 7171. If an ambulance is required, call extension 4444 (Gilmorehill) or 2222 (Garscube). It is advisable to forewarn A & E of the nature and activity of the contamination so that preparations for the reception of the patient can be made. This information should be put in writing and be carried by a responsible person accompanying the patient to the hospital.

Laboratory Fires and Explosions

In the event of a fire or explosion affecting a controlled or supervised radiation area, local area fire drill procedures should be followed and the Local Radiation Protection Supervisor and the Radiation Protection Service should be informed. In the event of the fire brigade arriving before the Radiation Protection Supervisor or the RPS, a responsible person should give relevant information regarding the location, type and activity of any radiochemicals within the fire area. It is considered radiologically safe for emergency services to enter supervised radiation areas because of the low handling and storage limits but chemical suits and breathing apparatus should always be worn when entering controlled radiation areas and then only on the advice of a responsible person.