MONASH University

Risk Management Program

AS/NZS 4801, OHSAS 18001
OHS20309
SAI Global

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Introduction

Monash University's Victorian campuses are all governed by the Victorian OHS Act 2004 and its subordinate regulations and codes of compliance. An inherent part of all OHS legislation is the requirement for workplaces to control the hazards its activities may pose to the health and safety of staff, visitors, contractors and students.

The Risk Management process outlined in these reference sheets is designed to assist in the appropriate selection of controls for identified hazards. This document outlines two processes the first being that of a traditional Risk Assessment, the second being Control Banding. Both processes use a similar framework of **Hazard Identification, Control Determination, and Control Implementation**.

The major hazard classes present at Monash University are:

1. Manual Handling
2. Physical
   - Equipment and Process
   - Lasers
   - Noise
   - Personal Interactions
3. Chemical Exposure
4. Biological Exposure (Micro / Animal & Insects)
5. Radiation Exposure

The risks (likelihood of injury or illness) associated with hazards must be identified **and where possible eliminated**, or minimised so far as is practicable. Reduction of risk is best done using the Hierarchy of Controls. With the exception of Elimination, in most cases a combination or layering of primary and secondary controls provides the safest option for reducing the risk of exposure to a hazard. *Primary controls* are those which provide the first layer of protection, their main aim being to control or restrict the impact of the hazard on those associated with the work activity. *Primary controls* are described in the top section of the hierarchy and include *Substitution, Isolation and Engineering* controls. *Secondary controls* are less reliable and provide the last layer of protection to those exposed to the hazard; these include *Administrative controls and Personal Protective Equipment.*

The Hierarchy of Controls is described below.

Elimination:

Design out the risk, Don't use the equipment. Don't use the process

The best way to eliminate the risk is to design out, remove the hazard or discontinue the hazardous work activity.

Substitution:

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

Substitute the hazardous part of the work activity with a safer option.

Isolation:

Keep it away from people.

Isolate the people from the equipment or work activity. For example, put the equipment or perform the activity in a booth or a separate room. Provide remote activation / control of the equipment or activity.

Engineering:
Modify the process or equipment

Engineering controls involve changing the equipment or the environment in which the work activity is undertaken and include;

- modifying the design of a piece of equipment
- modifying the workplace layout in which an activity is carried out
- installing guards to prevent exposure to the hazardous parts of a piece of equipment or work activity
- providing enclosures, fume cupboards, local exhaust ventilation or automation
- installing containment mechanisms to isolate energy or other hazards in emergency situations

Administration:
Procedures, signage and warnings

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

Examples include

- Performing the work activity out of normal hours or restricting access to a certain area
- Reducing the duration or frequency staff or students perform a specific task.
- Good housekeeping
- Contingency and emergency planning

Personal Protective Equipment (PPE):
Last Layer of protection for the person

PPE includes lab coats, overalls, aprons, footwear, gloves, safety glasses, face shields and respirators. PPE can often be used in combination with other risk controls to further reduce exposure to hazardous parts of equipment and work activities. If PPE is used as the only control measure it should generally be regarded as a short-term solution or last resort. Staff and students must be provided with the PPE of the correct fit and be trained in its use and maintenance. In addition, it should be ensured that the PPE is the applicable for the task and readily available.

How to Use This Document

There are two methodologies used to manage risks at Monash University;

Method 1: Risk Assessment
By reviewing your work area and activities against each of the major hazard classes, a comprehensive Risk Assessment can be developed and appropriate controls implemented with the aim of reducing the likelihood of an incident or injury occurring.

The primary aim of the risk assessment process is to identify all associated hazards within a process or piece of equipment, estimate the consequence and likelihood of an adverse event occurring, calculate a risk score and apply controls to lessen the risk to an acceptable level. An appropriate person should be responsible for ensuring the controls are implemented by the work area or support services as appropriate.

Method 2: Control Banding
1. This alternative method removes the need to estimate the likelihood and consequence and gives recommendations on the types of controls that should be in place for a given hazard.

The primary aim of this process is for the person or group of persons performing an activity to comprehensively identify the hazard/s associated with a process or piece of equipment and where practicable eliminate the hazard or implement pre determined control measures identified in the control band. The control band sets the **minimum level of controls required** to reduce the risk. An appropriate

person should be responsible for ensuring the controls are implemented by the work area or support services as appropriate.

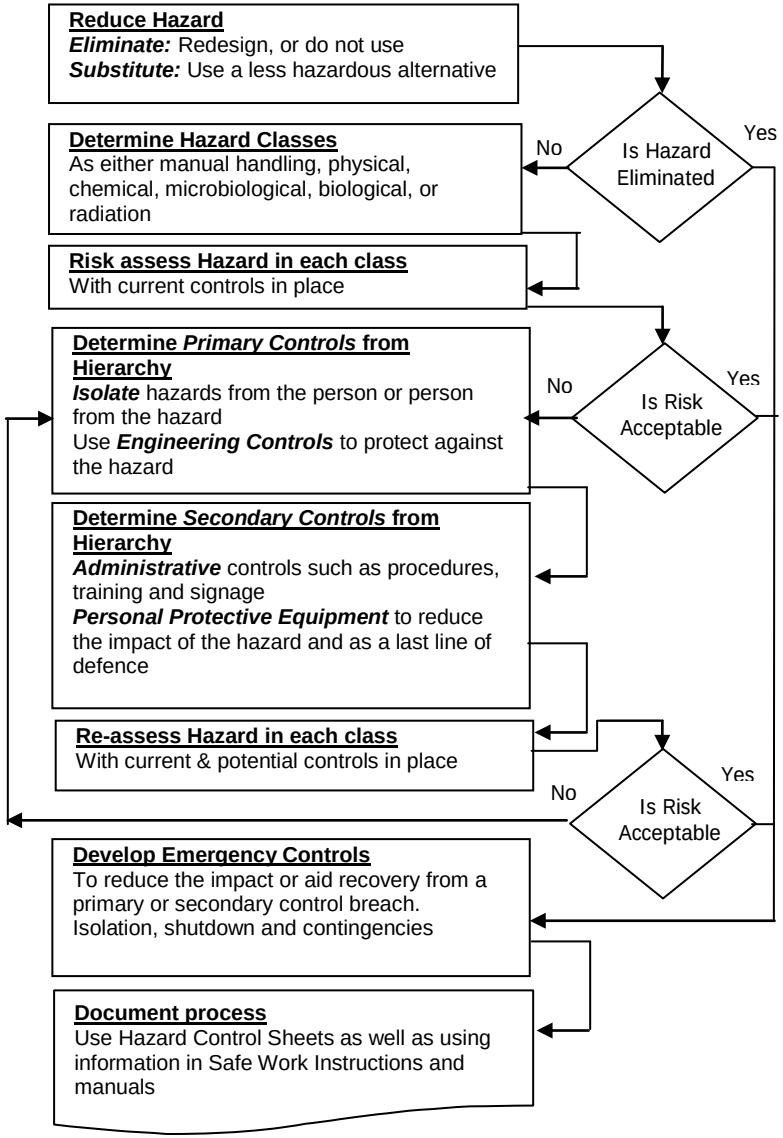
Methodology

1. Determine the method to be used
2. Identify if you can **eliminate** or **substitute** the current hazardous equipment or work activity with something less hazardous
3. If not practical, **identify the hazards** associated with your equipment, process or work activity. Start with the main process and then identify any associated processes. Take into account hazards generated through tasks such as;
    a. installation;
    b. operation;
    c. waste generated;
    d. any associated equipment, tasks or activities which may need to occur as part of the process and;
    e. decommissioning.

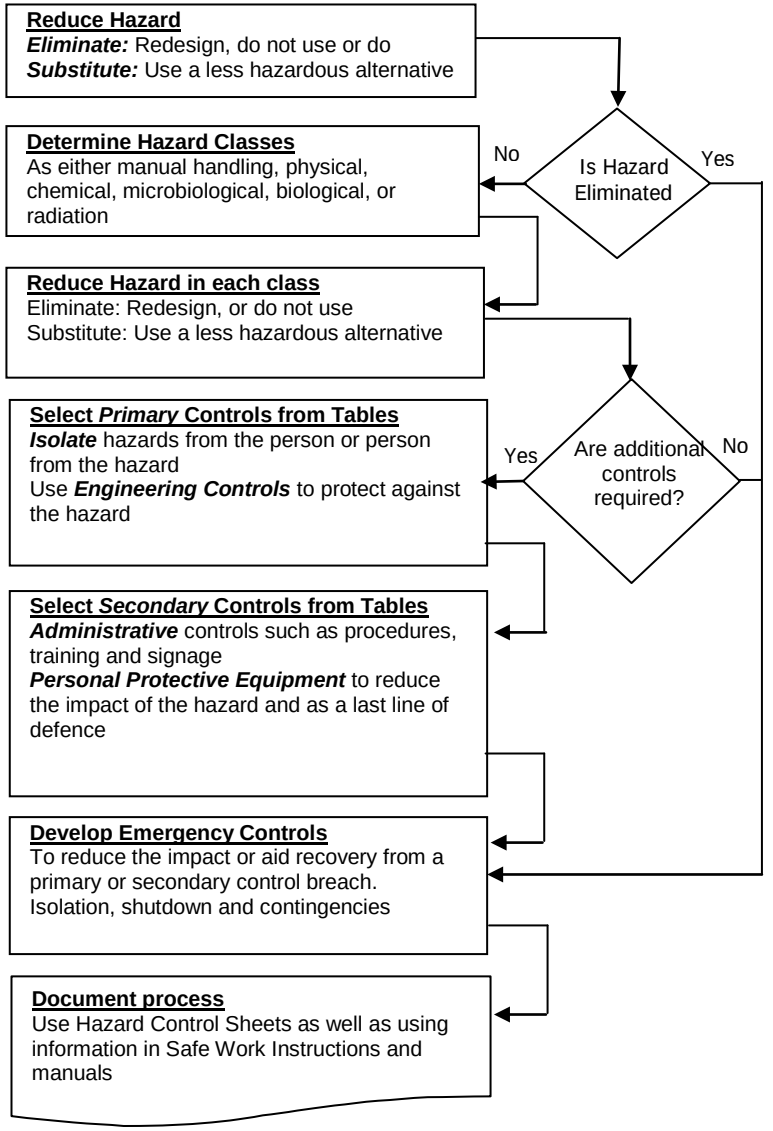
    Each of these should be listed and assessed separately as individual hazards.
4. **Categorise** each individual hazard into one of the **hazard classes** below**:**
    a. Manual Handling
    b. Physical Hazards
        i. General
        ii. Laser
        iii. Noise
    c. Chemical Exposure
    d. Microbiological Exposure
    e. Biological Exposure
    f. Radiation Exposure
5. **For each hazard** use the corresponding hazard class reference sheet to **identify;**
    a. the type of activity
    b. the corresponding control level (1,2,3 or 4)
6. If using **Method 1** (Risk Assessment);
    a. Estimate the likelihood and the consequence of an adverse event, with the current controls in place
    b. Calculate the risk score using the generic matrix.
    c. Identify any further controls required as outlined in the associated reference sheets
    d. Re-estimate likelihood and consequence assuming the new controls are implemented
    e. If risk is acceptable go to step 7. If further risk reduction is required repeat assessment (Further reduction will always be recommended if the assessment results in an extreme or high risk score)
7. If using **Method 2** (Control Banding**)** ;
    a. From the hazard class reference table, identify the **control level required** to be implemented
    b. **Identify the controls** from the corresponding control level reference sheet
    c. **Compare** these controls to those **currently in place**
8. **Implement** any controls which are **identified as outstanding** or not currently implemented
9. Use the **Hazard Control Worksheet** in appendix 1 to record the process and outcome of assessment.
10. Following completion of the **worksheet** copies of the risk assessment should be provided to those responsible for follow up action and on receiving evidence of completion signed off as **in place** by the safety officer or supervisor.

Principles of Monash's Risk Management and Hazard Control Process

Method 1: Risk Assessment



Method 2: Control Banding



Manual Handling

Manual handling is the use of the human body to exert force to handle, support or restrain any object.

Manual handling is not defined as just lifting or carrying heavy objects; it includes pushing, pulling, holding, lowering, throwing, packing, typing, assembling, cleaning, sorting and the use of tools. Manual Handing also extends to **tasks performed and the way they are performed at your workstation**.

While not all manual handling tasks will cause injury, some can lead to serious conditions known as musculoskeletal disorders (MSDs), including:

- muscle sprains and strains
- back injuries
- soft-tissue injuries to the wrists, arms, shoulders, neck or legs
- abdominal hernias
- chronic pain

The most effective way to prevent MSDs is to design a process or system of work so that the need for manual handling is either **eliminated** or reduced with automation or mechanisation.

When determining controls for a manual handling task, a number of factors need to be considered such as:

1. The **Physical Demand** based on the duration or frequency of task. Duration takes into account the increasing scale of static muscle load over periods of minutes to hours where as for frequency the emphasis is on an increasing scale of repetitive muscle force over shorter periods, seconds to minutes
    - **Low** physical demand;

      Duration of less than 1 hour (<1 hr) or;

      Frequency of less than once per minute
    - **Medium** physical demand:

      Durations are such that the task occurs for part of a normal work day (<1/2 of the day) or;

      Frequency of task between once and 20 times per minute
    - **High** physical demand:

      Long durations such as all or majority of a normal work day (>1/2 of the day) or;

      High frequency of task greater than 20 times a minute
2. The **Effort** required to carry out the task:
    - **Low** Effort: a load or force which the individual doing the tasks can easily manage
    - **Moderate** Effort: a load or force which the individual doing the task would be able to cope with and keep control of although some physical effort is required
    - **High** Effort: a load or force which the individual doing the task may find difficult because of the effort or control it requires
3. The involvement of **potentially hazardous postures** which may be repetitive or sustained movements and stances such as:
    - Working with one or both hands above shoulder height
    - Reaching behind the body
    - Squatting, kneeling, crawling, lying or jumping
    - Sideways twisting
    - Reaching forwards or sideways more than 30cm from the body
    - Lifting or lowering
    - Exerting force with one hand or one side of the body
    - Pushing, pulling or dragging
    - Exerting force while in an awkward posture

The **working environment** also needs be taken into consideration as stressors such as radiant heat, low temperatures, drafts or high humidity can add to an individual's ability to work effectively. The terrain the task is being

conducted over such as stairs; rough ground etc should also be a consideration when choosing appropriate controls.

The control of **Manual Handling** hazards is accomplished through a combination of;

- **Redesigning** the equipment or process or work activity including;
  - Modifying the object, making it lighter or less bulky
  - Modifying the workplace layout
- **Mechanical Aids**; introducing mechanical assistance or mechanical handling equipment such as trolleys, ergonomically designed equipment and powered equipment to assist the task.
- **Personnel Training**; increasing staff and students awareness of correct manual handling techniques and knowledge of their application. Training needs to be used in conjunction with other controls and on its own is not an effective risk reduction strategy.

NB: The handling of humans or animals is defined as a hazardous manual handling task and must include the use of controls consistent with level 2 control banding in conjunction with training in the specific work activity.

Method 1: Risk Assessment

1. Eliminate or substitute the process for a safer option and if not practicable;
2. Identify Manual Handling hazards using the table below;

Are repetitive or sustained forces present?	(a) Lifting, lowering, pushing, pulling, dragging, holding, supporting or restraining any object or tool (b) Exerting force with one hand or one side of the body (c) Gripping with the fingers pinched together or held wide apart (d) Exerting force whilst in an awkward posture
Are repetitive or sustained awkward postures involved?	(a) Squatting, kneeling, crawling, lying, semi-lying or jumping (b) Working with the hand wide apart or close together (c) Standing with most of the body's weight on one leg (d) Working with one or more hands above shoulder height (e) Working with the wrists in excessively bent positions (f) Carrying with one hand or one side of the body
Is repetitive or sustained movement required?	(a) Bending back or neck forwards or sideways more than 20 degrees (b) Twisting back or neck more than 20 degrees (c) Backwards bending of the back or neck more than 5 degrees (d) Reaching forwards or sideways more than 30 cm or reaching behind the body (e) Twisting, turning, grabbing, picking or wringing actions with the fingers, hands or arms (f) Very fast movements
Is the application of high force required?	(a) Hitting, kicking, throwing or catching or applying sudden or unexpected forces (b) Pushing or pulling objects that are hard to move or to stop (c) Jumping whilst holding a load (d) Exerting force in non-referred hand (e) Two or more people needed to handle the load
Is the load handled unstable, unbalanced or difficult to move?	(a) Is the load unstable or unbalanced? (b) Is the load difficult to move? (c) Does the size of the load influence the risk? (d) Is the load hot or cold or contain volatile materials?
Do environmental factors affect the handling?	(a) Radiant heat, high or low temperatures, draughts or high humidity (b) Is the visual environment suitable? (lighting levels, glare issues, reflections) (c) Does required protective clothing and other PPE increase the risk of musculoskeletal disorder? (d) Arm/hand vibration (e) Whole body vibration

3. Identify;
   a) the **effort** needed to perform the activity (relative to the individual performing the task)
   b) the **posture** as being either good (neutral) or potentially hazardous (awkward or bent / twisted)
4. Determine the **consequence** ranking of each activity

		Consequence Ranking				
		Major	**Severe**	**Moderate**	**Minor**	**Neg**
Hazard	**Category**	**A**	**B**	**C**	**D**	**E**
Manual Handling	Poor posture	High Effort	Considerable Effort	Moderate Effort	Small Effort	
	Good Posture		High Effort	Considerable Effort	Moderate Effort	Small Effort

5. Estimate Likelihood based on the **physical demand** for each of the tasks based on frequency or duration.

		Likelihood ranking				
Hazard	**Category**	**1**	**2**	**3**	**4**	**5**
Manual Handling	Frequency	> 30 per min	> 5 per min	1 - 5 per min	< 1 per min	occasionally
	Duration	Long periods all day	Long periods most of day > 1/2 day	Long periods some of day < 1/2 day	Short periods freq < 1 hr	Short periods Infreq < 1hr

6. Use the generic risk matrix below to determine the risk level associated with the activity.

		Likelihood of injury after current controls are considered					
	Consequence	**1 Highly Likely**	**2 Likely**	**3 Occasionally**	**4 Unlikely**	**5 Highly Unlikely**	
A	**Major**	Extreme	Extreme	High	High	High	**A**
B	**Severe**	Extreme	High	High	High	Medium	**B**
C	**Moderate**	High	High	Medium	Medium	Medium	**C**
D	**Minor**	High	Medium	Medium	Medium	Low	**D**
E	**Negligible**	Medium	Medium	Medium	Low	Low	**E**
		1	**2**	**3**	**4**	**5**	

7. Assess the acceptability of the risk, if high or extreme you must
   a) add controls to eliminate or reduce the risk
   b) change the frequency or duration of the activity
8. Recalculate the risk score and assess the risk, continue process until the risk is reduced to an acceptable level.
9. Use the hazard control worksheet to make a record of the process.
10. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Method 2: Control Banding

1. Eliminate or substitute the process for a safer option and if not practicable;
2. From the table below identify
   a) The **physical demand** for each of the tasks based on frequency or duration.
   b) The **effort** needed to perform the activity (relative to the individual doing the task)
   c) The **posture** as being either good (neutral) or potentially hazardous (awkward or bent / twisted)
3. Use control banding matrix below to determine the control level for each identified hazard.

Manual Handling

	Effort (guide only will depend on individual)	Low	Moderate	Moderate	High
	Posture	Either	Good	Potentially Hazardous	Either
Physical Demand	**High** Near maximum demand **F**- more than 30 per min **D**- long periods (>1/2 day)	**3**	**3**	**3**	**3**
	Medium Considerable demand **F**-Moderately 1-5 times per min **D**-Moderate periods (< ½ day)	**2**	**2**	**2**	**3**
	Low Sustained small demand **F**-Occasionally **D**-Short periods <1hr	**1**	**1**	**2**	**3**

4. Use the control level reference table to identify the measures required for the work activity
5. Identify what controls are currently in place and make a comparison with the reference table. Record further controls to be implemented on the hazard control worksheet. Implement recommended controls, using as many as possible without compromising the process or creating further hazards
6. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Manual Handling - Control Level Reference Table

Control Group	1	2	3
Description	**Manually operated processes with low risk of serious injury**	**Medium risk of serious injury to the operator or those potentially exposed to the hazard**	**High risk of serious injury to the operator or those potentially exposed to the hazard**
Engineering:	Use of trolleys for multiple components Bench workstation heights & angles Step ladders for accessing shelves	Workplace re-design Use of general trolleys/ manual handling type equipment Potential for specific equipment · Height adjustable trolleys · Designed specifically for process	Conveyers Assisted lifting devices Pallet trucks Power assisted trolleys, fork trucks, mobility device Automated process such as electronic pipette Adjust work height setup
Administration:	Training in the process with reference to ergonomic/manual handling issues Safe work instructions or guidelines on task Training on task performance Identification and awareness of hazards associated with equipment or process	Job rotation & additional help Safe work instructions (SWI) MoveSmart information pamphlet Basic manual handling training Ergonomics and workstation assessments	Safe work instructions and training in the use of engineering controls Training in manual handling/ lifting techniques MoveSmart information pamphlet Use of job rotation / breaks
Personal Protective Equipment (PPE):	Flat soled / fully enclosed footwear Clothing & PPE appropriate for task	Clothing & PPE appropriate for task Appropriate footwear (e.g. steel capped boots) in workshops or store environment.	Clothing & PPE appropriate for task Appropriate footwear (e.g. steel capped boots) in workshops or store environment Reflective vests where powered lifting equipment is used

Physical Hazards

Physical hazards are not limited to laboratories, workshops or studios. They exist in most workplaces and can be categorized under the following headings:

- ***Machinery:*** which may cause entanglement, crushing, trapping, cutting, stabbing, shearing, abrasion or tearing
- ***Stored Energy:*** such as pressurised containers or vessels
- ***Gravitational***: such as slip, trip, fall from a height, being hit by a falling object
- ***Kinetic Energy:*** being hit by the activities of another person, a moving vehicle or object
- ***Generated Energy***: Lasers (Physical Hazards pt2)
- ***Environmental stressors:*** exposure to noise (Physical Hazards pt3), vibration, extreme heat or cold (see Indoor thermal comfort information sheet)
- ***Thermal burn***: exposure to hot /cold surfaces or components, cryogenic gases, fire, explosion, exothermic reactions.
- ***Electrical:*** contact with an electrical conductor resulting in current flow through the body.
- ***Physico-chemical***: include reactions from corrosive or flammable chemicals, asphyxiants, explosive properties, dusts and particulates (inc. nanoparticles).
- ***Human Interaction***: *include potential interaction between people*

Sources of physical hazards are typically associated with the installation, commissioning, erection, operation, inspection, maintenance, repair, service and cleaning of any new and existing machine for use in the workplace. Further information may be found in the document: Use, design and modification of machinery/equipment at Monash University.

Other physical hazards may also be encountered such as those dealing or interacting with individuals or groups of people as part of a research project (i.e. interviewing, hospital placement) or specific job role (i.e. student complaints). In this instance **Method 1: Risk Assessment** should be used with an understanding of the general population being interacted with and past history of events which have occurred. Most organizational units will have protocols available for this type of interaction and these should be consulted as a guide to general risk management.

Method 1: Risk Assessment

1. Eliminate or substitute the process for a safer option and if not practicable;
2. Identify physical hazards involved in the activity from the table below

P1.	Machinery
P2.	Stored Energy
P3.	Gravitational
P4.	Kinetic Energy
P5.	Generated Energy
P6.	Environmental Stressors
P7.	Thermal Burn
P8.	Electrical
P9.	Physico- chemical
P10.	Human Interaction

3. Estimate the consequence for each hazard should an adverse event occur.

	Consequence ranking				
	Major	**Severe**	**Moderate**	**Minor**	**Negligible**
Hazard	**A**	**B**	**C**	**D**	**E**
Physical (exclude Lasers & noise)	Death or permanent incapacity	Extensive medical treatment / hospitalisation	Medical treatment by health service	First aid	Short term discomfort

4. Estimate likelihood of an adverse event occurring assuming the current controls are in place.

	Likelihood ranking				
Hazard	**1**	**2**	**3**	**4**	**5**
Physical (exclude Lasers & noise)	Highly Likely (<1:10)	Likely (1:100)	Occasionally (1:1000)	Unlikely (1:10,000)	Highly Unlikely (1:100,000)

5. Use the risk matrix below to determine the risk level associated with the activity.
6. Assess the acceptability of the risk and add additional controls if too high.
7. Recalculate the risk score and continue the risk assessment process until the risk is reduced to an acceptable level.
8. Use the hazard control worksheet to make a record of the process.
9. Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include Isolation, shutdown and contingencies for the release of physical hazards
10. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

		Likelihood of injury after current controls are considered					
	Consequence	**1 Highly Likely**	**2 Likely**	**3 Occasionally**	**4 Unlikely**	**5 Highly Unlikely**	
A	**Major**	Extreme	Extreme	High	High	High	**A**
B	**Severe**	Extreme	High	High	High	Medium	**B**
C	**Moderate**	High	High	Medium	Medium	Medium	**C**
D	**Minor**	High	Medium	Medium	Medium	Low	**D**
E	**Negligible**	Medium	Medium	Medium	Low	Low	**E**
		1	**2**	**3**	**4**	**5**	

Method 2: Control Banding

1) Identify all physical hazards (excluding lasers and noise) associated with your equipment or work activities. Begin with the main process and then identify any associated activities or equipment

2) Determine the existing level of **automation** of the equipment or process. Identify if it is operated manually, semi-automatically or automatically:

   a) **Manual Task** – machine operated or task completed by human interface (pedestal drill, grinder, hand operated equipment)

   b) **Semi-Automatic** – interactive control over machine in operation mode with some automatic features (milling machine, ball mill, other)

   c) **Automatic** – Little or no amount of control over machinery or equipment in operation mode (Robot, CNC machine, specialized test equipment)

3) Estimate the potential **consequence** for each hazard should an adverse event occur taking into account any past history of incidents and near misses. If the equipment has more than one type of injury assess for the most severe and apply as many controls as practicable from the control level indicated

   a) **Minimal** (negligible / First aid)

   b) **Moderate** (requiring medical treatment)

   c) **Serious** (Death or permanent incapacity)

4) Use control banding matrix below to determine the control level for each.

Physical Hazards 1

Level of Automation	Consequence: Minimal	Consequence: Moderate	Consequence: Serious
Automatic	**3**	**3**	**3**
Semi - Automatic	**2**	**2**	**3**
Manual	**1**	**2**	**3**

5) Use the control level reference table to identify the measures required for each work activity

6) Identify what controls are currently in place, make a comparison with the physical hazard control level reference table and record on the hazard control worksheet. Implement recommended controls, using as many controls as possible without compromising the process or creating further hazards

7) Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include Isolation, shutdown and contingencies for any adverse event.

8) Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Physical Hazards (Lasers)

All manufactured lasers are required by legislation to be classified based on their power and wave-length. The class of the laser is associated with its ability to injure people.

If lasers are constructed or modified in the laboratory, an assessment must be made of the power and wave-length so it can be classified as the appropriate class. Contact your Laser Safety Officer in this instance and refer to AS2211.1:2004.

1. Identify class to be used:

   i) **Class 1 & 2** lasers present a very limited hazard under normal conditions. However, reckless behaviour, such as inappropriate pointing of the beam or staring into the beam can result in damage to the eye.

   ii) **Class 1M and 2M** emit similar levels of radiation to class 1 and 2 respectively, however are evaluated with smaller measurement apertures or at a greater distance from the apparent source. The greatest hazard for these occurs if the beam is focused with optical instruments. **Class 3R** has the ability to cause moderate eye injury from intra beam viewing.

   iii) **Class 3B and 4** have the ability to cause serious injuries. In the case of class 4 lasers, serious eye injuries can even occur from reflections from dulled surfaces. With these classes of lasers it is important to institute robust controls, to prevent access to radiation of this intensity. Fail safes and redundancy of controls need to be built-in where practicable.

2) Use control banding matrix below to determine the control level based on the laser class.

Laser Hazards

Laser Class	Class 1 & 2	Class 1M, 2M & 3R	Class 3B & 4
Control level	**1**	**2**	**3**

3) Use the hazard control level reference table to identify the controls required for the equipment or process.

4) Identify what controls are currently in place, make a comparison with the physical hazard control reference table and record on the hazard control sheet. Implement recommended controls, using as many controls as possible without compromising the process or creating further hazards.

5) Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for the release of the beam or associated hazards.

6) Utilise information in Safe Work Instructions and laboratory manuals where appropriate.

Physical (including Laser Hazards) - Control Level Reference Table

Control Group	1	2	3
Description	**Manually operated processes AND equipment with minimal risk of serious injury to the operator or those potentially exposed to the hazard**	**Semi-Automatic processes and equipment OR manually operated processes with a moderate risk of serious injury to the operator or those potentially exposed to the hazard.**	**Automatic processes and equipment or any processes OR equipment with a high risk of serious injury or fatality to the operator or those potentially exposed to the hazard.**
Isolation:	Perform the process in a booth or a separate room. Use barricades to control others potentially exposed to the hazard.	Controls from control group 1 or; Operate from a control room or isolate the process from operator and others Laser - Terminate beam at end of useful length and enclose beam	Operate from a control room or isolate the process from operator and others Interlocking of isolation process to the control area Isolation material to be compatible with hazard Laser - Terminate beam at end of useful length and enclose beam, remote interlocks
Engineering:	Ensure guarding on rotating, shearing or pinch points is secure in place Modify the workplace layout in which a process is carried out to reduce hazards Use good ventilation or local exhaust for fume or dust exposure	Ensure guarding on rotating, shearing or pinch points is secure in place Interlocking or fixed guarding Emergency stop devices Modify the workplace layout in which a process is carried out to reduce hazards Use local exhaust or fume hood/booth for fume or dust exposure.	Use of local exhaust or fume hood/booth for fume or dust exposure. Interlocking on guarding Emergency stop devices (dead stop) Modify the workplace layout in which a process is carried out to reduce hazards Ensure guarding on rotating, shearing or pinch points is secure in place Laser – beam must be controlled using, elevation limiters, beam attenuators, beam terminations and reduction of reflective surfaces where appropriate
Administration:	Moderate level of supervision Users should be informed of the optical hazards from these classes of laser	High level of supervision or Assessed high level of Competency (skills and behaviour needed to effectively perform the task) with moderate supervision	Supervision : High risk processes **without isolation of hazard:** high level of supervision or buddy system

	Training on task performance Identification and awareness of hazards associated with equipment or process Safe work instructions or guidelines on task	Safe work instructions on task Identification and awareness of hazards associated with equipment or process Localised and entrance signage of hazards Develop emergency control, isolation, shutdown and contingencies for the release of physical hazards. Laser - Laser safety officer and training for all staff in contact with laser areas, emission indicator device for lasers over 3R power rating, eye tests prior to use of laser	High risk processes **with isolation of hazard** moderate supervision Competency Manual or semi – automatic high risk processes high level of competency Automatic processes training in process Identification and awareness of hazards associated with equipment or process Localised and entrance signage of hazards Develop Emergency Controls. Isolation, shutdown and contingencies for the release of physical hazards. Laser - Laser safety officer and training for all staff in contact with laser areas, emission indicator device for lasers, eye tests prior to use of laser. Laser must be in a designated laser area, with appropriate signage and interlocks.
Personal Protective Equipment (PPE):	Training in use and requirements of PPE Ensure PPE is appropriate for the application and readily available	Training in use and requirements of PPE Ensure PPE is appropriate for the application and readily available	High risk processes **without isolation** high level of PPE High risk processes **with isolation** PPE required for general area or associated hazards Training in use and requirements of PPE Ensure PPE is appropriate for the application and readily available. Laser eyewear (See AS1337.4/1337.5)

Noise

Under the Health and Safety Regulations 2007 employees must not be exposed to noise (sound pressure level) greater than an 8 hour equivalent of 85 dB(A) or instantaneous noise in excess of 140 dB(C).

1. Identify potential noise levels through referencing the manufacturer's equipment manuals or use the noise comparison reference table.
2. If it is believed that noise in a work area may have the potential to cause hearing damage, determine the actual level by contacting the Occupational Health and Safety branch arrange for the measurement of noise levels.
3. Determine the time the person is exposed to the noise.
4. Use the control banding matrix below to determine the control level required

Noise Hazards

Duration	85-90 dB(A)	90-100 dB(A)	>100 dB(A)
>2 hours	**2**	**2**	**3**
<2 hours	**1**	**2**	**2**
<10 min.	**1**	**1**	**2**

Level of Noise (decibels) Increasing ¾®

5. Compare the control measures in the noise control level reference table – Physical Hazards (Noise) with the controls already in place, record on the hazard control worksheet and implement recommended controls. Use as many as possible without compromising the process or creating further hazards
6. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Noise comparison reference table - Typical dB(A) Levels

Area or Equipment	Noise Levels dB(A)
Typical Office	50-60
Photocopier	59-71
Vacuum Cleaner	68-74
Typical Factory	76-82
Noisy Lawn Mower	87-94
Belt Sander	90-97
Hand Drill	95-101
High Pressure Spray Painting	98-103
Angle grinder	95-107
Chainsaw	106-115

Nuisance Noise

Nuisance noise is noise that does not cause permanent hearing loss, but may have an impact on work performance. Therefore, it should be minimised where possible. The cause of nuisance noise can be quite varied. Methods used to reduce nuisance noise are similar to reducing noise levels that exceed the exposure limits.

Noise Control Level Table

Control Group	1	2	3
Description	**Noise levels below 85dB(A) for extended periods of time. Short term exposure to >85dB(A). Low levels >130dB(C) of impact noise, Negligible risk of hearing loss or damage.**	**Noise levels > 85dB(A) but < 100dB(A) for sustained periods of time. Levels >140dB(C) of impact noise, High Risk of hearing loss or damage.**	**Noise levels > 100dB(A) for sustained periods of time. Levels >150dB(C) of impact noise, hearing loss or damage will occur. Hearing protection cannot be relied upon, work must cease until controls can reduce the noise level to level 2.**
Isolation:		Operate from a control room or isolate the process from operator and others.	Operate from a control room or isolate the process from operator and others Interlocking of isolation process to the control area Isolation to be compatible with type noise frequency
Engineering:	Redesign process to reduce noise produced can be considered if practical	Redesign the process to reduce noise exposure. Engineering controls such as equipment enclosures, internal sound proofing of equipment must be considered to eliminate or control the noise generated.	As per control group 2
Administration:	Ensure people are not exposed to equivalent of 8 hours of greater than 85 dB(A) or impact noise in excess of 140 dB(C) per day	Generation and documentation of strategies to reduce noise for work activity Consider reducing duration of exposure Institute a “buy quiet” policy Training must be given on use of PPE	Process stops until noise levels < 100dB(A)
Personal Protective Equipment (PPE):	Optional use of hearing protection for operators comfort	Hearing protection must be provided and maintained if other controls are not sufficient to reduce noise exposure. Hearing protection is standardised across Monash University; only hearing protection complying with SCL80 Class system appropriate to the risk is acceptable	Hearing protection cannot be relied upon as an interim control

Chemical Hazards

Chemicals are not limited to laboratories, workshops or studios. They exist in most workplaces and are be categorized as either hazardous or non hazardous substances. Hazardous substances are those defined in terms of their direct health effects on people based on the toxicology of their ingredients. All hazardous substances as well as dangerous goods must have a Materials Safety Data Sheet (MSDS), manufactures must provide this on request or when a material is first supplied. MSDS's can also be found on the Monash OH&S website under the Chemwatch database and are an important tool in assisting with this Risk Management process. In this process it is important to identify any chemical exposure hazards associated with your work activities. Your analysis must take into account the purchasing, storage, use and disposal of chemical/s and their waste products. Both the inhalation and skin contact components must be completed as part of the risk management process. Each hazard should be listed separately but assessed as part of an overall process.

Minimum Requirements

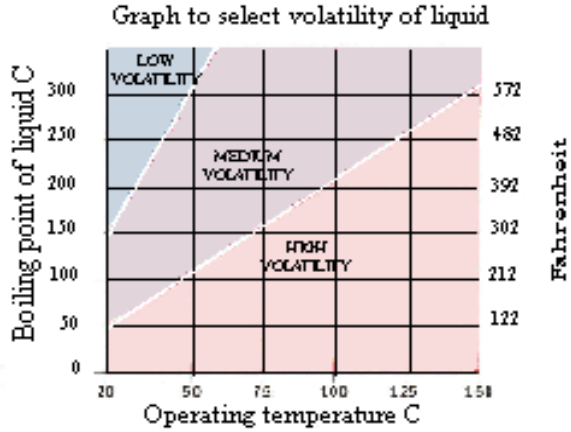
Level 1 controls must be implemented in all areas where chemicals are used or stored, however following this assessment greater levels of control may also be required.

Chemical Hazard Identification

1. Eliminate or substitute the chemical selected if possible.
2. Determine the amount of the substance to be used.
3. Determine the **Inhalation Risk Rating (IRR)** using either volatility or dustiness (solids) as an indicator.
4. Identify your chemicals hazard group. To do this, match the risk phrases listed in the Material Safety Data Sheet (MSDS) with those listed in the Chemical Hazard Group Classification Table (over page). Should risk phrases fall into different groups, the highest rating group (A= lowest, E= highest) should be used. If a risk phrase is associated with a skin (S) notation, classify the chemical according to the highest rated hazard group
5. Identify what controls are currently in place to perform the process
6. Using all the gathered information use either the Risk Assessment or Control Banding Methods to determine appropriate controls

Inhalation Risk Rating (IRR) – Volatility (Liquids)

Note: the boiling point of liquid chemicals can be found in the MSDS



Inhalation Risk Rating (IRR) – Dustiness (Solids)

	High	Medium	Low
Example	Fine, light powders. dust clouds can be seen When used & remain in air for several minutes. E.g. cement, carbon black, chalk dust	Crystalline, granular or flakey solids. When used, dust is seen but settles out quickly. Dust is left in surfaces after use. E.g. Soap Powder	Block and pellet like solids that don't break up. E.g. PVC pellets, waxed flakes, prills, solids in H_2O or under oil (e.g. sodium metal)
Particle size	< 10 micron	10 - 200 micron	> 200 micron

Chemical Hazard Group Classification Tables

To classify chemicals into the correct hazard group, risk phrases listed in the Material Safety Datasheet (MSDS) should be matched against those listed below. Should risk phrases fall into different hazard groups, the highest rating group (A = lowest, E =highest) should be used. If a risk phrase is associated with a skin (S) notation, classify the chemical according to the highest rated hazard group

Hazard Group A

Risk Phrase	Skin Notation	Risk Number
Irritating to eyes	**S**	R36
Irritating to eyes and skin	**S**	R36/38
Irritating to skin	**S**	R38

Hazard Group B

Risk Phrase	Skin Notation	Risk Number
Harmful by inhalation		R20
Harmful by inhalation and in contact with skin	**S**	R20/21
Harmful by inhalation, in contact with skin and if swallowed	**S**	R20/21/22
Harmful by inhalation and if swallowed		R20/22
Harmful in contact with skin	**S**	R21
Harmful in contact with skin and if swallowed	**S**	R21/22
Harmful if swallowed		R22

Hazard Group C

Risk Phrase	Skin Notation	Risk Number
Toxic by inhalation		R23
Toxic by inhalation and in contact with skin	**S**	R23/24
Toxic by inhalation, in contact with skin and if swallowed	**S**	R23/24/25
Toxic by inhalation and if swallowed		R23/25
Toxic in contact with skin	**S**	R24
Toxic in contact with skin and if swallowed	**S**	R24/25
Toxic if swallowed		R25
Contact with water liberates toxic gas		R29
Contact with acids liberates toxic gas		R31
Causes burns	**S**	R34
Causes severe burns	**S**	R35
Irritating to eyes and respiratory system	**S**	R36/37
Irritating to eyes, respiratory system and skin	**S**	R36/37/38
Irritating to respiratory system		R37
Irritating to respiratory system and skin	**S**	R37/38
Toxic: danger of very serious irreversible effects through inhalation		R39/23
Toxic: danger of very serious irreversible effects through inhalation and in contact with skin	**S**	R39/23/24
Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed	**S**	R39/23/24/25
Toxic: danger of very serious irreversible effects through inhalation and if swallowed		R39/23/25
Toxic: danger of very serious irreversible effects in contact with skin	**S**	R39/24
Toxic: danger of very serious irreversible effects in contact with skin and if swallowed	**S**	R39/24/25
Toxic: danger of very serious irreversible effects if swallowed		R39/25
Risk of serious damage to eyes	**S**	R41
May cause sensitisation by skin Contact	**S**	R43
Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin	**S**	R48/20/21
Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed	**S**	R48/20/21/22
Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed		R48/20/22
Harmful: danger of serious damage to health by prolonged exposure in contact with skin	**S**	R48/21
Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed	**S**	R48/21/22
Harmful: danger of serious damage to health by prolonged exposure if swallowed		R48/22

Hazard Group D

Risk Phrase	Skin Notation	Risk Number
Very toxic by inhalation		R26
Very toxic by inhalation and in contact with skin	**S**	R26/27
Very toxic by inhalation, in contact with skin and if swallowed	**S**	R26/27/28
Very toxic by inhalation and if swallowed		R26/28
Very toxic in contact with skin	**S**	R27
Very toxic in contact with skin and if swallowed	**S**	R27/28
Very toxic if swallowed		R28
Contact with acids liberates very toxic gas		R32
Very toxic: danger of very serious irreversible effects through inhalation		R39/26
Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin	**S**	R39/26/27
Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed	**S**	R39/26/27/28
Very toxic: danger of very serious irreversible effects through inhalation and if swallowed		R39/26/28
Very toxic: danger of very serious irreversible effects in contact with skin	**S**	R39/27
Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed	**S**	R39/27/28
Very toxic: danger of very serious irreversible effects if swallowed		R39/28
Possible risks of irreversible effects		R40 - Carc cat 3
Toxic: danger of serious damage to health by prolonged exposure through inhalation		R48/23
Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin	**S**	R48/23/24
Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed		R48/23/25
Toxic: danger of serious damage to health by prolonged exposure in contact with skin	**S**	R48/24
Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed	**S**	R48/24/25
Toxic: danger of serious damage to health by prolonged exposure if swallowed		R48/25
May impair fertility		R60
May cause harm to the unborn child		R61
Possible risk of impaired fertility		R62
Possible risk of harm to the unborn child		R63

Hazard Group E

Risk Phrase	Skin Notation	Risk Number
Harmful: possible risk of irreversible effects through inhalation		R40/20
Harmful: possible risk of irreversible effects through inhalation and in contact with skin		R40/20/21
Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed		R40/20/21/22
Harmful: possible risk of irreversible effects through inhalation and if swallowed		R40/20/22
Harmful: possible risk of irreversible effects in contact with skin		R40/21
Harmful: possible risk of irreversible effects in contact with skin and if swallowed		R40/21/22
Harmful: possible risk of irreversible effects if swallowed		R40/22
Possible risks of irreversible effects		R40 Mut cat 3
May cause sensitisation by inhalation		R42
May cause sensitisation by inhalation and skin contact		R42/43
May cause Cancer by inhalation		R49
May cause cancer		R45

Hazard Group - Undefined

Where a hazardous substance only has one or more of the risk phrases listed in the table below then treat it as a Hazard Group E chemical. Where there are other risk phrases then the hazard group of the substance should be assigned based on the other risk phrases.

Risk Phrase	Skin Notation	Risk Number
Danger of cumulative effects		R33
Danger of very serious irreversible effects		R39
Danger of serious damage to health by prolonged exposure		R48
May cause harm to breastfed babies		R64
Harmful: May cause lung damage if swallowed		R65

Method 1: Risk Assessment (Inhalation)

1. Use the table below to identify the consequence of the chemical being inhaled.

	Consequence of Inhalation				
	Hazard Group E	**Hazard Group D**	**Hazard Group C**	**Hazard Group B**	**Hazard Group A**
	A	**B**	**C**	**D**	**E**
Inhalation	Major	Severe	Moderate	Minor	Negligible

2. Identify the likelihood of inhaling the chemical based on the volatility /dustiness and the amount to be used using table below

Likelihood of Inhalation				
Amount	**High Dust or Aerosol potential & Volatility**	**Medium Volatility**	**Medium Dust or Aerosol potential**	**Low Dust or Aerosol potential & Volatility**
High (tonne or m^3)	Highly Likely (1)	Likely (2)	Likely (2)	Occasionally (3)
Medium (kg or litre)	Likely (2)	Likely (2)	Occasionally (3)	Occasionally (3)
Small (g or ml)	Occasionally (3)	Occasionally (3)	Unlikely (4)	Unlikely (4)
Very Small (mg or µl)	Unlikely (4)	Unlikely (4)	Highly Likely (5)	Highly Likely (5)
Micro (µg or < µl)	Unlikely (4)	Highly Likely (5)	Highly Likely (5)	Highly Unlikely (5)

3. Use the Generic risk matrix below to determine the risk level associated with the activity

		Likelihood of inhalation after current controls are considered					
	Consequence	**1 Highly Likely**	**2 Likely**	**3 Occasionally**	**4 Unlikely**	**5 Highly Unlikely**	
A	**Major**	Extreme	Extreme	High	High	High	**A**
B	**Severe**	Extreme	High	High	High	Medium	**B**
C	**Moderate**	High	High	Medium	Medium	Medium	**C**
D	**Minor**	High	Medium	Medium	Medium	Low	**D**
E	**Negligible**	Medium	Medium	Medium	Low	Low	**E**
		1	**2**	**3**	**4**	**5**	

4. Assess the acceptability of the risk and add further controls if deemed too high
5. Recalculate the risk score and continue the risk assessment process until risk is minimised to an acceptable level
6. Use the hazard control worksheet to make a record of the process
7. Develop Emergency Controls to reduce the impact or aid recovery of a primary or secondary control breach or failure.

These include isolation, shutdown and contingencies for the release of the chemical or associated hazards

Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Method 1: Risk Assessment (Skin Exposure)

1. Use the table below to identify the consequence of the chemical coming into contact with the skin.

	Consequence ranking				
Hazard	**Major A**	**Severe B**	**Moderate C**	**Minor D**	**Negligible E**
Skin Exposure	Hazard Group D or E		Hazard Group C	Hazard Group A or B	

2. Identify the likelihood of coming into contact with chemical.

	Likelihood ranking				
Hazard	**Highly Likely 1**	**Likely 2**	**Occasionally 3**	**Unlikely 4**	**Highly Unlikely 5**
Skin Exposure	Highly Likely	Likely splashing	Occasional splashing	Unlikely to have contact	Highly unlikely to have contact

3. Use the generic risk matrix below to determine the risk level associated with the activity.
4. Assess the acceptability of the risk and add further controls if too high.
5. Recalculate the risk score and assess the risk continue process until risk is reduced to an acceptable level.
6. Use the hazard control worksheet to make a record of the process.
7. Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for any adverse event.
8. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

		Likelihood of injury after current controls are considered					
	Consequence	**1 Highly Likely**	**2 Likely**	**3 Occasionally**	**4 Unlikely**	**5 Highly Unlikely**	
A	**Major**	Extreme	Extreme	High	High	High	**A**
B	**Severe**	Extreme	High	High	High	Medium	**B**
C	**Moderate**	High	High	Medium	Medium	Medium	**C**
D	**Minor**	High	Medium	Medium	Medium	Low	**D**
E	**Negligible**	Medium	Medium	Medium	Low	Low	**E**
		1	**2**	**3**	**4**	**5**	

Method 2: Control Banding

1. Determine the amount of the substance to be used.
2. Using the Inhalation Risk Rating & Hazard Group with the chemical hazard table adjacent, select the appropriate control level required for each hazard.
3. Identify what controls are currently in place and make a comparison with the chemical hazard control level reference table.
4. Use as many controls as possible without compromising the process or creating further hazards.
5. Use the hazard control worksheet to make a record of the process.
6. Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for any adverse event.
7. Utilise information in Safe Work Instructions and laboratory manuals where appropriate.

Hazard Group	Amount	Inhalation Risk Rating (IRR)	Hazard Control Level
D & E	£ 0.5 g or ml	Low	2
		Med/High	3
	> 0.5 g or ml & £ 20 kg or L	All	3
	> 20 kg or L	Low/Med	3
		High	4
C	£ 0.5 g or ml	All	1
	Concentrate > 0.5 g or ml & £ 0.5 kg or L	All	2
	Dilute (<5% of haz sub) > 0.5 g or ml & £ 0.5 kg or L	All	1
	>0.5 kg or L & <20 kg or L	All	2
	> 20 kg or L	Low/Med	2
		High	3
A & B	£ 0.5 g or ml	All	1
	> 0.5 g or ml & £ 20 kg or L	All	2
	> 20 kg or L	Low	2
		Med/High	3

Chemical Hazards - Control Level Reference Table

Control Group	1	2	3
Description	**Processes with a low risk of serious injury to the operator or those potentially exposed to the chemical.**	**Processes with a medium risk of serious injury to the operator or those potentially exposed to the chemical.**	**Processes with a high risk of serious injury or fatality to the operator or those potentially exposed to the chemical.**
Engineering:	General **ventilation should be of a good standard**. This includes natural ventilation or controlled ventilation where air is removed by a powered fan. Cold rooms typically have full recirculation of air and thus are not suitable as a work area for some chemicals Where possible use Fume hood or cupboard or extraction	**As per Control Band One** A fit tested respirator may be used for individuals Fume hood must be used if work has the potential to impact on others in area	Use all hazardous substances inside a **fume hood/cupboard** Refer to *OHS INFORMATION SHEET 13: Use of Local Exhaust Ventilation Systems & Fume Cupboards*
Administration:	Ensure all staff are provided with **information** regarding the hazards associated with the substance/s in use Ensure those using substances have completed a Dangerous Goods & Hazardous Substances training course Ensure good housekeeping standards are practiced at all times and ensure all containers are affixed with a compliant label (product name, concentration, DG code if applicable, date and decanter's name) Consult the **Material Safety Data sheet (MSDS)** before commencing work Place **lids** on containers immediately after use	**As per Control Band One and in addition;** Ensure all unattended reactions are clearly labelled Alert colleagues to your activities so they may also take precautions	**As per Control Band Two and in addition;** Keep the sash down as far as possible (at or below yellow diamond/ white label) Ensure **comprehensive training** on the process to be undertaken has been given/received and documented Ensure all requirements for **licenses, permits or notification to use** the chemical are met

	Store chemicals in accordance with the **Monash Chemical Storage Guidelines** and ensure spill kits are suitable for the type and quantity of substances in use. Consumption or storage of food and/or drink in the laboratory/workshop is prohibited Ensure Safe Operating Procedures/Safe Work Instructions are developed **Dispose of all wastes** as per the MSDS and waste disposal guidelines where applicable		All staff/students must be **confident and competent** before being allowed to perform tasks unsupervised Consider whether **after hours work** will be required and if so, develop and after hours procedures as per Work & study during times when emergency response is limited
Personal Protective Equipment (PPE):	Minimum PPE to be worn at all times - laboratory coat/dust coat/coveralls, safety glasses, closed toe footwear and gloves Ansell Glove Chart (pdf 544kb) Ensure **Personal Protective Equipment** (PPE) is appropriate for the task and chemical	**As per Control Band One and in addition;** Where fume cupboards are unavailable or impracticable use hazardous substances with an **appropriate respirator** which has been fit tested for the individual.	**As per Control Band Two**

Control Group 4

Control Group 4 is judged as a high or extreme hazard, and requires detailed research and planning. Consult your Safety Officer, OHS&E Consultant, or the central OHS branch prior to work beginning. A comprehensive, fully documented risk management plan must be developed for this category.

Microbiological Hazards (Biosafety)

Biosafety encompasses all those techniques required to prevent inadvertent exposure to and contamination with biological material which may be harmful to the persons exposed. Hazards which need to be taken into account are those associated with the handling, storage and disposal of microorganisms and their associated waste products.

Microbiological Hazard Identification

1. Identify which risk group (RG1-4) your organism belongs to by referring to AS/NZS 2243.3.
2. Identify if your activity involves a genetically modified organism (GMO), and if so determine which category it belongs to; Exempt dealing, NLRD, DNIR or DIR. Refer to the Gene Technology Act, 2000.
3. Identify if your activity involves the use of imported microbiologicals and whether they require an import permit. Refer to the ICON database, which can be accessed from the AQIS website. Check the conditions on the permit to see if a QAP facility is required for your organism.
4. Each hazard should be listed separately but assessed as part of an overall process.

Controlling Microbiological Hazards

Biosafety controls may include substitution with a less hazardous microorganism or finding a more controlled way to perform the process (i.e. use smaller quantities). Isolation of the microorganism involves separating people from the microbiological hazard by barriers such as Biocabinets to reduce exposure. Controls such as using a closed system or process, or an isolated / restricted access room may be considered for high risk organisms or where contaminants may affect the research outcome e.g. PC 2&3 laboratory requirements and practices.

Physical or Engineering controls (such as specialised equipment) may also be used to eliminate or reduce the generation of airborne biological hazards, suppress or contain the potential for airborne biological hazards or limit the area of contamination in the event of spills or leaks. Engineering controls in these cases are similar to isolation type processes and often entail partial enclosure, exhaust ventilation or automation.

Method 1: Risk Assessment

1. Determine if your work activity involves any of the following hazards:
   - Procedures or activities which may result in spills or splashes of liquids containing the microorganisms or human blood and bodily fluids
   - Procedures or use equipment that produce aerosols
   - Use of sharps that are brought into direct contact with either microorganisms or human blood and bodily fluids
2. Estimate the consequence of an adverse event occurring using the table below.

	Consequence of Exposure				
	Major	**Severe**	**Moderate**	**Minor**	**Negligible**
Hazard	**A**	**B**	**C**	**D**	**E**
Micro-Biological	Death/ permanent incapacity / shortened life	Infection/ disease with long term health implications	Medical treatment no long term effects	Minor infection	Negligible infection

3. Estimate the likelihood of that adverse event occurring using the table below.

Hazard	Likelihood of Exposure				
	1	2	3	4	5
Micro - Biological	Highly Likely (<1:10)	Likely (1:100)	Occasionally (1:1000)	Unlikely (1:10,000)	Highly Unlikely (1:100,000)

4. Use the generic risk matrix below to determine the risk level associated with the activity.

5. Assess the acceptability of the risk and add additional controls if deemed too high.

6. Recalculate the risk score and assess the risk continue process until the risk is reduced to an acceptable level.

7. Use the hazard control worksheet to make a record of the process

8. Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for the release of the micro biological agent or associated hazards

9. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

		Likelihood of exposure with current controls considered					
	Consequence	1 Highly Likely	2 Likely	3 Occasionally	4 Unlikely	5 Highly Unlikely	
A	**Major**	Extreme	Extreme	High	High	High	A
B	**Severe**	Extreme	High	High	High	Medium	B
C	**Moderate**	High	High	Medium	Medium	Medium	C
D	**Minor**	High	Medium	Medium	Medium	Low	D
E	**Negligible**	Medium	Medium	Medium	Low	Low	E
		1	2	3	4	5	

Method 2: Control Banding

1. Determine the type of procedure and risk group based on the table below.
2. Identify if the procedure has a high or low aerosol risk.
3. Use all the gathered information and the Microbiological hazard control level reference table below to select the appropriate control level required for each hazard.
4. Identify the controls currently in place, make a comparison between this and what the relevant control level stipulates should be in place and note (if applicable) which are yet to be implemented.
5. Use as many controls as possible without compromising the process or creating further hazards
6. Use the hazard control worksheet to make a record of the process
7. Develop emergency controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for the release of the micro-biological agent or associated hazards
8. Utilise information in Safe Work Instructions and laboratory manuals where appropriate

Microbiological Hazards

	Type of procedure	Procedure with low aerosol risk	Procedure with high aerosol risk
Organism Group	Risk group 4	**4**	
	Risk group 3	**3**	
	Risk group 2	**2A**	**2B**
	Diagnostic specimens from animals or humans – blood, bodily fluids, tissue	**2B**	
	Genetically Modified Organisms (GMOs): - DIR - DNIR - PC2 NLRD; 12 categories as listed in GT Act	**2A**	**2B**
	Genetically Modified Organisms (GMOs): - PC1 NLRD; 3 categories as listed in GT Act	**1**	**2B**
	Genetically Modified Organisms (GMOs): - Exempt dealings, *i.e.* exempt host-vector system, < 10L	**1**	
	Risk group 1	**1**	

Microbiological Hazards - Control Level Reference Table

Control Group	1	2	3
Regulatory requirements & minimum standards *These must be met before work can commence*	Work with Risk group 1 organisms must be carried out in facilities that meet the requirements of AS/NZS 2982 and AS/NZS 2243.3. Work with Exempt dealings and PC1 NLRDs must be carried out in facilities that have been certified as PC1 by the OGTR for exempt dealings, written Institutional Biosafety Committee (IBC) approval must be sought within 6 months of commencing work. For PC1 NLRDs written IBC approval must be sought prior to commencing work.	**Level 2 A:** Work with Risk group 2 organisms must be carried out in facilities that meet the requirements of AS/NZS 2982 and AS/NZS 2243.3 Work with PC2 NLRDs, DNIRs and DIRs must be carried out in facilities that have been certified as PC2 by the OGTR. Only work that has been assessed to have a **low aerosol risk** may be conducted on the bench IBC approval must be sought prior to commencing work with PC2 NLRDs. An OGTR license must be obtained prior to commencing work with DNIRs and DIRs **Level 2B:** All work must be conducted in a Class II Biosafety cabinet in addition to implementing Level 2A controls.	Work with Risk group 3 organisms must be carried out in facilities that meet the requirements of AS/NZS 2982 and AS/NZS 2243.3 and all work must be conducted in a Class II Biosafety cabinet. PC3 work practices must be adhered to at all times.
Isolation:		Access to PC2 laboratories should be restricted to appropriately trained staff	Access to PC3 laboratories must be restricted to appropriately trained staff
Engineering:		**Level 2B:** Any procedure which **may produce aerosols** of potentially infectious material must be performed in a **Class II Biosafety** cabinet. Centrifuges that are used for diagnostic samples or infectious microorganisms shall be fitted with either a sealed rotor or removable buckets, for easy decontamination in the event of a spill and samples must be placed in sealable tubes. A secondary unbreakable container which can be readily decontaminated must be used for the transport of microorganisms/GMOs between facilities.	**Level 2 controls and in addition;** Steam sterilizer (autoclave) must be located within PC3 facility for processing of infectious waste

Administration:	General waste and infectious waste must be segregated Food or drink are not to be consumed or stored in area If food/drink is to be used for research purposes, it must be clearly labelled "Not for human consumption". Safe Work Procedures/Safe Work Instructions for all procedures must be developed	**Level 1 controls and in addition;** **Level 2A:** Only work that has been assessed to have a **low aerosol risk** may be conducted on the bench. Training to include Monash Biosafety training and all relevant vaccination(s) **e.g. Hepatitis B, Q-fever** Suitable disinfectant must be available at all times for regular decontamination of work benches e.g. Sodium hypochlorite, Ethanol All potentially infectious waste must be steam sterilised before leaving the building or a medical waste contractor must be engaged for infectious waste disposal Safe work instructions for all procedures including spill cleanup procedures must be developed Moderate level of supervision is required	**Level 2 controls and in addition;** Training to include Monash Biosafety, Pathogen specific training, Emergency training including spill management Processes **without isolation of hazard:** high level of supervision and buddy system is required Processes **with isolation of hazard**: moderate supervision required Health surveillance where indicated, of those exposed to a potential hazard
Personal Protective Equipment (PPE):	Minimum PPE to be worn at all times: · laboratory coat/gown, · safety eyewear, · fully enclosed footwear · long hair tied back or hair net	**Level 1 controls and in addition;** Appropriate gloves able to protect against biological as well as any chemicals used for procedure must be worn. Refer to Ansell Glove chart (pdf 544kb)	**Level 2 controls and in addition;** Appropriate gloves able to protect against biological as well as any chemicals used for procedure must be worn Respiratory protection fit tested for the individual

Control Group 4 Microbiological Hazards

Work must be carried out in Physical Containment Level 4 (PC4) certified facilities. Monash University does not have any PC4 facilities on any of its campuses. There are however two PC4 facilities in Victoria, these are: Animal Health Laboratories in Geelong and VIDRL in North Melbourne.

Biological Hazards

Biological Safety encompasses all techniques required to prevent inadvertent exposure to and contamination with any animal, insect, plant or biological material which may be harmful to the persons exposed. Hazards which need to be taken into account are those associated with the handling, storage and disposal of animals, insects or plants and their associated waste products

Controlling Biological Hazards

The primary goal is to eliminate any risk to health arising during work with animals, insects or plants. Where elimination of risk is not practical, the risk must be reduced so far as practicable. Eliminating the risk involves not using the animal, insect or plant that creates the risk, alternately substitute the animal, insect or plant for a less hazardous form. Where this is not possible isolation of the people from the animal, insect or plant by distance or barriers to prevent or reduce exposure should be considered. 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. PC2 laboratory requirements and practices. Other physical or engineering controls such as equipment that eliminates or reduces the generation of airborne biological hazards, suppress or contain the potential for airborne biological hazards or control the animal, insect or plant that is the potential source of injury. These are often partial enclosure, exhaust ventilation or automation. Providing safe systems of work or safe work procedures can help to reduce exposure to animals, insects or plants that creates the risk, for example; reducing the duration or frequency of exposure and good housekeeping. Personal Protective Equipment (PPE) need to be used in combination with other risk controls to further reduce exposures to airborne allergens or to reduce the potential for direct harm due to bites, skin contact etc . Staff and students must be trained in correct fit use and maintenance of the PPE

Method 1: Risk Assessment

1. Determine if your work activity involves the following hazards;

   · Direct contact with a live animal, insect or plant that is capable of inflicting physical damage.

   · Routine handling of large numbers of animals, insects or plants that shed allergenic material known to cause sensitisation.

   · Contact with an animal, insect or plant that is capable of causing poisoning or a toxic reaction.

   · Contact with an animal or insect or parts thereof that may harbor microorganisms that could result in zoonotic infections.

2. Use the table below to estimate the consequence of an adverse event occurring.

	Consequence ranking				
	Major	**Severe**	**Moderate**	**Minor**	**Negligible**
Hazard	**A**	**B**	**C**	**D**	**E**
Biological	Death/ permanent incapacity / shortened life	Infection/ disease/ allergy with long term health implications	Medical treatment no long term effects, mild allergy	First aid treatmen t minor infection	Bruising or short term discomfort

3. Use the table below to estimate the likelihood of an adverse event occurring.

	Likelihood ranking				
Hazard	**1**	**2**	**3**	**4**	**5**
Biological	Highly Likely (<1:10)	Likely (1:100)	Occasionally (1:1000)	Unlikely (1:10,000)	Highly Unlikely (1:100,000)

4. Use the generic risk matrix below to determine the risk level associated with the activity.

		Likelihood of injury after current controls are considered					
	Consequence	1 Highly Likely	2 Likely	3 Occasionally	4 Unlikely	5 Highly Unlikely	
A	**Major**	Extreme	Extreme	High	High	High	A
B	**Severe**	Extreme	High	High	High	Medium	B
C	**Moderate**	High	High	Medium	Medium	Medium	C
D	**Minor**	High	Medium	Medium	Medium	Low	D
E	**Negligible**	Medium	Medium	Medium	Low	Low	E
		1	2	3	4	5	

5. Assess the acceptability of the risk and add further controls if deemed too high.
6. Recalculate the risk score and continue the risk assessment process until risk is minimised to an acceptable level.
7. Develop Emergency Controls to reduce the impact or aid recovery of a primary or secondary control breach or failure. These include isolation, shutdown and contingencies for the release of the biological agent or associated hazards.
8. Utilise information in Safe Work Instructions and laboratory manuals where appropriate.

IONISING RADIATION HAZARDS – X-RAY APPARATUS AND RADIOACTIVE MATERIAL (SEALED OR UNSEALED)

This section assists with the management of hazards associated with radioactive material (with the exception of neutron emitters) and X-ray apparatus.

The assessment must take into account purchasing, storage, use and disposal of radiation apparatus or radioactive material and the resulting waste products.

For assessment of the ionising radiation hazard from apparatus emitting UV light, radioactive material emitting neutrons, or any isotope which is not covered in these pages, contact the Occupational Health and Safety branch.

Methodology:

1. Identify which one OR MORE of the following hazards exist:

   A: radioactive material as an internal hazard [use for H-3, C-14, P-32, P-33, S-35, Cr-51, Zn-65, I-125]
   B: radioactive material as an external hazard [use for Cr-51, Zn-65, I-125]
   C: radioactive material as a skin burn hazard [use for P-32, Zn-65]
   D: X-ray apparatus, sealed sources, sealed source apparatus

2. For each hazard, identify the appropriate control level or exposure limits

3. Determine which controls are to be implemented. As many of the available controls should be implemented as is possible without compromising the process or creating further hazards.
   Note that a laboratory supervisor, Radiation Safety Officer or Head of Department may require adherence to controls over and beyond those indicated by the hazard assessment, to allow simplification of administrative or operating procedures.

4. Document the controls selected. Where possible, the effectiveness of the controls should be checked with measurement data and personal monitoring records of users.

HAZARD ASSESSMENT A: UNSEALED MATERIAL AS INTERNAL HAZARD

1) Identify the correct table for the isotope being used. For isotopes not covered by any table, contact Occupational Health and Safety.

2) Consider the type of operation to be undertaken and the amount of isotope to be used to determine the appropriate control band level.
3) Implement at a minimum the relevant controls from the appropriate band.

4) Document the controls.

H-3, C-14, (organically bound) S-35, Cr-51

	Operation Type					
	Simple storage	**Very simple wet operations** e.g. using aliquots of stock solution	**Normal chemical operations** e.g. analysis of simple chemical prep-arations	**Complex wet operations** e.g. multiple operations, or operations with complex glass apparatus	**Simple dry operations** e.g. manipulation of powders or work with **volatile radioactive compounds**	**Complex dry operations or work with radioactive gases**
20TBq	2	3	3	X	X	X
2TBq	2	2	3	3	X	X
200GBq	2	2	2	3	3	X
20GBq	2	2	2	2	3	3
2GBq	2	2	2	2	2	3
200MBq	2	2	2	2	2	2
20MBq	1	2	2	2	2	2
2MBq	1	1	2	2	2	2
200kBq	1	1	1	2	2	2
20kBq	1	1	1	1	2	2

P-33, Inorganic S-35

	Operation Type					
	Simple storage	**Very simple wet operations** e.g. using aliquots of stock solution	**Normal chemical operations** e.g. analysis of simple chemical prep-arations	**Complex wet operations** e.g. multiple operations, or operations with complex glass apparatus	**Simple dry operations** e.g. manipulation of powders **or work with volatile radioactive compounds**	**Complex dry operations or work with radioactive gases**
2TBq	3	3	X	X	X	X
200GBq	2	3	3	X	X	X
20GBq	2	2	3	3	X	X
2GBq	2	2	2	3	3	X
200MBq	2	2	2	2	3	3
20MBq	2	2	2	2	2	3
2MBq	1	2	2	2	2	2
200kBq	1	1	2	2	2	2
20kBq	1	1	1	2	2	2
2kBq	1	1	1	1	2	2

P-32, Zn-65

	Operation Type					
	Simple storage	**Very simple wet operations** e.g. using aliquots of stock solution	**Normal chemical operations** e.g. analysis of simple chemical prep-arations	**Complex wet operations** e.g. multiple operations, or operations with complex glass apparatus	**Simple dry operations** e.g. manipulation of powders **or work with volatile radioactive compounds**	**Complex dry operations or work with radioactive gases**
2TBq	3	3	X	X	X	X
200GBq	2	3	3	X	X	X
20GBq	2	2	3	3	X	X
2GBq	2	2	2	3	3	X
200MBq	2	2	2	2	3	3
20MBq	2	2	2	2	2	3
2MBq	1	2	2	2	2	2
200kBq	1	1	2	2	2	2
20kBq	1	1	1	2	2	2
2kBq	1	1	1	1	2	2

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	Operation Type					
	Simple storage	**Very simple wet operations** e.g. using aliquots of stock solution)	**Normal chemical operations** e.g. analysis of simple chemical prep-arations	**Complex wet operations** e.g. multiple operations, or operations with complex glass apparatus	**Simple dry operations** e.g. manipulation of powders **or work with volatile radioactive compounds**	**Complex dry operations or work with radioactive gases**
2TBq	X	X	X	X	X	X
200GBq	3	X	X	X	X	X
20GBq	3	3	X	X	X	X
2GBq	2	3	3	X	X	X
200MBq	2	2	3	3	X	X
20MBq	2	2	2	3	3	X
2MBq	1	2	2	2	3	3
200kBq	1	1	2	2	2	3
20kBq	1	1	1	2	2	2
2kBq	1	1	1	1	2	2
200Bq	1	1	1	1	2	2

Unsealed Material Internal Hazard- Control Reference Table

All Bands		
· Isotope used must be listed on Monash's unsealed sources licence. · Radiation workers must have undertaken the OHS multimedia radiation training, and passed the associated exams, in addition to training in local departmental and laboratory procedures		
Band 1	**Band 2**	**Band 3**
Engineering controls		
Primary and secondary containment is used (eg work in spill trays)	Primary and secondary containment is used (e.g. work in spill trays) A fume hood must be used for any work with volatiles or powders	Primary and secondary containment is used (e.g. work in spill trays) A fume hood must be used for any work with volatiles or powders
Administrative and procedural controls		
· Work must be undertaken in an area chosen in consultation with the RSO, and delineated in some manner from general laboratory space. · Non-radiation workers in the same laboratory must receive a briefing on radiation hazards. · Access to this area is restricted to laboratory workers. If other persons need to enter, they must be accompanied at all times. · No food and drink is consumed or stored in the laboratory · Good housekeeping at all times	· Work must be undertaken in a dedicated radiation laboratory · Access to this area is restricted to radiation workers. If other persons need to enter, they must be accompanied at all times. · No food and drink is consumed or stored in the laboratory · Good housekeeping at all times · Storage of isotopes conforms with the requirements outlined in *Using Ionising Radiation* · Personal dosimeter must be worn by all laboratory users if any isotopes other than	· Work must be undertaken in a dedicated radiation laboratory which complies with the Australian Standards for a medium-level radioisotope laboratory. · Access to the area is limited to a list of radiation workers authorised by the RSO. List is to be clearly displayed at the entrance. If other persons need to enter, they must be accompanied at all times, and must wear a personal dosimeter. · No food and drink is consumed or stored in the laboratory · Good housekeeping at all times · Storage of isotopes conforms with the requirements outlined in *Using Ionising*

· Storage of isotopes conforms with the requirements outlined in *Using Ionising Radiation* · Personal dosimeter must be worn by radiation workers if any isotope other than 3H, 14C, 33P, 35S is used. · Waste must be stored in clearly labelled containers, shielded if necessary, and disposed of in accordance with university guidelines. · Contamination monitoring using an appropriate hand-held radiation monitor (or by wipe testing for H-3, C-14 or S-35) is carried out and area decontaminated if necessary, regularly to a schedule set in consultation with the RSO, and before area is used for non-isotope work. Monitoring results must be logged and kept in the laboratory.	3H, 14C, 33P, 35S are used anywhere in the laboratory. · Waste must be stored in clearly labelled containers, shielded if necessary, and disposed of in accordance with university guidelines. · Contamination monitoring of the work area using a hand-held radiation monitor is carried out and the area decontaminated if necessary, before and after any procedure. If contamination monitoring has to be done using wipe testing (as for H-3, C-14 or S-35), monitoring must be done regularly to a schedule set in consultation with the RSO. Monitoring results must be logged and kept in the laboratory. · Workers using volatile iodine must regularly undergo thyroid testing as per *Using Ionising Radiation at Monash University*	*Radiation* · Personal dosimeter must be worn to enter the room. · Waste must be stored in clearly labelled containers, shielded if necessary, and disposed of in accordance with university guidelines. · Contamination monitoring using an appropriate hand-held radiation monitor is carried out and the area decontaminated if necessary, before and after any procedure. If contamination monitoring has to be done using wipe testing (as for H-3, C-14 or S-35), monitoring must be done regularly to a schedule set in consultation with the RSO. Monitoring results must be logged and kept in the laboratory. · Workers using volatile iodine must regularly undergo thyroid testing as per *Using Ionising Radiation at Monash University*.
Personal Protective Equipment (PPE)		
· Lab coat and appropriate gloving (as indicated by chemical risk assessment) · Safety glasses · Fully enclosed footwear · Long hair tied back	· Lab coat and appropriate gloving (as indicated by chemical risk assessment) · Safety glasses · Fully enclosed footwear · Long hair tied back	· Wrap-over type lab coat and double gloving (appropriate glove type as indicated by chemical risk assessment) · Safety glasses · Fully enclosed footwear · Long hair tied back

HAZARD ASSESSMENT B: RADIOACTIVE MATERIAL AS AN EXTERNAL HAZARD

1. Calculate the dose rate arising from the radioactive material by direct measurement, via nomogram (available from OH&S branch), or by using one of the following calculations.

   a) *If you know a dose rate for the isotope or x-ray source at a certain distance, then you can use the rule of thumb that radiation dose falls off with the square of distance.*

   $DR_1 \times Distance^2_1 = DR_2 \times Distance^2$

   <u>OR</u>

   b) *For gamma emitters, it is possible to calculate an approximate dose rate at a certain distance from a point source of known activity. Once you have this information, you can then use it to undertake an approximate calibration of the count rate meter:*

   Dose rate = $\Gamma A / D^2$ *µSv/h*

   where G= gamma dose rate in µSv/h from 1GBq at 1m. See table.
   A = Activity of source in GBq
   D = distance from the source in metres

Isotope	Γ	HVL (mmPb)	Isotope	Γ	HVL (mmPb)
Na-22	362	6.5	Ba-133	123	16
Na-24	523	20	Cs-137	103	6.5
Mn-54	138	11	Eu-152	201	6.6
Co-57	41	<1	Eu-155	18	0.4
Co-60	370	16	Pb-210	0.43	<1
Zn-65	89	14	Ra226 +decay products	223	12
Ge-68	16	4.2			
In-111	140	<1			
I-125	74	<1	Am-241	85	<1

If the source has integral shielding, this can be taken into account using HVL Value Layer.

2) Consider each location where a person may realistically be located.

3) Identify appropriate Control Band

Dose rate <0.5µSv/h above background	Dose rate between 0.5µSv/h and 25µSv/h	Dose rate >25µSv/h
Band 1	Multiply dose rate by number of hours per week when position will be occupied If result < 20µSv/week, **Band 1**	**Band 3**
	Multiply dose rate by number of hours per week when position will be occupied If result > 20µSv/week, **Band 2**	

4) Determine which controls are to be implemented. Ideally, as many of the available controls should be added as is possible without compromising the process or creating further hazards.

5) Document the controls selected. Controls must be included in the SOP for the practice. The effectiveness of the controls must be checked using measurement data and personal monitoring records of users.

Radioactive material as an external hazard- Control band reference table

Band 1	Band 2	Band 3
No control measures are mandated, however any controls which can reasonably be implemented should be considered eg additional shielding, distance	Dose rate per week must be reduced to <20µSv per week by implementing some or all of the following controls. Engineering controls should be considered preferable to administrative. Reduce: Reduce the activity of the source, or the amount of material in-use Shield: Place source in lead container or behind lead screen Personal lead screens for use during work Lead apron Distance: Use tongs or remote handling Time: limit the amount of time spent at the task (Practice routine operations before isotope use to improve dexterity and speed	Make area of high dose rate inaccessible, or shield to <25µSv/hour. THEN Select controls as for Band 2

1. Choose the most appropriate description of Dose Rate from the examples given in the table, at the distance most applicable to your situation. Choose the maximum applicable value for either a contact dose or a dose to the skin at close distance.

   For high-energy beta emitters other than P-32, contact the OH&S branch.

DOSE RATES OF BETA RADIATION ON SKIN AT VARIOUS DISTANCES

	Working near a point source of 1MBq	Working near a flat source of 1MBq (eg. Spill)	Working near a glass vial containing 1MBq in solution	Contact with a glass beaker containing 1MBq	Contact with a plastic syringe containing 1MBq
P-32	118 mSv/hr (distance of 30cm)	140 mSv/hr (distance of 10cm) 48 mSv/hr (distance of 1m)	0.0013 mSv/hr (distance of 1m)	0.71 mSv/hr (distance of 0cm)	239 mSv/hr (distance of 0cm)

2. If the Activity being handled varies from 1MBq (27 mCi), then multiply out to adjust the dose rate. ***Record the adjusted dose rate below***. i.e.

$$Doserate(adjusted) = Doserate(\ from\_table) \times Activity(MBq)$$

= _____ mSv/h

Where: Dose rate is in units of mSv/h
Activity is in MBq

3. If the exposure distance from the source differs from those given, then convert the dose rate. Record the adjusted dose rate below.

Dose rate (adjusted)

$$= \frac{\textit{Dose rate (after Step 2)} \times (\textit{Distance from Table C.1, in metres})^2}{(\textit{Actual distance, in metres})^2}$$

= _____ mSv/h

4. Select the appropriate control band. The hazard being considered is exposure to the extremities, which are less radiosensitive and have higher dose limits than for whole-body exposure, leading to dose rate values that are higher than those in other hazard assessments

Dose rate <25µSv/h	Dose rate between 25µSv/h and 250µSv/h	Dose rate >250µSv/h
Band 1	Multiply dose rate by number of hours per week when position will be occupied If result < 500µSv/week, **Band 1**	**Band 3**
	Multiply dose rate by number of hours per week when position will be occupied If result > 500µSv/week, **Band 2**	

Radioactive material as an external (skin burn) hazard- Control band reference table

AS/NZS 4801, OHSAS 18001
OHS20309
SAI Global

Band 1	Band 2	Band 3
No control measures are mandated, however any controls which can reasonably be implemented should be considered eg additional shielding, distance	Extremity (ring) dosimeter must be worn	Make area of highest dose rate inaccessible, develop alternate methods, or shield to <250µSv/hour. THEN Controls as for Band 2
	Dose rate per week must be reduced to <25µSv in any hour by implementing some or all of the following controls. Engineering controls should be considered preferable to administrative.	
	Reduce: Reduce the size of the source, or the amount of material in-use *Shield:* Perspex shield, or Thick Perspex shield with lead on user side Syringe shields *Distance:* Use tongs or remote handling *Time:* limit the amount of time spent at the task (Practice routine operations before isotope use to improve dexterity and speed)	

5. Determine which controls are to be put in place. Ideally, as many of the available controls should be added as is possible without compromising the process or creating further hazards.

6. All physical and/or administrative controls implemented must be documented and included in a SOP. The effectiveness of the controls must be checked using external dosimeter records of users.

HAZARD ASSESSMENT D: X-RAY APPARATUS, SEALED SOURCES, SEALED SOURCE APPARATUS

Method 1 or Method 2 may be used

Method 1

For some types of radiation sources (currently veterinary X-ray apparatus, industrial radiography X-ray units, X-ray analysis units, and nuclear soil moisture density gauges), compliance with an ARPANSA or NH&MRC Code of Practice is mandated under the conditions of licence of that apparatus.

In this case, documented adherence to the controls required under the relevant Code of Practice would be considered to provide appropriate controls under normal operating conditions.

Method 2
(can also be used to assess the external hazard of gamma emitters in all forms)

1. Draw a diagram of the apparatus or experimental setup and/or take a photograph, showing the location of the radioactive or X-ray source and any permanent shielding

2. Determine all locations where a person may realistically be located during use when routine shielding and other controls are in place.

For large sources, this will include locations in adjoining rooms; however, in this case, an occupancy factor may be applied.

3. Calculate dose rate at positions accessible during operation via one or more of the following:
   - isodose curves
   - manufacturer's information
   - theoretical calculation (for a method for theoretical calculation for gamma emitters, see assessment B)
   - survey using correctly calibrated appropriate radiation monitor

4. Select the appropriate band.

<table>
<tr><th>Dose rate <0.5µSv/h above background</th><th>Dose rate between 0.5µSv/h and 25µSv/h</th><th>Dose rate >25µSv/h</th></tr>
<tr><td rowspan="2">Band 1</td><td>Multiply dose rate by number of hours per week when position will be occupied

If result < 20µSv/week, Band 1</td><td rowspan="2">Band 3</td></tr>
<tr><td>Multiply dose rate by number of hours per week when position will be occupied

If result > 20µSv/week, Band 2</td></tr>
</table>

5. Determine which controls are to be implemented. Ideally, as many of the available controls should be added as is possible without compromising the process or creating further hazards

6. The physical or administrative controls implemented must be documented as part of SOP, and their efficacy backed up with measurement data and personal monitoring of users.

X-Ray apparatus, sealed sources and sealed source apparatus- Control band reference table

Band 1	Band 2	Band 3
No control measures are mandated, however any controls which can reasonably be implemented should be considered eg additional shielding, distance	Dose rate per week must be reduced to <20µSv per week by implementing some or all of the following controls. Engineering controls should be considered preferable to administrative. *Reduce:* Use a source of lower activity *Shield (ideally permanent and/or interlocked shielding is preferred to movable):* Shielded enclosure Source placed in lead container or behind shielding screen Personal lead screens for use during work Lead apron *Distance:* Use tongs or remote handling *Time:* limit the amount of time spent at the task	Make area of high dose rate inaccessible, or shield to <25µSv/hour. THEN Select controls as for Band 2

MONASH University

Risk Management Worksheet

June 2010

OHS System
Occupational Health and Safety
AS/NZS 4801 OHS20309
SAI Global

Description of Task / Project / Activity					
Campus		**Faculty**		**School / Department**	
Building		**Room No**		**Date**	

Persons Completing Worksheet

Name	Signature	Name	Signature

HOW TO USE THIS WORKSHEET

1) Identify the general task/process at the top of the worksheet
2) Briefly list the hazards associated with the task or process (**Description of hazard)**
3) Classify each **hazard type** as manual handling, physical, chemical, biological, or radiation
4) Use the specific reference sheet for the hazard type
5) Use either Method 1:**Risk Assessment** or Method 2:**Control Banding** that applies to each hazard.

Risk Assessment -

i) Estimate the consequence and likelihood based on controls in place
ii) Use the matrix to determine risk
iii) Assess the acceptability of the risk and add additional controls if deemed too high

Control Banding -

i) Identify variables in process
ii) Use Control Level Reference Table to determine control band
iii) Identify appropriate controls from control level reference table

6) List:
   - The hazard controls that are already in place
   - The hazard controls yet to be implemented
7) Nominate the person responsible implementing further controls
8) Provide a date for implementation of controls and, thus, work/study to commence

Review of hazard controls

Whenever new hazards are identified and/or additional hazard controls are required, add the additional information to the existing risk assessment, sign and date.

NOTE

a All controls listed for the hazard control band in the reference sheet **must be in place** before work/study commences.

a If **any** of the controls listed for the hazard control band in the reference sheet are **not** to be used, a full risk assessment using the Monash University Risk control program must be completed, documented; and held in the area(s) where the work/study is undertaken.

Task / Process / Procedure								
Method 1: Risk Assessment		**Conseq'nce & Likelihood**	**Risk Score**					
Method 2: Control Banding **Description of hazard**	**Hazard Type**	**Hazard Variables**	**Control Band**	**Controls Currently in Place**	**Controls to be Implemented**	**By Who**	**By When**	**In Place (Sign)**