



UNIVERSITY  
OF TASMANIA

## RADIATION SAFETY POLICY & PROCEDURES (RADIATION MANAGEMENT PLAN)

### OVERVIEW

The University of Tasmania is committed to promoting safe work practices including the prevention of unnecessary exposure to radiation in the workplace. In addition, the University must comply with legislative requirements relating to the use of regulated radiation. This document provides the framework for employees, students, contractors and visitors to assist the University to meet those requirements and to fulfil our stated commitment to providing a safe workplace.

The Radiation Safety Policy and Procedures applies to all teaching and research using sources of ionising radiation, certain types of laser products and some types of apparatus that employ the principle of “nuclear magnetic resonance” for imaging or analysis, sealed and unsealed sources and the storage of radiation sources. This document has been developed in accordance with legislative requirements of the Radiation Protection Act 2005, the Radiation Protection Regulations 2006, including Regulation 8. It also complies with Australian Standards, Codes of Practice and the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA) recommendations

### DEFINITIONS

#### **Accountable Person:**

An individual, who assumes responsibility for the health or welfare of any other person in a workplace by providing instruction, direction, assistance, advice or service, is deemed an Accountable Person in accordance with the *Workplace Health & Safety Regulations 1998*. All management and supervisory staff (which includes those with responsibility for students) are therefore considered “Accountable Persons”.

#### **Authorized Items:**

Radioactive material or electronic products (x-ray equipment, class 3B or greater lasers and NMR equipment) which are authorised by the University of Tasmania’s Radiation Site Licence.

#### **Authorised Persons:**

Persons who are authorised by the University of Tasmania’s Radiation Site Licence to deal with radioactive material or electronic products, this includes staff member and student, contractor or visitor.

#### **Dealing:**

Is defined as any use, acquire, install, dispose of, transport, store, sell, service, possess, repair or manufacture of sources of radiation.

#### **Employee:**

For the purposes of this Policy and Procedure, employee refers to any staff member, student, contractor or visitor.

#### **Licensee:**

The licensee of the University of Tasmania’s Radiation Site Licence is the University of Tasmania with separate licenses for radiation materials, equipment and lasers.

**Licence Variation:**

Licence variation is defined as a variation to the University's Licence, e.g. additions to authorised employees/items or changes to conditions.

**Occupational Health & Safety Committee:**

Is a committee which reports to the Vice-Chancellor and is responsible for the development of the University's OH&S policies and procedures.

**Radiation:**

Radiation is the emission of energy in the form of rays, wave motion or particles, from a source.

**Radiation Advisory Committee (RAC):**

Is a sub-committee of the University's Occupational Health & Safety Committee.

**Responsible Officer:**

Deans, Heads of Division, Heads of School and Administrative Sections have been designated as Responsible Officers under the *Workplace Health & Safety Act 1995*.

**School/Section Radiation Safety Officer:**

Is a School/Section employee who is authorised as a Radiation Safety Officer under the University of Tasmania's Site Licence and is able to deal with radiation for legitimate teaching or research purposes.

**University of Tasmania Radiation Site Licence:**

The University of Tasmania's Site Licence is issued under the *Radiation Protection Act 2005 and Regulations 2006*, and consists of:

- The University of Tasmania's Radioactive Material Site Licence
- The University of Tasmania's Electronic Equipment (ionising) Site Licence
- The University of Tasmania's Laser and NMR (non ionising) Site Licence

**University Radiation Safety Manager:**

Is an Occupational Health and Safety Unit employee authorised under the University of Tasmania's Radiation Site Licence. The employee is also the Radiation Advisory Committee Secretary.

**RESPONSIBILITIES****Accountable Persons:**

Ensure that employees are able to deal with all radiation sources or products, electronic equipment and lasers in a safe manner by following this Policy and Procedure. Where an Accountable Person is required to supervise activities dealing with radiation sources or products, electronic equipment and lasers, the Accountable Person is responsible for ensuring that delegated safety responsibilities are fulfilled and that appropriate supervision is provided. Accountable Persons must also ensure that appropriate records relating to radiation are kept e.g. training and induction, risk assessments, instruction manuals, monitoring and annual reports.

**Employees:**

Employees must participate in radiation induction and training programs, comply with safety instructions relating to radiation and report potential radiation exposures/incidents to their Accountable Person as soon as practicable. All employees whilst dealing with radiation at the University of Tasmania must follow the Radiation Policy and Procedures.

**Licensee:**

The licensee must ensure that all licensing requirements are fulfilled.

**Occupational Health & Safety Unit:**

The OH&S Unit is responsible for the following activities:

- Administering the University of Tasmania's Radiation Site Licence and all variations
- Coordinating the induction and training programs related to radiation safety

- Monitoring School/Section practices involving sources of potentially harmful radiation, including:
- Annual inspections at any site controlled by the University of Tasmania where authorised dealings under the University's Licence occur
- Reviewing contamination survey reports and annual reports provided by authorised persons
- Maintaining records associated with radiation matters e.g. training, reviews, reports etc
- Maintaining at least two radiation monitors, one monitor for measuring surface contamination and the other to take real time dose rate measurements. The real time dose measurement meter will be held in the central storage facility
- Appointing a University Radiation Safety Manager who has completed a recognised radiation protection course and who will conduct monitoring programs and provide advice to University employees on radiation matters

### **Radiation Advisory Committee (RAC):**

RAC is responsible for:

- Providing advice and information on sources of potentially harmful radiation to the Occupational Health and Safety Committee and employees who deal with radiation
- Reviewing and providing recommendations to the Department of Health & Human Services (Director of Public Health) regarding the University of Tasmania's Radiation Site Licence application and variations
- Developing policies and procedures relating to radiation which will provide a framework for employees to work safely with sources of potentially harmful radiation and ensure these are consistent with legislative requirements
- Reviewing monitoring programs for potentially harmful radiation
- Investigating and evaluating any incidents involving sources of potentially harmful radiation matters
- The RAC Chair is authorised to require a School/Section to immediately cease any activity dealing with radiation if there is a belief that the activity poses an unnecessary risk to employees. Such matters would be the subject of a special meeting of RAC and may be referred to the Director of Public Health

### **Radiation Management System (RMS)**

This is a web-based database that is provided by Information Technology Resources (ITR) and administered by the RAC Secretary position.

### **School/Section Radiation Safety Officer (RSO):**

The RSO is responsible for providing advice on radiation matters and implementing monitoring programs which are reviewed by RAC. The RSO must be appropriately trained in accordance with the University of Tasmania's Radiation Site Licence and as determined by RAC. The RSO will:

- supervise the radiation protection aspects of the radiation practice that are specified in the radiation management plan; and
- operate and interpret the readings from radiation monitoring equipment that is required for the radiation practice; and
- understand the precautions (including the use of protective clothing and equipment) to be taken in carrying out the radiation practice; and
- understand the extent to which the precautions referred to in paragraph (c) will restrict exposure to radiation; and
- know the actions required to carry out the emergency procedures specified in the radiation management plan; and
- assist the authorised person to implement the employer's duties specified in Chapter 5 of the *National standard for limiting occupational exposure to ionizing radiation* [NOHSC:1013(1995)] republished in 2002 by the chief executive officer of ARPANSA; and
- carry out the duties specified for a radiation safety officer in the *National standard for limiting occupational exposure to ionizing radiation*.

### **Responsible Officers:**

Must ensure that where employees are required to deal with radiation that this Policy and Procedure is implemented within their area of responsibility. In addition they must ensure that School/Section specific radiation guidelines are developed where necessary, they must fund the implementation of those guidelines and that they are consistent with the information contained in this document, legislative requirements and the conditions outlined in the University of Tasmania's Radiation Site Licenses, including the appointment and training of a RSO. Responsible Officers must ensure that all School/Section specific guidelines are forwarded to RAC for approval.

## **PROCEDURES**

### **Background**

The *Workplace Health & Safety Act 1995* requires that the University of Tasmania ensure as far as reasonably practicable that all persons while at work are safe from injury and risks to health by providing them with a safe working environment and safe systems of work.

As employees are required to undertake activities which involve the use of radiation for research, teaching or instruction purposes, the University of Tasmania must ensure that authorised persons strictly adhere to safe systems of work.

In order to achieve this goal the University of Tasmania has developed procedures which, if implemented appropriately, should ensure that the risks associated with exposure to radiation are minimised. In order to effectively manage radiation safety, the University of Tasmania has adopted a central site licence known as the University of Tasmania Radiation Site Licence.

Copies of forms and guidelines for various radiation activities are available from the University Radiation Safety Manager.

### **University of Tasmania Radiation Site Licence**

The University of Tasmania's Radiation Site Licence is issued under the *Radiation Control Act 1977*, and includes the University of Tasmania's Radioactive Material Licence, the University of Tasmania's Electronic Equipment (ionising) Licence, and the University of Tasmania's Laser and NMR (non ionising) Licence. All dealings with regulated radiation must be authorised under the University of Tasmania's Radiation Site Licence. The application for the licence is made to the Director of Public Health on an annual basis and is prepared by the OH&S Unit. The annual application for the licence and variations which can be made at any time, are reviewed by RAC and then forwarded to the Director of Public Health for approval. Failure of authorised persons to comply with the University of Tasmania's Radiation Policy and Procedures will result in a recommendation from RAC to the Director of Public Health to revoke the authorisation to deal.

### **New Proposals for the Use of Regulated Radiation**

All new proposals for the use of regulated radiation will require a variation to the University of Tasmania's Radiation Site Licence. The School/Section Responsible Officer must forward an application for such a variation to the Radiation Advisory Committee (RAC) through the RAC Secretary (OH&S Unit). The application must detail all aspects of the proposal. Approval of state regulatory agencies may be necessary, e.g. if the proposal is for material to be removed to a remote site for use or disposal. Where research projects or teaching activities are conducted in conjunction with other employers, approval may be required from that employer in addition to approval from RAC.

Applications for Licence Variations must include the following:

- Proposal Form
- Application for Licence Variation
- Risk Assessment Documentation- The maximum dose rate that is anticipated for each class of person specified must be included in new proposals but risk assessments have shown that only fractions of ALI's are available for ingestion in laboratories. Lasers are enclosed, X-Ray

equipment is contained and the operator is not permitted in the room and BMD are low does, scatter only. Liquid stock sources are mainly diluted prior to use and much of the everyday use is a fraction of an ALI.

- Emergency Procedures Documentation
- A waste management plan
- Radiation monitoring procedures
- A statement outlining relevant training and experience of the proposed authorised personnel
- Technical information relating to authorised items e.g. X-ray equipment, laser or radioactive material
- An outline of safety procedures and rules relating to the proposed research project or teaching activity
- Floor plan(s) of where the research project or teaching activity will be undertaken
- Storage proposal (for remote sites, maps or other relevant details must be included).
- Signage
- Classes of persons likely to be exposed to radiation during teaching and research must be listed. In the teaching areas, only trained staff and postgraduate students are exposed to source of radiation. Undergraduates are exposed to "school sources". Pregnant women who wish to continue the use of regulated sources of radiation must obtain approval from a Physician. The exposure level of unborn child must be assessed as a member of the public even though the mother may be assessed as a radiation worker. Alternate duties or personal dose monitoring of the persons are viable options. Children are not exposed in the teaching areas. Research projects exposing members of the public, including children, to sources of radiation must have Southern Ethics Committee (SEC) approval prior to RAC approval to use sources regulated radiation. Ethics approval is conditional on RAC approval so proposals usually have the approval of SEC and RAC. No researching or teaching proposals can commence until the Director of Public approval has been provided. Students must be operate under academic supervision, they must also complete a written exam as evidence of competency and must undertake training & induction.

### **Application for a Licence Variation (Authorised Person(s))**

Responsible Officers who seek to vary the University of Tasmania's Site Licence by nominating an employee as an authorised person must submit an application for Licence Variation. Applications must include details of the teaching or research that is being undertaken.

All employees seeking to become an authorised person are required to successfully complete an open book examination which is set and marked by the Health Physics Branch of the Department of Health & Human Services. This is only required if records of previous training are not supplied or the training is deemed unsatisfactory by RAC. Employees who have successfully completed the exam on a previous occasion will not be required to participate again unless required by the Health Physics Branch. Further details on examinations are available through contacting the University's Radiation Safety Manager. Application for variations must be forwarded to the RAC Secretary (OH&S Unit) for review by RAC.

### **Approval Process**

RAC will meet as required to consider proposals and requests for licence variations. RAC must be satisfied that the proposal or request for variation meets legislative and University of Tasmania requirements. RAC will make a recommendation to the Director of Public Health through the Health Physics Branch of the Department of Health and Human Services. If the proposal/variation request does not meet these requirements, RAC will provide advice to the applicant regarding suggestions as to how the proposal/variation request can be improved. If RAC requires further advice it may recommend the proposal be subject to a peer review. The Chair of RAC is authorised to recommend the addition of employees to the licence.

### **Annual Inspections**

Authorised persons are required to arrange for the University's Radiation Safety Manager to undertake an annual inspection of all sites controlled by the University where authorised dealings

under the University of Tasmania's Radiation Site Licence occurs. Once complete, the University's Radiation Safety Officer will prepare a report for RAC. Authorised persons with approved projects/activities are also required to submit an annual report to RAC.

### **Annual Report**

An annual report covering the licence conditions must be provided to RAC through the RAC Secretary. The School/Section Responsible Officer must sign the report. The annual report form is available from the University's Radiation Safety Manager.

The report must contain the following information:

- Audit records and a statement accounting for all material
- A record of usage and whether trace back of material is possible
- Mention of any sensitive issues arising during the period
- Documentation of any incidents occurring during the period and the control strategies utilised
- Documentation of all reviews of procedures
- An outline of the disposal pathway of any waste from the project or whether it has been stored (including location)

### **Health Surveillance**

The risk assessment process will identify employees who will require health surveillance. All health surveillance will be co-ordinated through the OH&S Unit and paid for by the relevant School/Section. The OH&S Unit who will also advise employees of the results of any monitoring activity will keep all records for 30 years.

### **Induction and Training**

Employees who are required to deal must receive appropriate training as determined by RAC. The OH&S Unit links page provides a number of on line sites for appropriate training. The site also contains a list of reading material and videos held in the libraries for use in training. On completion of the training a person then sits the Health Physics Radiation Examination in their School or Section. Records of the training and induction must be held at the School/Section level. Not all authorised persons are required to be listed on the University Radiation Licenses. Only School or Section RSO must e on the licence. Authorised persons must be recorded at the School/Section level. Records Of training for those authorised persons being nominated as RSO must be sent to the OH&S Unit. The relevant School/Section is required to fund any training programs.

The training levels for the use of radiation determined by the Radiation Advisory Committee are:

Level 1 - Authorised Person to deal with radiation. The successful completion of the Health Physics examination and training and induction at School level. Persons who are authorised persons but have not worked with radiation sources for five years must undertake the radiation training again.

Level 2 - Radiation *Safety* Officer. The successful completion of Health Physics Radiation Safety Officer exam and recognition of previous training or a RAC recommendation for further training. e.g. RSO Course. Frequency - RSO training must be updated every five years.

Level 3 - University Radiation Safety Manager. Successful completion of Level 2 training. Activities, which include working with Health Physics and within the University of Tasmania Radiation Laboratories, are also an inherent requirement for level 3.

Employees who have received training with another employer may be considered to have been appropriately trained, providing that training meets the minimum requirements determined by RAC. Training will include, but not be limited to, the following categories:

- Basic radiation safety training
- Characteristics of radiation sources
- Interaction of radiation with matter
- Radiation detection equipment

- Definitions, units, and quantities unique to radioactivity
- Biological effects and risks estimates
- Risks to the unborn and control of prenatal exposures
- ALARA principles, optimising radiation protection
- Personnel monitoring procedures and criteria
- Responsibilities of individual radiation users
- Administrative requirements of the University of Tasmania
- Personal Protective Equipment and monitoring devices
- Monitoring and Inspection Procedures
- Waste Disposal
- Emergency Procedures
- Use of radioisotopes in animals
- Risk Assessment
- Supervision at each site and each site has a School/Section Radiation Safety Officer (RSO). This person oversees the supervision of all activities in a School/Section. Each authorized person and the Director of Public Health approves RSO.

All employees must be appropriately inducted, according to the requirements determined by RAC, prior to undertaking any activity involving radiation.

### **Radiation Management System (RMS)**

This is a web-based database that is provided by Information Technology Resources (ITR) and administered by the RAC Secretary position. The RMS holds a list of all radiation sources as listed on the University's Site Licences. The School Radiation Safety Officer, one per School or one per licence e.g. 1 per radiation materials licence plus one per electronic equipment licence, have access to amend details. RAC members have read only access unless they are an RSO. Contact the IBC Secretary for any details. When any entry is made an email is sent automatically to the RAC Secretary. All Approved Facilities for dealing with sources of radiation/equipment are listed in the Asset Management Services database. Project/Equipment/Source proposals are submitted via signed applications only. Once the a source or equipment is listed on the RMS, all amendment, audits etc are actioned through the RMS only as the system provides a corporate record for the School/Sections RSO and for the University as all actions initiate an automatic email notification.

### **Records**

A copy of all training registers, contamination monitoring, School/Section specific instruction manuals must be available to the University's Radiation Safety Manager at the OH&S Unit.

### **Risk Assessments**

Accountable Persons are responsible for ensuring that risk assessments for all tasks are undertaken as outlined in Sections 17, 18 & 19 of the *Workplace Health & Safety Regulations 1998*. All documentation relating to the risk assessment process must be maintained within the School/Section. Assistance with risk assessments for radiation sources is available *in Attachment 1 and* from the University Radiation Safety *Manager*

### **School/Section Radiation Emergency Procedures**

Procedures must be developed to accommodate any unique aspects of the teaching or research activity associated with the use of radiation. A checklist for emergencies can be obtained from the University Radiation Manager. This will need to be modified for each School/Section activity and each Accountable Person must ensure that it is consistent with the University of Tasmania's Emergency Procedures. All employees must be trained in the correct emergency procedures associated with radiation and Accountable Persons must maintain a record of all training. A School/Section must have sufficient resources to deal in house with any emergency e.g. radiation liquid (unsealed source) spill.

## Security

Safeguarding radioactive material from unauthorised access is a fundamental requirement of the University of Tasmania's Radiation Site Licence. Security is a responsibility shared by all authorised persons on the University of Tasmania licence and Responsible Officers. Procedures for securing and controlling radioactive materials should be developed with special care, in order to provide the necessary safeguards without imposing excessive controls. The decision to lock designated storage areas within laboratories should be based on the level of activity of the individual stock radiation sources. Designated storage areas that open directly into a public access area must be locked whenever an authorised user is not present.

## Signage

Warning signs that bear the universal symbol for radiation (trefoil) and describe access requirements **must** be posted near the entrance to any area where radiation is stored or in use. Examples of recommended signs can be provided by the University Radiation Safety Manager and are available commercially. These must be displayed on or near doorways to storage areas or laboratories.

## Storage

Designated storage, and areas where radiation is used, must be located in laboratories where authorised persons control access. Storage areas may be an interior room, a designated refrigerator, freezer, cabinet or the central storage facility.

## Central Storage Facility

This area is under the control and supervision of the University's Radiation Safety Manager. Access to the Central Storage Facility is available through the University's Radiation Safety Manager or a member of RAC, and is limited to persons who have been trained in the use of the facility.

All sources for long-term storage must be stored in the central radiation storage facility and must be accompanied by the RAC approved storage label. Sources must be contained in an appropriate storage container prior to placement in the facility. Sources that are no longer used by Schools/Sections must be disposed of correctly or placed in the long-term storage facility if there is no suitable disposal path. Such sources remain the responsibility of the authorised person from the relevant School/Section. They must not remain in the Schools/Sections area if they are not required for any RAC approved use, including long term storage. They must be considered for disposal by an approved means, including resale to an approved organisation, at the earliest opportunity

## Transport

The transportation of radiation sources (Class 7) must be carried out in accordance with the Code of Practice for the Safe Transport of Radioactive Substances 2002. This document can be obtained by contacting the University's Radiation Safety Manager. School/Section specific procedures must be provided to the Health Physics Branch of the Department of Health and Human Services for approval **prior** to any transport activity. It is recommended that this be done well in advance should transportation be required. Transportation includes movement between campuses and from the University to an off campus location or from an off campus location to the University. It includes all sources of regulated radiation, including equipment and radioactive waste. In most cases waste should be sent directly to disposal pathways from the activity e.g. directly from the off campus location and not to a storage point at the University. Guidelines on transportation of radiation sources are available from the University's Radiation Safety Manager.

## Waste

For the purpose of environmental protection is essential to estimate the amount of waste prior to the commencement of the project. Guidelines for Radioactive Waste are obtainable from the OH&S Unit and should be modified to suit each School/Section's specific requirements. The waste disposal path must be identified on the proposal/variation application. For fieldwork, waste must be sorted by activity levels and in most cases this can then be sent for disposal without the requirement to return the waste to the University for storage.

Waste must be sorted into 2 categories, contaminated and non contaminated, and then by activity levels at the beginning of the process. Waste may also involve chemical and/or biological hazards in addition to radiation requirements, and this must be taken into account when developing the waste disposal path. All waste must be labelled according to the RAC disposal label.

Sinks for the disposal of radioactive material must be identified and labelled. These should be flushing sinks, or sinks that do not splash. Disposal sinks must be approved and be labelled as a disposal sink for radioactive sources. Water flow rates to sewer are available from the University's Radiation Safety Manager in the OH&S Unit.

### **Work Areas**

The radioactive materials listed in the licence schedules may only be used at the locations specified in the licence. They must not be used in a non approved work area. Contamination checks are to be performed at appropriate intervals by authorised persons. The contamination survey form is to be used on a weekly basis for frequently used areas, or monthly for infrequently used areas. Copies of surveys are to be forwarded to the University's Radiation Safety Officer at the OH&S Unit.

### **FURTHER INFORMATION**

Further information regarding the University of Tasmania's Radiation Policy and Procedures and copies of forms and guidelines for various radiation activities are available from the University Radiation Safety Manager in the Occupational Health & Safety Unit, on (03) 6226 7509.

### **Forms and guidelines available from the University Radiation Safety Officer**

The University Radiation Safety Manager can provide forms and guidelines for various radiation activities as detailed below. Prior to the commencement of any radiation related activity, employees are required to obtain copies of relevant documentation following discussion with the University Radiation Safety Manager.

The guidelines listed below are generic and should be read in conjunction with the original source documents which have been used in their compilation. All guidelines contain a reference section which details the original sources for each document. These have been developed for Schools/Sections to use as a basis for the development of their own procedures, which will need to take into account each area's particular requirements. All guidelines have been reviewed by RAC.

- 1 Licence Variation Application - Radiation Sources/Addition of Authorised Persons
- 2 Licence Variation Application - Electronic Products/Lasers
- 3 Quality Assurance Audit for Lasers
- 4 Quality Assurance Audit for the Use of Unsealed Radiation Sources
- 5 Annual Report to RAC from Authorised Persons - Projects/Equipment
- 6 Guidelines for the Use of Radiation Sources
- 7 Signage Examples for Radiation
- 8 Guidelines for Spills/Exposure/First Aid/Decontamination
- 9 Guidelines for Procedures for the Use of Specific Isotopes
- 10 Guidelines for the Waste Disposal of Radioactive Material
- 11 Guidelines for the Monitoring of Personnel, Laboratories and Storage Facilities involving radiation
- 12 Guidelines for the Transportation of Radioactive Material
- 13 Central Store - Radiation Sources Procedures
- 14 Guidelines of Laser Safety

## REFERENCES

- The following documents have been used in the development of the University of Tasmania's Radiation Policy and Procedures:
  - 
  - *Workplace Health and Safety Act 1995*
  - *Workplace Health & Safety Regulations 1998*
  - *Tasmanian Protection Act 2005*
  - *Tasmanian Radiation Protection Regulations 2006*
  - *AS/NZS 2982.1:1997 Laboratory design and construction*
  - *AS 2242.4-1998 Safety in laboratories-ionising radiations*
  - *National Health and Medical Research Council (NH&MRC)/Workplace publication "Recommendation for limiting exposure to ionising radiation (1995)(Guidance note [NOHSC:3022(1995) and National [NOHSC: 1013(1995)*
  - *Consensus Radiation Protection Practices for Academic Research Institutions*
  - *Code of Practice for the Disposal of Radioactive Wastes by the User (1985)*
  - *National Health & Medical Research Council's Recommended limits on radioactive contamination on surfaces in laboratories (1995)*
  - *National Health & Medical Research Council's National Guidelines for Waste Management in the Health Care Industry*
  - *Code of Practice for the Safe Transport of Radioactive Substances 2002*
  - *Australian Radiation Protection & Nuclear Safety Agency ARPANSA Radiation Protection Series*

Approved by OH&S Committee: 14<sup>th</sup> September, 2000

Reviewed and approved by OH&S Committee: 8 Dec 2005 and implemented once the Policy and Procedures were approved after the Radiation Protection Regulations came into effect in June 2006.

Approved by the VC in accordance with the Radiation Protection Regulations 19 Oct 2006.

For review March 2008 as required by the Radiation Protection Regulations

### Disclaimer

This Policy/Procedure was designed for use within the University of Tasmania. The University makes no guarantee and assumes no responsibility as to the absolute correctness for all circumstances or for the adaptation outside the University of Tasmania environment.

## HAZARD IDENTIFICATION AND RISK CONTROL GUIDELINES

The information detailed below may be used in the risk assessment process. It is not an exhaustive list and may need to be customised for individual circumstances. However, it does provide an example of radiation hazards and their control. It can be attached to the Risk Assessment (RA) at the attachment section on the RA. The information has been sourced from the following:

References:

[www.adm.monash.edu.au/ohse/](http://www.adm.monash.edu.au/ohse/)

[www.acue.adelaide.edu.au/hr/policies/ohs/](http://www.acue.adelaide.edu.au/hr/policies/ohs/)

[www.latrobe.edu.au/ohs/ohs](http://www.latrobe.edu.au/ohs/ohs)

[www.utas.edu.au/chemistry](http://www.utas.edu.au/chemistry)

Identification

### Radiation Hazards – Exposure Risk

Does your task or activity involve any of the following:

- |                                   |                      |
|-----------------------------------|----------------------|
| <b>R1.</b> Ultra-violet           | <b>R3.</b> Infra-red |
| <b>R2.</b> Strong Magnetic fields | <b>R4.</b> X-Ray     |

Assessment

		Likelihood of injury after current controls are considered				
Consequence		L1. Highly Likely	L2. Likely	L3. Occasionally	L4. Unlikely	L5 Highly Unlikely
Injury resulting in death or permanent incapacity	<b>C1 Major Injury</b>	Extreme	Extreme	High	High	High
Injury requiring extensive medical treatment and/or hospitalisation	<b>C2 Severe Injury</b>	Extreme	High	High	High	Medium
Injury requiring medical treatment by health service, LMO etc.	<b>C3 Moderate Injury</b>	High	High	Medium	Medium	Medium
Injury requiring first aid treatment	<b>C4 Minor Injury</b>	High	Medium	Medium	Medium	Low
Short term discomfort	<b>C5 Negligible Injury</b>	Medium	Medium	Medium	Low	Low

**Risk control** measures for hazards associated with radiation hazards should be considered in the following priority order:

***Priority One – Elimination***

The best way to eliminate the risk of exposure to radiation is to remove the hazardous source/equipment, or the hazardous process.

**Don't use the equipment. Don't use the process.**

***Priority Two - Substitution***

Substitute the hazardous part of the equipment/source or hazardous part of the process with a safer option.

**Find a safer piece of equipment or better way to perform the process.**

***Priority Three – Isolation***

Isolate the people from the equipment or process, which is producing the radiation. For example, put the equipment/source or perform the process in a booth or a separate room. Provide remote activation / control of the equipment/source or process.

**Keep it away from people.**

***Priority Four - Engineering Controls***

Engineering controls involve the use of measures to change the equipment or the environment in which the process is undertaken in order to minimise the exposure of the users to the radiation.

Control measures can include:

- modifying the design of a piece of equipment
- modifying the workplace layout in which a process is carried out
- installing guarding or shutter to prevent exposure to the hazardous source of the piece of equipment or process
- installing cutout devices to prevent accidental exposure to the radiation source
- providing enclosures, fume cupboards, local exhaust ventilation or automation.

**Engineer a better way.**

***Priority Five - Procedures and Training***

Systems of work or safe work procedures can often help to reduce risk associated with the exposure to radiation from equipment and processes. All staff and students must be trained in the safe systems of work or safe work procedures. Periodic inspections and audits should be conducted to ensure that the systems or procedures are being followed.

Examples include:

- Performing the task out of normal hours or restricting access to a certain area.
- Reducing the duration or frequency staff or students perform a specific task.
- Development of procedures of operation which prevent exposure to the radiation source – guard/shutter is closed before the source is activated or the exposed.
- Good housekeeping.

***Priority Six – Personal Protective Equipment (PPE)***

This is the last line of defense and should only be employed when all the options and controls have been deemed not practicable.

PPE includes overalls, aprons, footwear, gloves, safety glasses, face shields and respirators. PPE can often be used in combination with other risk controls to further reduce exposures to hazardous parts of equipment and processes. However, if they are used as the only control measure they should be generally regarded as a short-term solution or a last resort. Staff and students must be trained in correct fit use and maintenance of the PPE. In addition, you should make sure that the equipment is the right one for the job and readily available.

## Ionising Radiation – Internal Exposure Risk

Do you work with any of the following:

- R5.** Unsealed sources\* of radioactive material?      **R6.** Unsealed sources\* of radioactive materials that emit neutrons\*\*.

- Note: an unsealed source is one in which the radioactive material may readily escape, e.g. a liquid source in a glass vial.

\*\*For Neutron Sources - you will need to seek advice from your School/Section RSO or the University RSO.

**Table 1: Determining the Internal Hazard Potential**

Radioisotope Radiotoxicity Group^^	Total Activity Used In One Operation				
	> 20,000 MBq (> 540 mCi)	≥ 2000 MBq to ≤ 20,000 MBq (≥ 54 mCi to < 540 mCi)	≥ 20 MBq to < 2000 MBq (≥ 0.54 mCi to < 54 mCi)	≥ 0.2 MBq to < 20 MBq (5.4 μCi to < 0.54 mCi)	< 0.2 MBq (< 5.4 μCi)
<b>1</b> (Am-241)	Very High	Very High	High	Medium	Low
<b>2</b> (I-125, Co-60, Ra-226)	Very High	High	Medium	Low	Low
<b>3a</b> (P-32)	High	Medium	Low	Low	Low
<b>3b</b> (Co-57, Fe-55, Na-22, P-33, S-35)	High	Medium	Low	Low	Very Low
<b>4</b> (H-3, C-14, Cr-51, Tc-99m)	High	Medium	Low	Very Low	Very Low

^^ Consult AS2243.4 Table C3 for a more comprehensive listing, if your radioisotope is not listed in this standard contact the RSO for advice.

**Table 2: Determining Likelihood of Contamination**

Procedure	Likelihood of Contamination	Examples
Simple storage	Highly Unlikely	
Very simple wet operations	Unlikely	Using aliquots of stock solutions
Normal chemical operations	Occasionally	Analysis of simple chemical preparations.
Complex wet operations	Occasionally	Multiple operations. Operations with complex glass apparatus. Northern blots.
Work with volatile radioactive compounds	Likely	Using <sup>14</sup> C-Toluene. Performing an iodination.
Simple dry operations work	Likely	Manipulation of powders
Complex dry operations	Highly Likely	Where powders are likely to become airborne.
Work with radioactive gases	Highly Likely	



**Table 3. Determining the risk of internal exposure**

Hazard Potential	Likelihood of Contamination				
	Highly Likely	Likely	Occasionally	Unlikely	Highly Unlikely
Very High	Extreme	Extreme	Extreme	High	Medium
High	Extreme	Extreme	High	Medium	Medium
Medium	Extreme	High	Medium	Low	Low
Low	High	Medium	Low	Low	Low
Very Low	Medium	Medium	Low	Very Low	Very Low

**Classes of Persons**

Classes of persons likely to be exposed to radiation during teaching and research must be considered. In the teaching areas, only trained staff and postgraduate students are exposed to source of radiation. Undergraduates are exposed to “school sources”. Pregnant women who wish to continue the use of regulated sources of radiation must obtain approval from a Physician. The exposure level of unborn child must be assessed as a member of the public even though the mother may be assessed as a radiation worker. Alternate duties or personal dose monitoring of the persons are viable options. Children are not exposed in the teaching areas. Research projects exposing members of the public, including children, to sources of radiation must have Southern Ethics Committee (SEC) approval prior to RAC approval to use sources regulated radiation. Ethics approval is conditional on RAC approval so proposals usually have the approval of SEC and RAC.

**Risk controls** are actions taken to control risks to the health and safety of staff and students. The primary duty is to eliminate any risk to health arising during work with ionising radiation. Where elimination of risk is not practical, you must reduce the risk as far as practicable.

**Risk control** measures for hazards associated with working with ionising radiation should be considered in the following priority order:

#### ***Priority One – Elimination***

Eliminating the risk by eliminating the use of the radioisotope that creates the risk is the most effective way of protecting the health of staff and students. When considering the possibility of eliminating a radioisotope from your protocol you need to begin by answering questions like:

- Why is the radioisotope being used? (What is its purpose or function in the process?)
- Could I use a non-radioactive technique? - e.g. Use a fluorescent tracer instead of a radioisotope as a biological tracer.

**Don't use the ionising radiation hazard. Don't use the process.**

#### ***Priority Two – Substitution/Reduction***

Substitute the ionising radiation hazard for a less hazardous form or reduce the activity being used. The radiotoxicity rating can be used to identify lower hazard radioisotopes. You can readily calculate the minimum amount of radioisotope needed.

e.g. Use S-35, which is in radiotoxicity group 4, instead of P-32, which is in radiotoxicity group 3a.

Use P-33, which is in radiotoxicity group 3b, instead of P-32, which is in radiotoxicity group 3a

**Find a less hazardous radioisotope or find a better way to perform the process.**

#### ***Priority Three – Isolation***

Isolation involves separating people from the ionizing radiation hazard by distance or barriers to prevent or reduce exposure. Barriers may take the form of a totally closed system or process, an enclosure with exhaust extraction or an isolated / restricted access room.

e.g. Restricting radiation use to a special secure laboratory.

**Keep it away from you.**

#### ***Priority Four - Engineering Controls***

Engineering controls are physical controls (such as equipment) that eliminate or reduce the generation of airborne ionising radiation hazards, suppress or contain the potential for airborne ionising radiation hazards. Engineering controls often entail partial enclosure, exhaust ventilation or automation.

**Engineer a better way.**

e.g. Use of a fume cupboard where there is potential for an airborne radiation hazard.

#### ***Priority Five - Procedures and Training***

Systems of work or safe work procedures can often help to reduce exposure to ionising radiation hazards.

Examples include:

- Secondary containment (e.g. spill trays) to minimize the potential for spread of a spill.
- Reducing the duration or frequency staff or students perform a specific task.
- Good housekeeping.

#### ***Priority Six – Personal Protective Equipment (PPE)***

PPE includes overalls, aprons, footwear, gloves, safety glasses, face shields and respirators. PPE can often be used in combination with other risk controls to further reduce exposures to radioactive contamination. However if they are used as the only control measure they should be generally regarded as a short-term solution or a last resort. Staff and students must be trained in correct fit use and maintenance of the PPE. In addition, you should make sure that the equipment is the right one for the job and readily available.

## Ionising Radiation – External Exposure Risk

Do you work with any of the following ionizing radiation hazards?

- |  |   |
|--|---|
| <p><b>R7.</b> Unsealed radioactive sources that emit high energy beta radiation*</p> <p><b>R8.</b> Unsealed radioactive sources that emit gamma radiation</p> <p><b>R9.</b> Radioactive materials that are considered to be sealed sources</p> | <p><b>R10.</b> Radioactive materials that emit neutrons</p> <p>X-ray equipment or sealed source</p> <p><b>R11.</b> apparatus where a "beam" is produced #</p> |
|--|---|

\* For Beta Emitters: P-32 can present a moderate external hazard. S-35 and P-33 generally present a low external hazard, however the attached reference table should be consulted for estimated dose rates at typical distances and typical activities.

\*\*For Neutron Sources - you will need to seek advice from your School/Section RSO or the University RSO.

# If so, you will need to seek advice from your School/Section RSO or the University RSO.

**Note 1:** Alpha Emitters do not present an external hazard

**Note 2:** The formula for calculating dose rates for Gamma and X-ray emitters, together with some standard dose rates for commonly used radioisotopes, is attached.

Dose Rate*	Duration of exposure over a one week period (7 days)				
	≥ 16 hrs & ≤ 40hrs	≥ 8 hrs & < 16 hrs	≥ 1hrs & < 8hrs	≥ 5 min & < 1hrs	< 5 min
> 500 μSv/h to ≤ 1500 μSv/h%	Unacceptable	Unacceptable	Unacceptable	Extreme/ Unacceptable	High
> 50 μSv/h to ≤ 500 μSv/h	Unacceptable	Unacceptable	Unacceptable	Extreme	Medium
>25 μSv/h to ≤ 50 μSv/h	Unacceptable	Extreme	High	Medium	Low
>10 μSv/h to ≤ 25 μSv/h	Extreme	High	Medium	Low	Low
> 5 μSv/h to ≤ 10 μSv/h	High	High	Medium	Low	Low
> 1 μSv/h to ≤ 5 μSv/h	High	Medium	Low	Low	Low
≤ 1 μSv/h	Low	Low	Low	Low	Low

\* Equivalent dose rate is typically used for this risk assessment process.

%: Dose rates above 1500 μSv/h present an unacceptable risk regardless of the exposure time.

Identification

Assessment

**Risk controls** are actions taken to control risks to the health and safety of staff and students. The primary duty is to eliminate any risk to health arising during work with animals or insects. Where elimination of risk is not practical, you must reduce the risk as far as practicable. **Risk control** measures for hazards associated with working with animals or insects should be considered in the following priority order:

***Priority One – Elimination***

Eliminating the risk by eliminating the use of ionizing radiation is the most effective way of protecting the health of staff and students. Consider the questions:

- Why is ionising used?
- Is it necessary to carry out this function?
- Could this function be achieved by doing things differently?

**Don't use the ionising radiation hazard. Don't use the process.**

***Priority Two – Substitution/Reduction***

Substitute the ionizing radiation hazard for a lower energy emitter and/or use a lower activity. e.g. Use P-33 (low energy beta emitter) instead of P-32 (high energy beta emitter).

**Find a less hazardous radioisotope or use a lower activity.**

***Priority Three – Isolation***

Isolation is separating people from the ionising radiation hazard by distance or shielding. Barriers may take the form of a totally closed system or process, an enclosure with exhaust extraction or an isolated / restricted access room.

**Keep it away from you.**

***Priority Four - Engineering Controls***

Engineering controls are physical controls (such as equipment) that eliminate or reduce the ionising radiation emission that can reach the person. Engineering controls for ionising radiation often entail shielded enclosures with safety interlocks.

**Engineer a better way.**

e.g. Design a remote handling device to insert a high activity source into a Mossbauer spectrometer.

***Priority Five - Procedures and Training***

Systems of work or safe work procedures can often help to reduce exposure to hazardous substances. Examples include:

- Reducing the duration or frequency staff or students perform a specific task.
- Performing dry runs prior to working with radiation. (i.e. do procedure without radiation first)

***Priority Six – Personal Protective Equipment (PPE)***

PPE includes lead aprons, footwear, gloves, safety glasses and face shields. PPE can often be used in combination with other risk controls to further reduce exposure to ionising radiation. However if PPE is used as the only control measure it should be generally regarded as a short-term solution or a last resort. Staff and students must be trained in correct fit use and maintenance of the PPE. In addition, you should make sure that the equipment is the right one for the job and readily available.

## Radiation Reference Sheet: Calculating Dose Rate

$$\text{Dose rate} = \frac{\Gamma A}{D^2}$$

$\Gamma$  = Gamma dose rate from 1 GBq at 1 metre  
 A = Activity of source in GBq  
 D = distance from the source in metres

Gamma dose rates ( $\Gamma$ ) for a number of radioisotopes are listed in appendix C of Australian Standard 2243.4 Safety in Laboratories - Part 4 Ionising Radiations. This can be viewed as a PDF document via the library database (Note: you must have a current authcate to access this).

### Dose Rate Estimates for Some Commonly Used Gamma Emitters

Radioisotope	$\Gamma$ $\mu\text{Sv/h}$ from 1 GBq at 1 m	Dose Rate $\mu\text{Sv/h}$ From			
		1 MBq		1 mCi *	
		at 0.3 m	at 1m	at 0.3 m	at 1 m
Iodine-125	74	0.82	0.074	30.44	2.74
Chromium-51	6.3	0.07	0.006	2.59	0.23
Technetium-99m	33	0.37	0.033	13.57	1.22

\*Note: 1 mCi equals 37 MBq

### Dose Rate Estimates for Some Commonly Used Beta Emitters

Radioisotope	$E_{\text{max}}$ MeV	Range in Air	Dose Rate [mGy/hr at 6 cm from 1 MBq]
Phosphorus-32	1.7	7.2 m	2.6
Sulfur-35	0.167	0.3 m	3.2
Hydrogen-3 (tritium)	0.018	< 5 mm	4.5
Carbon-14	0.156	0.3 m	3.3