Appendix 6

Local Rules for the use of ionising radiation and radioisotopically labelled chemicals in the School of the Environment and Society

Person responsible for all radioactive work within the Radioactive Suite Room 130 Wallace Building:
Dr. R.S. Conlan
Radiation Protection Supervisor (RPS)
Room 405, School of Medicine, Institute of Life Sciences
Tel. Internal 5386, External 01792 295386
Tel. out of hours: 07545 42911

Email: r.s.conlan@swan.ac.uk

Technician responsible for isotope work in the School:
Mrs. E.P. Diffley
Room 127 Wallace Building
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Emergency Contact Telephone Numbers

UWS Emergency Switchboard **333**

Dr. John Lancaster
School Safety Officer (SSO)
School of the Environment and Society **5451**

Dr J. Bishop
Safety Officer (SO)
School of Medicine 2175

University Safety Office
University Radiation Protection Supervisor (URPS) **5152**

University Policy Documents and Mandatory Forms for completion are available online at:

http://www.swan.ac.uk/estates/SafetyOffice/

Use of ionising radiation and radioisotopically labelled chemicals in the School of the Environment and Society

General

In the Department of Pure and Applied Ecology, you will be dealing predominantly with unsealed radioactive sources. In the Department of Geography, you will be dealing with either a sealed radioactive source or a commercial x-ray machine with safety interlocks. The following general regulations which operate in the laboratories of the School of the Environment and Society supplement the University of Wales Swansea Laboratory Rules for Unsealed Radioactive Substances (F9626).

Every individual working with radiochemicals is required to protect both him/herself and others by complying with national legal requirements (The Radioactive Substances Act, 1993 and the Ionizing Radiations Regulations, 1999) concerning radiation hazards, which embody the principle that all necessary steps shall be taken to reduce, as far as reasonably practicable, the extent to which people are exposed to ionizing radiation. The local regulations together describe the procedures which must be followed to ensure both good experimental practice and compliance with legislation in the use of radioactive substances. The regulations are, of course, to be observed in addition to the normal 'School of the Environment and Society Safety Regulations'.

All individuals wishing to use ionizing radiation in their project/thesis work must complete a Radiation Workers Registration Form available online at http://www.swan.ac.uk/estates/SafetyOffice/ as fully as possible. The form must be authorized by the School of Medicine Radiation Protection Officer (RPS) as the School of Medicine now has responsibility for use of the Radioisotope Suite (Room 130) and a copy deposited in the Safety Office *before* ordering or using radioisotopes.

1 Authorization

a) Compliance with the regulations concerning use of radioactive substances in the School is administered by the School of Medicine Radioisotope Protection Officer (RPS)

b) Staff and students within the School are only allowed to use radioisotopes within the School facilities with the permission of the RPS and this permission is given on the agreement by the worker that the general regulations together with any further additional conditions (Local Rules) that are applied will be observed. Breaches of these regulations may lead to the individual's permission to work with radioisotopes being withdrawn.

c) All new graduate students, graduate research assistants, postdoctoral fellows,

technicians and members of academic staff must discuss any proposed usage of radioisotopes with the RPS, have the work approved and be registered as an "authorized radioisotope worker" by completing the Radiation Workers Registration Form , which must be authorized by the RPS and a copy deposited in the Safety Office before ordering or using radioisotopes. Necessary training must be given in the relevant radiochemical techniques by the appropriate academic supervisor.

d) Undergraduate students, if required to use radioisotopes in project work, must be individually authorized by the RPS. Those students whose work involves use of radioisotopes must be instructed by the academic supervisor in relevant practical aspects of radioisotope usage and radiation protection.

2. Ordering and Keeping Records

i) Orders for radioisotopes marked for delivery to the Safety Office MUST be countersigned by the RPS and MUST be accompanied by a completed Application to Acquire Unsealed Radioactive Sources form countersigned by the RPS (and where appropriate by the worker's supervisor). It is also a UWS requirement that the proposed acquisition be notified to the UWS Radiation Protection Supervisor (URPS)/Safety Office for approval. In the absence of the RPS, the acquisition MUST be approved by the URPS/Safety Office before the order is placed.

ii) Acquisition of radioisotopes as gifts, samples, transfer from other Institutes, Departments, research groups etc. must be notified to, and authorized by the RPS prior to arrival of the material.

iii) Incoming radiochemicals will be delivered to the Safety Office and will only be issued to the principal user, who must assign a Laboratory Unsealed Source Record from for every radiochemical source and will be responsible for accounting for the use/disposal of that radiochemical. Incoming radiochemicals will not be issued to undergraduates. http://www.swan.ac.uk/media/Media,27068,en.doc

iv) Accurate records of usage and disposal must be entered on the Laboratory Unsealed Source Record for every source. All disposals must also be recorded on the Radioactive Waste Disposal Form held in room 130 in the Wallace Building. Accurate records of usage and disposal for rooms Wallace 130 and 130A will be completed every month.

v) Each recorded purchaser of radioisotopes will be required to account for the remaining stocks annually.

3. Experimental Use

i) Work with radiochemicals and other ionising radiation sources may normally only be carried out in the following designated laboratories under the respective Local Rules:

a) Laboratories 130 and 130A (Wallace Building). [Radiochemicals]]
b) Laboratory 018 (Wallace Building). [x-ray machine only]

ii) Procedures involving specialised facilities at other locations must be discussed with, and approved by, the School Safety Officer and RPS before initiation. Only workers authorized by the RPS may enter radioisotope laboratories.

iia) You are required to "sign in" in the log book in the radioactive suite when you start a session of work, and to sign out when you finish, indicating which isotope(s) you were using and the results of your contamination check at the end of the session of work (see 3ixb below).

iib) To minimise exposure appropriate shielding must be used when manipulating or storing radioactive material (including waste) as indicated below:-

Low energy β-emitters (including ^{3}H, ^{14}C and ^{35}S)

Glass vessels and aqueous solutions provide adequate shielding for sources <183MBq (5mCi). Above this level 10mm Perspex or acrylic shielding must be used.

High energy β-emitters (including ^{45}Ca, ^{32}P, ^{33}P)

10mm acrylic or perspex shielding must be placed on the bench between the radioactive source and worker's trunk and face. Radiochemical stocks are to be stored in the shielded containers as supplied by the manufacturer; experimental samples generated and waste are to be stored in lidded boxes constructed of 10mm acrylic or perspex.

Low energy γ-emitters (including ^{125}I and ^{55}Fe)

1mm lead sheeting or 10-12mm thick lead acrylic (equivalent to 0.5mm lead) shielding must be placed on the bench between the radioactive source and worker's trunk and face. Radiochemicals are to be stored in the shielded containers as supplied by the manufacturer; experimental samples generated and waste are to be stored in lidded boxes constructed of 1mm lead sheeting or 10mm lead acrylic.

iic) Workers using high energy β-emitters and/or low energy γ-emitters must wear a personal dosemeter and an extremity "finger" dose meter and return these monthly to the technician with responsibility for the radioisotope suite for assessment.

iiia) Protective gloves, safety spectacles and a fastened laboratory coat must be worn when handling radioactive substances. The mouth **MUST NOT** be allowed to come into contact with any apparatus; pipettes, for example, must be operated by other means. The work area should be clean, tidy and clear of extraneous equipment, and the whole working surface covered with a disposable liner such as Lab-Top. Wherever practicable, manipulations must be carried out inside a suitably lined tray to provide secondary containment preventing spread of contamination in the event

of spillage.

iiib) When working with any radioisotope except ^{3}H, work areas should be continually monitored with either a β- or γ-contamination monitor, as appropriate, so that any spillages or radiation leakages are detected as soon as they occur and appropriate remedial action can be taken immediately.

iv) Eating, drinking, smoking, taking of snuff and the application of cosmetics must not take place in designated laboratories. Cuts and other breaks in the skin must be covered. Disposable tissues must be used instead of handkerchiefs.

va) Stocks of radiochemicals must only be held, as appropriate to the stability of the radiochemical, in the designated locked cupboards, refrigerators or freezers in the radioisotope facilities.

vb) When opening new batches of radiochemicals labelled with γ-emitters or β-emitters, except tritium, the containers must be monitored for leakage/contamination with the appropriate monitor. For tritium-labelled radiochemicals, wipe-tests for contamination (see 3vixb) below must be carried out on the containers.

v) Radioactive stocks must be adequately sealed and stored in a stable container, e.g. a small flask within a larger beaker, and should be adequately labelled, including the:-

a) principal user's name
b) nature of the radiochemical
c) total amount of radioactivity initially present
d) radioactivity/unit volume of solution

vii) If it is necessary to transport radioactive materials, including samples for scintillation counting, from one laboratory to another, they must be transported in a container providing adequate secondary containment and shielding. Samples containing >40 kBq (1 micro Curie) must be transported in the special containers available.

viii) Radioactive experimental samples, labelled with the user's name, the isotope, the nature and where possible the estimated amount of radioisotope, must be stored in a designated refrigerator/freezer or other appropriate designated area within the radioisotope facility.

ixa) Manipulation of isotopes (as opposed to counting) should normally be carried out only within normal working hours (9.00 a.m. - 5.30 p.m., Monday - Friday) when there are others present to render assistance if needed.

ixb) At the end of a session of work, the surfaces of your work areas, equipment and body indicated in the table below must be monitored for contamination.

SURFACES TO BE MONITORED FOR CONTAMINATION

Surfaces to be monitored at end of work session before removing laboratory coat and gloves:-

a) Work area(s) used (including bench areas and fume cupboards) and free standing equipment used
b) Floor area(s) (2m x 1m) adjacent to work area(s)/equipment
c) Laboratory coat front
d) Gloves
e) Trousers/skirt/legs, neck and face
f) Shoe uppers and soles
g) Fridge/freezer handles
h) Sink tap handles
i) Telephone receiver
j) Light switches
k) Laboratory door handles

Surfaces to be monitored after removing laboratory coat and gloves and washing hands:-

a) Whole of laboratory coat
b) Hands
c) Soles of shoes

Monitoring Procedure

After working with radioisotopes other than ^{3}H, monitoring should be carried out by slowly passing a β-contamination monitor (for ^{14}C, ^{35}S, ^{32}P, ^{33}P or ^{45}Ca) or γ-contamination monitor (for ^{125}I or ^{55}Fe) held 0.5cm above each surface specified in the table above.

If a reading higher than normal background ($\leq$ 5 c.p.s. for β-monitor, $\leq$ 10 c.p.s. for γ-monitor) is detected, the monitor should be held stationary over the most active area. A sustained reading in excess of 5 c.p.s. on the β-monitor indicates residual β-contamination above the acceptable level, and a sustained reading in excess of 10 c.p.s. on the γ-monitor indicates an unacceptably high level of γ-contamination.

Mark the contaminated area. If on disposable material, e.g. benchliner, cut out and

dispose as solid waste. In other cases, institute decontamination procedures by washing with water/detergent solution or other appropriate solvent, and continue until count rate falls to an acceptable level ($\leq$ 5 c.p.s. for β-contamination, $\leq$ 10 c.p.s. for γ-contamination). If, after reasonable attempts the contamination level remains unacceptably high, seek further advice and help from the technician responsible for the radioisotope laboratory and the SRPS, but DO NOT TAKE CONTAMINATED MATERIAL (e.g. LABORATORY COAT, SHOES) OUTSIDE THE RADIOACTIVE SUITE.

Tritium radioactivity cannot be detected with β-contamination monitor instrument. Workers using ^{3}H should carry out 'wipe-testing' for tritium contamination. Representative areas from the surfaces indicated in the table above should be wiped with 1cm^2 pieces of tissue moistened with water, and the 'wipe' obtained counted by liquid scintillation counting for 5 minutes. A count rate for the wipe in excess of 50 cpm indicates an unacceptably high level of contamination. If you are not able to count all your wipes at the end of the day before leaving the laboratory, give those for your body and shoes and highest priority; you must check the counts data the following day for all areas monitored, and take the appropriate remedial action if contamination is detected.

A record of results of your contamination monitoring at the end of each session of work with radioisotopes must be entered when you sign out of the laboratory, or, in the case of ^{3}H-wipe-test monitoring, as soon as all the scintillation counting results are available. Indicate whether you detected unacceptably high levels of residual contamination and, if so, its location and whether decontamination procedures were successful.

x) Any manipulation involving radioactive spray, vapour, aerosol, dust or gas must be carried out in the designated fume cupboards in the radioisotope laboratories. Where it is expected that a radioactive gas or vapour may be generated, the experimental design should incorporate a system to trap any volatile radioactivity.

xi) Contaminated glassware should be soaked in clearly labelled containers of detergent solution prior to washing, 24h generally being adequate. Sink areas used for this purpose must be kept especially tidy.

xii) All equipment must be decontaminated before it is returned to the stores or to general laboratories.

xiii) Radioactive warning tape is only to be used when a piece of equipment, container, etc. contains radioactive material or is contaminated and is **NOT** to be used under any other circumstances.

xiv) Experiments involving ^{14}C, ^{3}H, ^{55}Fe or ^{35}S in amounts exceeding 3.7 MBq (100 microCuries) in a single experiment, or isotopes other than ^{14}C, ^{3}H, ^{55}Fe or ^{35}S regardless of quantity, must be specifically discussed with the research supervisor and the RPS prior to execution, and any additional conditions of experimental use required by the RPS must be observed.

xv) Records of usage of stock solutions must be entered on the record sheet held by the individual or supervisor as soon as practicable.

xvi) No user shall carry out maintenance work, effect repairs or dismantle any instrument containing a radioactive source without written authorization from the SRPS.

4. Accumulation and Disposal of Radioisotopes

i) Radioisotopes, including material contaminated with radioisotopes, may be accumulated or disposed of routinely in the following forms, subject to the monthly limits indicated in Table below.

LIMITS AND ROUTES FOR DISPOSAL OF RADIOCHEMICALS

CATEGORY OF WASTE		ACCUMULATION/ DISPOSAL ROUTE	ACCUMULATION/ DISPOSAL LIMIT per WORKER per MONTH	
			MBq*	microCuries*
Water soluble	All water soluble waste	Designated sink	18.3	500
Organic solvent soluble	Organic solvent **other** than scintillant	Designated container	2	50
	Scintillation fluid and vials	Designated disposal drum	0.4	10
Solid Waste	Long half-life isotopes (half-life > 60 days)	Bagged in designated containers	2	50
	Short half-life isotopes to be held for decay (half-life < 60 days)		20	500
Gaseous Waste	Tritium	Designated fume cupboards	$8x10^3$	200
	Carbon-14		4	11

* 1 microCurie = 2.2×10^6 d.p.m.; 1MBq = 1×10^6 d.p.s (60×10^6 d.p.m)

EXPERIMENTS INVOLVING DISPOSALS GREATER THAN ABOVE MUST BE DISCUSSED WITH THE APPROPRIATE SRPS PRIOR TO EXECUTION.

ii). Water soluble radioactive waste must be disposed of only via designated sinks in the Radioisotope Laboratories. The waste should be washed down with large quantities of water. Consult the RPS before disposing of amounts in excess of 18.3 MBq (500 microCuries). An accurate estimate of the amount and identity of the isotope must be entered in the record book by the sink and on your disposal record form.

UNDER NO CIRCUMSTANCES IS WASTE ORGANIC SOLVENT OR SCINTILLATION FLUID TO BE PUT DOWN THESE SINKS.

iii) **Organic Liquid Waste**

a) Scintillation counting fluid:- Used scintillation vials, complete with contents, must normally be transferred directly to the designated 30 litre disposal drums in the appropriate radioisotope facility. A separate, clearly labelled drum should be used for each isotope; where samples contain more than one isotope, these should be segregated into an appropriately labelled disposal drum. **If individual vial contents exceed 0.36MBq (0.5 microCuries), these must be segregated and disposed of via the route described under 4 iiib).**

b) Solutions of radioactive waste in other organic solvents must be transferred to a Winchester bottle or can bearing a disposal label identifying the isotope and its amount, the major solvent and the individual generating the waste and the date. The container is to be stored in a solvent cabinet in the radioisotope laboratory, in accordance with regulations for the storage of organic solvent, and when full or otherwise completed, the technician with responsibility for the facility advised to arrange disposal.

iv) **Solid Waste and Sealed Radioactive Sources** - Solid waste containing radioactivity must be segregated into two categories (a) waste contaminated with isotopes of long half-life (half-life > 60 days) and (b) waste contaminated with isotopes of short half-life. Long half-life waste is to be disposed of as soon as practicable, whilst short half-life waste should be held to decay in the School External Holding Facility Chemical Store following approval of the SRPS.

In the case of long half-life waste non-incinerable items, e.g. glass and metal must be separated from wholly incinerable waste such as paper and plastic disposables, and the non-incinerable items decontaminated by soaking, and after decontamination disposed of by the normal route for broken glassware, etc. If decontamination is not practicable, as for example with syringe needles, these should be transferred to a ‘Sharpsbin' type safety container in the appropriate radioactive suite.

a) Wholly incinerable waste contaminated with long half-life radioisotopes should be bagged and labelled with the name of the originator, identity of the isotope and nominal maximum activity. The bag is then to be transferred to the designated containment bin in the radioisotope laboratory, and the disposal record sheet on the bin completed.

b) Waste contaminated with short-lived isotopes, e.g. ^{32}P, ^{125}I, waste should be bagged and labelled with the name of the originator, nominal activity and isotope and transferred to the School External Holding Facility, as arranged with the SRPS.

c) When sealed radioactive sources, e.g. calibration sources for instrumentation, are no longer required, they must be disposed of ONLY by arrangement with the SRPS and the URPS/Safety Office.

v) Gaseous waste must be discharged only via the designated fume cupboards in

radioisotope suites, and any experiment in which there is a possibility of exchange of volatile radiolabelled material with the laboratory atmosphere must be carried out in a designated fume cupboard. Note that only ^{3}H and ^{14}C may be disposed of by this route, and that the maximum limits for disposal are relatively low (0.4 MBq, 10 microCuries). Any experiment involving larger amounts of gaseous waste of these or any other nuclides must be discussed with the SRPS and planned to ensure efficient trapping of volatile radioactivity.

vi) A record of disposals must be returned on the form provided, which should be completed at the time of disposal. A radioisotope usage return will be made at the end of each month by the RPS or designated person.

5. Personal hygiene

i) Contamination monitors are available for monitoring β- and γ- emitter contamination. A reading in excess of normal background indicates contamination above the maximum permissible level and steps must be taken to remove the contamination. If in doubt consult the RPS or Safety Office.

ii) When not in use, laboratory coats and rubber gloves should be left in the radioisotope laboratory. Individuals should monitor these items for contamination on a frequent and regular basis and at least at end of each session of work, and appropriate action taken if contamination is detected.

iii) After completing a session of work with radiochemicals, individuals should check their person and site of work with the contamination monitor as required and thoroughly wash their hands before leaving the laboratory.

6 Accident and Emergency Procedure

i) Where contamination of the clothing or body has occurred, immediately remove contaminated articles and decontaminate body with water or other appropriate solvent as described below. Do not abrade skin, however. Dial 333 for assistance and follow the Emergency and Accident Procedures given below, additional copies of which are available in each radioisotope laboratory.

ii) In less major incidents, where a relatively small amount of contamination is limited to the working surface, floor and equipment, attempt to limit the spread of contamination, e.g. by soaking up solution in tissues, **PROVIDING THIS CAN BE DONE WITHOUT CONTAMINATING THE WORKER'S PERSON**, following the procedures described overleaf.

THE RPS AND THE TECHNICIAN WITH RESPONSIBILITY FOR THE RADIOTOPE LABORATORY, MUST BE NOTIFIED OF THE SPILLAGE AS SOON AS POSSIBLE.

If the floor is contaminated, prevent access to the contaminated area by erecting a barrier with e.g. stools and tape, and a sign reading '**RADIOACTIVE CONTAMINATION, KEEP AWAY**'.

ADDITIONAL EMERGENCY AND ACCIDENT PROCEDURES WHERE IONISING RADIATION IS INVOLVED

These procedures are additional to fire regulations and relate to:

1. Incidents, however minor, in which it is suspected that a person has been exposed to radiation abnormally.
2. Incidents in which a person and/or his/her clothing have been significantly contaminated with radioactive material
3. The ingestion of any radioactive material into the body through cuts, wounds, by breathing through the mouth, etc.
4. Any fire or explosion where radioactive materials exist.
5. A large spillage of radioactive material.

IN ANY OF THE ABOVE EVENTS, DIAL 333, TELL THE OPERATOR THAT A RADIATION ACCIDENT HAS OCCURRED.

Tell the operator where it happened. (The operator has a list of staff to call in an emergency). Contact the RPS, the URPS, another RPS or a School Safety Officer (see front cover for details).

Also contact your research supervisor and whilst waiting for assistance, warn everyone in the immediate area of the hazard and proceed as follows:

Personal Contamination

Contaminated clothing should be removed and the following decontamination measures should be taken where appropriate

Wounds Contaminated wounds should be washed under running water and reasonable bleeding should be encouraged. Care should be taken not to contaminate eyes, mouth or nostrils. The wound should finally be washed with soap and water and dressed

Mouth Should be washed out several times with hydrogen peroxide solution (1 tablespoon of 10 volume solution to a tumbler of water).

Eyes Should be irrigated with tap water or with saline solution (1% common salt solution).

Hands Care must be taken not to damage the skin. Hands should be washed with water, if necessary using a **soft** nail brush. If this is unsuccessful, they could be washed with undiluted washing-up liquid.

Skin Rub **gently** with cotton wool, taking care not to damage the skin.

Decontamination should continue in all cases until monitoring shows that contamination has been removed, unless there is a danger of contamination entering the blood stream **via** skin roughened or broken by decontamination procedures.

Ingestion

If a radioactive substance has been swallowed use a conc. salt water emetic (or a large finger). It is particularly important that no action should be taken likely to destroy evidence of the quantity and material ingested.

Fire and Explosion

Make reasonable efforts to minimise the spread of contamination.

Spillages

Spillages must only be tackled by personnel wearing laboratory coats, safety goggles and gloves.

If a **liquid** spill occurs:

1) Drop a handful of paper tissues on the spillage
2) Mop up the spill with paper tissues, preferably using a tool to hold the tissues
3) Dry the surface with tissues
4) Monitor to confirm decontamination

Repeat if necessary

Contaminated tissues must be placed in a bag for incineration. The bag must be marked with the radioisotope details and the best estimate of the activity.

If a **solid** spill occurs:

1) Cover with moist paper tissues
2) Proceed as for a liquid spill

If contamination persists it may be necessary to attempt to clean it with a brush or scouring pad (Scotchbrite) and a strong laboratory detergent such as Decon. In some cases it may be necessary to remove the contaminated surface.