MANDATORY

LOCAL RULES: THE DEPARTMENT OF CHEMISTRY

IONISING RADIATIONS REGULATIONS 2017: REGULATION 18

LOCAL RULES FOR THE USE OF UNSEALED RADIOACTIVE MATERIALS (U/ Th) IN CHEMISTRY RESEARCH

All persons (including visiting research workers) engaged in full-time (or similar) research or teaching programmes must register with the RSU prior to working with sources of ionising radiation.

Exceptions included users of cabinet X-ray generators, persons using schools type radioactive sources, undergraduates and their supervisors 'working' in laboratory classes, certain post-graduate short course classes

School of Natural Sciences, Department of Chemistry	These local rules apply to all areas within the Chemistry Building
Radiation Protection Supervisor (RPS) **ACoP 336(c)**	Departmental RPS: Prof F R Livens Dalton Nuclear Institute, Floor G, Pariser Building ☎ 0161 275 4325 ☎ 07949 939960 Local RPS: Dr Ashley Wooles. Room 3.13, Chemistry Building. ☎ 0161 275 4295 ☎ 07763471660
University Radiation Safety Unit (RSU)	Ian Haslam (Head of Radiological Protection) ☎ 07873 979608 ian.haslam@manchester.ac.uk Pavle Mocilac (Radiation Technical Advisor) pavle.mocilac@manchester.ac.uk
Radiation Protection Adviser & Radioactive Waste Adviser (RPA / RWA)	For U/Th work: Public Health England; David Wilson (general site RPA) For issues relating to new Np/Pu facility in CRR: Wood plc; Gordon John & Nigel Reeves (specialist for Henry Royce Building and the Centre for Radiochemistry Research)

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Approved by the Radiation Protection Supervisor

Sign……  …… 8 July 2020

ACoP 337(i)	To contact an RPA or RWA firstly discuss your enquiry with the RSU. The RSU need to manage and collate all contacts and requests for assistance, then keep a log of all responses.
Emergency contact	In the event of an emergency contact the University Security Service at Precinct Control Room (PCR). 52728 or 69966 PCR will put you in touch with an Emergency Incident Manager.
Lost or stolen radioactive source (or suspected loss or theft)	Contact the RSU. If unavailable contact the Environment Agency incident hotline without delay on 0800 80 70 60 (24 hour service) and the PCR. The Environment Agency representative receiving your call will ask for brief details, your name and a contact phone number. They will also ask for the location of the event / incident so be precise (University Building and Street name). Give the contact details of the RSU. Do not put the Environment Agency in contact with the RPA. It is the University's responsibility to resolve accidents, theft or loss of materials.

Management and supervision of work	**Radiation Protection Supervisors** The radiation protection management system (University of Manchester Arrangements Chapter 4 and 25) are 'top level' document approved by the Wellbeing, Safety and Health Committee. **The status of Chapter 25 is MANDATORY.** **The status of the local rules is STATUTORY.** Radiation workers, supervisors and role holders must comply with the requirements of these local rules. The RPS is a role defined in legislation and their remit is to assist the 'radiation employer' in ensuring that work in designated areas is undertaken in compliance with: • all relevant statutory requirements, in particular the Ionising Radiations Regulations 2017 (IRR17), the Environmental Permitting (England and Wales) Regulations 2016 (EPR) • the local rules (IRR17; Reg 18), and, • any other local instructions. Where the deputies and assistants have been appointed it is should be assumed that they have delegated authority.
ACoP 336(e)	The purpose of local rules is to summarise the essential points of the management system. This means that if workers comply with local rules and local instructions they will be working safely and they will be compliant with all other measures. The Departmental RPS is responsible for oversight of radiation protection arrangements

	management of Local Rules and Radiological Risk Assessments control of major (>100 kBq alpha) isotope imports and exports provision of advice as required. The Local RPS is responsible for: day-to-day radiological protection and advice management of SOPs sealed source accounting management of area and personnel monitoring dosimeter issue management of nuclear and radioactive materials, including reporting nuclear materials accountancy data management of waste disposals control of routine (<100 kBq alpha) isotope imports and exports seeking advice as necessary Appendix 1 shows the document hierarchy for these activities.
Controlled Area [Areas of a potential high contamination or dose exposure risk] **ACoP 336(d), 336(e) & 337(i), 337(f)**	**Department of Chemistry Radioisotope Store** This store is for the storage and dispensing of U/Th radiochemical powdered stocks (e.g. UO_3, UO_2, uranium and thorium salts), as well as storage of other radionuclides and sealed sources that are currently not routinely used. <u>Related Protocols and written systems of work</u> SOP 15: Protocol for Access to the Radioactive Materials Store SOP 1 General Radiochemistry Procedures Access to the store is controlled by both card and key access. Only people authorised by the Head of Department have card access and the local RPS holds the keys to the store and acts as a gatekeeper to the stores. Users without card access to the stores must be accompanied in the stores by a card holder.
Designated Supervised Area [Area where there is a risk of contamination arising and being spread] **ACoP 336(d), 336(e) & 337(i), 337(f)**	**B.01 Instrument Room** This room contains counting instrumentation. Experimental work is not permitted in this room, nor is the opening or manipulation of samples. All samples must be prepared and sealed (and the sample vessel walls checked for external contamination) in labs prior to transfer to room B.01. ***Brief description of work*** Liquid Scintillation counting ***Related protocols*** SOP 1 General Radiochemistry Procedures ***Who / how is work in this area managed & supervised*** Access is granted and controlled by the Local RPS who holds the keys to the room. Users arrange a time to use the instrumentation and

	following local training can use it unattended.
Designated Supervised Area [Area where there is a risk of contamination arising and being spread] **ACoP 336(d), 336(e) & 337(i), 337(f)**	**3.15/ 5.52 U/Th Labs** ***Brief description of work*** For the handling of open sources of uranium and thorium for the use in chemistry research. It is expected that novel techniques and experiments will be performed but in each case a radiological and chemical risk assessment should be carried out prior to work and these should be reviewed at least on an annual basis. ***Related protocols*** SOP 1 General Radiochemistry Procedures_ SOP 2 Managing Radioactive Materials ***Who / how is work in this area managed & supervised*** The Principal investigators for work in these labs are Prof Steve Liddle (3.15) and David Mills/ Louise Natrajan (5.52). They have a series of SOPs which control the methods of work, and any work is approved by the PI or a nominated deputy (i.e PDRA or E.O). A diagram to show outline of document ownership and hierarchy is shown at the end of these local rules.
Associated area (non-designated) **ACoP 336(d), 336(e) & 337(i), 337(f)**	**X-ray diffraction suite (B23)** X-ray crystallography on contained samples. ***Who / how is work in this area managed & supervised*** Users take the minimal amount of sample, appropriately contained, needed to the X-ray lab prior to experiment taking place. No manipulation of radioactive material in the diffraction suite is permitted. During experimentation signs are used to warn others of radioactive samples present. Following completion of work the samples are returned to 3.15 or 5.52.
Associated area (non-designated) **ACoP 336(d), 336(e) & 337(i), 337(f)**	**NMR spectroscopy suite (B14, B11, B10, B07, B06)** NMR spectroscopic measurements on contained samples. ***Who / how is work in this area managed & supervised*** Users prepare their sample in 3.15 or 5.52 and take the sample appropriately contained to the NMR suite. No manipulation of radioactive material in the NMR suite is permitted. No radioactive samples are left unattended during or after experimentation. Following completion of work the samples are returned to 3.15 or 5.52.
Associated area (non-	**5.47**

designated) **ACoP 336(d), 336(e) & 337(i), 337(f)**	Luminescence spectroscopy on contained samples. ***Who / how is work in this area managed & supervised*** Louise Natrajan is the PI for the equipment contained in 5.47. SOPS have been developed for this equipment and any work approved by LN or a nominated deputy (i.e PDRA). Excess material/samples are stored in 5.52.
Associated area (non-designated) **ACoP 336(d), 336(e) & 337(i), 337(f)**	**Photon Science Institute** 1.032 Luminescence spectroscopy G.311 EPR and magnetometry laboratory, including National EPR Facilities ***Who / how is work in this area managed & supervised*** These rooms contain analytical instrumentation. Experimental work is not permitted in this room, nor is the opening or manipulation of samples. All samples must be prepared and sealed (and the sample vessel walls checked for external contamination) in labs prior to transfer. Sample transport protocols are present and should be followed. Note that Local Rules for the Photon Science institute are being updated at the time of writing (June 2020) and this section will be revised once that exercise is complete ***Related protocols*** SOP 10 Transport and Handling of Low Quantities of U/Th Samples for EPR/SQUID
Authorised access to radiation laboratories	The only persons permitted to enter **Controlled and Supervised Areas** are: • radiation workers who are registered with the Radiation Safety Unit, • persons specifically authorised by the Departmental or Local RPS, • service engineers, maintenance contractors, Estates Services personnel (plumbers, electricians, cleaners, etc.) who have received clearance to enter and carry out works, have exchanged local rules and / or permits to work and method statements, and who must make arrangements to enter with the RPS or Local RPS. • Department of Chemistry health and safety personnel • line managers.

Radiation dosimetry **ACoP 337(d)**	RSU will advise on the use of radiation dosimetry. The primary hazard for work carried out in the Chemistry building is low level alpha emitting U/Th samples. Local shielding and adequate ventilation can mitigate risks or radiation doses. Personal whole body dosimeters (chest badges) will be provided to each radiation worker. Routine work in the Chemistry building does not require finger-stall dosimeters but these can be requested by workers where necessary for work performed in other buildings on campus or at other institutions • Exceptions include persons using small quantities of exempt radioactive materials, schools 'type' sealed sources and (interlocked) cabinet x-ray generators or x-ray systems where it has been determined that there is no likelihood of doses exceeding 1 mSv/y.
Dose investigation or other trigger limits **ACoP 336(a), 337(d)**	Where there is a requirement to wear dosimeters, dosimetry records will be received by the RSU from the provider (Public Health England). Whole body and extremity dose triggers are 1 mSv/y and 10 mSv/y respectively. Personal dosimeters are to be worn when doing U/Th work because, while these are not likely to pick up alpha contamination, they are sensitive to the beta/gamma emissions from decay products in U/Th. Regular surface monitoring is done in work areas and any areas of high does contamination should be assessed individually to estimate any does received to the user. A method for this estimation is provided by RSU. At these trigger values a note is made on the Event (incident) database so that doses can be identified and investigated to determine the cause, with feedback being given to the RPS. The primary aim of these low dose investigations is to determine whether the cause is a one-off event, the failure of a safety feature or shielding, or a behavioural matter. At doses of 1 mSv to the whole body (the public dose limit) and 10 mSv to the extremities the investigation the investigation will also consider the risk of exposure (or potential for exposure) of members of the public including undergraduate students, pregnant or breastfeeding persons, and the need to thoroughly investigate working practices. The RPA will be notified.
Working instructions (general)	Local rules apply to all designated Controlled and Supervised Areas. Controlled Areas are Isotope Stores. Supervised Areas are 3.15 and 5.52. Other areas (5.47, B01 and PSI) are non-designated areas but where relevant Local rules should be adhered to when using radioactive materials. Academic units must ensure that, where appropriate, their local rules must be supported by (local) specific written instructions or Standard Operating Procedures (e.g. for waste disposal) and experimental protocols (e.g. for specific detailed procedures), and other locally created instructions / protocols such as laboratory manuals. See Appendix 1 for hierarchy of document control and ownership. In particular the following must be prepared by academic units, and all radiation workers must have read and be familiar with the content of these: • Generic Radiological Risk Assessments and CRR Standard Operating Protocols are available on the CRR intranet: http://www.ssnet.chemistry.manchester.ac.uk/health-and-

ACoP 336(e)	safety/centre-for-radiochemisty-research-safety/ • Department of Chemistry Procedures and Methods can be found : http://www.ssnet.chemistry.manchester.ac.uk/health-and-safety/procedure-and-methods/ • Research group protocols and chemical risk assessments are generated and stored locally. • Source accountancy arrangements, : see SOP 2 Managing Radioactive Materials
Working instructions (risk assessment). **ACoP 337(f)**	An overarching radiological risk assessment approved by the radiation safety unit is used to assess radiation risks during routine U/ Th work. These local rules have summarised the control measures, but the worker and their line manager must also read and understand the relevant risk assessments and CRR standard operating protocols to ensure the appropriate control measures are implemented in the area to which these local rules refer.
Working instructions (handling sources). **ACoP 336(e), 336(f)**	Work with unsealed radioactive sources should be carried out inside a fumehood or inside an enclosed glovebox. Where this is not possible a suitable risk assessment must be done and approved by the RPS or Local RPS. • Samples and must be held in sealed vessels when not in use e.g. glass jars, plastic pot, schlenk tube. • Radioactive sources kept in the isotope stores must at all times be held in a suitably secure container (e.g. Nalgene bottles). • U/Th powder sources kept in the isotope stores can be opened in the isotope stores on a work tray when there is no risk of volatile components being released or dusts generated. If there are risks of generating dusts or volatile material then the source should be moved to 5.52 or 3.15 prior to opening and only opened in a fumehood or glovebox. • Techniques should be rehearsed until familiar so as to minimise the duration of time activity is handled.
Contamination monitoring **ACoP 337(b)**	Manipulations of U/ Th stocks in 3.15 or 5.52 should be done inside a glovebox or fume hood. Work areas should be monitored before and after work and frequently during work. Decontaminate / remove any spillages or spots of contamination as soon as they are found. • Each active laboratory will have its own regular monitoring regime which must be adhered to. See SOP 1 General Radiochemistry Procedures
Working instructions (storage of sources in isotope stores). **ACoP 336(e), 336(f)**	In all cases: • Sources and materials should be contained e.g. using proprietary source containers and / or shielded boxes, which if necessary should themselves be held in sealable plastic containers or bags. It may be necessary to provide additional lead shielding around sources to reduce dose rates to <0.5 µSv/h. All materials must be labelled with a minimum of the radionuclide, chemical name and the id number (IS number).
Working instructions	Radioactive materials must be transported, i.e. moved between labs

(movement and transport of sources). **ACoP 336(e), 336(f)**	and to / from storage in a suitable non-breakable container (e.g Nalgene pot) and additionally a secondary containment used in case of failure. Glass vessels do not count as containment. Any containment should be capable of withstanding impact and remain intact if dropped. • Relevant protocols are SOP-2---Managing-Radioactive-Materials and SOP 10 Transport and Handling of Low Quantities of U/Th Samples for EPR/SQUID and https://www.staffnet.manchester.ac.uk/rsu/ionising-radiation/transport-radioactive-materials/
Local arrangements for dealing with radioactive waste. **ACoP 336(e), 336(f)**	Solid waste must be collected in black sacks / bin bags and not in "tiger" sacks. All waste should be double bagged and disposed of into waste streams that are destined for landfill. Limits of activity per waste bag/ waste item are described in SOP 2 and must be adhered to. There are sinks designated for disposal of permitted liquid radioactive waste in each of 3.15 and 5.52. Prior to disposal liquid waste must be kept in appropriately vented bottles in a designated space until sanctioned for disposal. Incompatible waste must not be mixed in a waste container. All waste containers must be labelled and referenced so that their contents are known and traceable to the original stock records. The Local RPS or a local person nominated by the Local RPS should be informed when a final waste disposal is performed to ensure all record keeping is done and that no site limits are exceeded. • Further details on waste disposal can be found in SOP 2 Managing Radioactive Materials
Arrangements for the ordering and collection of radioactive sources **ACoP 336(e), 336(f)**	Written permission to purchase, acquire or 'borrow' radioactive materials must be received from RSU, and also the Departmental RPS, and Head of Department. The form that must be used to acquire actinides (including uranium and thorium) and other radionuclides can be found at www.staffnet.manchester.ac.uk/rsu/ionising-radiation/acquisitions-of-actinides/ Radioactive materials must be delivered to a designated delivery point. The Local RPS must be contacted for details of the approved delivery address. After delivery is complete the Departmental RPS or Local RPS should log the source into the records and store securely as soon as reasonably practical.
Personal Protective Equipment (PPE) **ACoP 336(e), 336(f)**	Personal protective equipment such as laboratory coats, lab specs and (nitrile) gloves must always be worn when working in radiation labs or handling radioactive waste.
Leaving radiation laboratories **ACoP 336(e), 336(f)**	Remove gloves and lab coats, taking care not to touch the external surfaces of gloves. Wash your hands.
Contamination monitoring (repeated from above)	Manipulations of U/ Th stocks in 3.15 or 5.52 should be done inside a glovebox or fume hood. Work areas should be monitored before and after work and frequently during work. Decontaminate / remove any spillages or spots of contamination as soon as they are found. Each active laboratory will have its own regular monitoring regime which must be adhered to. See SOP 1 General Radiochemistry

ACoP 337(b)	Procedures
Maintenance, testing and inspection **ACoP 337(a)**	The Local RPS should ensure that designated areas are thoroughly inspected and monitored for contamination on a weekly basis to ensure that • the area is free from contamination, • the facility is well managed and free from defect, and, • that any safety features, PPE, shielding, etc. are in good condition. • Ventilation systems and other infrastructure are checked regularly by Estates. **The results of these checks should be recorded. Estates will record infrastructure records.** Monitoring regimes are described in SOP 1 General Radiochemistry Procedures
Pregnant and breast feeding staff **ACoP 337(e)**	Your work is highly unlikely to expose you to hazardous levels of radiation and the safety measures already specified in these local rules will provide sufficient protection. The following HSE guide provides good information http://www.hse.gov.uk/pubns/indg334.pdf, and the Head of Radiological Protection will be able to give further confidential advice if you are still worried.
Procedures for initiating investigations **ACoP 337(h)**	Small contamination events do occur in radiation labs, mostly involving small splashes or aerosols that contaminate the radiation workstation or adjacent benches. Where these are detected by the worker, they should be cleaned up with Decon® (or similar; further instructions are given in the SOPs: SOP 1 and SOP 2). Providing that there is no residual contamination these events do not need reporting. Where incidents occur that involve the contamination of clothing, spillage of large volumes or activities, or more widespread contamination the worker should follow the contingency plans below and notify the RPS. The RPS will then initiate any investigations and make a report on the University Health and Safety on-line accident reporting system (www.healthandsafety.manchester.ac.uk/toolkits/accidents/reporting

CONTINGENCY PLAN FOR U/Th WORK IN THE CHEMISTRY BUILDING

1) This is a contingency plan in the event of an incident involving U/Th work in the chemistry building. This can cover fire, chemical spill and chemical contamination. For routine U/Th work the chemical hazard that is a greater risk to health than the radiological risk. Please consult the relevant Chemical Risk Assessment for additional advice.
2) Do Not Panic. Verbally warn anyone else in the laboratory. Remain where you are and don't walk around more than is necessary.
3) If a fire is present then consult the chemical risk assessment for a suitable fire extinguishing medium and if you feel able and confident to do so attempt to extinguish the fire. If in doubt raise the nearest alarm to allow evacuation of the area.
4) Deal with life threatening conditions first: summon someone trained in First Aid if necessary.
5) Stabilise the Situation: without exposing yourself to further risk, take simple measures to prevent any spillages from worsening. For example, use thick wads of paper towel, absorbent granules (e.g. cat litter) to circle and cover spillages to prevent them from spreading. If a radioactive spill kit is available, this can be used to help tidy the spill area.
6) If any chemical has spilled onto your skin then rinse with copious diphoterine as quickly as possible. If a spill has contacted the eyes or a large amount has spilled onto the face/head areas then use eye wash or emergency shower.
7) Monitor yourself: using an appropriate radiation monitor check yourself (skin, hair, and clothing) for contamination. If your laboratory coat is contaminated take it off and place in a waste bag or out of the way on the floor. Wash your hands thoroughly. If your hair or clothing is contaminated do not panic, you have plenty of time to take action.
8) Prevent Access: prevent anyone else from coming into laboratory unless they are there to help.
9) Get help: can another radiation worker in your laboratory help you? Also contact your RPS or the Responsible Person for the laboratory, or failing that the Radiation Safety Unit.
10) Evacuate: all work should cease and non-essential workers should leave the laboratory.
11) Monitor Yourself Again: carry out a thorough contamination check of yourself. Remove any contaminated clothing (within decency) and place in a pile for later inspection. If your skin is contaminated, wash with mild soap and water. Keep washing and monitoring until the skin is thoroughly decontaminated, or until no further contamination can be removed. If contamination remains, contact the Radiation Safety Unit for further advice. If larger areas of skin, e.g. the arms, legs or trunk of the body have become contaminated it will probably be necessary to shower if not already done. Never use scrubbing brushes, exfoliants or solvents to remove contamination.
12) Working with your Radiation Protection Supervisor use a radiation monitor to identify any contaminated areas or equipment. Check the benches, floors, walls, workstations, cupboards, chairs, sinks, taps, door handles, computer keyboards, equipment, etc. Decontaminate using appropriate agents.

Nature of the surface	**Decontamination agent**
Floors, bench tops, safety screens, plastics, paintwork	Detergents such as Decon®
Metal tools and trays	Dilute acids e.g. sulphuric acid
Glassware	Alkaline detergents, or chelating agents e.g. EDTA
Plastics	Dilute nitric acid (do not use ketonic solvents)

13) All solid waste (paper towels, swabs, absorbent materials, and contaminated items) should be placed in waste bags. Aqueous waste should be disposed of via the designated sink. (Deface any trefoil signs before putting them in the waste bags.)
14) If contamination remains after cleaning contact the Radiation Safety Unit for further advice.
15) After the incident has been satisfactorily dealt with you will need to help your Radiation Protection Supervisor to write a report on what happened, which report should be filed on the health and safety accident reporting system

Emergency Contact Details

Departmental RPS

Francis Livens

Office: 0161 275 4325

Mobile: 07949 939960

Local RPS

Ashley Wooles

Office: 0161 275 54295

Mobile: 07763 471660

Departmental Safety Advisor

Simon Holden

Office: 0161 276 0577

UNIVERSITY RADIATION PROTECTION OFFICER

Ian Haslam

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Radiation Safety Unit

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Appendix 1.

Below is a diagram showing document hierarchy and ownership.