

Risk assessment for LASER ribbon pulling and welding system to be supplied to LASTI

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January 2007

1. INTRODUCTION

This is a risk assessment for the laser ribbon pulling and welding machine to be supplied by RAL to LASTI, to designs provided by the University of Glasgow. We have used CCLRC safety code number 1 which is specific to lasers.

2. FIRST STAGE - HAZARD IDENTIFICATION

2.1 Description of the activity

A machine is being developed at Glasgow to pull ribbons of silica and to weld them using a 100W CO₂ laser. A copy of the machine will be supplied to the LASTI laboratory at MIT where it will be used to pull ribbons and weld them for the “noise prototype” suspension system, and potentially for other development work.

We have assumed that members of the public will not be admitted to the area where the machine is sited. If public visits are contemplated then a further risk assessment should be carried out.

Line of responsibility for safety of the machine at Glasgow is Mark Barton – Ken Strain – Jim Hough.

Line of responsibility for safety at LASTI is: Myron MacInnis – David Shoemaker

The plan for protecting the area at LASTI is as follows. The room in which the machine will be sited will be classed as a laser hazard area. There will be an illuminated “LASER IN USE” sign outside each of the two doors which is interlocked to the laser control unit so that the laser cannot be energised unless the sign is lit. The doors will be signed to designate a laser area. LASTI operating procedure is that laser eyewear must be used while the sign is lit. In addition, there will be a curtain in the room to partition the area where the machine is sited. This will be designed so that it cannot easily be pulled aside and so that there is a serpentine entry route. Within this area the laser machine will be screened as at Glasgow, with the possible addition of a roof to the enclosure and with the addition of tubing around the beam where feasible. A similar facility at RAL would be fitted with interlocks on the doors that would cut out the laser were the doors to be opened, however the arrangements outlined above are standard operating procedure at LASTI and will provide an appropriate level of protection.

Visitors will be allowed to view the machine in operation, from outside the protective curtain. They will be afforded protection by the enclosure, the curtain, and laser eyewear.

Local laser safety officers are Johannes Courtial (Glasgow) and Bill McCarthy (MIT).

2.2 List of hazards

Electricity; laser light; hot silica; silica vapour (extent unclear); computer workstation; moving machinery – remotely controlled; trailing cables/pipes

2.3 List of potentially injurious situations: Glasgow

Electric shock

Vapour inhalation

Skin burns – direct laser exposure

Skin burns – touching hot silica

Eye damage – exposure to laser

Eye damage – staring at heated silica

Injuries arising from badly-designed computer workstation

Manual handling

Trapping and entanglement with remotely-controlled moving machinery

Tripping on trailing cables etc

2.4 Additional hazards: LASTI

No additional hazards identified.

3. SECOND STAGE - FORMAL RISK LISTING

Injurious Situation	Persons at risk			Worst case outcome				Likelihood/probability					Risk rating	Comments
	E	Pub	Vis	F	MP	MI	NI	LF	Prob	Poss	Imp	Rem		
1. Electric shock	X		X	x							x		3	Good practice should be followed in carrying out electrical work at LASTI.
2. Vapour inhalation	X		X			X						X	tolerable	Glass blowers take no special precautions.
3. Skin burns - direct laser exposure	X					x				x			tolerable	100W is similar to large soldering iron
4. Skin burns - touching hot silica	X					x				x			Tolerable	
5. Eye damage - exposure to laser	X		X		x						x		tolerable	Protection arrangements for the room in which the laser will be sited make this improbable.
6. Eye damage - staring at heated silica	X		X		X					X			3	To quantify this properly would require measurement of the frequency structure of the light.
7. Injuries arising from badly-designed computer workstation	X					x				x			tolerable	Should be given consideration when machine is installed at LASTI.

8. Manual handling	X				x				x			tolerable	Training can help
9. Trapping and entanglement with remotely-controlled moving machinery	X				x					x		Tolerable	
10. Tripping on trailing cables etc	X		X		x				x			tolerable	Needs thought on installation at LASTI
11. Visits by MIT guests to view machine operation			X		X					X		Tolerable	Needs vigilance to ensure proposed arrangements are enforced

Key:

Person at Risk: **E** = Employee, **Pub** = Public, **Vis** = Visitor

Worst Case Outcome: **F** = Fatal, **MP** = major injury or permanent disability, **MI** = Minor injury, **NI** = no injury

Likelihood / Probability: **LF** = likely or frequent, **Prob** = probable, **Poss** = possible, **Imp** = improbable, **Rem** = remote.

Use the table below to rate the risk for each potentially injurious situation, into one of four ranks: high (1), medium (2), low (3) and tolerable.

	Likely	Probable	Possible	Improbable	Remote
Fatal	1	1	2	3	Tolerable
Major injury	2	2	3	Tolerable	Tolerable
Minor injury	3	3	Tolerable	Tolerable	Tolerable
No injury	Tolerable	Tolerable	Tolerable	Tolerable	Tolerable

4. THIRD STAGE - CONSIDERATION OF RISKS WITH RATING 3 OR HIGHER

Situation number	Existing controls	Existing info	Existing Training	Best Practice	Relevant Standard	OK	Not OK	Comments
1. Electric shock	Insulation of all live elements. Suitable connectors.	Some issue with how the mains cable is wired into the power supply	Not known	Cover up exposed terminal block	Electricity at work regs 1989. US standards.	yes		Consider covering up terminal block. Follow good practice when installing at LASTI.
6. Eye damage from staring at heated silica	None					yes		Avoid staring at the heated silica - if necessary use local CCD camera. If that does not work then a spectral analysis of the light would be required.

5. STAGE 4 - ACTION PLAN

Injurious situation	Action required
1. Electric shock	Standard good practice - ensure this is followed through in LASTI installation.
5. Eye damage - exposure to laser	Enclose beams as far as practicable. Include reflected beams from silica (or where the laser the misses the silica). Consider a roof on the enclosure. Warning signs on the enclosure.

	<p>Training of all operators.</p> <p>Pay attention to maintenance.</p> <p>Ensure that all users at LASTI are trained including the hazard of invisible radiation damaging eyes. Ensure LASTI staff have been trained in electricity safety.</p> <p>Ensure that all Glasgow staff who will commission the facility, and RAL staff who may become involved, are properly trained for laser and electricity safety. This also applies to LASTI staff.</p> <p>Consider fitting an audible alarm to sound before the laser comes on.</p>
6. Eye damage from staring at heated silica	Warn staff not to stare at the heated silica.

Reference: "Ocular hazards of light" DH Sliney, in International Lighting in Controlled Environments Workshop T.W.Tibbitts (editor) 1994 NASA-CP-95-3309