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General Health & Safety Risk Assessment Template

Work activity / task	Experimental research in atomic & laser physics, photonics and spectroscopy

Assessor(s)	Dr Tim Freegarde	**Responsible Manager**	Dr Tim Freegarde	**Date**	5/1/2016

Faculty / Service	Physical Sciences & Engineering	**Academic Unit / Team**	School of Physics & Astronomy	**Location**	B46/1017

Brief description of activity / task	Experimental research in atomic & laser physics, photonics and spectroscopy.

Additional notes **(eg, references, persons at risk, risk factors, etc)** **[optional]**	The most hazardous operations involve the positioning of components within the laser beam. Careful thought should be given to the directions of new reflections, especially with regard to other individuals present. It is good practice to block the laser beam securely before introducing or removing components. Lone working could exacerbate some hazard consequences and should generally be avoided for work incurring such risks.

Declaration by responsible manager: I confirm that this is a suitable & sufficient risk assessment for the above work activity / task.

Signed		**Print name**	Dr Tim Freegarde	**Date**	5/1/2016

Declaration by users: I confirm that I have read this risk assessment, will implement the controls outlined herein, and will report to the responsible manager any incidents that occur or any shortcomings I find in this assessment.					
Signed		**Print name**	Max Carey	**Date**	
Signed		**Print name**	Mohammed Belal	**Date**	
Signed		**Print name**	Jonathan Woods	**Date**	
Signed		**Print name**	Tim Freegarde	**Date**	
Signed		**Print name**	Matt Himsworth	**Date**	
Signed		**Print name**	Ned Hawes	**Date**	
Signed		**Print name**		**Date**	
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Health & safety risk assessment: A basic guide

(1) **Identify all hazards, hazard events, and reasonably foreseeable worst case consequences.** A 'hazard' is something with the potential to cause harm (ie, injury or ill-health). A 'hazard event' is the incident where the harm from the hazard occurs. A 'hazard consequence' is the nature and extent of the harm caused.

'Reasonably foreseeable worst case consequence': 'Worst case' means it is not necessarily the most likely consequence that should be considered, but, 'reasonably foreseeable worst case' means that far-fetched, improbable hazards and consequences need not be considered.

(2) Estimate inherent risk for each hazard. 'Inherent' risk is that without any controls applied.

Risk: Is likelihood of the hazard event and the reasonably foreseeable worst case consequence combined.

In estimating risk, also consider factors that could exacerbate risk, such as reasonably foreseeable emergencies, inexperience, lone work, new & expectant mothers, waste disposal, potential effects on others such as contractors or visitors, etc. A separate 'row' for a particular hazard / event / consequence may be needed to account for these.

Estimate risk using the matrix on the next page, and place an X in the appropriate box.

'High' risks must be reduced before activity / task can commence or continue.
'Medium' risks must be reduced as much and as soon as is reasonably practicable.

(3) Devise controls for each hazard. A 'control' is a measure taken to reduce risk.

Controls: As a general principle, the 'hierarchy' of control that is to be applied (from most to least preferable) is: avoid the risk; substitute something less hazardous that gives same or similar outcomes; 'engineering controls' (ie, equipment and articles that mitigate or contain a hazard); 'safe system of work' (ie, a prescribed work method); and 'personal protective equipment' ('PPE', eg, gloves, safety glasses, respirator, boots, etc). So, PPE is a last resort.

Other controls that should be considered: training, supervision, planning for reasonably foreseeable emergencies, health surveillance, validation and maintenance of any engineering controls, and correct specification of any PPE.

'Low' risks, by definition, do not require controls.

(4) Estimate residual risk for each hazard. 'Residual' risk is that with controls applied.

Residual risk is estimated as above, and the objective is for all risks to be low so far as is reasonably practicable.

(5) The responsible manager, supervisor, research leader, principal investigator or project leader must sign the Declaration on the front page.

- Health & safety risk assessments must be 'suitable and sufficient', ie, cover all relevant issues and include enough detail.
- It is activities / tasks that should be risk assessed, and not, as such, substances (but rather use of substances), or equipment (but rather use of equipment), or locations (but rather activities therein), or people (but rather what they do).
- This template is for 'general' health & safety risk assessment, suitable for most hazards, but certain hazards do require additional regulatory and technical detail (eg, ionising radiations, biological agents, genetic modification, noise, hazardous chemicals, etc).
- Health & safety risk assessments can be generic, provided they remain 'suitable and sufficient'.
- Health & safety risk assessments need to be reviewed periodically (at least every two years or sooner if inherent risk is high), and also after incidents, after significant changes to the activity / task, if staff raise any concerns, if there is a relevant change to the law or to other relevant standards, or if there is anything to suggest the assessment is not suitable or sufficient.
- You may remove pages 3 and 4 from the final assessment.

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Health & safety risk estimation matrix

High risk – requires controls to reduce risk before activity / task can commence (or continue).

Medium risk – requires controls to reduce risk as much and as soon as is reasonably practicable.

Low risk – all risk should be reduced to this tolerable level, so far as is reasonably practicable.

Reasonably foreseeable worst case consequence / Likelihood [3] of hazard event	**Minor** superficial injury; or slight and temporary health effect	**Moderate** significant injury or illness [1]; or temporary minor disability	**Major** serious injury or illness [2]; or significant or permanent disability	**Critical** fatal injury or illness; or substantial and permanent disability	**Catastrophic** fatal injury or illness for multiple persons
Likely high probability, 1 in 10 chance or higher, once in two weeks or longer for activities on a daily basis	medium risk	high risk	high risk	high risk	high risk
Possible significant probability, 1 in 100 chance or higher, once in six months or longer for activities on a daily basis	low risk	medium risk	high risk	high risk	high risk
Unlikely low probability, 1 in 1,000 chance or higher, once in four years or longer for activities on a daily basis	low risk	low risk	medium risk	high risk	high risk
Rare very low probability, 1 in 10,000 chance or higher, once in a decade or longer for activities on a daily basis	low risk	low risk	low risk	medium risk	high risk
Almost never extremely low probability, less than 1 in 100,000 chance, once in a century or longer for activities on a daily basis	low risk	low risk	low risk	low risk	medium risk

[1] 'Significant injury' could include, for example, laceration, burn, concussion, serious sprain, minor fracture, etc.
'Significant illness' could include, for example, dermatitis, minor work-related musculoskeletal conditions, partial hearing loss, etc.

[2] 'Serious injury' could include fracture or dislocation (other than digits), amputation, loss of sight, penetration or burn to eye, electric shock, asphyxia, or any injury leading to unconsciousness or requiring resuscitation or admittance to hospital for more than twenty-four hours. 'Serious illness' could include, for example, requiring medical treatment after chemical, biological or radiological exposure, severe debilitating musculoskeletal conditions, severe dermatitis, asthma, etc.

[3] For likelihoods in between the listed values, use the higher likelihood to estimate risk. These probability definitions are only a guide.

Hazards, hazard events, and reasonably foreseeable worst case consequences	Inherent risk (no controls) from matrix (mark with X)		Controls (measures to reduce risk)	Residual risk (with controls) from matrix (mark with X)	
Alignment and use of high-power mid-IR fibre laser amplifier 1560 nm, 30 W Corneal and skin exposure: Burns and corneal damage potentially resulting in partial to complete blindness.	High		Beams should be restricted to fibres when possible. Open fibres and connectors should be securely blocked by caps or beam guards; open or damaged fibres and connectors should be treated as potentially hazardous within 1 m. Free-space beams should be restricted to a plane securely bounded by solid beam-guards. Unusual beam paths should be securely blocked by solid beam-guards. Suitable protective eyewear shall be worn during beam alignment and by all temporary lab visitors while free-space beams are exposed; it should be noted that eyewear may be insufficient to block high intensity beams. Rings, wristwatches and reflective jewellery on hands and arms shall be removed before carrying out optical alignment. Laser sources shall be interlocked to the lab door, either through their controllers or via a mechanical shutter close to the beam output. A clear warning light above the lab door shall indicate when the interlock is engaged.	High	
	Medium	X		Medium	
	Low			Low	X
Alignment and use of high-power near-IR SHG sources 780 nm, 15 W Retinal, corneal and skin exposure: Burns and mild to very severe retinal damage potentially resulting in partial to complete blindness.	High		Beams should be restricted to fibres when possible. Open fibres and connectors should be securely blocked by caps or beam guards; open or damaged fibres and connectors should be treated as potentially hazardous within 1 m. Free-space beams should be restricted to a plane securely bounded by solid beam-guards. Unusual beam paths should be securely blocked by solid beam-guards. Care should be taken to avoid loose optics and objects during alignment. Suitable protective eyewear shall be worn during beam alignment and by all temporary lab visitors while free-space beams are exposed; it should be noted that eyewear may be insufficient to block high intensity beams. Rings, wristwatches and reflective jewellery on hands and arms shall be removed before carrying out optical alignment.	High	
	Medium	X		Medium	
	Low			Low	X
Alignment and use of near/mid-IR diode and fibre lasers and SHG sources FP diode, 780 nm, 100 mW Tapered amplifier diode, 780 nm, 1 W DFB diode, 780 nm, 80 mW DBR diode, 780 nm, 120 mW Fibre laser, 1560 nm, 50 mW Retinal exposure: Mild to very severe retinal damage potentially resulting in partial to complete blindness.	High		Open fibres and connectors should be securely blocked by caps or beam guards; open or damaged fibres and connectors should be treated as potentially hazardous at close range. Free-space beams should be restricted to a plane securely bounded by solid beam-guards. Unusual beam paths should be securely blocked by solid beam-guards. The use of suitable goggles is strongly advised and encouraged, especially during beam alignment and by guests and others not actively involved. Rings, wristwatches and reflective jewellery on hands and arms should be removed during optical alignment. Laser sources shall be interlocked to the lab door, either through their controllers or via a mechanical shutter close to the beam output. A clear warning light above the lab door shall indicate when the interlock is engaged.	High	
	Medium	X		Medium	
	Low			Low	X

Hazards, hazard events, and reasonably foreseeable worst case consequences	Inherent risk (no controls) from matrix (mark with X)		Controls (measures to reduce risk)	Residual risk (with controls) from matrix (mark with X)	
High voltage supplies to ion pumps, Pockels cells and photomultipliers; mains supplies to general lab equipment; Electric shock, electrical fire: Electrical burns, shocks, paralysis, fire	High	X	Electrical shielding and earthing of all mains and high voltage supplies shall be intact and secure. Mains electrical equipment should be raised above the floor to avoid electrical hazards in the event of spillages or flooding. Repair and alterations to electrical items should be carried out or checked by competent persons. Mains apparatus shall be tested regularly by qualified personnel,	High	
	Medium			Medium	
	Low			Low	X
Electronic prototyping; Contact of soldering iron with skin or flammables; electric shock: High-degree burns, paralysis, fire;	High		Devices should be detached from any power supply and high voltage/capacity capacitors discharged safely before working on them. High voltage circuitry should not be exposed unnecessarily. Components, cables and circuit boards should when possible be positioned securely for soldering and testing to minimize the chances of shocks and soldering iron burns. Exposed metalwork should be earthed, during testing and afterwards, to give protection should high voltage wiring become loose. Testing should only be carried out by appropriately briefed or experienced personnel, and not while working alone. Mains, high voltage and high power devices should be checked after servicing or modification by competent personnel before being connected to a supply.	High	
	Medium	X		Medium	
	Low			Low	X
Solvent storage and use Acetone, IPA; Spillage, skin exposure, ingestion : Skin irritation, eye damage, poisoning, fire.	High		Solvents should be stored in appropriate containers at a low level to reduce the risk of breakages. Storage and distribution vessels should be appropriately labelled. The use of low flow-rate-outlet plastic bottles is advised to reduce the risk of spillage. Goggles and protective gloves should be worn to avoid eye/skin contact if otherwise likely. Inhalation should be avoided.	High	
	Medium	X		Medium	
	Low			Low	X

Hazards, hazard events, and reasonably foreseeable worst case consequences	Inherent risk (no controls) from matrix (mark with X)		Controls (measures to reduce risk)	Residual risk (with controls) from matrix (mark with X)	
SAES Rubidium dispensers used in the experiment chamber contain Zirconium and Rb Chromate; Inhalation or skin exposure: may cause irritation or cancer.	High		The SAES dispensers are enclosed in metal boats which only expose the carcinogens upon activation by heating to >400˚C. Gloves should be worn when handling the dispensers, which shall be activated only when enclosed and under vacuum. Dust inhalation should be avoided on the rare occasions that the chambers are opened.	High	
	Medium	X		Medium	
	Low			Low	X
Solder, flux and insulation fumes; Inhalation: Irritation and poisoning.	High		Care should be taken to minimize inhalation of solder, flux and inhalation fumes while soldering. For big jobs, fume extraction apparatus should be used. Iron tips should be kept clean and solder with a lower-hazard flux used when possible.	High	
	Medium	X		Medium	
	Low			Low	X
Compressed gas bottles and piping; Handling and connections: Toppling, rupture, skin penetration.	High		Gas bottles should be handled with care using appropriate trolleys etc., and secured to suitable fixings if mounted vertically. Liquifiable gases should be mounted vertically unless bottles are fitted with an appropriate dip tube. Bottles should be positioned so that the stem is protected from impacts. High pressure gas lines should be treated with care and awareness of the hazards of skin penetration should a high pressure leak be directed towards the body..	High	
	Medium	X		Medium	
	Low			Low	X

Hazards, hazard events, and reasonably foreseeable worst case consequences	Inherent risk (no controls) from matrix (mark with X)		Controls (measures to reduce risk)	Residual risk (with controls) from matrix (mark with X)	
General trip hazards; Trips and falls: Minor to moderate personal injury, potentially severe injury in lone working situations.	High		Floors should be kept clear of clutter and trip hazards. Good illumination is recommended unless darkness is specifically required, when directional dimmer lights may be used. Coolant pipes etc. that run across the floor are to be taped and/or covered by a suitable ramp. Potentially risky scenarios, such as the movement of hard-to-reach equipment, should be avoided when working alone.	High	
	Medium	X		Medium	
	Low			Low	X