RSPhys Risk Assessment: RA_044594_D5 – Thermal Evaporator Operation

- 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_044594_D5 Thermal Evaporator Operation	26/5/2026	26/5/2029	1.0	Low

Name of the activity	**Thermal Evaporator (TE) for thin films deposition** Hazards Assessed: Electrical, Chemical, Plant and Equipment, Ergonomics, and Manual tasks					
Description of the activity	Deposition thin films of non-toxic metals and oxides—such as gold (Au), aluminum (Al), copper (Cu), silver (Ag), silicon monoxide (SiO), and magnesium fluoride (MgF_2)—onto substrate surfaces for microfabrication, optical coating, and materials research applications.					
School/ Department	Research School of Physics, Department		**Location**	Building 160, Level 3, Room P3.51		
Risk Assessment Team Have you completed ANU WHS Risk Management Training? ☒ Yes ☐ No **IF NO, DO NOT PROCEED**	**Person responsible for equipment**	Li Li	**Email**	lily.li@anu.edu.au	**Ph**	02 612 50380
	Name	Kaushal Vora	**Email**	Kaushal.Vora@anu.edu.au	**Ph**	0433190549
	Person responsible for room	Horst Punzmann	**Email**	Horst.punzmann@anu.edu.au	**Ph**	02 6125 0001
	Name	Rick Walsh	**Email**	Rick.walsh@anu.edu.au	**Ph**	02 6125 0105
	Name	Huma Latif	**Email**	Huma.latif@anu.edu.au	**Ph**	0406681584
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)		Horst Punzmann; Kaushal Vora; Naiyin Wang; Olivier Lee Cheong Lem;		
WHS Legal and Other Requirements	Work Health and Safety Act 2011 (Cth) Work Health and Safety Regulations 2011 (Cth) ANU Chemical Management Handbook			ANU WHS Risk Management (Chapter 3.1) Australian Radiation Protection and Nuclear safety ACT 1998 Australian Radiation Protection and Nuclear Safety Regulations		
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) ➢ Electrical Burns (both minor and major) ➢ Electrocution ➢ Overheating and fire	Possible	Major	High	**Isolation** • Power supply cables routed under floor **Engineering** • Residual Current Devices (RCDs) installed on all electrical circuits in the area. • Emergency Stop installed in the room **Administration** • Testing and Tagging of all electrical equipment. • Signage indicating location and type of hazard	Rare	Moderate	Low
Chemical – compressed gas ➢ N2 Inert gases leak risks asphyxiation.	Unlikely	Moderate	Medium	**Engineering** • Operational lab ventilation system • Oxygen depletion monitoring system installed in lab. • Gases are fixed plumbed to equipment via certified gas installation • Gas flow rate is controlled by equipment mass flow controller. **Administration** • Operate the sputter only after appropriate training	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
Chemical - liquid ➢ Cleaning solvents, like Isopropanol, Acetone and Ethanol, are flammable and may cause skin or eye irritation	Possible	Moderate	High	**Substitution** • Only small volumes of flammable liquids (< 1 L) to be stored in the lab space adjacent to the machine. **Administration** • Tier 2 Training: Hazardous Substances (WHSO11, Pulse) • First Aid Equipment located in gowning area. • Chemical Register up to date (Chemwatch) • Chemical storage containers/vessels to be appropriately labelled. • Dispose of waste materials, contaminated wipes, and broken substrates according to laboratory chemical waste procedures **PPE** • Enclosed shoes, clean room suit, gloves, safety glasses	Rare	Moderate	Low
Chemical – aerosols / dust particles ➢ Fine metal or oxide particles may cause respiratory or eye irritation if inhaled or contacted directly ➢ Some evaporated materials may generate dust or fumes during loading/unloading ➢ Broken substrates or crucibles may create sharp fragments.	Unlikely	Minor	Medium	**Engineering** • Operate the thermal evaporator only after appropriate training • Competency check • Operational lab ventilation system • Oxygen level monitoring system installed in lab. • Handle source materials carefully to minimize dust generation • Safety Showers / Eye Wash stations available in the area **Administration** • Tier 2 Training: Hazardous Substances (WHSO11, Pulse) • First Aid Equipment located in gowning area. **PPE** • Enclosed shoes, cleanroom suit, gloves, P2-type face mask • Safety glasses	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
Plant and Equipment ➢ Vacuum Chamber risk of implosion ➢ Viewing window damage and subsequent cuts from broken glass or substrates	Unlikely	Major	Medium	**Engineering** • Vacuum chamber and window design to withstand operational requirements. • Instruction Manual of each equipment placed next to equipment/area. • Emergency Stop	Rare	Moderate	Low
Plant and Equipment ➢ Burns from heated sources, crucibles, or recently deposited samples	Possible	Moderate	High	**Administration** • Operate equipment only after completing user training • First Aid Equipment located in gowning area. • Ensure chamber is fully vented before opening • Allow sufficient cooling time before handling sources or samples. • Inspect chamber glass and vacuum components regularly for damage • Handle hot samples or internal components only with appropriate tools (e.g. plier, tweezer) **PPE** • Nitrile gloves for <200C operations, and Tweezer/Tongs for higher temperature handling	Unlikely	Insignificant	Low
Plant and Equipment ➢ Entanglement and trapping parts ➢ Cables running between main unit and various electronic racks and vice versa .	Possible	Moderate	High	**Isolation** • All surface lying cables are routed below the floor. **Engineering** • Emergency Stops available on the tool as well as in lab	Unlikely	Insignificant	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 tasks ➢ Long duration of the same posture (e.g. standing, sitting)	Unlikely	Minor	Medium	**Engineering** • Ergonomically designed chairs available **Administration** • Tier 2 Training, Setting up your workstation (WHSO29, Pulse) • Tier 2 Training, Manual Tasks (WHSO22, Pulse) • Regular movement breaks	Rare	Minor	Low
Plant and Equipment Maintenance of Chamber			High	**See** RA_04494 – D5 Thermal Evaporator Maintenance and SWP_054382 – D5 Thermal Evaporator maintenance			Low
Plant and Equipment Broken substrates or crucibles may create sharp fragments.	Possible	Minor	Medium	**Elimination** • No controls are required except being mindful of sample **Administration** • Provide appropriate sharps container for waste pipets, needles, scalpel blades, glass slides etc. • In case of broken glass, appropriate cleaning tools (broom, shovel, vacuum cleaner) are available for clean-up and disposal. • First Aid kit in gowning area. **PPE** • Enclosed shoes, clean room suit, gloves, safety glasses	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	**Person Responsible for Equipment**	Li Li 29/05/2026	**Low**	**Supervisor**	
Medium	**Person responsible for room**	Horst Punzmann	**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**
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	**Least Effective**

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 month	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 occur • 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		