

Lincoln University – Laboratory hazard/risk register

June 15 2016

Hierarchy of controls

1. Eliminate
2. Isolate
3. Minimise

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Severe <i>Eg. Potential Fatality of Injury or Illness with permanent disability</i>	MEDIUM	MEDIUM	HIGH	EXTREME	EXTREME
	Major <i>Eg. Potential Lost Time Injury (but non-permanent disability)</i>	LOW	MEDIUM	MEDIUM	HIGH	EXTREME
	Moderate <i>Eg. Potential Medical Treatment injury or illness (but no lost time)</i>	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Minor <i>Eg. Potential First Aid injury</i>	LOW	LOW	LOW	MEDIUM	MEDIUM
	Minimal <i>Eg. Hazard or near miss requiring reporting and follow up action</i>	LOW	LOW	LOW	LOW	LOW

Actions required based on Risk Assessment

Extreme	An "extreme" risk requires immediate assessment and senior staff consideration is required; a detailed mitigation plan must be developed, and consideration should be given to ceasing the activity unless the risk can be reduced to a level of high or less; regular monitoring and reported on to the relevant management/steering committee. Target resolution should be within 1 month.
High	A "high" risk may also require immediate assessment and senior staff consideration; a mitigation plan must be developed; regular monitoring and reported on to the relevant management/steering committee. Target resolution (ideally reduction to medium or low level of risk) should be within 3 months.
Medium	A mitigation plan must be developed; existing controls need to be reviewed. Target resolution (ideally reduction to low level of risk) should be within 1 year.
Low	Risk is tolerable; manage by well established, routine processes/procedures and be mindful of changes to nature of risks.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Large teaching classes	<p>Increased chances of incidents due to large classes.</p> <ul style="list-style-type: none"> - Spills, broken glassware 	Medium	No	No	Yes	<p>Class sizes limited to one demonstrator/staff member per 12 students.</p> <p>Minimise the use of hazardous substances. Students are informed of hazards at the start of the lab session.</p> <p>Lab coats, enclosed footwear and safety glasses are compulsory.</p> <p>Gloves and other PPE provided as necessary.</p> <p>Fumehoods used for concentrated hazardous substances or hazardous tasks.</p>		Each laboratory Session
Visitors and contractors	Unaware of lab hazards and pose risk to themselves and other lab users	Medium	No	No	Yes	<p>Only authorised users allowed access,</p> <p>Visitors and contractors must report to lab manager before entering.</p> <p>Lincworks contractors inducted before working on campus.</p>		Each visit.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Communicable disease transmission (colds, flu, meningitis, SARS, etc.)	Bacterial or viral illness.	Low	No	No	Yes	Training and awareness of highly infectious diseases. Sick workers to stay at home. Masks available on request to prevent spread by coughing and sneezing. Publicise flu immunization programme. Hand sanitiser and soap provided. Signage in toilets to encourage hand washing.		As required.
Ventilation/heating system. Can cause extremes of temperature.	Possible infection & illness	Low	No	No	Yes	Continue planned maintenance cycle as implemented by Lincworks. Faults reported on job card system.		6 monthly regular Lincworks maintenance plan.
Lighting levels	Can cause headaches and discomfort	Low	Yes	No	No	Assess lighting levels with lux meter.		Annually
Fumehoods	Escape of hazardous substances into the lab due to cluttered fumehood. Cluttered fumehoods increase chances of spills.	Low	No	No	Yes	Do not use fumehoods as storage areas. All equipment and chemicals to be removed from hoods after use. Ensure adequate cleaning of hoods after use. Only trained users to use fumehoods.		With each use

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Lab Furniture and benches	Contamination and poisoning due to contact with residues in permeable benches or furniture. DPI from non-ergonomic furniture or incorrect bench height.	Low	Yes	No	Yes	All bench tops and lab furniture to be covered with impervious material. Furniture is ergonomic. Adjustable height chairs and stools used for high benches and fumehoods, laminar hoods and Class II cabinets. Keyboards on computers are washable or covered to make them impervious.		Audited annually
Trip Hazards	Physical injury.	Low	Yes	No	Yes	Keep electrical cords and cables and other trip hazards away from walking areas and egress points. All boxes or other articles to be stored in designated areas.		Audited annually
Electrical equipment	Electrocution Fire hazard	Low	Yes	No	Yes	All electrical equipment checked and tagged annually. Keep use of multi-boxes to a minimum.		Tagging annually
Loose electrical wiring	Possible fire and electrocution hazard	Medium	Yes	No	No	Building maintenance to be informed immediately when noticed.		Checked with each use.
Swipe card access to labs	Potentially people can't access lab to aid someone in the lab if needed.	Low	No	No	Yes	Kick door down to access lab in an emergency. Doors are unlocked if evacuation alarm is activated.		As required.
Equipment on shelving	Crushing injury from falling equipment	Low	No	No	Yes	Heavier equipment stored on benches or lower shelves. Plastic or other types of guarding attached to shelving.		Audited annually.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Noise	Hearing loss	Low	No	Yes	Yes	Assessment of noise level may be required. Use appropriate graded hearing protection. Regular hearing test may be required.		
Asbestos - Riddolls	Chronic exposure risks-asbestiosis	Low	No	No	Yes	Ceiling cavity to be closed off where suspected asbestos fibres are getting into labs. Regular on-going asbestos monitoring or as requested.		Monthly monitoring.
Falling tube lights in plant growth room RFH026 during earthquake	Cuts and eye damage	Low	No	No	Yes	Safety glasses and lab coats provided.		Each use.
Door entry into RFH027	Person being knocked down by opening door.	Low	No	No	Yes	Open door gently to ensure no one is standing in front of door. Leave door open when inside.		Each use.
Transient people using B611 as a thoroughfare	Unaware of hazards. Creating a crowding hazard.	Low	No	No	Yes	Educate people to use appropriate doors. Security lock on the inner and outer doors.		As required.
Pipetting	DPI from prolonged and constant use.	Low	No	No	Yes	Use ergonomic pipettes where possible. Use autodispenser where possible. Rotate tasks. Swap hands. Micro-pauses and stretching. No mouth pipetting. Use pipette fillers for bulb pipettes.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Microscopes	DPI from prolonged use. Eye strain. Eye infection.	Low	No	No	Yes	Microscope workstations setup ergonomically. Take regular micropauses and breaks. Trained users only. Light levels turned down and lowest objective eyepiece replaced at end of session to avoid next user being blinded. Wipe eye piece with disinfectant before each use.		Each use.
Weighing of samples	DPI from repetitive movements and ergonomic setup of balance weighing area	Low	No	No	Yes	Ensure furniture is correct for balance area. Use micro-pauses and take regular breaks.		Each use.
Manual handling -lifting -trolleys -working at height -shelving -tweezers and scalpels and other fine motor skills work	Sprains and strains from lifting and ergonomic hazards	Low	No	No	Yes	Training on correct use of equipment. Do not overload trolleys that will make them heavy to push and hard to steer. Keep heavy items on lower shelves. Use step ladders for high reaching. COP for manual handling available.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Acid digestions	Burns and eye damage from hot acid splashes. Inhalation of corrosive fumes.	Medium	No	Yes	Yes	Must be carried out in fumehood. PPE worn at all times. Drench shower, eye wash station and spill kit immediately available. Not to be carried out in isolation or after hours.		Each use.
Use of acid baths	Burns and eye damage from acid splashes. Inhalation of corrosive fumes.	Medium	No	Yes	Yes	Acid baths kept in dedicated extraction cabinet or in fume hood. PPE to be worn.		Each use.
Glassware	Cuts from broken glass or chipped surfaces. Chemical or biological residues on used glassware.	Low	No	No	Yes	Dispose of damaged glassware. Train users in correct washing and cleaning techniques for glassware. Wear correct PPE for task.		Each use.
Needle stick injuries and cuts from scalpels, needles etc.	Cuts and abrasions	Low	No	No	Yes	Sharps disposal containers provided. Needle holder forceps are provided to insert blades. Blade removal containers provided. Medical sharps training provided.		Each use.
Block heater/Water baths	Burns from contact or from steam.	Low	No	No	Yes	Only trained users. Appropriate PPE worn. Ensure items are switched off when not in use.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Water bath –B331	Burns	Low	No	No	Yes	Appropriate PPE-heat resistant gloves and lab coat with sleeves down. Notice left on lid when temp is raised > 50°C. Temp must be returned to 50°C again afterwards.		Each use.
PCR block & Gel Tanks	Burns	Low	No	No	Yes	Only trained users. Appropriate PPE worn. Ensure items are switched off when not in use. "Caution: hot" sign provided for display during use and cooling.		Each use.
Electrophoresis	Electrocution	Low	No	Yes	Yes	Switch off electrophoresis power pack before opening tank lid. Avoid both hands on power pack at the same time. Don't overfill tank. Only trained users.		Each use.
Bunsen Burners	Burns. Explosion hazard.	Low	No	No	Yes	Only trained users. Gas mains switched off when burners not in use. Heat protection gloves provided. Gas cut off switch by lab door.		Each use or lab session.
Gas Hob	Burns. Explosion hazard. Asphyxiation hazard.	Medium	No	No	Yes	Only trained users. Gas mains switched off when hob not in use. Heat protection gloves provided. Gas cut off switch by lab door. "Caution: hot" sign provided for display during use and cooling.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
UV radiation from lightbox	Eye damage and burns	Low	No	No	Yes	Wear PPE and never put hands into lightbox while the lamp is on. Always look through the viewing window.		Each use.
UV radiation from lightbox-BPRC	Cataracts and eye damage. Skin damage and burns.	Low	No	Yes	Yes	Use full face shield, gloves and lab coat. A plastic shield is available.		
Centrifuge	Chemical or biological spill – contamination. Physical injury from centrifuge failure.	Low				Correctly balance rotors and buckets. Use aerosol lids on buckets. Regular cleaning and maintenance. Only trained users. Spill kits available. Biosafety training module for how to deal with chemical/biological spills. Centrifuge volatiles in the fumehood when possible.		Each use.
Rotary incubators	Chemical/biological spill or contamination.	Low	No	No	Yes	Correct balancing of tubes, buckets. Training on use and cleaning of incubators. Items to be double contained. Training on dealing with spills.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Centrifuge –NRE105	An imbalanced centrifuge can cause damage to building and people near it. Pneumatic arm for holding up the lid is weak and the lid can close without warning – crush hazard.	Low	No	No	Yes	Training required before use. Log book kept for use and maintenance. Centrifuge checked monthly. Warning sign placed on centrifuge requiring users to have training before use and warning about lid.		Each use.
High Speed centrifuge	Severe harm if rotor or centrifuge fail	Medium	No	No	Yes	Operators must be trained before use. Rotors cleaned and checked regularly. Rotors de-rated or de-commissioned if too pitted or old. Centrifuges checked annually.		Each use.
-80 Freezer	Burns from extremely low temperatures	Low	No	No	Yes	Freezer locked to non-lab users. Cold resistant gloves worn when handling frozen items. Instructions to limit handling of frozen items.		Each use.
Dishwasher	Burns Chemical irritation from detergents (Decon, Pyroneg etc.)	Low	No	Yes	Yes	Use PPE when loading and unloading dishwasher. Open carefully.		Each use.
Freeze Drier	Burns from supercooled chamber or from hot oil in vacuum pump. Chemical exposure	Low	No	No	Yes	Only trained users. Wear PPE-safety glasses, thermal gloves and labcoat. Do not put hands into collector chamber until it has reached room temp.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Air gun –Riddolls 037	Aerosol hazard	Low	No	No	Yes	Use appropriate PPE – dust masks provided.		Each use.
Ebulliometer-Winery teaching lab.	Burns Fire hazard Mercury spill from thermometer breakage.	Low	No	Yes	Yes	Specific workstation. Minimised quantity of methylated spirit. Mercury spill kit nearby and instructions at the workstation.		Each lab session.
Titration-Winery teaching lab	Chemical exposure-burns, poisoning etc. Cuts from broken glassware.	Low	No	Yes	Yes	Small quantities of working strength reagents used. Glassware clamped and other glassware in trays.		Each lab session.
Flame sterilisation-B007	Sterilising agent (96% ethanol) on tools can ignite bulk ethanol in coplin jars or sterilising vessel.	Low	No	No	Yes	Ensure flame has completely extinguished/burnt off before dipping tool back into ethanol. Rest flaming tools on stainless steel rack for at least 30 seconds before use. Coplin jars fitted into stainless steel anti-tip holders. Keep 96% ethanol away from flames (close to air flow).		With each use.
Microwave – superheated solutions	Burns from vessels or spilled solutions. Cuts from shattered glass if solutions cooled too quickly.	Low	No	No	Yes	Heat protected gloves provided for use. Loosen lids before heating. “Caution: Hot” sign provided for display during use and cooling. Hot glass bottles left to cool slowly – do NOT run under cold water or cool in ice. Users trained. Add additional chemicals once cooled.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
						Do not place on glass bench covers.		
Laminar Flow hood –B007	Burns from UV lamps.	Low	No	Yes	Yes	Timers set to 20-30 minutes and UV turned off after set time.		Each use.
Laminar Flow hood –BPRC	Burns from UV lamps.	Low	No	Yes	Yes	Ensure doors and warning notice are in place when UV is on-added a new sign 22/06/15. Ensure shields do not have significant gaps.		Each use.
Laminar Flow hood –BPRC	Flame sterilisation – Burns Fire hazard	Low	No	Yes	Yes	Glass bead sterilisers available. Ensure all ethanol containers, including spirit burners, are in non-spill collars. Train users in correct procedure. Do not leave lit burners unattended. Turn off gas taps in the cabinet and at the wall.		
Soil washing – B708	DPI and ergonomic hazards	Low	No	No	Yes	Ergonomic assessment of posture. Rotate tasks. Micropause and stretch.		Each use.
Cryostat	Burns from supercooled parts	Low	No	No	Yes	Trained users only. Thermal gloves provided.		Each use.
Laminar Flow hood –B007	Injury from heavy metal doors	Low	No	Yes	Yes	Two hands used to remove and replace doors.		Each use.
Class II Biological Cabinet	Burns from UV lamps	Low	No	Yes	Yes	UV-resistant glass sash and side windows. UV light cuts out/switches off if window sash is raised.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Water leaks and spills	Slip hazards. Electrocution hazard.	Low	No	Yes	Yes	Clean up spills immediately. Contact Lincworks plumber for immediate repair. Leave signage or mop bucket in spill area to warn others. If risk of electrocution, evacuate immediate area and contact Lincworks to isolate power to the affected area.		As required.
Light Banks-B007	Burns	Low	No	Yes	Yes	Ensure power is witched off before changing fluorescent bulbs. Use heat resistant gloves to handle recently used bulbs.		Each use.
Dark Room	Disorientation –trip, fall, abrasion hazards	Low	No	No	Yes	Use white and red lights as practical. Minimise time in the dark.		Each use.
DGGE-Chemicals	Toxic effects	Medium	No	Yes	Yes	See controls for Class 5, 6 and 9 hazardous substances.		Each use.
DGGE apparatus	Burns Crushing from moving equipment (orbital shaker) Chemical spills from gel stain trays	Low	No	Yes	Yes	Only trained users. Correct PPE. No other work to be carried out in DGGE area. Use orbital shaker on stable surface only. Don't overstack trays on shaker. Confine use of chemicals to well labelled spaces. Benchkote applied to bench and replaced biannually. Clear signage and tape around bench to isolate DGGE area only.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
LPG cylinder on flame photometer.	Gas leakage of flammable gas.	Low	Yes	No	No			Each use.
Gas supply- gas taps left on by mistake or leaking taps.	Inhalation hazards and fire/explosion hazards from flammable gases.	Low	No	No	Yes	Gas turned off at mains when not in use. Signs show location of gas mains switch off valves.		Each use.
Sonicator	Hearing damage Musco-skeletal damage	Low	No	Yes	Yes	Wear hearing protection when using the sonicator. Isolate the sonicator from other lab personnel if possible. Do not put fingers into sonicator while it is running.		Each use.
Unguarded moving parts of equipment	Physical injury	Low	No	No	Yes	Use guards where provided for equipment. Only approved and trained people to use the equipment. Wear suitable clothing – no entanglement hazards- and correct PPE.		Each use.
Elementar Analysers	Burns from hot tubes and sample crucibles	Low	No	No	Yes	Instrument guarded when unloading hot crucibles. Crucibles colled down in guarded container. Tubes must be cooled before removing and re-packing.		Each use.
Elementar Analysers -sicapent (P ₂ O ₅) caustic	Exposure from contact or inhalation may result in burns, eye damage and/or poisoning.	Medium	No	No	Yes	Wear correct PPE. Pack and clean tubes in fumehood.		Each use.
Elementar Analysers - Waste from reaction tubes	Exposure to copper and tungsten	Low	No	No	Yes	Handle waste in fumehood. Wear correct PPE. Store and dispose of waste according to LU procedures.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Magnetic Separator	Exposure to high magnetic fields.	Low	No	No	Yes	Machine is guarded. All users must be trained before use.		Each use.
Flame Photometer	Flammable gas (LPG) leak from photometer – fire hazard	Medium	No	No	Yes	Check connections before igniting. No other gas or ignition sources in the lab at the same time.		Each use.
Microwave digester	Corrosive solutions at high temperatures and pressure	Medium	No	No	Yes	Sample preparation and post digestion procedures carried out in fumehood. PPE worn. Only trained users to operate microwave.		Each use.
FIA -tubing	Tubes under pressure could pop off and release corrosive reagents onto user.	Low	No	No	Yes	Safety Glasses and PPE worn when operating the FIA. Check and replace tubes regularly.		Each use.
HPLC- Eluents	Exposure to flammable, corrosive and/or toxic chemicals	Low	No	No	Yes	Eluents are prepared in fumehood. PPE worn.		Each use.
HPLC-waste	Exposure to flammable, corrosive and/or toxic chemicals	Low	No	No	Yes	Waste collected and disposed of according to LU protocols. Eluent collection containers fitted with vapour and safety caps. Acidic eluents are neutralised before disposal.		Each use.
HPLC – ELSD exhaust gases	Exhaust vapour may contain toxic fumes, e.g. acetonitrile.	Medium	No	No	Yes	Exhaust tube is vented into a fumehood or outside the lab.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
GC –hot surfaces, e.g. GC-O sniffer port and GC injection ports	Burns	Low	No	No	Yes	Turn off sniffer port when not in use. Train all users to cool heated zones before touching them.		Each use.
GCMS – constant noise from 2 x rotary vacuum pumps	Hearing damage	Medium	No	No	Yes	Wear earplugs when spending significant amounts of time in room.		Each use.
GC/GCMS - solvents	Inhalation hazard – solvents in sample vials can evaporate into lab once the septum has been pierced.	Medium	No	No	Yes	Remove all analysed vials ASAP to reduce evaporation of solvents into lab air. Lab has been fitted with an air refresher system rather than a re-circulation system.		Each use.
GC/GCMS – injection needles	Puncture wounds from handling needles	Low	No	No	Yes	Keep all needles in boxes when not in use. Train all users on how to install needles into GC injector safely.		Each use.
Greenhouse GC - caps	DPI from repetitive and constant task of capping and de-capping exetainers	Medium	No	No	Yes	Use capper/de-capper station for all sample exetainers. Use auto-sampler station for degassing vials. Take regular breaks and rotate tasks.		Each use.
Greenhouse GC-integrating chromatograms	DPI from repetitive clicking of mouse for GC software.	Medium	No	No	Yes	Workstations setup ergonomically. Use micropauses and exercises. Rotate tasks.		Each use.
Greenhouse GC -ECD	Exposure to radioactive ⁶³ Ni source of ECD.	Low	No	No	Yes	Source is sealed in ECD. Perform annual swipe tests.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Greenhouse GC-vial evacuation manifold	Needle stick injuries	Low	No	No	Yes	Always replace needle guards when not in use. Replace needles if pricked by them to prevent contamination and/or transferral to others who may contact needles. Needles disposed of in sharps bin.		Each use.
ICP-plasma	Burns	Low	No	No	Yes	Interlocks prevent access to hot plasma – automatic shut off.		Each use.
GF-AAS	Burns	Low	No	No	Yes	Only trained staff and students to operate.		Each use.
Muffle Furnaces – up to 1000°C	Burns	Low	No	No	Yes	Tongs and heat resistant gloves provided. PPE worn. Heat resistant surfaces next to furnace for hot crucibles etc. Only trained personnel to use.		Each use.
Ovens	Burns	Low	No	No	Yes	Tongs and heat resistant gloves provided. PPE worn. Heat resistant surfaces next to furnace for hot crucibles etc.		Each use.
End over end shaker	Entanglement hazard	Low	No	No	Yes	Shaker fully guarded with cut-off switch		Each use.
Autoclave	High pressure steam burns	Medium	No	No	Yes	Training provided. Hot areas isolated. Warning signage in place. Steam blow off away from people traffic. Interlocks prevent door being opened while temperature and pressure are high.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Autoclave rubbish disposal –B712	<p>Cuts, broken skin, toxic fumes, acid and solvent burns, back strain</p> <p>Hazardous substance or biological spill.</p>	Medium	No	Yes	Yes	<p>Use “HOT” label for waste- remove when cooled down. Operators to wear appropriate PPE- refer to autoclave SOP. Provision of heavy duty gloves, face visor, apron, mask for fumes. To be used according to the type of waste or if hazardous substances are spilled. Weight and volume of bags to be re-iterated at lab meetings. Educate users on correct disposal of sharps during lab safety induction.</p> <p>If operator detects noxious fumes then the waste is to be treated as a chemical spill – Turn on extraction fan to full and open windows. Evacuate the area as far as the smell can be detected. If the smell persists after the waste cools, then contact the lab manager or LU spill team.</p> <p>Following the events try to identify the individual responsible and educate. Education of autoclave operators, staff & students on what can and can’t be autoclaved by email or lab meetings.</p>		

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Pressure Cooker	High pressure steam burns Noise induced hearing loss	Medium	No	No	Yes	Only trained users. Heat protection gloves provided. "Caution: hot" sign provided for display during use and cooling. Wear ear plugs.		Each use.
AAS – flames and vapours	Burns Inhalation hazard.	Medium	No	No	Yes	Only trained staff and students to operate. Must have extractor on while flame is lit.		Each use.
AAS - gases	Explosion and fire hazards from acetylene and nitrous oxide.	Medium	No	No	Yes	Only trained staff and students to operate.		Each use.
Use of acetone soaked papers for thin section preparation.	Inhalation hazard. Flammable substance-fire risk.	Medium	No	Yes	Yes	Room ventilation installed. PPE including gas mask provided. Papers stored in running fumehood until the acetone has evaporated. Towels disposed of regularly.		Each use.
Vacuum impregnation of resin into thin sections	Implosion hazard	Low	No	No	Yes	Perspex guard fitted.		Each use.
CS10 cut off saw	Inhalation of aerosol forms of Macron A oil, soil and resin.	Low	No	No	Yes	Saw used in fumehood. PPE, including faceshield provided. Perspex cover fitted to saw.		Each use.
LP30 lapping and polishing machine	Physical injury from equipment malfunction	Low	No	No	Yes	Perspex cover fitted. Regular maintenance.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
4°C and 10°C Cold rooms and -18°C walk-in freezers	Exposure to and discomfort from constant low temperatures while working in these areas. Hypothermia.	Low	No	No	Yes	Plan ahead. Wear appropriate clothing and take regular breaks. Inform others that you are working in these area.		Each use.
Insufficient shelving in 8°C cold room -BPRC	Containers stacked on floor make it hard to reach samples at the back. Potential cause for back injury and falls.	Medium	No	No	Yes	Monitor and organise cold room regularly to make access way as clear as possible. Ideal to have more shelving but not possible at this stage as the space is limited and room structure not sufficient.		Every two months.
Growth Rooms –Biotron Asphyxiation hazard	Asphyxiation hazard from lack of oxygen in growth cabinets. Death	Medium	Yes	No	Yes	Chambers are all electronically monitored for CO ₂ build-up. _set alarms so that chambers will be shut down before hazardous levels are reached.		Daily
Growth Rooms – Biotron\Falling hazard	Falling hazard – possible to fall through holes in the floor. Fractures, abrasions, striking hazard.	Medium	Yes	No	Yes	Only designated people in this area. Educate on height issues. Keep caps over holes when rhizotrons not in place.		Every time a growth room is entered.
Growth Rooms –Biotron Lighting hazard	Lighting levels- cabinet are very bright and can cause headaches.	Low	Yes	No	No	Assess lighting levels with Lux meter. Wear tinted glasses when working inside growth cabinets.		Every time a growth room is entered.
Growth Rooms –Biotron Electrical hazard	Use of electrical equipment in wet/humid areas – possible electrocution hazard	Low	Yes	No	No	Only use RCD protected outlets provided inside growth rooms.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
Growth Rooms –Biotron Emergencies	Harm from lack of egress					Emergency drills practised regularly and remedial actions communicated to staff through Lincworks debriefs. When working in growth rooms with door closed always leave window open so that others know that the room is occupied. Always carry cordless phone in case of emergency.		6 monthly.
Rhizotron room –Biotron Forklift hazards	Crushing and striking hazards from when forklift is moving rhizotron containers weighing 120 kg Electrocution hazard from charging forklift.	Medium	No	Yes	Yes	Only trained operators to use forklift. Only designated people in area while forklifts are working. Safety cut-off feature for forklift. Use isolating charge system. Only trained operators to perform task.		
2.2	Asphyxiation hazard. Physical injury from sudden pressure releases, faulty regulators, cylinder failure. Poisoning from inhalation of toxic gases.	Low	No	Yes	Yes	All cylinders restrained upright. Cylinders turned off when not in use. Empty cylinders replaced by trained users. Flammable gases shall not be used near ignition sources. Flammable gas regulators shall have a flash back arrestor fitted. Ensure adequate ventilation.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Replacement cylinders and bulk gas storage located in the hazardous substances store. Trolleys used for transporting cylinders. PPE worn, especially when working with cryogenic liquids.	Status Review/s	Frequency of monitoring
2.1.1A &B, 2.1.2A	Fire hazard. Explosion hazard. Asphyxiation hazard. Physical injury from sudden pressure releases, faulty regulators, cylinder failure. Poisoning from inhalation of toxic gases.	Medium	No	Yes	Yes			Each use.
Cryogenic liquids and solids (liquid nitrogen, dry ice, liquid CO ₂ cylinders, etc.)	Burns from ultra-low temperature. Asphyxiation hazards.	Medium	No	Yes	Yes	Follow SMOU protocols for handling and transporting liquid nitrogen. Evacuation procedures for any leaks of cryogenic liquids, e.g. liquid nitrogen or carbon dioxide. Cold resistant gloves, lab coats and safety glasses to be worn when working with CO ₂ cylinder or dry ice. Visual and audible checks carried out for leaks each time the CO ₂ cylinder is replaced and/or -80 freezer is moved. Use in well ventilated areas. B217 fitted with oxygen sensor. Vent unwanted dry ice in fumehood.		Each use.

Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring
<p>< 0.5L 3.1C & 3.1D 0.5 - 1L 3.1B 0.5 - 1L 3.1C & 3.1D < 500 mL 3.1A 3.1C if heated > Flash Point</p>	<p>Fire Risk. Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.</p>	Low	No	Yes	Yes	<p>SDS and SMOU consulted before use. Minimum quantities kept in lab and 3.1A and 3.1B substances stored in approved cabinet when not in use. No more than 10L outside a cabinet. Storage is segregated from incompatible substances, especially corrosives and oxidisers. Usage confined to fumehoods where possible or well ventilated areas where all sources of ignition are identified and eliminated from flammable area. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.</p>		Each use.
Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring

<p>>500 mL 3.1A 3.1A if heated > Flash Point >1L 3.1B >2L 3.1C 3.2A, 3.2B, 3.2C</p>	<p>Fire Risk. Explosion Risk. Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.</p>	<p>Medium</p>	<p>No</p>	<p>Yes</p>	<p>Yes</p>	<p>SDS and SMOU consulted before use. A SMOU for substances of higher risk is developed for tasks involving 3.1A. Minimum quantities kept in lab and 3.1A and 3.1B substances stored in approved cabinet when not in use. 3.1A and 3.1B substances are stored in spark-free fridges when required or double contained in standard fridge upon risk assessment. No more than 10L outside a cabinet. Storage is segregated from incompatible substances, especially corrosives and oxidisers. Usage confined to fumehoods where possible or well ventilated areas where all sources of ignition are identified and eliminated from flammable area. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.</p>		<p>Each use.</p>
Hazard/risk	Potential Harm	Risk rating	E	I	M	Action Proposed	Status Review/s	Frequency of monitoring

4.1.1A & B, 4.1.2B and 4.1.3A-C 4.2 A-C < 100mg 4.3 A-C < 100 mg	Fire Risk. Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.	Low	No	Yes	Yes	SDS and SMOU consulted before use. Minimum quantities kept in lab and no more than 50 L stored in approved cabinet when not in use.		Each use.
4.2 A-C > 100mg 4.3 A-C >100 mg	Fire Risk. Explosion Risk. Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.	Medium	No	Yes	Yes	No more than 10L of any one class outside a cabinet. Class 4.3 stored away and used away from moisture. Class 4.1.3 substances are stored wet and checked every 3 months. Storage is segregated from incompatible substances, especially corrosives and oxidisers. Usage confined to fumehoods where possible or well ventilated areas where all sources of ignition are identified and eliminated from flammable area. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.		Each use.
5.1.1B and 5.1.1C	Fire Risk. Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.	Low	No	Yes	Yes	SDS and SMOU consulted before use. Minimum quantities kept in lab and no more than 50 L stored in approved cabinet when not in use.		Each use.
5.1.1A and 5.1.2A	Fire Risk. Explosion Risk.	Medium	No	Yes	Yes	No more than 10L of any one class outside a cabinet.		Each use.

	Exposure from contact or inhalation resulting in poisoning and illness. Adverse reactions with incompatible compounds.					Storage is segregated from incompatible substances, especially corrosives and combustible organic compounds. Usage confined to fumehoods where possible. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.	
6.3, 6.4, 6.5, 6.6 & 6.7 substances	Exposure from contact resulting in poisoning, burns and illness. Adverse reactions with incompatible substances possible depending on the other HSNO classifications of the substance.	Low	No	Yes	Yes	SDS and SMOU consulted before use. A SMOU for substances of higher risk is developed for tasks involving 6.1A, B & C and 6.7A substances. Minimum quantities kept in lab Storage is segregated from other substances by separate cabinets or shelves.	Each use.
6.1A,B & C 6.8 & 6.9	Exposure from contact resulting in poisoning, burns and illness. Adverse reactions with incompatible substances possible depending on the other HSNO classifications of the substance.	Medium	No	Yes	Yes	Storage is segregated in fridges and freezers. Usage confined to fumehoods where possible. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.	Each use.
Low energy β emitters and sealed sources	Health effects-cancer etc.	Low	No	Yes	Yes	Users must be trained by the University Radiation Safety Officer.	Each use.
High energy β emitters, α emitters and γ emitters	Health effects-cancer etc.	Medium	No	Yes	Yes		Each use.

<p>(Na-24, P-32, Rb-86, I-131, Fe-59, Zn-65 etc.)</p>						<p>Choose minimum quantities and lowest energy emissions appropriate to experiment. Choose chemical or physical form that provides minimum risk of internal and/or external exposure. Must be used in dedicated areas that are well signed with restricted access as necessary. Use appropriate shielding. Ensure an appropriate monitoring scheme. Ensure appropriate cleaning and decontamination procedure is in place. Ensure appropriate storage. Keep an inventory of all radioactive sources. Work with animals or biologicals will need further approval from IBSC or animal ethics committee. Waste disposal must be approved by National Radiation Laboratories. Specific SMOU may need to be developed.</p>		
<p>Acids with $K_a < 1$ Bases with $K_b < 1$ Acids with $K_a > 1$ and concentration $< 2M$</p>	<p>Exposure from contact and inhalation resulting in skin burns and eye damage, poisoning and illness.</p>	Low	No	Yes	Yes	<p>SDS and SMOU consulted before use. A SMOU for substances of higher risk is developed for tasks involving 8.2A.</p>		Each use.

<p>Acids with $K_a > 1$ and concentration $> 2M$ Bases with $K_b > 1$ $HF < 500 \text{ mL}$</p>	<p>Exposure from contact and inhalation resulting in skin burns and eye damage, poisoning and illness.</p>	Medium	No	Yes		<p>Minimum quantities kept in lab and stored in approved cabinet when not in use. No more than 20L outside a cabinet. Storage is segregated from incompatible substances, especially flammables and oxidisers. Acids and alkalis segregated in storage. Usage confined to fumehoods for concentrated acids and bases. Correct PPE is used as identified from SDS and glove guide. Spill kits, safety showers, eyewash stations and fire extinguishers available in lab.</p>		Each use.
Waste Chemical Disposal	<p>Adverse reactions due to incorrect labelling or storage of waste chemicals. Personal injuries (burns, poisoning etc.) due to inadequate labelling or storage. Environmental contamination due to incorrect disposal methods.</p>	Low	No	Yes	Yes	<p>All waste containers are labelled with yellow labels compliant with LU system. Waste substances are stored separately from other substances in use. Waste is stored according to their HSNO class(es) and segregated appropriately. Waste substance containers are transferred to the HSS as soon as possible for collection by the contracted waste disposal company.</p>		Each use.
Chloroform extractions for microbial biomass assays	Exposure to toxic chemical	Medium				All work carried out in fumehood.		Each use.

6.1D, 6.1E, 6.3A, 6.4A, 6.7B, 6.8B, 6.9A, 6.9B, 9.1D, 9.3B < 500 mL						Double glove with nitrile gloves and change every 5 minutes. Only trained users to use vacuum box. Vacuum pump exhaust must be vented to fumehood.		
Mercury Thermometers	Broken thermometers-exposure to mercury	Low	No	No	Yes	Replace with non-mercury thermometers where possible. Mercury spill kit available.		
Hazardous organisms	Risk of laboratory exposures that may cause infection or allergies due to accidental exposure or incorrect disposal methods.	Low	No	Yes	Yes	Approval to work with hazardous organisms is granted by the IBSC. Training for lab workers must be completed prior to working with hazardous organisms. All biological organisms will be identified and categorised as either Risk Group 1 or 2. Risk Group 2 organisms are always handled in PC2 laboratories. All biological organisms are handled as per the LU Quarantine & Containment Manual procedures, which includes the use of appropriate PPE and equipment. All biological organisms to be disposed of via autoclaving. NOTE: No work other than that to identify is to be carried out with unidentified organisms isolated from the environment.		6-monthly internal audits
Autoclave waste	Infection Risk. Spill Risk.	Low	No	Yes	Yes	Autoclave bags sealed before storage. Bags cleared regularly to avoid overflow of bins.		Each use.

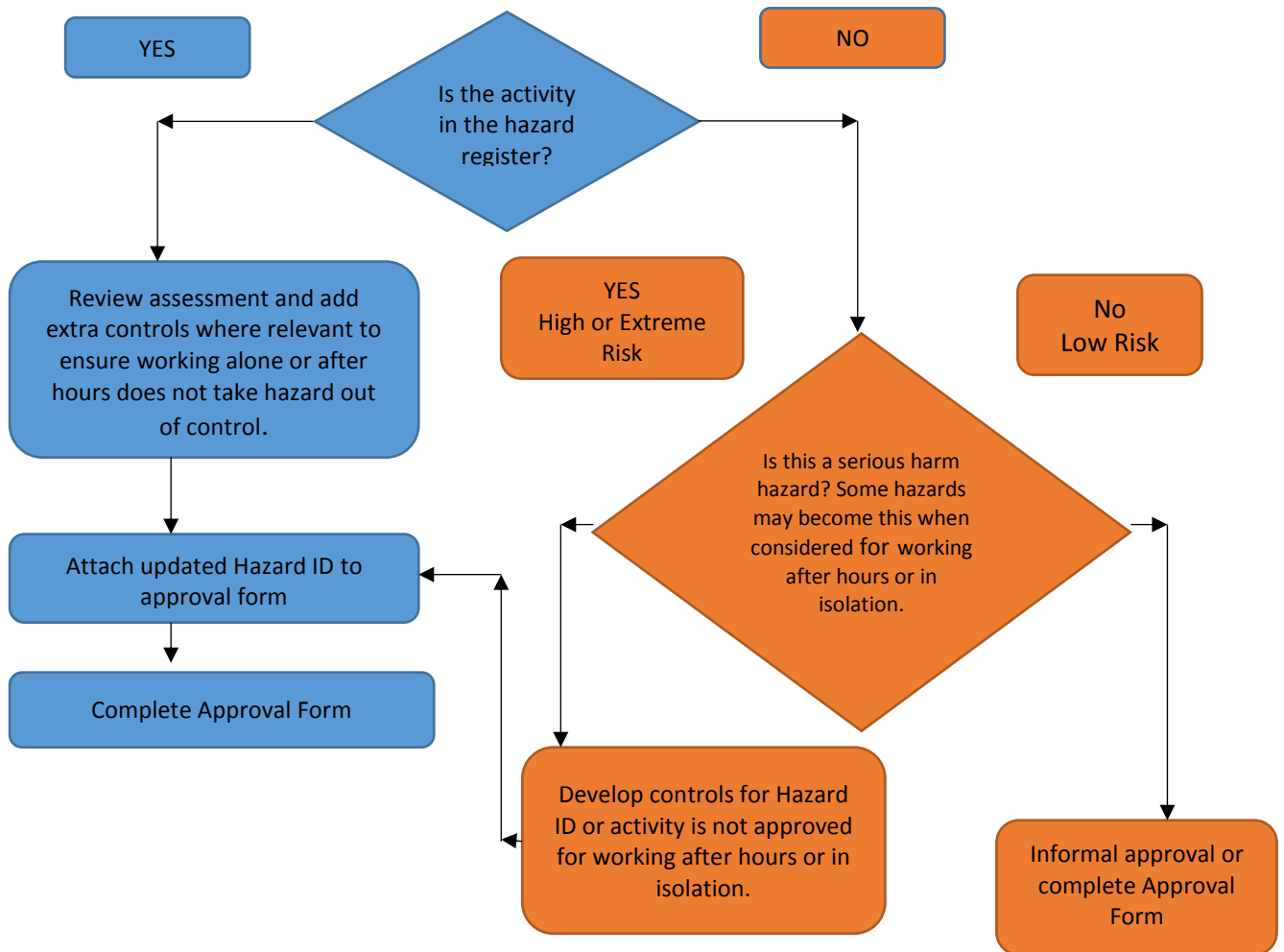
						Solid waste only – liquid waste disposed of in bottles.		
Bacteria and fungi	Respiratory illness Allergies May be pathogenic especially to immunosuppressed individuals.	Low	No	Yes	Yes	All fungal and bacterial organisms with airborne spores subcultured in Class II biological cabinet. Spray area with ethanol and run UV sterilisation cycle after each use. All culture media sealed when not in use. Immunocompromised people or with unidentified illnesses are not to work with restricted organisms.		Each use.
Specimens and samples	Inhalation of material (e.g. scales from moth of butterfly wings) which are potential carcinogens.	Low	No	No	Yes	Face masks and fumehood available.		Each use.
Mites	May be pathogenic and cause allergy or illness.	Low	No	No	Yes	Keep incubators clean – use miticides.		Each use.
Chemical analysis of effluent –B110	Contracting bacterial and viral illnesses.	Medium	No	Yes	Yes	Work carried out in designated space. Wear correct PPE and minimise exposure. All surfaces disinfected with bleach after use. Hand sanitizer provided.		Each use.
Hazardous Substances spill	Physical Injury – eye damage, skin burns Poisoning Fire hazard Slip hazard	Medium	No	Yes	Yes	Spill kits readily available. Drench showers and eye wash available. Follow spills procedure on emergency flip chart and in HSNO manual Call LU spill response team for large spills		At inductions and lab training.

Risk Assessment and Guidelines for Working After Hours in the Laboratory

A risk/hazard identification should be carried out before the approval for after-hours/working alone lab access is granted by the HOD or HLM.

The hazard identification should cover:

- Identification of all potential hazards
- Risk assessment of each hazard
- Control of hazard (eliminate, isolate or minimise and is reasonably practicable)



Risk Assessment and Guidelines for Working After-Hours in the Laboratory (continued)

Examples of low, medium, high and extreme risks are given in the table below.

Procedure	Hazard (s)	Risk	Control
Computer work – data processing, chromatography integrating, etc...	GPI Non-serious harm hazards	Low (as long as no work with hazardous substances is carried in the vicinity of the computer)	Ergonomic setup for PC. No work with hazardous substances at the same time.
Lab work already assessed as low risk with no hazardous substances involved e.g. microscope work, weighing samples, cleaning glassware	GPI Broken glassware Non-serious harm hazards	Low if already assessed as such in current hazard register	See hazard register
Undertaking low risk experiment in a laboratory with moderate risk items	Exposure to hazardous substances – poisoning, burns and fire risk	Medium	Approval given if: 1) Controls for medium risk hazards have been identified and are in place. 2) The person is deemed competent in a potential emergency situation. 3) A buddy and regular checking-in system has been instigated
Refluxing and experiments with volatile organic substances	Explosion injury Inhalation injury Fire hazard	High /Extreme	Read SMOU and SDS. No approval for after-hours work.
Acid digestions of soil, plant and feed materials	Explosion injury Serious burns to skin and eyes Lung corrosion	High /Extreme	Read SMOU and SDS. No approval for after-hours work.
Working with substances of higher risk (6.1A, 6.1B, 6.1C, 6.7A, 3.1A or 8.2A)	Serious Harm Injury Death Environmental contamination	High /Extreme	Read SMOU and SDS. No approval for after-hours work.

The following items may influence the risk factor:

- The number of people working in the area after hours
- Consequences of leaving an experiment or piece of equipment unattended
- Competency of the person undertaking the after-hours work
- Whether the substance is too hazardous or dangerous to be used after hours – all substances classified as ‘substances of higher risk’ are not to be used after hours.
- Availability of a buddy (see Section 2: Definitions)
- Access to communication – is there a lab phone or PC nearby, or mobile phone?

For work procedures deemed low risk, then the assessment can be informal and made part of the induction and no further action is required.

Authority for After Hours Laboratory Access Form

Authority Approval for After Hours Laboratory Access			
Name(s):		Title:	Staff <input type="checkbox"/> PG <input type="checkbox"/> Visitor <input type="checkbox"/>
ID Number (T4)			
Activity:			
Lab(s):			
Hazard ID Controls	Low Risk – see dept. register <input type="checkbox"/>	Medium / High <input type="checkbox"/> Attach Hazard ID and controls to this form	Extreme <input type="checkbox"/> No approval given
For Medium to High Risk Activities			
Buddy Available <input type="checkbox"/>	Name:	Contact Number:	
Emergency contacts:	Name:	Contact Number:	
SIGN OFF:			
Staff /Student / Visitor		HLM / HAS	
The controls devised from the Hazard ID are adequate and I will ensure all control measures are implemented to the full. I understand the emergency procedures for this activity. Signed: Date:		The controls for the hazards identified for this after hours/alone work have been adequately addressed and I believe it is safe for this work to be undertaken in this manner. Signed: Date:	

Note: A blanket or bulk approval may be acceptable for laboratories where all hazards have been identified and the risks and controls in place are acceptable for circumstances of after-hours work or working alone.

Appendix 2: Corrosivity and Flammability Data

Corrosivity Table

K_a and K_b Values					
Name of Acid	Acid	K_a	Name of Base	Base	K_b
Sulfuric acid	H ₂ SO ₄	large	hydrogen sulfate ion	HSO ₄ ⁻	very small
Hydrochloric acid	HCl	large	chloride ion	Cl ⁻	very small
Nitric acid	HNO ₃	large	nitrate ion	NO ₃ ⁻	very small
Hydronium ion	H ₃ O ⁺	55.5	water	H ₂ O	1.8 × 10 ⁻¹⁶
Hydrogen sulfate ion	HSO ₄ ⁻	1.2 × 10 ⁻²	sulfate ion	SO ₄ ²⁻	8.3 × 10 ⁻¹³
Phosphoric acid	H ₃ PO ₄	7.5 × 10 ⁻³	dihydrogen phosphate ion	H ₂ PO ₄ ⁻	1.3 × 10 ⁻¹²
Hexaaquairon(III) ion	Fe(H ₂ O) ₆ ³⁺	6.3 × 10 ⁻³	pentaquahydroxoiron(III) ion	Fe(H ₂ O) ₅ OH ²⁺	1.6 × 10 ⁻¹²
Hydrofluoric acid	HF	7.4 × 10 ⁻⁴	fluoride ion	F ⁻	1.4 × 10 ⁻¹¹
Formic acid	HCO ₂ H	1.8 × 10 ⁻⁴	formate ion	HCO ₂ ⁻	5.6 × 10 ⁻¹¹
Benzoic acid	C ₆ H ₅ CO ₂ H	6.3 × 10 ⁻⁵	benzoate ion	C ₆ H ₅ CO ₂ ⁻	1.6 × 10 ⁻¹⁰
Acetic acid	CH ₃ CO ₂ H	1.8 × 10 ⁻⁵	acetate ion	CH ₃ CO ₂ ⁻	5.6 × 10 ⁻¹⁰
Hexaaquaaluminum ion	Al(H ₂ O) ₆ ³⁺	7.9 × 10 ⁻⁶	pentaquahydroxoaluminum ion	Al(H ₂ O) ₅ OH ²⁺	1.3 × 10 ⁻⁹
Carbonic acid	H ₂ CO ₃	4.2 × 10 ⁻⁷	hydrogen carbonate ion	HCO ₃ ⁻	2.4 × 10 ⁻⁸
Hydrogen sulfide	H ₂ S	1 × 10 ⁻⁷	hydrogen sulfide ion	HS ⁻	1 × 10 ⁻⁷
Dihydrogen phosphate ion	H ₂ PO ₄ ⁻	6.2 × 10 ⁻⁸	hydrogen phosphate ion	HPO ₄ ²⁻	1.6 × 10 ⁻⁷
Hypochlorous acid	HClO	3.5 × 10 ⁻⁸	hypochlorite ion	ClO ⁻	2.9 × 10 ⁻⁷
Ammonium ion	NH ₄ ⁺	5.6 × 10 ⁻¹⁰	ammonia	NH ₃	1.8 × 10 ⁻⁵
Hydrocyanic acid	HCN	4.0 × 10 ⁻¹⁰	cyanide ion	CN ⁻	2.5 × 10 ⁻⁵
Hexaaquairon(II) ion	Fe(H ₂ O) ₆ ²⁺	3.2 × 10 ⁻¹⁰	pentaquahydroxoiron(II) ion	Fe(H ₂ O) ₅ OH ⁺	3.1 × 10 ⁻⁵
Hydrogen carbonate ion	HCO ₃ ⁻	4.8 × 10 ⁻¹¹	carbonate ion	CO ₃ ²⁻	2.1 × 10 ⁻⁴
Hydrogen phosphate ion	HPO ₄ ²⁻	3.6 × 10 ⁻¹³	phosphate ion	PO ₄ ³⁻	2.8 × 10 ⁻²
Water	H ₂ O	1.8 × 10 ⁻¹⁶	hydroxide ion	OH ⁻	55.5
Hydrogen sulfide ion	HS ⁻	1 × 10 ⁻¹⁹	sulfide ion	S ²⁻	1 × 10 ⁵

Graph to select volatility of liquid

