RSPhys Risk Assessment: RA_080229 – Direct Laser Writer MLA150

- This form is used when a documented risk assessment is required in accordance with Appendix A of WHSMS Handbook Chapter 3.1.
- Original risk assessments must be provided in a convenient location accessible by all people affected by the risk assessment.
- Static risk assessments must be forwarded to local WHS Manager for inclusion in the School Static Risk Assessment Register.

Static Risk Assessment No.	Assessment Date	Reviewed by Date	Version	Top Residual Risk
RA_080229	09 Sep 2024	09 Sep 2027	1.0	Low

Name of the activity	The Heidelberg MLA 150 is a high-speed, direct laser write tool for pattern generation on light-sensitive resist. Hazards Assessed: Plant and Equipment, Electrical, Laser Radiation, Magnetic Fields, Ergonomics and Manual Tasks, After Hours					
Description of the activity	The MLA150 is used to transfer pattern onto photosensitive coated waver substrates, using a laser beam.					
School/ Department	Research School of Physics, EME		**Location**	Building: 160, Room: P3.51B		
Risk Assessment Team Have you completed ANU WHS Risk Management Training? ☒ Yes ☐ No **IF NO, DO NOT PROCEED**	**Supervisor**	Horst Punzmann	**Email**	horst.punzmann@anu.edu.au	**Ph**	+612 612 50001
	Name	Gayatri Vaidya	**Email**	gayatri.vaidya@anu.edu.au	**Ph**	+612 612 59638
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	Name		**Email**		**Ph**	
	Name		**Email**		**Ph**	
Who is affected by this RA?	☒ All people at the location ☐ A group of people (list right) ☐ A single person (list right)	**People consulted on this RA.** (All persons affected, or their representatives need to be consulted)	Nayin Wang, Li Li, Oliver Cheong Lem			
WHS Legal and Other Requirements	Work Health and Safety Act 2011 (Cth) Work Health and Safety Regulations 2011 (Cth) ANU WHSMS Handbook Chapter 3.1: Hazard Management ANU WHSMS Handbook Chapter 3.7: Radiation Safety ANU Procedure: Radiation Safety (ANUP_000682)					
Type of RA	☒	**Static RA (long term, > 6 months)**	Send a copy to WHS Manager and keep original locally near the activity/location, accessible to all people affected.			
	☐	**Dynamic RA (short term < 6 months)**	Keep the original locally (electronically or physically) near the activity/location, accessible to all people affected.			

Risk Assessment Instruction

1. List the hazards of the activity in the 'Hazards' column of the RA Form. Include information on when and where the hazard is present during the activity.
2. Estimate inherent risk of the hazard (without any controls in place) using the Likelihood against Consequences definitions described in Table 1 and Table 2 and the ANU WHS Risk Matrix (Table 3). List them in 'Inherent Risk' column of the RA Form for each hazard.
3. Develop control measures in accordance with the Hierarchy of Control Principle (Table 4) and list them in 'Control' column of the RA Form.
4. Estimate the residual risk of the hazard after implementing all controls. Remember that engineering, administrative and PPE controls only reduce the likelihood of an event occurring, not the consequences.
5. Identify any controls that are not in place as corrective actions and implement them before undertaking the activity.
6. Obtain approval from relevant people as identified.
7. Identify if this is a static risk assessment (> 6 months) or dynamic risk assessment (< 6 months).
8. Send a copy of the static risk assessments to WHS Managers– Keep on file for 7 years.
9. Keep originals of risk assessments in close vicinity of the activity. Dynamic risk assessments can be destroyed 1 year after the activity ceases.
10. Review the static risk assessments and associated safe work procedures in accordance with Section 3.1.2.6: Step 4 of Chapter 3.1 requirements.

Risk Assessment

Hazards Also list where and when can the hazards present?	Inherent Risk			Control Measures When designing controls, follow the Hierarchy of Controls Principle, assigning the most effective controls before less effective controls (see Table 4). List the control category and the controls for each hazard below. For any controls that are not in place, fill in the Actions table on the next page.	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
Electrical ➢ Electrical Shock (both minor and major) ➢ Electrocution	Possible	Catastrophic	High	**Isolation** • Power supply cables routed under floor and closed duct • The electronics rack is locked, and standard users are not able to access any modules inside. **Engineering** • RCDs installed on laboratory circuits • Emergency Stop/ EPO (Emergency Power Off) installed on the tool • Emergency Stop/ EPO (Emergency Power Off) installed in the room **Administration** • Tier 3 Induction (160_L3_P3.51_2.50_CR_SF Induction) • Tier 3 Training: IM_160-P3.51H_MLA150 • Test and tag of all electrical plugged into electrical sockets. • Electrical hazard label is visible on rear door of the electronics rack.	Rare	Moderate	Low

Risk Assessment							
Hazards Also list where and when can the hazards present?	**Inherent Risk**			**Control Measures** When designing controls, follow the Hierarchy of Controls Principle, assigning the most effective controls before less effective controls (see Table 4). List the control category and the controls for each hazard below. For any controls that are not in place, fill in the Actions table on the next page.	**Residual Risk**		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
Laser Radiation ➢ Exposure to laser radiation (class 4: 375 nm < 3 W, 405 nm < 4 W class 2: 632 nm < 0.6 mW)	Rare	Major	Hight	**Engineering** • All moving parts, lasers and their associated optics are enclosed within a climate control 'flow box'. During operation, opening the flow box window will immediately stop any exposure or measurement process. • When the loading window and all safety covers are closed, the system complies with the safety standard IEC 60825-1:2014 for a laser class 1 product. • The class 4 write lasers (375, 405 nm) are only energized during the design exposure. They are not accessible by the operator, fully enclosed, fibre coupled between modules and the front-loading window is interlocked. Opening the loading window at any time stops the write lasers. During exposures, the loading window cannot be opened. • The class 2 position measurement interferometer laser (632 nm) remains on in standby mode when equipment is energized. Laser radiation class 2 is accessible when the loading window is open. **Administration** • Tier 3 Induction (160_L3_P3.51 Induction) • Tier 3 Training: IM_160-P3.51H_MLA150 • Laser radiation signage on equipment, 2D sample holder table and interferometer components. **PPE** • Safety goggles for 632nm, on site, according to the manufacturer, laser protection eyewear is usually not required. However, laser protection eyewear will be prepared for users who want additional protection.	Rare	Minor	Low

Risk Assessment							
Hazards Also list where and when can the hazards present?	**Inherent Risk**			**Control Measures** When designing controls, follow the Hierarchy of Controls Principle, assigning the most effective controls before less effective controls (see Table 4). List the control category and the controls for each hazard below. For any controls that are not in place, fill in the Actions table on the next page.	**Residual Risk**		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
Strong Magnetic Fields ➢ Exposure to strong DC magnetic fields may affect functioning of medical implants (e.g. cardiac pacemakers, implanted defibrillators, neurostimulators, or insulin pumps, etc.) ➢ Magnetic fields will attract metallic objects in close proximity.	Rare	Major	Medium	**Engineering** • High-power magnetic field area is localized around the linear drive section of the sample holder table. **Administration** • Tier 3 Induction (160_L3_P3.51_2.50_CR_SF Induction) • Tier 3 Training: IM_160-P3.51H_MLA150 • Signage (sticker) of high-magnetic field location within equipment to alert operator.	Rare	Minor	Low
Plant and Equipment ➢ Entanglement or trapping ➢ Cables running between main unit and electronic rack ➢ Mild pinched hazard to fingers (front window closing, movement of internal 2D sample holder stage)	Unlikely	Major	High	**Isolation** • All electrical cables, compressed air line and chiller cooling lines are routed below the floor or in closed duct to avoid trip hazards • Equipment is fully enclosed by a smooth-wall climate-control chamber **Engineering** • Ethernet data cable is covered with cable cover to avoid trip hazard • Front window is pneumatically operated and set to very slow motion with minimal force required to lift window and to limit the pinch force • Moving parts of 2D sample holder stage movement is automatically stopped via an interlock if the window is opened. **Administration** • Tier 3 Induction (160_L3_P3.51_2.50_CR_SF Induction) • Tier 2 Training: ANU Risk Management Training (WHSO03, Pulse) • Instruction Manual (IM_160-P3.51H_MLA150) • Signage of pinch hazard on 2D sample holder table	Rare	Moderate	Low

Risk Assessment

Hazards Also list where and when can the hazards present?	Inherent Risk			Control Measures When designing controls, follow the Hierarchy of Controls Principle, assigning the most effective controls before less effective controls (see Table 4). List the control category and the controls for each hazard below. For any controls that are not in place, fill in the Actions table on the next page.	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
Ergonomics and Manual Tasks ➢ Repetitive movements ➢ Long duration of the same posture (e.g., sitting)	Possible	Moderate	High	**Engineering** • Ergonomically designed chairs available **Administration** • Tier 2 Training, Setting up your workstation (WHSO20, Pulse) • Rest breaks every 20 mins	Rare	Moderate	Low

Actions

The activity must not be commenced until all controls are in place.
List below which controls are currently not in place, who will implement them and by when. Add additional rows as needed.

List of Controls not in place	Who is to implement them?	Timeframe	Date Completed

If the level of residual risk is assessed as high or extreme,

1. Stop the activity immediately; AND
2. Tag out the plant/equipment; and/or
3. Secure any chemical; and
4. Implement, or seek advice from WHS Officer or Subject Matter Experts to implement, additional controls to reduce the residual risk further to medium [Supervisor signature required];
5. If the above is not possible, seek approval from relevant authority (High – School/Division Director/College Dean; Extreme – COO). NOTE: Approval will only be granted in exceptional circumstances after consultation with Associate Director, WEG and/or a Subject Matter Expert. See Chapter 3.1 for details.

Approval required

Worker conducted RA			Student conducted RA		
Residual Risk Level	**Authority required**	**Signature and date**	**Residual Risk Level**	**Authority required**	**Signature and date**
Low	**Author of RA**	*K.D.Vora* 10/09/2024	**Low**	**Supervisor**	
Medium	**Supervisor**		**Medium**	**Supervisor**	
High	**School Director**		**High**	**School Director**	
Extreme	**COO**		**Extreme**	**COO**	

Table 1. Likelihood Table

Ranking	Description	Probability or frequency of event happening
Almost certain	The hazard is expected to lead to an event in most circumstances at the University	A daily to monthly occurrence
Likely	The hazard could lead to an event in most circumstances at the University	Between monthly to yearly occurrence
Possible	The hazard has led to an event at some time at the University	Occurs once between 1 to 5 years
Unlikely	The hazard could lead to an event at some time	Occurs once between 5 to 20 years
Rare	The hazard may lead to an event in exceptional circumstances	Occurs once between 20+ years

Table 2. Consequences Table

Ranking	Injury, Illness or Disease	Plant, Equipment, and materials	Environment
Catastrophic	Fatality / fatalities or permanent disability. Permanently unable to work	Destroyed or cannot be reused	Long term permanent effect to ecosystems. Significant intervention required to remediate
Major	Requiring extensive medical treatment such as hospitalisation as in patient and possibly a Notifiable Incident LTI >1 week	Damage requiring repairs/rebuild and possible recertification prior to reuse, lost use for one or more days	Notification to environmental agency, ecosystem will need time to recover, intervention required to remediate
Moderate	Minor medical treatment injury, such as treated by a health professional, hospital outpatient, no potential to be a Notifiable Incident LTI < 1 week and can return to normal duties	Damage requiring a repair/service by a trade/technician within the day	Contamination event that does not impact on ecosystem. Short impact does not need intervention
Minor	Injury needing significant first aid treatment and can return to work within shift	Equipment able to be reset or gotten back into operation by the operator	Minor contained contamination ceasing when the short event is over, can remediate (e.g., spill kit)
Insignificant	Report only, no injury OR minor first aid (e.g., Band-Aid); short-term discomfort	Report only, no damage	Report only, no contamination

Table 3. ANU WHS Risk Matrix

	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium (10)	High (14)	Extreme (21)	Extreme (22)	Extreme (25)
Likely	Medium (7)	High (13)	High (16)	Extreme (20)	Extreme (24)
Possible	Low (4)	Medium (9)	High (15)	High (18)	Extreme (23)
Unlikely	Low (2)	Medium (6)	Medium (8)	High (17)	High (19)
Rare	Low (1)	Low (3)	Low (5)	Medium (11)	Medium (12)

Table 4. Hierarchy of Controls

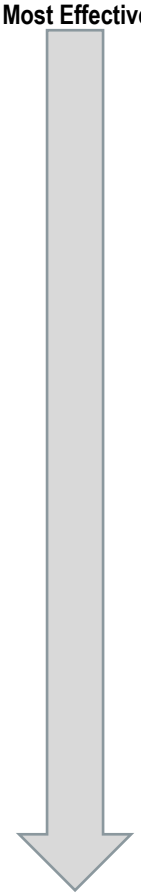
Level	Examples	Effectiveness
Elimination	• Remove the hazards completely • Cease the activity • Dispose of unwanted hazardous chemicals or plant etc	**Most Effective**  **Least Effective**
Substitution	• Use less hazardous chemicals • Use safer plant equipment • Use handset instead of telephone • Move smaller weight loads instead of large weight	
Isolation	• Physical separation from the hazard by distance or complete shielding • Install guard rails around edges and holes to floors • Move workers to a new room away from hazardous noise	
Engineering Control	• Use ventilation system • Use fume cupboard when working with hazardous chemicals • Install guarding around rotating and crushing parts • Use trolley or hoist to lift heavy loads • Use duress alarm system while doing home interview or offsite field work	
Administrative Control	• Use Safe Work Procedures **[See section 3.1.3.1]** or instructions • Induction and WHS information • Training **[See Handbook Chapter 3.2]** • Contingency Planning and Testing **[See section 3.1.3.2]** • Permit to Work system **[See section 3.1.3.3]** • Signage	
Personal Protective Equipment (PPE)	• Lab coat • Safety glasses/face shield • Gloves/cryogenic gloves • Respirators/Masks • Personal hearing protectors	

Table 5. Risk Assessment and SWP review timeframe

Use this Table to determine review timeframe and frequency for the risk assessment and any safe work procedures.

Residual Risk	Review Frequency		What to do during the review.
Extreme	6 months	And/or • After an incident where deficiencies in identifying or controlling hazards have been observed • When changes to the activity need to occur • When significant changes (e.g., renovation) to the workplace occurs • When HSRs request a review	**Stop work.** Review the control measures and introduce additional control measures to reduce the residual risk to **Medium** as a maximum.
High	1 Year		
Medium	2 Years		Review the control measures.
Low	3 Years		