

IONISING RADIATION (OPEN SOURCES) POLICY AND MANAGEMENT SYSTEM

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Policy Officer	Senior Responsible Officer	Approved By	Date
Head of Health & Safety	University Secretary	Health & Safety Committee	19 th Feb 2010

This Policy will be reviewed in 2025

1. INTRODUCTION

This document describes Bangor University's Policy for ensuring the safety of staff, students, contractors and any other personnel who may be exposed to sources of ionising radiation. It details how the protection of personnel and the environment against ionising radiation are managed by Bangor University.

By law the University must ensure that:

- Procedures and protocols are in place to ensure all statutory duties are discharged.
- Radiation doses achieved are as low as reasonably practicable (ALARP).

2. POLICY STATEMENT AND SCOPE

It is the policy of Bangor University, so far as is reasonably practicable, but in accordance with the relevant statutory requirements and good practice, to ensure the health and safety of staff, students and visitors to the University.

This Policy states University policy to ensure the safety of staff, students, contractors and any other personnel who may be exposed to open sources of ionising radiation. It details how the University manages the use of open sources in order to protect both personnel and the environment.

The requirements of this Policy must be followed by all Colleges handling open sources of ionising radiation and Professional Services who may, because of the services they provide, come into contact with open sources of ionising radiation, in addition to all guidance given by the University's Radiation Protection Advisor (RPA), Radiation Waste Advisor (RWA) and Radiation Protection Officer (RPO).

Section 5 contains the University's formal Ionising Radiation Policy Statement.

The Policy applies to:

- Each College and Professional Service.
- Staff, students and maintenance personnel.
- All open sources of ionising radiation.

The Policy does not apply to:

- Radon*.
- X-Rays*.

** Dealt with by other specific Policy Standards.*

3. RELATED POLICIES AND LEGISLATION

In addition to those general duties in law, the University and its constituent Colleges and Services, have obligations under the following items of legislation that relate to the use of Ionising Radiation:

- Environmental Permitting Regulations 2016 (EPR 2016).
- The Ionising Radiations Regulations 2017 (IRR 2017).
- Work with Ionising Radiations (IRR 2017) ACOP L121 (second edition).
- Bangor University Policies and Local Rules.

4. DEFINITIONS / TERMINOLOGY

For the purposes of this Policy the following definitions apply:

- Ionising Regulations: This refers to the use of 'open sources' of radiation only.
- Open Source: Is a source of Ionising Radiation in the form of a radioactive material which is not encapsulated or otherwise contained. This means the open radioactive material can move around and if uncontrolled would lead to contamination.
- ALARP: As Low As is Reasonably Practicable.

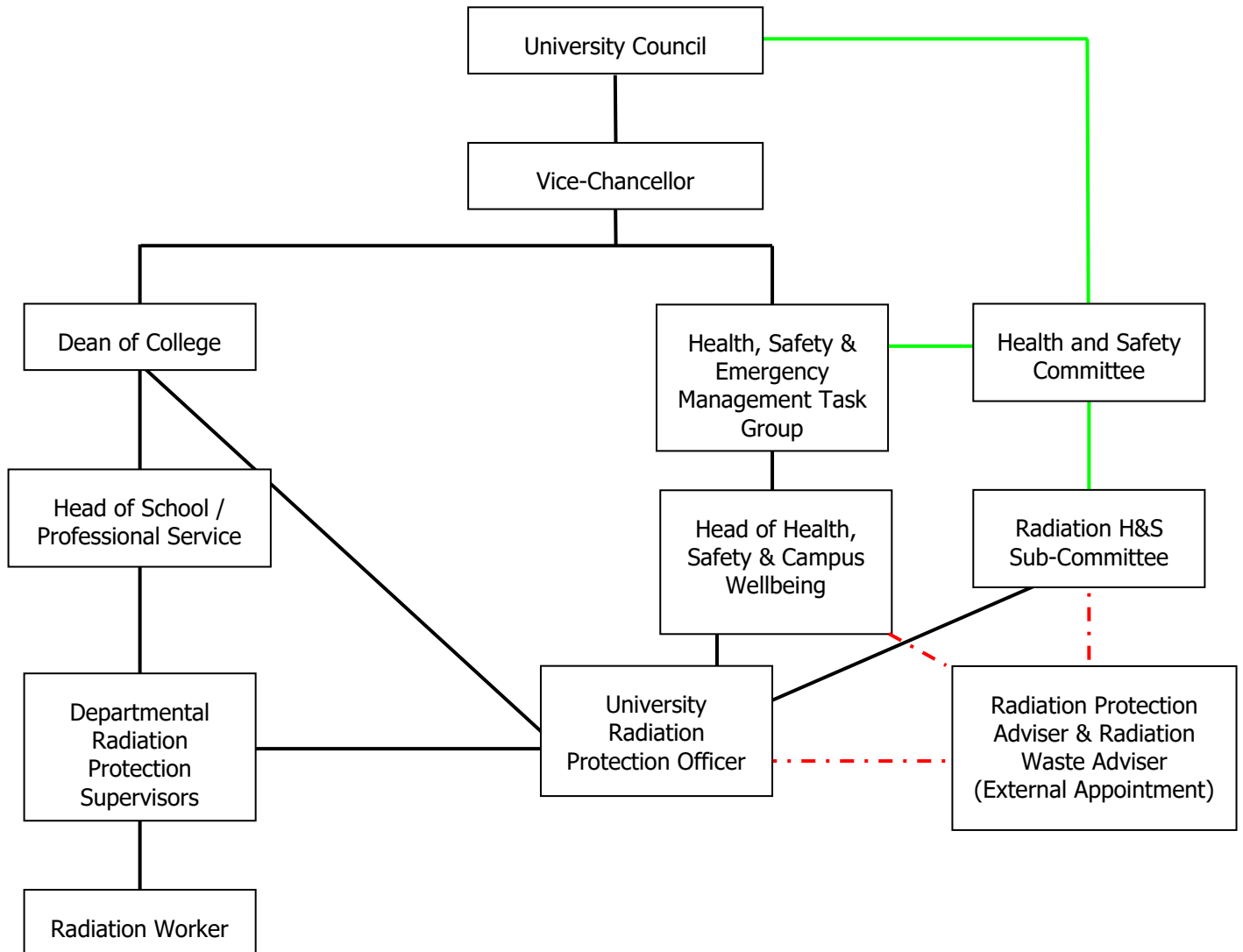
5. UNIVERSITY RESPONSIBILITIES: IONISING RADIATION POLICY STATEMENT

Bangor University is committed to the effective management of ionising radiation. The ALARP principle is applied to all radiation work to ensure employees, students, contractors, visitors and the environment is protected. To ensure doses are ALARP the following controls will be implemented:

- a. The University will comply with the standard conditions issued by Natural Resources Wales authorisations to accumulate and dispose of radioactive waste, and in particular will apply "best available technique" for all work carried out.
- b. All work will be carried out in accordance with relevant legislation, in particular:
 - The Ionising Radiations Regulations 2017 (IRR 2017) and supporting ACOP and guidance.
 - Environmental Permitting (England & Wales) Regulations (EPR 2016).
 - Overall responsibility for effective protection against radiation on site lies with the University Council. At the operational level, the Dean of College and Head of Professional Service (where applicable) is responsible for radiation protection within his/her area of responsibility.
- c. The University will ensure the organisation and specific roles as detailed in Section 6 & 7 are in place.
- d. The University will appoint a '*Qualified Expert*', Radiation Protection Advisor (RPO) who will be consulted to provide advice to the University on all work with ionising radiation.
- e. The University will appoint a '*Qualified Expert*', Radioactive Waste Adviser (RWA) who will be consulted as necessary to achieve and maintain an optimal level of protection of the environment and population.
- f. The University will appoint a Radiation Protection Officer (RPO) to oversee the University's Radiation Protection Supervisors (RPSs).
- g. The RPSs will oversee, on a day to day basis work with ionising radiation within their areas of responsibility. RPSs are named in the appropriate Local Rules document.
- h. In each location where ionising radiation is used, Local Rules, approved by the RPA, will detail arrangements to achieve radiation protection of employees, students, contractors and visitors.
- i. All new research or teaching, involving the use of ionising radiation, will be subject to a prior risk assessment to justify its use, identify measures needed to restrict exposure to individuals and any contingency arrangements needed to manage foreseeable accidents and incidents.
- j. The Radiation Health and Safety Sub-Committee will provide advice to senior management to ensure the safe use of ionising radiation. The Sub-Committee meets annually and in turn reports to the University Health and Safety Committee that meets three times a year.

6. ORGANISATION

UNIVERSITY ORGANISATION CHART - RADIATION PROTECTION



- Management Reporting Line
- H&S Committee Reporting Line
- - - Advice & Support

7. ROLES AND RESPONSIBILITIES

This Section details the specific duties of 'responsible groups / persons' for delivering the environmental and health and safety commitments to ensure compliance with relevant legislation.

These are in addition to the general duties of all employees, students, contractors and visitors to comply with all aspects of Local Rules and other health and safety documents relevant to the area they are working in (or entering):

University Health and Safety Committee

The University Health and Safety Committee meets three times per year and is attended by relevant personnel from across the University.

The Committee receives and acts on reports from various specialist sub-Committees including the Radiation Health and Safety Sub-Committee and is the route by which all health and safety issues are channeled to the Employer (University Council).

Radiation Health and Safety Sub-Committee

The Radiation Health and Safety Sub-Committee which includes the RPA, RPO and RPSs meets annually to discuss, monitor and examine radiological issues affecting the University and to update on potential or impending changes to legislation.

Dean of College

Deans of College are responsible for the implementation of the Ionising Radiation Policy and the (as identified by the RPA and RPO) Local Rules. The Dean of College, with guidance from the RPO and RPA shall nominate a suitably qualified and trained member of staff to manage radiation safety on a daily basis i.e. Radiation Protection Supervisors. The Dean of College must also be satisfied that all relevant staff and students within their area of responsibility are aware of the University's rules and requirements regarding the management of open sources of ionising radiation.

Radiation Protection Advisor (RPA)

In accordance with the IRR2017, the University has appointed a Radiation Protection Advisor (RPA). The RPA, who is an external consultant, shall advise University management of all aspects of the use of ionising radiation and radioactive substances relating to the health and safety of workers, including the designation of workers and the classification of designated areas. The RPA's responsibilities include:

- Implementation of requirements relating to Controlled and Supervised Areas.
- Prior examination of plans for installations and the acceptance into service of new or modified sources of ionising radiation in relation to any engineering controls, design features, safety features and warning devices.
- Regular checking of work systems provided to restrict exposure to ionising radiation.
- Annual calibration of radiation monitoring equipment and ensuring such equipment is serviceable and correctly used.
- Periodic examination and testing of engineering controls, design features, safety features, and warning devices and regular checking of systems of work to restrict exposure to ionising radiation.

The RPA will also be consulted in relation to:

- Prior Risk Assessments.
- The conduct of various investigations required by IRR2017.

- The drawing up of contingency plans.
- Dose assessments and required records.

Radiation Waste Adviser (RWA)

The Environmental Permitting Regulations require the permit holder to consult a Radioactive Waste Adviser on the following matters and have due regard to the advice provided by the Radioactive Waste Adviser:

- Achieving and maintaining an optimal level of protection of the environment and the population.
- Checking the effectiveness of technical devices for protecting the environment and the population.
- Acceptance into service, from the point of view of surveillance of radiation protection, or equipment and procedures for measuring and assessing, as appropriate, exposure and radioactive contamination of the environment and the population.
- Regular calibration of measuring instruments and regular checking that they are serviceable and correctly used.

Radiation Protection Officer (RPO)

To ensure the requirements of the Ionising Radiation Regulations and the Environmental Permitting Regulations are met, the University has appointed a Radiation Protection Officer (RPO) to provide guidance and support. In addition, the RPO will provide support and co-ordinate with both the RPA and the RPS's with regards to ionising radiation issues. Responsibilities include:

- Managing the radiation database.
- Ensuring all radiation workers receive appropriate training before undertaking any radiation work.
- Appointing a sufficient number of local RPS' with training provided as required.
- Ensuring suitable Local Rules and risk assessments are produced.
- Monitoring radiation areas to ensure Local Rules, Risk Assessments and safe working practices are followed.
- Coordinating the work required to upgrade / commission / de-commission radiation laboratory facilities.
- Provide advice and guidance to Campus Services, Colleges and Professional Services if impacted by radiation work.
- Provide advice and guidance to the Radiation Health and Safety Sub-Committee and University Health and Safety Committee, as appropriate.
- Liaising with Natural Resources Wales, the Health and Safety Executive and other relevant bodies on behalf of the University.
- Ensuring all accidents and incidents associated with radiation work are reported to Health and Safety, the RPA and other Regulatory Authorities as required with the subsequent investigation appropriate to the nature of the incident.

Radiation Protection Supervisors (RPS)

As required by the IRR2017, the University will appoint Radiation Protection Supervisors in all Colleges using ionising radiation to provide an adequate level of day-to-day supervision for all radiation work.

Persons appointed to the role of RPS should be suitably competent through their knowledge, ability, training and experience to carry out this role. The RPO and RPA will make recommendations to the Dean of College as to the suitability of potential / proposed RPS's. Each RPS must be appointed in writing by their Dean of College and will:

- Know and understand the requirements of the IRR2017 and relevant Local Rules.
- Command sufficient authority from radiation workers to allow them to supervise the radiation protection aspects of their work.
- Understand the necessary precautions to be taken and the extent to which these precautions restrict exposure.
- Monitor their work areas to ensure the general infrastructure condition, to check safe working practices are followed and that equipment is tested / maintained / inspected as appropriate.
- Regularly check records to ensure they are maintained in accordance with the Local Rules with records forwarded to the RPO as required.
- Report faults / concerns as required.
- Know what action to take in an emergency.

RPSs will also assume responsibility as competent persons under EPR 2016 except where work with electrically generated x-rays is the only ionising radiation source use.

Radiation Worker

Radiation workers have a legal responsibility to protect both themselves and others from any hazard arising from their work and must not expose themselves or others to ionising radiation more than is reasonably necessary for the purpose of their work. They must also make full use of all protective equipment provided for their safety and dosimeters, reporting all defects immediately to the RPS.

As documented below, training will be provided to all new radiation workers. Before starting work with ionising radiations, radiation workers must be registered and receive a copy of the Local Rules for the area they will be working in, and which they must familiarise themselves with before training.

The RPO may revoke registrations to undertake radiation work if Local Rules, safe working practices etc are not followed.

Maintenance Engineers

Maintenance personnel carrying out any maintenance/repairs to equipment in Designated Areas must be authorised and supervised by the RPS or RPO.

8. TRAINING AND INFORMATION

New Radiation Workers

To become registered as a University Radiation Worker, all radiation workers must receive the following training.

The RPO will provide EPR 2016, IRR 2017 and relevant University Health and Safety Policies training to all new workers, which includes the action to take in an emergency and maintain a record of such training. Following this awareness training the RPS will provide practical training, including both

method and Local Rules training and maintain a record of this. The RPO / RPA will periodically audit the RPS's training methods.

RPO

The RPO will be required to attend the RPS training course and specific training provided by the RPA. Additional / refresher training will then be arranged as advised by the RPA.

RPS(s)

Prior to appointment, all RPS's will be required to attend a 1 day site based RPS training course run by the RPA. Refresher training will be provided as required by the RPA.

Maintenance Engineers/Campus Services Maintenance Staff

The local RPS will provide job awareness training that covers the hazards and risks to maintenance engineers and Campus Services maintenance staff before they are permitted access, under direct supervision to radiological areas. In addition, the RPO will provide Laboratory Awareness training to relevant maintenance staff at the request of Campus Services.

Records of Training

The RPA will be responsible for maintaining records of RPO and RPS training. The RPO will maintain records of Radiation Worker training on the radiation database.

All records will include the date of the training, the title of the course, the person's name and who provided the training. Further information on the course content will be provided by the RPA / RPO if required.

Local Rules and Other Information

Local Rules are a legal requirement for Controlled and if applicable, Supervised Areas and are designed to ensure all exposures to ionising radiation are kept to as low as is reasonably practicable. Local Rules reflect good practice and are the cornerstone in ensuring compliance with IRR 2017 and EPR 2016. As such the University issues Local Rules (produced by the RPO and RPA) for all Designated Areas.

Radiation workers are informed and instructed about all Local Rules relevant to their work, which are also available in each Supervised Area.

In addition, a copy of the relevant Authorisations (Permit / Licence) will be available in each Radiation Laboratory.

9. PLANNING AND IMPLEMENTATION

Source Acquisition

All sources must be ordered via the database. The nominated RPS or the RPO will then order isotopes following checks to ensure a risk assessment is in place and that stock limits will not be exceeded.

Risk Assessments – General

A Radiological risk assessment must be completed and approved by the RPA / RPO before any new work activity involving ionising radiation commences.

The risk assessment must identify the hazards and evaluate the nature / magnitude of the risks to which workers and others could be subjected. In addition, it should take account of both normal operating conditions and realistic foreseeable accidents and incidents. Where an accident / incident is reasonably foreseeable a contingency plan must be detailed in the Local Rules and all radiation workers trained in implementing the contingency plan.

Infrastructure

The RPO will liaise with the RPA to make certain radiation laboratory facilities are suitable and fit for purpose. This will include communicating with Campus Services where required to ensure any building works carried out as part of radiation laboratory upgrades and / or during commissioning / de-commissioning are undertaken safely and in accordance with legislative requirements.

Equipment

Suitable equipment will be provided in each Radiation Laboratory for the radiation work to be undertaken with the local RPS seeking the advice of the RPO before purchasing any new equipment. In addition, the local RPS will be responsible for ensuring equipment is tested, maintained and inspected as required with records kept.

The RPO will ensure appropriate monitors are available in each laboratory. The RPA will calibrate monitors annually affixing a label to indicate this has been undertaken.

Installation of X-ray Equipment

See specific Policy.

Incidents and Accidents

Appropriate spill kits will be provided in all radiation laboratories with the RPS instructed in their use, including the safe disposal of any materials and equipment used to clean spills.

All radiation workers will be instructed that any incident such as loss, theft, contamination of persons, spillage of stock material, contamination spread outside the work area, failure of engineering controls etc must be reported immediately to the RPS who will notify the RPO.

The RPO will then be responsible for informing Head of Health and Safety, Campus Services and the RPA.

Investigation

The RPO (with assistance from the RPA) will investigate any incident / accident, acting on the results of the investigation and preparing a report for the RPA and Senior Management. The RPO, with guidance from the RPA, will determine if the incident is notifiable to the regulator/s (Natural Resources Wales (NRW), Health & Safety Executive (HSE)) and the Police.

Notification of Certain Occurrences

The RPO will notify, without delay NRW (0300 065 3000) of the following events:

- Malfunction, breakdown or failure of equipment or techniques or accident, which has caused, is causing or may cause significant pollution or may generate significant amounts of radioactive waste
- The breach of a limit specified in a permit
- Any significant adverse environmental effects
- Any escape of accumulated radioactive waste
- Theft or loss of radioactive waste or material. **NOTE:** The Police will also be informed in such instances.

Records

Records of risk assessments, accident and incidents and the isotope database will be maintained by the RPO.

Monitoring

The local RPS will, on a day to day basis, be responsible for ensuring radiation workers comply with relevant Local Rules and controls outlined in associated radiation work Risk Assessments. The RPO will support this by undertaking regular spot checks to ensure safe working practices are followed.

Change in Details / Cessation of Use

The RPO will notify the EA / NRW in writing, at least 14 days in advance of any change in the University's registered name or address and 21 days in advance of the intention to cease to keep or use radioactive material, or to cease to accumulate or dispose of radioactive waste.

10. EQUALITY IMPACT ASSESSMENT

Every effort must be made to support individuals so they are treated equally and to enable them to undertake their tasks in the same way as their peers.

However, in some rare instances, there may be a requirement to treat 'persons with a protected characteristic' differently in order to safeguard their own health, safety and well-being. Any such consideration will be discussed with the RPA, the RPO and the individual concerned with reasonable adjustments made where possible.

11. AUDITS

Health and Safety, Campus Services, may undertake periodic audits or reviews to assess the effectiveness of and compliance with, this Policy.

Colleges / Professional Services must periodically review their own procedures to ensure the requirements of this Policy are implemented, suitable and effective.

The Health, Safety and Emergency Management Task Group will review this Policy in accordance with the agreed Review Schedule, with any significant changes considered by the University Health and Safety Committee.

In addition, this Radiation Management System will be audited by the RPA on an annual basis with the formal report and any remedial actions required sent to the RPO for implementation.

Ends.



BANGOR UNIVERSITY
IONISING RADIATION
(OPEN SOURCES)
MANAGEMENT SYSTEM

1. STATEMENT ON BEST AVAILABLE TECHNIQUE (BAT)

The University's Natural Resources Wales (NRW) authorisations (Permits) to accumulate and dispose of radioactive waste issued under the Environmental Permitting Regulations requires the use of BAT. As such the University will implement systems to:

Operating Techniques

- i. Use alternative materials, other than radioactive sources where possible.
- ii. Minimise the activity of radioactive material kept or used on the premises
- iii. Minimise the period over which radioactive waste is accumulated
- iv. Minimise the activity of radioactive waste produced on the premises that will need to be disposed of on or from the premises
- v. Ensure all relevant parts of the premises are constructed, maintained and used in such a manner that:
 - a. they do not readily become contaminated; and
 - b. any contamination which does occur can be easily removed
- vi. Prevent:
 - a. the loss of any radioactive material or radioactive waste; and
 - b. access to any radioactive material or radioactive waste by any person not authorised by the operator.
- vii. Maintain in good repair the systems and equipment provided.
- viii. Checking of the effectiveness of the systems, equipment and procedures provided.

Waste Disposal

Implement BAT with regards to the disposal of radioactive waste to:

- i. Minimise the activity of gaseous and aqueous radioactive waste disposed of by discharge to the environment;
- ii. Minimise the volume of radioactive waste disposed of by transfer to other premises; and
- iii. Dispose of radioactive waste at times, in a form, and in a manner so as to minimise the radiological effects on the environment and members of the public.

The University's Radiological Impact Assessments associated with the license AI3330/CD6101 (Science Site) and BS8222/CD8678 (School of Ocean Sciences) have indicated that the dose to the public from the discharges from each site is significantly below 20 $\mu\text{Sv/y}$. This assessment was based on:

- i. Disposing of the maximum activity permitted per month.
- ii. The activity disposed of being the same isotope which has the highest ingestion dose coefficient.

The procedures given below are necessary to ensure the University continues to minimise the radiological effects on the environment and the public from the use of ^3H , ^{14}C , ^{32}P , ^{33}P and ^{125}I . This BAT statement relates to the use of open source radionuclides only.

1.1 **Justification and Optimisation of the Use of Radioactive Material**

Researchers in the School of Natural Sciences and School of Ocean Sciences (all part of the College of Environmental Sciences and Engineering) periodically conduct biological research involving the use of radio labelled compounds. This research is essential in the understanding of biological systems at the ecosystem, organism and cellular level.

Levels of radioactivity will be selected which are as low as possible, but still allow detection of metabolites and residues in the test systems. The radioactive material used in experiments will be kept as low as possible, in order to reduce the amount of waste produced.

1.2 **Assessment to demonstrate Optimisation of Radiation Waste Production and Disposal Procedures**

Waste is generated from plant, fish, soil and other biological research. A significant amount of the radioactivity used in this research is associated with activity balance work where known amounts of radioactivity are administered to test systems, e.g. soil is routinely collected and analysed to check overall recovery of radioactivity.

Routes available for disposal of such waste are detailed in the current Certificate of Authorisation for the Accumulation and Disposal of Radioactive Waste.

Currently the accumulation routes available on the Science Site and the School of Ocean Sciences are:

1. Organic liquid waste
2. Solid waste
3. Very low level waste
4. Aqueous waste (only on the Science site - ^3H only)

The disposal routes available on each site are:

1. Aqueous waste
2. Organic liquid waste
3. Solid waste
4. Very low level waste

These are summarised in Figure 1.

The disposal route used, where several are available, will be largely dictated by the radioisotope, the chemical form it is present in and the Best Available Technique (BAT). These are summarized for each research group below:

1) ^{32}P - use in Cancer Research within the School of Medical Sciences

The best practicable environment option is to accumulate all solid ^{32}P wastes up to 6 months so activity levels reduce to <0.015% of the original. Waste should then be disposed of as VLLW to landfill. Approximately 30% of the ^{32}P waste produced in an assay is in the aqueous form and because accumulation of aqueous ^{32}P waste is not authorised and there are significant negative health & safety implications for solidification of this waste, all aqueous ^{32}P waste are immediately disposed to drains via a designated sink. The remaining 70% of the waste produced is in the solid form and is accumulated for decay storage and subsequent VLLW disposal.

2) ^3H - School of Ocean Sciences (SOS) and School of Natural Sciences (SNS)

Tritium has for some time been used to measure the rates of protein synthesis in fish and the techniques have now been extended to a range of different animals including crustaceans and mollusks. In addition, the range of fish species and sizes studied has also been increased. Techniques have been refined to reduce the amounts of radioactivity used and wastes arising. More of the radiolabel is now incorporated into test animals (previous estimates indicated up to 95% of injected label leached out and was disposed of as aqueous waste) allowing substantial reductions in the amounts of radioactivity required to obtain valid results. A series of experiments have determined waste streams for a variety of test animals;

Mussels/whelks - 18.5 kBq injected per gram of mussel wet weight. Approximately 95% is retained within the animal, 5% is aqueous waste and <1% is organic (counting waste). All mussels are disposed of as VLLW since on average they weigh between 3 (whelks) and 5-6 grams (mussels) and thus contain no more than 105kBq activity, substantially less than the single item limit of 400 kBq. Since the accumulation of aqueous tritium waste is not authorized and there are significant negative health and safety implications for solidification of this waste all aqueous waste is disposed of immediately to drains via a designated sink. Organic waste produced from liquid scintillation counting is incinerated via the licensed waste contractor.

Crabs – 37 kBq injected per gram of crab wet weight. Approximately 95% is retained within the animal, 5% is aqueous waste and <1% is organic (counting waste). Small animals of <10g are disposed of as VLLW whilst larger animals are incinerated via the licensed waste contractor. Experimental work is planned to determine whether the dose administered can be reduced whilst still meeting the validation criteria for the methodology? Since the accumulation of aqueous tritium waste is not authorized and there are significant negative health and safety implications for solidification of this waste all aqueous waste is disposed of immediately to drains via a designated sink. Organic waste produced from liquid scintillation counting is incinerated via the licensed waste contractor.

Fish – Gobies, bass and salmonids are currently used as study animals. Small fish are injected with 37kBq of tritium per gram wet weight. Techniques have been refined to enable less tritium per gram to be injected into larger fish. Approximately 40% of the activity injected is retained within the animal body, 60 % leaches out and is disposed of as aqueous waste and <1% is disposed of as organic (counting waste). Bass used in studies average 6g wet weight whilst gobies are 1g on average and thus both species are disposed of as VLLW. Salmonids show a considerable size range and animals below 20g in weight are disposed of as VLLW whilst those above 20g are incinerated via the licensed waste contractor.

3) ^{14}C / ^{33}P – School of Natural Sciences (SNS)

Radionuclides are used in SNS to determine respiration rates in soil samples. Methods have been refined to reduce the amounts of aqueous waste produced and the overall amounts of radioactivity used. Very small amounts of ^{14}C are used to spike the soil such that contaminated soil can be safely disposed of as VLLW.

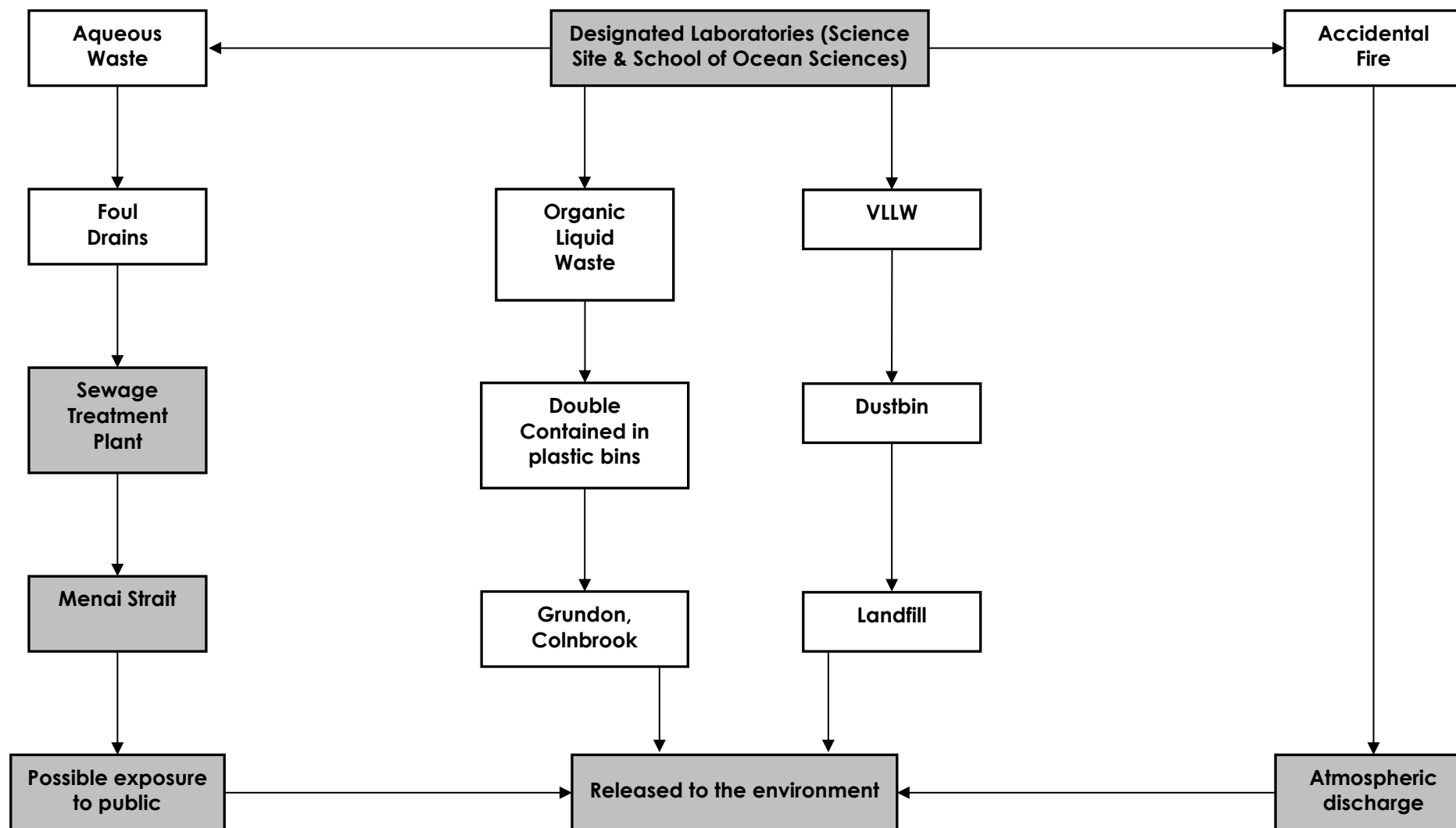
A typical experiment would use 2 MBq of ^{14}C split over ten soil samples housed in separate plastic containers. Approximately 65% of the label remains in the soil and is disposed of as VLLW since each container contains no more than 130kBq of ^{14}C , well below the single

item limit of 400 kBq. Carbon dioxide given off as a product of respiration is chemically trapped producing aqueous waste (5%) and because accumulation of aqueous ^{33}P and ^{14}C waste is not authorised and there are significant negative health and safety implications for solidification of this waste, all aqueous waste is disposed of immediately to drains via a designated sink. Liquid scintillation counting produces organic waste (30%) which is incinerated via the licensed waste contractor.

4) ^{125}I – School of Natural Sciences (SNS)

Iodinations produce approximately 30% solid waste and 70% aqueous waste. The solid waste is accumulated for decay storage and subsequent VLLW disposal. The aqueous waste is disposed of to drains immediately via a designated sink since accumulation of liquid waste is not permitted and there are substantial health and safety risks associated with solidifying the waste.

Figure 1 Routes for the Disposal of Radioactive Substances



1.3 **Source Acquisition**

- 1) The University's registration limits are apportioned between research groups / laboratories such that if the maximum activity is held within each research group / laboratories then the license limit is not exceeded.
- 2) The RPS will ensure minimal quantities of radioactivity are ordered, to cover use in experiments.
- 3) Only the relevant RPS may order a new unsealed source; the RPO is notified when the source is ordered.
- 4) The RPSs maintain current lists of unsealed sources held in their radiation work area / School / Professional Service.

1.4 **Storage**

- 1) All radiochemical stocks are stored in designated laboratories only.
- 2) Access to these laboratories is restricted to authorised radiation workers only.
- 3) Shielded containers are used for hard beta and gamma sources.
- 4) All primary and secondary stock containers, and, wherever practicable samples, holding radioactive material will be marked with the word 'Radioactive', a trefoil symbol and other information necessary for the identification of the material presents. Exceptions where this trefoil and wording is not deemed practicable is for very small and / or very numerous sample tubes in which case the rack / box containing them should be labeled with a trefoil and the word 'Radioactive'.
- 5) All waste receptacles shall be labeled with the word 'Radioactive' and a trefoil, wherever practicable.
- 6) Regular contamination monitoring of source storage areas is conducted (organised by RPS).

1.5 **Use of Radiochemicals**

- 1) Risk assessments of new procedures are performed, and the risk assessment approved by the RPS and RPO before the start of any work.
- 2) Experiments using radioactivity are miniaturised wherever possible, to reduce usage, waste volumes and activity.
- 3) Stock levels and location are recorded on a paper copy at the point of storage, removal of stock for experiments is recorded at the time of use.
- 4) A summary of stock holdings is provided to the RPO monthly.
- 5) Use of stocks is monitored by the Radiation Protection Supervisor.
- 6) All radioactive work is performed in spill trays (or on Benchcote) in designated areas, and behind appropriate shielding (when using hard beta and gamma sources).
- 7) Monitoring for contamination of designated radioactive work areas is performed immediately before and after use.

1.6 **Waste Production & Accumulation**

- 1) The University's authorisation limits are apportioned between research group / laboratories such that if the maximum activity is held within each research group / laboratories then the license limit is not exceeded.
- 2) Aqueous waste is not accumulated.
- 3) ^3H & ^{14}C solid and organic liquid waste is stored double contained in one way burn bins provided by the waste contractor. A record of the inventory of waste inside each bin and its storage location is maintained by the RPS and provided to the RPO monthly. When full each bin is sealed and stored within the designated area prior to collection.
- 4) ^{125}I and ^{32}P solid waste is double contained inside shielded containers for the time required for the activity to decay to below VLLW waste limits. Each waste bag is labeled and the waste production date so that it is clear at any one time which bags can be disposed as VLLW. This waste is stored for up to 6 months before disposal as VLLW (see below).
- 5) Waste storage areas area will be monitored for contamination as part of the routine laboratory survey.
- 6) The RPS provides a summary of the waste accumulated in each designated area to the RPO each month.

1.7 **Waste Disposal**

- 1) The University's authorisation limits are apportioned between research group / laboratories such that if the maximum activity is disposed within each research group / laboratories then the license limits are not exceeded.
- 2) ^3H and ^{14}C solid and organic liquid wastes are collected six monthly by Grundon Waste Management. It is Grundon policy to collect only waste hermetically sealed in plastic one-way burn bins. The RPO/RPA completes the Grundon declaration form using the information provided by the RPSs. The RPO is the point of contact to the Grundon driver and assists with the collection.
- 3) Aqueous waste is disposed of immediately to the designated disposal sink and a record made on the source stock sheet. Designated disposal sinks and surrounding areas are monitored for contamination immediately after disposal (after flushing with water or decon).
- 4) Decay stored ^{32}P and ^{125}I wastes and other laboratory items such as gloves tissues, benchcote etc are monitored and then disposed of into black polythene bags in designated radiation laboratories. These are taken to outside wheelie bins which are collected weekly by the University's waste contractor.

1.8 **Records**

A combination of paper and electronic systems are used to record stock acquisition, use and waste production. The electronic system is ideal for monitoring stock levels and ensuring that authorization limits are not exceeded but has proved quite cumbersome for maintaining waste records and thus paper records are used for this purpose in some labs.

1.9 **Maintaining Best Practice**

- 1) The University RPA is to be notified by the RPO of a researcher's intention to begin work with a radionuclide not covered by this BAT document or when a significant increase in activity is proposed. The RPO, RPA and RPS will assess the methodology provided to ensure it complies with the relevant licences and advise on stock use and waste production, accumulation and disposal so as to maintain best practice. This document will then be amended.
- 2) The RPO will liaise with the Natural Resources Wales as required to ensure radiation work complies with relevant authorisations.
- 3) The RPO / RPA will meet to discuss continuing best practice at least annually and these discussions will be summarised in the RPA report

A formal review of this document will take place as per the Policy review schedule and / or if required by changes in legislation.