HAZARD		INHERENT HAZARD LEVEL			CURRENT CONTROLS	LEGAL AND OTHER REQUIREMENTS	RESIDUAL HAZARD LEVEL			ACCEPTABLE?	ADDITIONAL CONTROLS IF UNACCEPTABLE	
What is the Hazard?	What could happen?	Likelihood	Consequence	Hazard Score	What are the existing ways this hazard is managed?	What law or standards are associated?	Likelihood	Consequence	Hazard Score	Is the hazard score acceptable? (i.e. only low or medium)	If No what else do you need to do?	Who is responsible?
Chemicals such as HF, HCN, CO, F2, Me2Hg, benzene, and research chemicals with unknown but potentially harmful properties.	**Exposure (workers)** leading to **serious injury/illness** or **death** through toxic effects, **chemical pneumonitis**, **burns**, **carcinogenic effects** , **nano toxicity**; uncertainty factor due to regular handling of unexplored research chemicals; **significant negative reputation** (media)	LIKELY	CATASTROPHIC	EXTREME (24)	**Elimination** - **Substitution** - Wherever possible, alternatives to hazardous chemicals for research purposes are being used over hazardous chemicals. **Isolation** - Wet laboratories physically segregated from office areas. Where highly hazardous chemicals are deemed necessary, isolated high-hazard laboratories (e.g. flames lab, stinks lab, pressure labs etc.) available within the buildings. These laboratories are restricted access areas. Only authorised staff/students familiar with and trained in experiments performed are allowed to access and work in these laboroatories. **Engineering** - All work involving chemicals is to be performed in fume cupboards fit for work with hazardous chemicals by Australian Standards. The number of fume cupboards in a wet chemistry laboratory depends on frequency of work, available space, and existing infrastructure. The air flow is provided either by strobic fans that linked to the fume cupboards via a manifold system that runs through the buildings, or stand-alone extraction fans for each fume cupboard. Each laboratory is completely (physically) segragated from adjacent laboratories and office areas. Permanently installed safety showers and eye wash stations in wet chemistry areas. Designated storage cabinets for chemicals. Gas cabinets with extraction spigots inside for cylinders being used (alternatively, usage of up to D-size cylinders inside fume cupboards). Some buildings have sinks connected to a neutralisation pit that lab sinks are connected to. Ventillated space for temporary chemical waste storage. **Administration** - ANU- and School-wide procedures, policies and guidelines such as chemical management, copmressed gases, hazardous waste management, HF handling that address a number of major chemical hazards and how to safely deal with them, and they also prescribe individual risk assessments being required by each worker prior to performing any experiment/reaction. Local induction and training and/or relevant existing background for handling high hazard chemicals. ANU courses (e.g. chemical safety, corrosives, gases/cryogenics). For experiments involving chemicals of high hazard (e.g. strong corrosives, toxics, pyrophorics), academic supervisors have to sign off on the experiment prior to commencement. Spill control (ECO, Spill kits). Strict no-food policy in experimental areas to minimise risk of ingestion. Induction for	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) --- ///--- Chapter 7 - Hazardous Chemicals --- ///--- Scheduled Carcinogenic Substances (schedule 10).---///--- Schedules 11, 12, 13, 14 --- ///--- Medicines, Poisons and Therapeutic Goods Act 2008 --- ///--National Industrial Chemicals Notification & Assessment Scheme (NICNAS) --- ///--- Industrial Chemicals (Notification & Assessment) Act 1989 --- ///--- Dangerous substances Act 2004 (ACT) --- ///--- Chemical Weapon conventions. **Standards and CoPs:** • Australian Dangerous Goods Transport Code Edition 7 --- ///--- Occupational Health and Safety Code of Practice 2008 ---///--- AS 1216 Class Labels for Dangerous Goods --- ///--- AS 1940 The Storage and Handling of Flammable and Combustible Liquids --- ///--- AS 2567 Laminar Flow Cytotoxic Drug Safety Cabinets --- ///--- AS/NZS 2243.2: Safety in laboratories – Chemical aspects --- ///--- AS/NZS 2243.10 Safety in Laboratories – Storage of Chemicals --- ///--- AS/NZS 1596 The Storage and Handling of LP Gas --- ///--- AS 1345 Identification of the Contents of Pipes, Conduits and Ducts --- ///--- AS 2030 (series) The Verification, Filling, Inspection, Testing and Maintenance of Cylinders for Storage and Transport of Compresses gases --- ///--- AS 1894 The Storage and Handling of Non-Flammable Cryogenic and Refrigerated Liquids --- ///--- AS/NZS 4757 Handling and Destruction of Drugs --- ///--- AS/NZS 2229 Fuel Dispensing Equipment for Explosive Atmospheres --- ///--- AS 1692 Steel Tanks for Flammable and Combustible Liquids --- ///--- AS/NZS 60079.10.1 Explosive Atmospheres – Classification of Areas – Explosive Gas Atmospheres (IEC 60079-10-1 Ed 1.0 (2008) MOD) --- ///--- HB9 Occupational Personal Protection --- ///--- Globally Harmonized System of Classification and Labelling of Chemicals (GHS). 3rd Edition, 2009, UNECE --- ///--- AS1319 Safety Signs for the Occupational Environment ---///--- AS 2982 Laboratory Design and Construction ---///--- AS 4775 Emergency Eyewash and Shower Equipment ---///--- Chemicals of Security concern --- Until 31 December 2016: • National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011 (2003)] --- ///--- National Model Regulation for the Control of Workplace Hazardous Substances [NOHSC:1005(1994)] --- ///--- National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC:2007(1994)] --- ///--- Guidance Note for the Assessment of Health Risks Arising from the Use of Hazardous Substances in the Workplace [NOHSC:1317(1994)] --- ///--- Approved Criteria for Classifying Hazardous Substances [NOHSC:1008 (2004)] --- ///--- National Model Regulation for the Control of Scheduled carcinogenic Substances [NOHSC: 1011(1995)] --- ///--- Code of Practice for the control of Scheduled carcinogenic substances [NOHSC:2014 (1995)] --- ///--- National Code of Practice for the labelling of workplace Substances [NOHSC:2012 (1994)] --- ///--- Approved code of Practice for storage and handling of dangerous goods (Commonwealth) --- ///--- Standard for the uniform Scheduling of Drugs and Poisons (Commonwealth) --- ///--- National Standard Storage and handling of Workplace Dangerous goods [NOHSC:1015 (2001)] --- ///--- National Standard Storage and handling of Workplace Dangerous goods [NOHSC:1017 (2001)] From 1 January, 2017: • Labelling of Workplace Hazardous Chemicals – Model Code of Practice, Safe Work Australia, September 2015 --- ///--- Preparation of Safety Data Sheets for Hazardous Chemicals, Model Code of Practice , Safe Work Australia, February 2016, **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision as of Oct 2016 as part of the preparation for transition to self-insurance. • Chemical Risk Management --- ///--- Regulated Plant Risk Management --- ///--- Personal Protective Equipment --- ///--- Risk Management --- ///--- Workplace Inspection --- ///--- Waste Management --- ///--- Health Surveillance Procedure	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Chemicals such as mercury, cyanides, carcinogens, heavy metals.	**Environmental pollution** (business as usual) leading to substantial damage to waterways and water purification plant and/or **illness to the community** if exposed to contaminated water or air; **intense negative reputation (media)**	LIKELY	CATASTROPHIC	EXTREME (24)	**Elimination** - **Substitution** - Wherever possible, alternatives to environmentally hazardous chemicals are to be used (e.g. one-way valves with pressure setpoint instead of mercury bubblers, alcohol thermometers instead of mercury thermometers). **Isolation** - Chemicals should be handled in laboratories that have no connection to stormwater or direct connection to sewers. In some buildings, drains from sinks within laboratories are connected to a neutralisation pit. **Engineering** - Work with toxic volatiles to be done in purposely built scrubbed fume cupboards where applicable. In some buildings, sinks are connected to a neutralisation pit for pH adjustment prior to release into waste water. **Administration** - Australian Standards (e.g. lab safety series 2243), Codes of Practice (e.g. managing risks of hazardous chemicals in the workplace, labeling chemicals, SDSs, first aid), ANU- and School-wide safety policies and regulations, all of which address a number of major chemical hazards and related infrastructure and how to safely handle those. Local induction and training and/or relevant existing background for handling high hazard chemicals. Risk assessments prior to performing any experiment/reaction and supervisor sign-off for experiments involving chemicals of high hazard (e.g. strong corrosives, toxics, pyrophorics), prior to commencement. Transport of chemicals to be done in secondary containment. Liquids to be stored in secondary containment (spill trays). Regimented chemical waste disposal program (funded by individiual budget areas to 100%) through external contractors on an appropriate pick-up cycle to minimise stock of waste chemicals. Spill kits located in main areas where chemicals are being handled, including near stores and loading dock. "No chemicals down the sink" policy (induction, notices, TOs). **PPE** - N/A	As under "Chemicals" above	UNLIKELY	CATASTROPHIC	HIGH (19)	NO	Toxic components not being tested for. Neutralisation pit adjusts pH only, i.e. not a means of destroying/capturing toxic components.	
Chemicals such as mercury, cyanides, carcinogenics, heavy metals, products forming under heat (fire) such as phosgene, CO	**Enviornmental pollution** (in an emergency scenario) leading to substantial damage to waterways and water purification plant and/or **illness to the community** if exposed to contaminated water or air; **significant negative reputation (media)**	POSSIBLE	CATASTROPHIC	EXTREME (23)	**Elimination** - **Substitution** - **Isolation** - **Engineering** - Fire detection and sprinkler system to detect early signs of fire and prevent the spread of fire. Compartmentalised experimental areas (segregated laboratories). In some buildings, there are no floor drains in laboratories to avoid spilled material reaching waterways. In some buildings, floor drains are connected to a neurtalisation pit. **Administration** - Australian Standards (e.g. laboratory design, emergency control), Codes of Practice (e.g. managing risks of hazardous chemicals in the workplace, labeling chemicals, SDSs), ANU- and School-wide safety policies and regulations, all of which address a number of major chemical hazards and related infrastructure and how to safely handle those.Moving away from large stocks of chemicals such as DGC3 and instead purchasing smaller quantities of chemicals at a higher frequency as the chemicals are needed to reduce holdings. Minimise holdings of chemicals such as flammable gases and liquids to a minimum (part of safety inspections). Segragation of incompatible materials. Strict guidelines about naked flames (prohibited under normal circumstances, high-risk category if used in association with DGC3s). Strict guidelines about distillation setups. Secondary containment for liquids to avoid spread of chemicals in the event breakage of primary containment. CMS for location of hazardous chemicals. School-wide annual clean-up involving all reasearch groups, part of which serves to identify chemicals that have exceeded their safe life cycle. ECO including technical staff familiar with laboroatory environment. ANU crisis managment structure (campus evacuation, mass communication of emergencies on campus). **PPE** - N/A	As under "Chemicals" above	RARE	CATASTROPHIC	MEDIUM (12)	YES	This is hard to probe. The 2005 fire at RSC is an example of an emergency situation that would have relesaed all sorts of toxic combustion products into the air and that were not contained. Whether this had an effect on people present or people in the wider community is not clear.	

Chemicals and equipment of security and legal concern	**Misuse** (criminal intentions, unintentional release to community) leading to **illness** and/or **negative reputation** (media)	ALMOST CERTAIN	MAJOR	EXTREME (22)	**Elimination -** **Substitution -** **Isolation -** **Engineering -** Controlled building acces. **Administration -** Code of practice (chemicals of secuirity concern), ANU policies, procedures and guidelines (chemicals of security concern). Stocktake/inventory (CMS). Controlled purchasing (fixed delivery points). Controlled (locked) storage locations (e.g. safe or cabinet) for certain types of chemicals (cyanides, arsenic, scheduled carcinogens, HF). Highlighting risk during induction and communicate importance of preventing unauthorised access (e.g. piggy bagging, bringing external people on site "friends"). Staff challenging unknown people found inside building. Complete curfew at times when no staff is on site for controlling access/challenging unauthorised access (vigilance). **PPE -** .	As under "Chemicals" above	POSSIBLE	MAJOR	HIGH (18)	NO	Raise access restrictions, more regimented user control, wider range of chemicals under tighter access restrictions.	
Chemicals such as highly pyrophoric liquids, flammable gases and liquids, alkali metals	**Fire, explosion, violent reaction**, due to wrong handling, storage with incompatible materials, mixing of incompatible chemicals, or decomposition **leading to substantial injury, illness or death** of building occupants, illness of the community around the building, and/or substantial damage to the building infrastructure, which could potentially put in excess of 200 workers out of work for significant periods of time, i.e. **significant loss of productivity** and research output, leading to reduced income. **And/ or negative reputation (media)**.	LIKELY	CATASTROPHIC	EXTREME (24)	**Elimination -** **Substitution -** Wherever possible, alternatives to hazardous chemicals for research purposes are being used over hazardous chemicals. **Isolation -** Where highly hazardous chemicals are deemed necessary, isolated high-hazard laboratories (e.g. flames lab, stinks lab, pressure lab) available within the building are to be used. These laboratories are to be used by one person at a time only. Chemical waste is stored in a designated storage location outside the building. All liquids are doubly contained (trays, stillages with liners) **Engineering -** Fire detection (including heat sensors within fume cupboards) and sprinkler system to detect early signs of fire and prevent the spread of fire. Compartmentalised experimental areas (segregated laboratories). Fridges equipped with external thermostats. Flammable cabinets for the majority of DGC3. Bulk solvents stored external to the main building. Fridges and freezers equiped with external thermostats. Designated ventillated (and/or external) storage location for chemical waste. **Administration -** Moving away from large stocks of chemicals such as DGC3 and instead purchasing smaller quantities of chemicals at higher frequency as they are needed to reduce holdings. Minimise holdings of chemicals such as flammable gases and liquids to a minimum (part of safety inspections). Segragation of incompatible materials. Strict guidelines about naked flames (prohibited under normal circumstances, high-risk category if used in association with DGC3s). Strict guidelines about distillation setups. Secondary containment for liquids to avoid spread of chemicals in the event breakage of primary containment. Controll risk through keeping scale small. Emergency Control Organisation (ECO) including senior chemists and SCBA trained staff. Regular (e.g. fortnightly) disposal of chemical waste to minimise holdings of chemical waste. Unless fairly neat solvent waste mixtures (e.g. from HPLC) are generated and generated at a rate that renders larger containers most practicable, maximum unit volume for flammable liquid waste containers is 5L to avoid mixing of liquid waste from various workers/labs and to avoid decanting into larger containers, minimising exposure, spills, and manual handling, and keep floor loading of flammable materials low. Storage of chemicals by DGC (segregated by storage trays) to avoid accidental mixing of	As under "Chemicals" above	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Non-ionising radiation (UV, RF)	**Eye injury or illness (cancer), fire.** And/ or **negative reputation** (media)	POSSIBLE	MAJOR	HIGH (18)	**Elimination -** **Substitution -** Dipping solutions rather than UV lamps can be used in some cases to develop TLCs. **Isolation -** UV lamps are operated in enclosures preventing UV radiation to leak out. **Engineering -** Laminar flow cabinets have interlocks that prevent operation of the UV light unless UV-blocking shields are in place. High-power (10-1000W) UV lamps for UV-activated reactions are operated in specially designed housings with various interlocks that respond to unauthorised opening of the housing, lack of cooling supply, lack of ventillation (air flow) or heat development within the housing. Eximer laser beam (UV) running inside perspex housing that couts out all UV. **Administration -** Internal training based on the SOP is mandatory for all users of UV reaction chambers. Exposure limits from UV sources are determined together with ANU WEG. All UV sources are registered on the ARPANSA register for radiation sources (SIWB). Most UV sources for TLC viewing. Leakage testing on newly installed equipment (e.g. flow chemistry reactor, reactor for UV-activated reactions). **PPE -** Nitrile gloves cut out the UV light emitted from lamps used for TLC viewing.	**Legislation:** • Work Health and Safety Act 2011 (Cth) ---///--- Work Health and Safety Regulations 2011 (Cth) ---///--- Australian Radation and Nuclear Safety (ARPANS) Act ---///--- ARPANS Regulations ---///--- Nuclear Non-proliferation (Safeguards) Act 1987 **Standards and CoPs:** • HB 9 Occupational Personal Protection ---///--- Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation [Commonwealth] ---///--- Radiation Protection series (ARPANSA) ---///--- Radiation Health Series (ARPANSA) ---///--- Occupational Health and Safety Code of Practice 2008 ---///--- • AS 2243.5 Safety in Laboratories – Non-Ionising Radiations – Electromagnetic, Sound and Ultrasound ---///--- AS 2397 Safe Use of Lasers in the Building and Construction Industry ---///--- AS/NZS 2211 (series) Safety of Laser products ---///--- AS/NZS 1338.2 Filters for Eye Protectors - Filters for Protection Against Ultraviolet Radiation --- ///--- AS/NZS 1337.4 Personal Eye-Protection - Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors) ---///--- AS/NZS 1338.3 Filters for Eye Protectors - Filters for Protection Against Infra-Red Radiation ---///--- HB 9 Occupational Personal Protection ---///--- Radiation Protection Standard for Maximum Exposure levels to Radiofrequency Fields – 3kHz to 300GHz [Commonwealth] ---///--- Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation [Commonwealth] ---///--- Radiation Protection Series (ARPANSA) ---///--- Radiation Health Series (ARPANSA) ---///--- Occupational Health and Safety Code of Practice 2008 ---///--- Refer to "Plant" classification for plant standards/codes/Guidance **ANU Policies and Procedures:** A large number of ANU Policies and Procedures are under revision through 2017/2018. • Risk Management --- ///--- Workplace Inspection --- ///--- Health Surveillance Procedure ---///--- • Ionising Radiation Risk Management --- ///--- Radiation Safety Procedure --- ///--- Waste Management --- ///--- Hazardous Waste disposal procedure --- ///--- Radiation Safety Policy --- ///--- Procedure for Control of access to Hazardous and restricted location --- ///--- Refer to "Plant" classification for University policies and procedures	RARE	MAJOR	MEDIUM (11)	YES		
High-power Lasers (class 3 and 4)	**Serious eye injury, skin injury** (burns), **fire leading to serious injury or death; chemical exposure** (fluorine) **leading to serious injury or death**, and/ or **negative reputation** (media).	LIKELY	CATASTROPHIC	EXTREME (24)	**Elimination -** **Substitution -** **Isolation -** Lasers are operated in access-controlled laser rooms/labs (key or combination lock) with access granted to trained users and emergency/worksop staff only. **Engineering** - Where possible, experiments are designed so that beams are fully enclosed. Emergency stop buttons are typically installed within arm reach. Fluorine/krypton gas cylinders needed for eximer laser housed within its own ventilated cabinet, with shut-off solenoid valves that are activated with low air flow. Older style biological safety cabinets can now be replaced with double-interlocked ones (ARPANSA registration no longer required). **Administration -** Internal laser training/skill assessment through Laser Safety Officer mandatory for all users of class III and IV lasers. ANU laser course and laser eye exam mandatory for all ANU staff and students. ARPANSA regulations. ANU radiation policy and procedure, including approval for new work. Appointed laser safety officers in loca areas. Safety consultants with relevant responsibilities at ANU level. Experiments to be designed in a way that avoids laser beams to leave the table, and run enclosed beams where possible. Flammable materials (e.g. cardboard) not to be used around the laser tables (e.g. proper metallic beam dumps and shutters used to intercept beams, metallic shields around the table). Laser tables with open beams are equipped with non-reflective (mate) components such as side shields and stands for optics, and lasers are aligned so as to keep the laser beam in the plane of the table. Laser facility part of saety inspection regime. **PPE -** Laser goggles suitable for the laser power and wavelength used in a laser lab have to be present near the entrance of the lab and must be worn where open laser beams are worked with (insofar as practicable, requirements assessed by Laser Safety Officer; PPE inventory part of radiation safety inspections).	**Legislation:** • Work Health and Safety Act 2011 (Cth) ---///--- Work Health and Safety Regulations 2011 (Cth) ---///--- Australian Radation and Nuclear Safety (ARPANS) Act ---///--- ARPANS Regulations ---///--- Nuclear Non-proliferation (Safeguards) Act 1987 **Standards and CoPs:** • HB 9 Occupational Personal Protection ---///--- Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation [Commonwealth] ---///--- Radiation Protection series (ARPANSA) ---///--- Radiation Health Series (ARPANSA) ---///--- Occupational Health and Safety Code of Practice 2008 ---///--- • AS 2243.5 Safety in Laboratories – Non-Ionising Radiations – Electromagnetic, Sound and Ultrasound ---///--- AS 2397 Safe Use of Lasers in the Building and Construction Industry ---///--- AS/NZS 2211 (series) Safety of Laser products ---///--- AS/NZS 1338.2 Filters for Eye Protectors - Filters for Protection Against Ultraviolet Radiation --- ///--- AS/NZS 1337.4 Personal Eye-Protection - Filters and Eye-Protectors Against Laser Radiation (Laser Eye-Protectors) ---///--- AS/NZS 1338.3 Filters for Eye Protectors - Filters for Protection Against Infra-Red Radiation ---///--- HB 9 Occupational Personal Protection ---///--- Radiation Protection Standard for Maximum Exposure levels to Radiofrequency Fields – 3kHz to 300GHz [Commonwealth] ---///--- Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation [Commonwealth] ---///--- Radiation Protection Series (ARPANSA) ---///--- Radiation Health Series (ARPANSA) ---///--- Occupational Health and Safety Code of Practice 2008 ---///--- Refer to "Plant" classification for plant standards/codes/Guidance **ANU Policies and Procedures:** A large number of ANU Policies and Procedures are under revision through 2017/2018. • Risk Management --- ///--- Workplace Inspection --- ///--- Health Surveillance Procedure ---///--- • Ionising Radiation Risk Management --- ///--- Radiation Safety Procedure --- ///--- Waste Management --- ///--- Hazardous Waste disposal procedure --- ///--- Radiation Safety Policy --- ///--- Procedure for Control of access to Hazardous and restricted location --- ///--- Refer to "Plant" classification for University policies and procedures	RARE	CATASTROPHIC	MEDIUM (12)	YES		

Ionising radiation from X-ray machines	**Serious injury or illness leading to death** on long or repeated exposure. And/ or **negative reputation** (media).	POSSIBLE	CATASTROPHIC	EXTREME (23)	**Elimination -** **Substitution -** **Isolation -** X-Ray instruments are located in designated laboratories. X-Ray instruments that do not have interlocked enclosures are located in laboratories not accessible to unauthorised staff and students (key access only for trained staff and research group members). **Engineering** - The majority of modern X-Ray instruments are (semi-) enclosed, shielded, and equipped with interlocks that do not allow shutters to open unless the enclosures are fully closed. LEDs indicate when instruments are energised and shutters are open. **Administration** - ANU Radiation Safety Policy and Procedure, including requirement for approval of new work. ARPANSA regulations. User radiation badges that are analysed every 3 months (i.e. individual dose rate monitoring). Individual training is provided for each user for each instrument. Interlock override keys are kept in a key safe, with limited senior staff having access to the safe. Safety consultants with relevant responsibilities at ANU level. Where labs are used for various purposes, lights outside the room indicate when X-ray instruments inside the room are being operated. Regular leak checks on each instrument. Repairs are only permitted by professional workshop/technical staff or maintenance contractors from the supplier company. All radiation equipment and material recorded on ARPANSA register (SIWB). Radiation Safety Officer available locally and at ANU level. Mandatory ionising radiation safety training (ANU) and local induction. **PPE** - Lead aprons.	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) ---///--- Australian Radation and Nuclear Safety (ARPANS) Act ---///--- ARPANS Regulations ---///--- Nuclear Non-proliferation (Safeguards) Act 1987 **Standards and CoPs:** • AS 2243.4 Safety in Laboratories – Ionizing Radiations --- ///--- HB 9 Occupational Personal Protection --- ///--- Recommendations for Limiting Exposure to Ionizing Radiation and National Standard for Limiting Occupational Exposure to Ionizing Radiation [Commonwealth] --- ///--- Code of Practice for the Safe Transport of Radioactive Material [Commonwealth] --- ///--- Safety Guide for the Safe Transport of Radioactive Material [Commonwealth] --- ///--- Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz [Commonwealth] --- ///--- Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources [Commonwealth] --- ///--- National Directory for Radiation Protection [Commonwealth] --- ///--- Recommendations for Intervention in Emergency Situations Involving Radiation Exposure [Commonwea --- ///--- Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes [Commonwealth] --- ///--- Code of Practice for the Security of Radioactive Sources [Commonwealth] --- ///--- Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation [Commonwealth] --- ///--- Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges [Commonwealth] --- ///--- Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation [Commonwealth] --- ///--- Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology [Commonwealth] --- ///--- Safety Guide for Radiation Protection in Nuclear Medicine [Commonwealth] --- ///--- Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) [Commonwealth] --- ///--- Safety Guide for the Predisposal Management of Radioactive Waste [Commonwealth] --- ///--- Radiation Protection series (ARPANSA) --- ///--- Radiation Health Series (ARPANSA) --- ///--- Occupational Health and Safety Code of Practice 2008 --- ///--- Refer to "Plant" classification for plant Standards/Codes/Guidance **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision as of Oct 2016 as part of the preparation for transition to self-insurance. • Risk Management --- ///--- Workplace Inspection --- ///--- Health Surveillance Procedure ---///--- Non-Ionising Radiation Risk Management ---///--- Radiation Safety Policy ---///--- Radiation Safety Procedure ---///--- Refer to "Plant" classification for University plant policies and procedures --- ///--- Waste Management --- ///--- Procedure for Control of access to Hazardous and Restricted Locations --- ///---	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Cryogenic liquids and solids such as liquid nitrogen and helium and solid carbon dioxide	**Skin and eye injury** (cold burns), **explosion** (vessels rupturing, condensing liquid oxygen), **asphyxiation**	POSSIBLE	CATASTROPHIC	EXTREME (23)	**Elimination -** **Substitution -** **Isolation -** Bulk source of liquid nitrogen (storage tanks) stored outside buildings in locked cages with limited access (maintenance contractors, workshop/emergency staff). Bulk dry ice stored in external areas (e.g. at loading dock). **Engineering** - Pressurised 200L dewars for decanting LN2 for every-day use in labs within buildings equipped with pressure relief valves and preferably dispensing nozzles (minimising splashes). Solenoid valves with dead-man switch allow remote operation of the valves and prevent accidental release of LN2. Internal decanting areas often equipped with oxygen sensors to warn users of oxygen deficient atmosphere. Particularly in newer buildings, areas where cryogenics are located or potentially be used and that have limited ventilation (e.g. cold rooms, physchem laboratories, NMR rooms) are equipped with alarmed oxygen sensors. Somer areas (e.g. NMR suite) equipped with ventillation system that kick in once oxygen levels drop below critical level (18.5%). Wet chemical laboratories are equipped with fume cupboards that prevent formation of inert gas pockets (low-oxygen environment) within the laboratories. Negative pressure inside the labs prevents gases to dissipate into adjacent corridors or office areas. **Administration** - ANU training module on compressed gases and cryogenics available. Access to laboratories using liquid nitrogen/dry ice only after general induction and under supervision of experienced research group member for on-site training. Some budget units hold SCBA equipment and trained personnel on-site to assist with low-oxygen scenarios. In-lab training covers risk of condensing oxygen in LN2 cooling traps (risk of fire/explosion); cooling traps normally not allowed for extended periods of absence (e.g. over night). Technical Officers with relevant experience within the budget areas. Scientific dewars only to be used for cryogenic liquids. Cryogenics not to be trapped in vessels without pressure relief valves or permanent openings. Individual risk assessments. Portable oxygen sensors available on site. **PPE** -Where operating mechanical valves close to the decanting nozzle is required, thermal gloves and face shield are mandatory. Lab coat and	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) **Standards and CoPs:** • Australian Dangerous Goods Transport Code Edition 7 --- ///--- Occupational Health and Safety Code of Practice 2008 ---///--- AS 1216 Class Labels for Dangerous Goods --- ///--- AS 1894 The Storage and Handling of non-flammable cryogenic and refrigerated liquids --- ///--- --- ///--- AS/NZS 2243.2: Safety in laboratories – Chemical aspects --- ///--- AS/NZS 2243.10 Safety in Laboratories – Storage of Chemicals --- ///--- AS/NZS 1596 The Storage and Handling of LP Gas --- ///--- AS 1345 Identification of the Contents of Pipes, Conduits and Ducts --- ///--- AS 2030 (series) The Verification, Filling, Inspection, Testing and Maintenance of Cylinders for Storage and Transport of Compresses gases --- ///--- HB 9 Occupational Personal Protection --- /// Globally Harmonized System of Classification and Labelling of Chemicals (GHS). 3rd Edition, 2009, UNECE ---///--- AS1319 Safety Signs for the Occupational Environment ---///--- AS 2982 Laboratory Design and Construction ---///--- AS 4775 Emergency Eyewash and Shower Equipment ---///--- From 1 January, 2017: • Labelling of Workplace Hazardous Chemicals – Model Code of Practice, Safe Work Australia, September 2015 --- ///--- Preparation of Safety Data Sheets for Hazardous Chemicals, Model Code of Practice , Safe Work Australia, February 2016, **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision through 2017/2018. • Chemical Risk Management --- ///--- Regulated Plant Risk Management --- ///--- Personal Protective Equipment --- ///--- Risk Management --- ///--- Workplace Inspection --- ///--- Waste Management --- ///---	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Vacuum or high-pressure vessels (gas cylinders, dewars, sealed reaction vessels)	**Serious injury or death** following **explosion/rupturing/implosion** ; and/ or **negative reputation** (media)	POSSIBLE	CATASTROPHIC	EXTREME (23)	**Elimination -** Use non-pressurised gas if pressurised gas is not needed (e.g. use hydrogen generator rather than pressurised gas cylinder) **Substitution -** Actively aim for using smallest possible yet reasonably practicable cylinder size so that large cylinders are avoided. **Isolation -** Bulk source of liquid nitrogen (2000L storage tank) stored outside the building in locked cage with limited access (maintenance contractors, RSC workshop/emergency staff). Stock of pressurised G-size cylinders stored in designated areas outside the building (external H2 and O2 cages, external ventillated room for nitrogen/argon/helium cylinders). Cylinders within the building are normally stored outside the laboratories in purpose-built, vented gas cabinets; the cabinets allow easy connection of the cylinders to a main valve followed by a single stage regulator, from where gas lines are plumbed into the fume cupboards inside the labs via fixed stainless steel lines (most common gases are argon and nitrogen). Designated pressure laboratories available for setting up reactions under pressure. **Engineering** - Pressurised 200L dewars for decanting LN2 for every-day use in labs within building 137 equipped with pressure relief valves. The regulators inside the gas cabinets are fixed to the wall, i.e. transportation of cylinders with regulators attached not likely to occur. Flammable and oxidising gases only to be used if one-way valves/flashback arrestors are in place (all permanent lines fitted with such valves). **Administration** - Proper procedure for retrieving and connecting gas cylinders (e.g. buddy system, designated trained people). Trolleys must be used for moving cylinders. Cylinders must be restrained at all times. Cylinders in labs kept to an absolute minimum. Location of gas cylinders inside the building recorded on the CMS. Gas cylinders must not be used without regulators. Sealed reaction vessels by default high-risk experiments, requiring supervisor approval and working behind blast shield. Buddy system mandated for setting up pressure reactions in pressure laboratories. Individual risk assessments always needed for chemical experiments, and pressure experiments by default highe risk category, requiring supervisor approval. Check vessel quality (e.g. stars/cracks in glass vessels, test for leakage at low pressure differential) prior to commencing experiment. **PPE** - Additional PPE (face shield, ear muffs, cut-proof gloves, leather	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) **Standards and CoPs:** • Australian Dangerous Goods Transport Code Edition 7 --- ///--- Occupational Health and Safety Code of Practice 2008 ---///--- AS 1216 Class Labels for Dangerous Goods --- ///--- AS 1894 The Storage and Handling of non-flammable cryogenic and refrigerated liquids --- ///--- --- ///--- AS/NZS 2243.2: Safety in laboratories – Chemical aspects --- ///--- AS/NZS 2243.10 Safety in Laboratories – Storage of Chemicals --- ///--- AS/NZS 1596 The Storage and Handling of LP Gas --- ///--- AS 1345 Identification of the Contents of Pipes, Conduits and Ducts --- ///--- AS 2030 (series) The Verification, Filling, Inspection, Testing and Maintenance of Cylinders for Storage and Transport of Compresses gases --- ///--- HB 9 Occupational Personal Protection --- /// Globally Harmonized System of Classification and Labelling of Chemicals (GHS). 3rd Edition, 2009, UNECE ---///--- AS1319 Safety Signs for the Occupational Environment ---///--- AS 2982 Laboratory Design and Construction ---///--- AS 4775 Emergency Eyewash and Shower Equipment ---///--- AS4267 pressure regulators for use with industrial compressed gas cylinders ---///--- AS4603-1999 Flasback arresters - Safety devices for use with fuel gases and oxygen or compressed air ---///--- Pressure gauges for regulators used with compressed gas cylinders ---///--- AS2473 Valves for compressed gas cylinders ---///--- AS/NZS1200:2015 Pressure equipment ---///--- AS/NZS 3788:2006 Pressure equipment - In-service inspection. ---///--- AS4343:2014 Pressure equipmetn - hazard levels. ---///--- Comcare guide for applicants WHS014 - Plant registration. From 1 January, 2017: • Labelling of Workplace Hazardous Chemicals – Model Code of Practice, Safe Work Australia, September 2015 --- ///--- Preparation of Safety Data Sheets for Hazardous Chemicals, Model Code of Practice , Safe Work Australia, February 2016, **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision through 2017/2018. • Chemical Risk Management --- ///--- Regulated Plant Risk Management --- ///--- Personal Protective Equipment --- ///--- Risk Management --- ///--- Workplace Inspection --- ///--- Waste Management --- ///--- Compresse gas cylinder safety procedure ---///--- Pressure equipment safety procedure ---///---	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Mechanical impact (heavy weights, repetitive tasks, awkward posture, high force, vibration, twisting/bending)	**Short-term, long-term or permanent injury or disability** (limbs, joints, back)	LIKELY	MAJOR	EXTREME (20)	**Elimination -** **Substitution -** Substitute one large unit for several smaller units (e.g. 5L waste containers instead of 20L drums). Use lighter materials over heavier ones (e.g. carbon fibre cylinders over steel cylinders). Make use of state-of-the-art equipment (smaller and/or fewer components, lighter materials). **Isolation -** **Engineering** - Mechanical transport and lifting aids (forklift, trolleys, vehicles, stackers, walkers, platform ladders, hoists, gantries, cranes, lifting tackles) to move heavy load. Ergonomic light-weight pipettes for frequent pipetting. Low-lying trolleys (avoid lifting weight too high). **Administration** - Local induction/informatio/training (e.g. proper lifting techniques). Advice through OSLO. Optimise process to minimise double-handling (e.g. stillage for waste containers directly loaded onto truck). Buddy pair/team system (e.g. gas cylinder transportation). Use of trolleys. ANU Early intervention program. Work aids (stands, clamps, low-lying trolleys, well designed gas cylinder trolleys). ANU early intervention program (recognise and eliviate problems early). **PPE** - Back/knee/elbow support braces for heavy lifting. Knee padding for kneeling.	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth): Part 5 - Manual Handling. **Standards and CoPs:** • National Standard for Manual Tasks --- ///--- Occupational Health and Safety Code of Practice 2008 ---///--- National CoP of musculoskeletal disorders from performing manual handling tasks at work ---///--- National CoP for Manual Handling (NOHSC:2005 (2009) ---///--- National Standard for Manual Tasks (2007) ---///---Model CoP: Hazardous Manual Tasks ---///--- Model CoP: How to manage work health and safety risks ---///--- **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision through 2017/2018. • Risk Management --- ///--- Workplace Inspection --- ///--- Health Surveillance Procedure ---///--- Safety for Reduction of Manual Handling Injuries ---///--- Work Health and Safety Hazard Management Procedure	POSSIBLE	MAJOR	HIGH (18)	NO	Stronger promotion of proper techniques, and ensure required infrastructure is available and being used adequately.	

Heavy machinery and plant such as compressors, centrifuges, steam generators, saws, guillautines.	**Injury** (e.g. **eye damage, amputation, crushes, burns**)	LIKELY	MAJOR	EXTREME (20)	**Elimination** - **Substitution** - **Isolation -** Building plant is located in designated plant rooms (roof, basement, loading dock, pump rooms), heavy machinery is located in designated workshops. Where possible, heavy equipment (e.g. pressure reactor, ultracentrifuges, bio reactor, steam generator) is located in designated areas away from general work places (such as communcal laboratories). **Engineering** - Guarding/enclosure around moving parts (e.g. around compressors, hot parts). Interlocks (e.g. ultracentrifuges, autoclaves). **Administration** - Warning signage of mechanical and thermal hazards. Regular inspection and servicing/maintenance of plant equipment (e.g pressure vessels, compressors) through external contractors. Workshop SOPs. ANU Workshop Safety Training course. Removal of decommissioned plant by budget areas. **PPE** - Gloves, substantial footwear, safety specs for any job around heavy machinery/plant where required.	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth); Part 5 - Plant and Structures ---///--- **Standards and CoPs:** • AS 3892 Pressure Equipment – Installation ---///--- AS 4024 (series) Safety of Machinery ---///--- AS 1200 Pressure equipment ---///--- AS 2243.6 Safety in Laboratories – Plant and Equipment aspects ---///--- AS 1893 Code of Practice for the Guarding and Safe Use of Metal and Paper Cutting Guillotines ---///--- AS 1418 (series) Cranes, Hoists and Winches ---///--- AS 1353 (series) Flat Synthetic-Webbing Slings ---///--- AS 1380 (series) Fibre Rope Slings ---///--- AS1418.1 Cranes, hoists and winches- General Requirements ---///--- AS 1438 (series) Wire-Coil Flat Slings ---///--- AS 4497 (series) Round slings—Synthetic Fibre ---///--- AS 1473 (series) Guarding and Safe Use of Woodworking Machinery ---///--- AS/NZS 1576 (series) Scaffolding ---///--- AS 4024.3001 Safety of Machinery - Materials Forming and Shearing - Mechanical Power Presses ---///--- AS 4024.3002 Safety of Machinery - Materials Forming and Shearing - Hydraulic Power Presses ---///--- National Standard for Plant [NOHSC:1010(1994)] ---///--- Occupational Health and Safety Code of Practice 2008 ---///--- Refer to "Electrical" classification for electrical Standards/Codes/Guidances ---///--- Refer to "Ionising Radiation" classification for ionising radiation Standards/Codes/Guidances ---///--- Refer to "Non-Ionising Radiation" classification for non-ionising radiation ---///--- **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision through 2017/2018 as part of the preparation for transition to self-insurance. • Regulated Plant Risk Management ---///--- Personal Protective Equipment ---///--- Risk Management ---///--- Workplace Inspection ---///--- Health Surveillance Procedure ---///--- Plant Risk Management ---///--- Plant (Equipment) management Policy ---///--- Plant (Equipment) hazard management Procedure ---///--- Plant (Equipment) Risk Assessment Guidelines ---///--- Lock out, Tagging and Isolation ---///--- Unsafe Plant & Equipment ---///--- Plant life cycle risk management ---///--- Refer to "Electrical" classification for University electrical radiation policies and procedures ---///--- Refer to "Ionising Radiation" classification for University ionising radiation policies and procedures ---///--- Refer to "Non-Ionising Radiation" classification for University non-ionising radiation policies and procedures	RARE	MAJOR	MEDIUM (11)	YES		
Electrical	**Injury** through electric shock, **death** by electrocution, or **equipment fire** due to usage of faulty equipment, faulty/non-compliant design	ALMOST CERTAIN	CATASTROPHIC	EXTREME (25)	**Elimination** - **Substitution** - **Isolation -** Restricted access workshop for all electrical work. Restricted access to high voltage environments (plant room, circuit boards, power generators). **Engineering** - Use of RCDs. **Administration** - Regular test and tagging of all electrical equipment (6-monthly to 5-yearly). Desing checklist for all equipment desinged in-house (HR50). Asset register. Electrical work/installations only to be done by certified ANU staff or external contractors. Access to circuit boards (e.g to reset circuit breakers) restricted to authorised staff (such as electricians, workshop manager). Pre-work risk assessment (workshop and laboratories). Besides electrical testing and tagging, early school-wide clean-up to identify faulty/damaged equipment. Incident reporting and job request system to alert immediate environments of potential electrical hazards. ANU Electrical Safety Committee. Visible external barrier while work on life equipment is carried out inside workshop. Work on life equipment limited to an absolute minimum. Trained staff (electricians, electronics engineers) available on site. **PPE** -	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) (Part 4.7)---///--- Electrical Safety Act 1971 ---///--- Construction Occupations Act 2004.. **Standards and CoPs:** • AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules) ---///--- AS/NZS 3008.1 Electrical Installations – Selection of cables – Cables for alternating voltages up to and including 0.6/ 1 kV – Typical Australian installation conditions ---///--- AS/NZS 3012 Electrical Installations - Construction and demolition sites ---///--- AS/NZS 3017 Electrical Installations – Testing and inspection guidelines ---///--- AS/NZS 3100 Approval and test specification - General requirements for electrical equipment ---///--- AS/NZS 3260 Approval and test specification - Safety of information technology equipment including electrical business equipment (incorporating Amendments 1, 2, 3 and 4 ---///--- AS/NZS 3760In-service safety inspection and testing of electrical equipment ---///--- AS/NZS ISO 31000: Risk Management – principles and guidelines ---///--- AS/NZS 4836 Safe working on low-voltage electrical installations ---///--- AS 1188 Radio transmitters and similar equipment - safe practices ---///--- AS 1319 Safety signs for the occupational environment ---///--- AS 2243.1 Safety in laboratories; Part 1: General ---///--- AS 2243.7 Safety in laboratories; Part 7: Electrical aspects ---///--- AS/NZS 3260: Approval and test specification - Safety of information technology equipment including electrical business equipment (Incorporating Amendments 1, 2, 3 and 4) ---///--- AS 61010.1Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements ///--- Occupational Health and Safety Code of Practice 2008 ---///--- Model CoP: Managing electrical risks in the workplace ---///--- **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision as of Oct 2016 as part of the preparation for transition to self-insurance. • Regulated Plant Risk Management ---///--- Personal Protective Equipment ---///--- Risk Management ---///--- Workplace Inspection ---///--- Health Surveillance Procedure ---///--- Plant (Equipment) management Policy ---///--- Plant (Equipment) hazard management Procedure ---///--- Plant (Equipment) Risk Assessment Guidelines ---///--- Lock out, Tagging and Isolation Procedure ---///--- Unsafe Plant & Equipment ---///--- Plant life cycle risk management ---///---	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Loss of corporate knowledge	Drop in safety standards, lack of expertise, leading to **incidents through poor technique**; **equipment damag**e due to wrong handling; loss of time through loss of efficiency	LIKELY	MODERATE	HIGH (16)	**Elimination** - **Substitution** - **Isolation** - **Engineering** - . **Administration** - Risk assessments for all experiments. Written procedures/SOPs (including budget unit specific safety regulations) available for some but not all affected areas (particularly experimental areas). Meeting minutes (e.g. RSC WHS Committee). Use of central business servers or electronic databases rather than individual hard drives and email accounts. Use of centralised systems for data/information storage (Alliance, Figtree, shared drives) to store and maintain records and track version control. **PPE** - .		POSSIBLE	MODERATE	HIGH (15)	NO	ARREST LOSS. Ensure sufficient overlap between outgoing and incoming staff. Ensure capacity/resources for carrying increasing administrative burden (write/review procedures and risk assessments) is warranted in all budget areas.	
Uncontrolled Emergency (fire, chemical spill, power otuage, intruder, bomb threat)	**Injury or death** due to inappropriate or delayed response to emergencies. **Damage to reputation** (media coverage).	POSSIBLE	CATASTROPHIC	EXTREME (23)	**Elimination** - **Substitution** - **Isolation** - **Engineering** - Automatic emergency evacuation in a fire scenario (detection, announcement/evac alarm, fire brigade). Centrally alarmed critical plant equipment and lab infrastructure (e.g. cooling water pumps, heat sensors, oxygen sensors, safety showers). Gasguard system for automatic natural gas shut-off. **Administration** - ECO communication during emergency via 2-way radios (independent of power grid, internet etc.; highly flexible). ECO (incl. SCBA trained staff, First Aiders, Chief Wardens, Floor Wardens, Communicators). Building inductions. Practice evacuations. Radio checks. Emergency debriefs. ANU ECO training. Fire extinguisher training. SCBA training. Yearly first aid training. Highly conservative evacuation policy ("if in doubt, get out"), including power outages. No-ear phone policy in labs, one-earphone policy in office areas (early detection of alarms/calls for help). Buddy system for after-hours work. ANU Security presence in emergencies, and after-hour patrols. After-hour contacts for emergencies. Presence of permanent technical staff (Technical Officers, Workshop staff, Admin staff) with training and experience in emergency response. **PPE** -	**Legislation:** • Work Health and Safety Act 2011 (Cth) ---///--- Building Code of Australia. **Standards and CoPs:** • Occupational Health and Safety Code of Practice 2008 ---///--- AS 3745 Emergency Control Organisation and Procedures for Buildings, Structures and Workplaces ---///--- AS 1603 (series) Automatic Fire Detection And Alarm Systems ---///--- AS 1670 (series) Fire Detection, Warning, Control And Intercom Systems ---///--- AS/NZS 1841 (series) Portable Fire Extinguishers ---///--- Australian Journal of Emergency Management ---///--- First Aid Compliance Code **ANU Policies and Procedures:** Note: All ANU Policies and Procedures are under revision through 2017/2018. • Risk Management --- ///--- Workplace Inspection --- ///--- Emergency Procedure in Buildings ---///--- First Aid, Provision of Services Procedure.	RARE	CATASTROPHIC	MEDIUM (12)	YES		
Noise (heavy machinery, plant equipment, pressure vessels)	**Hearing loss**	LIKELY	MODERATE	HIGH (16)	**Elimination** - **Substitution** - **Isolation -** Plant equipment in designated areas (plant rooms), heavy machinery in workshops. **Engineering** - Mufflers (e.g. LN2 tank). Shock absorbers (e.g. rubber pads for pumps). **Administration** - Equipment maintenance (reduction of noise generated from scraping/loose parts). Warning signage. Risk assessment. Regularly changing tasks/job variety (noise level not permanent). **PPE** - Ear muffs/ear plugs.	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) (Part 4.1)---///--- Safety, Rehabilitation and Compensation Act 1988. **Standards and CoPs:** • AS/NZS 4801:2001 Occupational Health and Safety Management Systems ---///--- AS/NZS 1269.0-4 Occupational noise management - overview and general requirements. **ANU Policies and Procedures:** Note: A large number of ANU Policies and Procedures are under revision through 2017/2018. • Personal Protective Equipment ---///--- Risk Management ---///--- Workplace Inspection ---///--- Health Surveillance Procedure ---///--- Noise management procedure ---///--- Work Health and Safety Monitoring and Testing Procedure	UNLIKELY	MODERATE	MEDIUM (8)	YES		
Unsealed Radiation Sources	**Exposure to radiation through external contact (hard beta and gamma radiation) or ingestion/inhalation, leading to adverse health effects** (potentially death due to, e.g. cancer, particularly with repeated exposure).	LIKELY	CATASTROPHIC	EXTREME (24)	**Elimination** - **Substitution** - A lot of work that used to require radioactive marking in the past has been made redundant due to availability of advanced analytical technology and equipment. **Isolation** - Designated radiation laboratories to minimise traffic in radiation areas. **Engineering** - Restricted access (key, swipe, combination; building/lab/storage doors). **Administration** - ALARP principle (minimise scale, workers, activities). Swipe testing. Radiation monitors (badges, surface detectors, scintillation counters). No food/drink policy in labs (reduces risk of ingestion). Specifically marked workplace. Double containment (work on trays, transport in secondary containers). Controlled purchase and waste dipsosal. Appropriate training. Materials on ARPANSA inventory (checked and maintained by RSOs locally, monitored centrally). Warning signage (doors, containers). Expert advice and monitoring of compliance through Work Environment Group. **PPE** - Gloves, dedicated area lab coats. Shielding/distance (hard beta and gamma emitters), e.g. lead apron, lead glass shielding, lead bricks, lead enclosures.	**Legislation:** • Work Health and Safety Act 2011 (Cth) --- ///--- Work Health and Safety Regulations 2011 (Cth) ---///--- Australian Radation and Nuclear Safety (ARPANS) Act ---///--- ARPANS Regulations ---///--- Nuclear Non-proliferation (Safeguards) Act 1987 **Standards and CoPs:** • AS 2243.4 Safety in Laboratories – Ionizing Radiations --- ///--- HB 9 Occupational Personal Protection --- ///--- Recommendations for Limiting Exposure to Ionizing Radiation and National Standard for Limiting Occupational Exposure to Ionizing Radiation [Commonwealth] --- ///--- Code of Practice for the Safe Transport of Radioactive Material [Commonwealth] --- ///--- Safety Guide for the Safe Transport of Radioactive Material [Commonwealth] ///--- Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources [Commonwealth] --- ///--- National Directory for Radiation Protection [Commonwealth] --- ///--- Recommendations for Intervention in Emergency Situations Involving Radiation Exposure [Commonwealth] --- ///--- Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes [Commonwealth] --- ///--- Code of Practice for the Security of Radioactive Sources [Commonwealth] --- ///--- Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges [Commonwealth] --- ///--- Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation [Commonwealth] --- ///--- Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology [Commonwealth] --- ///--- Safety Guide for Radiation Protection in Nuclear Medicine [Commonwealth] --- ///--- Safety Guide for the Management of Naturally Occurring Radioactive Material (NORM) [Commonwealth] --- ///--- Safety Guide for the Predisposal Management of Radioactive Waste [Commonwealth] --- ///--- Radiation Protection series (ARPANSA) --- ///--- Radiation Health Series (ARPANSA) --- ///--- **ANU Policies and Procedures:** Note: A large number of ANU Policies and Procedures are under revision through 2017/2018. • Risk Management --- ///--- Workplace Inspection --- ///--- Health Surveillance Procedure ---///--- Radiation Safety Policy ---///--- Radiation Safety Procedure ---///--- Refer to "Plant" classification for University plant policies and procedures --- ///--- Waste Management --- ///--- Procedure for Control of access to Hazardous and Restricted Locations --- ///---	RARE	CATASTROPHIC	MEDIUM (12)	YES		
