

## RSPHys Risk Assessment: RA\_058B\_L1\_W2.04\_EME – EME Lab in Weigold Building

- 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_058B_L1_W2.04_EME		02.07.2024	02.07.2026	3.0	Medium
<b>Name of the activity</b>	ANFF Laboratory Work – Nanofabrication for users and process development. EME Users – XRD and Hall Measurements Hazards Assessed: Electrical, Chemical, Radiation, Plant/Equipment, Ergonomics and manual Tasks, Public Safety, After Hours and COVID 19.				
<b>Description of the activity</b>	Thin film deposition of dielectrics such Al <sub>2</sub> O <sub>3</sub> , ZnO, TiO <sub>2</sub> etc. XRD analysis for checking film properties, Hall Effect Measurements to determine carrier concentration and mobility				
<b>School/ Department</b>	Research School of Physics, EME	<b>Location</b>	Building 58B, Weigold, level 1, Rm W2.04		
<b>Risk Assessment Team</b> Have you completed ANU WHS Risk Management Training? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <b>IF NO, DO NOT PROCEED</b>	<b>Person responsible for lab</b>	Hoe Tan	<b>Email</b>	Hoe.Tan@anu.edu.au	<b>Ph</b> 50356
	<b>Name</b>	Kaushal Vora	<b>Email</b>	Kaushal.Vora@anu.edu.au	<b>Ph</b> 0433190549
	<b>Name</b>	Rick Walsh	<b>Email</b>	Rick.Walsh@anu.edu.au	<b>Ph</b> 50105
	<b>Name</b>	Huma Latif	<b>Email</b>	Huma.latif@anu.edu.au	<b>Ph</b> 0406681584
	<b>Person responsible for area</b>	Lan Fu	<b>Email</b>	Lan.fu@anu.edu.au	<b>Ph</b> 54600
<b>Who is affected by this RA?</b>	<input checked="" type="checkbox"/> All people at the location <input type="checkbox"/> A group of people (list right) <input type="checkbox"/> A single person (list right)	<b>People consulted on this RA</b> (All persons affected, or their representatives need to be consulted)	Gayatri Vaidya, Li Li, Olivier Lee Cheong Lem, Naiyin Wang, Hoe Tan, Horst Punzmann, Lan Fu		
<b>WHS Legal and Other Requirements</b>	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		
<b>Type of RA</b>	<input checked="" type="checkbox"/>	<b>Static RA (long term, &gt; 6 months)</b>	Send a copy to WHS Manager and keep original locally near the activity/location, accessible to all people affected.		

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Approved by: Person responsible for Area – Lan Fu

Release Date: 02.07.2024

This process is uncontrolled after printing.

Review Date: 02.07.2026

Version: 3.0

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	<input type="checkbox"/>	<b>Dynamic RA (short term &lt; 6 months)</b>	Keep the original locally (electronically or physically) near the activity/location, accessible to all people affected.

### Risk Assessment Instruction

- 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.
- 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.
- Develop control measures in accordance with the Hierarchy of Control Principle (Table 4) and list them in 'Control' column of the RA Form.
- 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.
- Identify any controls that are not in place as corrective actions and implement them before undertaking the activity.
- Obtain approval from relevant people as identified.
- Identify if this is a static risk assessment (> 6 months) or dynamic risk assessment (< 6 months).
- Send a copy of the static risk assessments to WHS Managers– Keep on file for 7 years.
- Keep originals of risk assessments in close vicinity of the activity. Dynamic risk assessments can be destroyed 1 year after the activity ceases.
- 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). <i>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.</i>	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
<b>Electrical</b> <ul style="list-style-type: none"> <li>➤ Electrical Shock (both minor and major)</li> <li>➤ Electrical Burns (both minor and major)</li> <li>➤ Electrocutation</li> <li>➤ Overheating and fire</li> </ul>	Possible	Major	High	<b>Engineering</b> <ul style="list-style-type: none"> <li>• Room access limited inducted workers through Cardex/Salto.</li> <li>• Testing and Tagging of all electrical equipment.</li> <li>• Residual Current Devices (RCDs) installed on all electrical circuits in the area.</li> <li>• Emergency Stop.</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>• Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> <li>• Signage indicating type of hazards contained within.</li> </ul>	Rare	Major	Medium

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). <i>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.</i>	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
<b>Chemical</b> ➤ Flammable Liquid Tri-methyl Aluminium, Diethyl Zinc ➤ Corrosive Liquid Titanium Tetrachloride ➤ Toxic and health hazard (Metal Organic Sources) Titanium Tetrachloride, Bis(diethylamino)silane, Tetrakis(ethylmethylamino)Hafnium, Tris(ethylmethylamino)(tert-butylamido)tantalum	Possible	Major	High	<b>Engineering</b> <ul style="list-style-type: none"> <li>Chemicals stored in shipping drum outside in pump shed.</li> <li>Fume Cupboards to be used when working with fuming substances.</li> <li>Lab Ventilation System</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> <li>Signage describing hazards in the area.</li> <li>Equipment use and lab entry only allowed after thorough training.</li> <li>Tier 2 Training: ANU WHS Risk Management Training (WHSO03, Pulse)</li> <li>Tier 2 Training: Hazardous Substances (WHSO11, Pulse)</li> <li>Tier 2 Training: Flammable Substances (WHSO16, Pulse)</li> <li>Tier 2 Training: Toxic Materials (WHSO32, Pulse)</li> <li>Tier 2 Training: Corrosive Safety (WHSO14, Pulse)</li> <li>Only ANFF trained staff can replace the sources.</li> <li>Safe Work Procedure: SWP_058B_L1_W2.04_Changing_source</li> <li>Tier 3 Training: SWP_058B_L1_W2.04_Changing_source</li> <li>Minimise Chemicals quantities store wherever reasonable.</li> <li>Limit flammable liquid quantity to Australian Standard (6.8 L in 34.1 m<sup>2</sup>)</li> <li>Limit corrosives quantity to Australian Standard (13.6 L/kg in 34.1 m<sup>2</sup>)</li> <li>Chemical Register (Chemwatch)</li> <li>Chemical storage containers to be labelled to GHS Requirements.</li> <li>Pipes/vessels/containers to be identified and correctly labelled.</li> </ul> <b>PPE</b> <ul style="list-style-type: none"> <li>Dust coats and suits only while changing metal-organic sources.</li> <li>Full face mask only while changing metal-organic sources.</li> <li>Gloves</li> <li>Enclosed shoes</li> </ul>	Rare	Major	Medium

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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). <i>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.</i>	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
<b>Plant and Equipment</b> ➤ Hotplate	Possible	Moderate	High	<b>Engineering</b> <ul style="list-style-type: none"> <li>Room access limited inducted workers through Cardex/Salto.</li> <li>Emergency Stops</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Tier 2 Training: ANU WHS Risk Management Training (WHSO03, Pulse)</li> <li>Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> <li>Signage “hot surface” indicating type of hazard.</li> </ul> <b>PPE</b> <ul style="list-style-type: none"> <li>Enclosed Shoes</li> <li>Gloves</li> </ul>	Rare	Moderate	Low
<b>Plant and Equipment</b> ➤ Vacuum Chamber	Possible	Moderate	High	<b>Engineering</b> <ul style="list-style-type: none"> <li>Room access limited inducted workers through Cardex/Salto.</li> <li>Emergency Stops</li> <li>Vacuum chamber design to withstand operational requirement.</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Tier 2 Training: ANU WHS Risk Management Training (WHSO03, Pulse)</li> <li>Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> </ul>	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). <i>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.</i>	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
<b>Radiation</b> ➤ Exposure to EM Radiations (X-rays and magnetic field)	Unlikely	Moderate	Medium	<b>Isolation</b> <ul style="list-style-type: none"> <li>No physical interaction with X-rays or magnetic field</li> <li>Shielding of radiation source</li> </ul> <b>Engineering</b> <ul style="list-style-type: none"> <li>Room access limited inducted workers through Cardex/Salto.</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> <li>Tier 2 Training: ANU WHS Risk Management Training (WHSO03, Pulse)</li> <li>Tier 2 Training: Ionising Radiation Safety-Machines (WHSO18, Pulse) for XRD users.</li> <li>Appropriate signs affixed to lab door indicating hazards contained within.</li> <li>Radiation Dosimeter Badges.</li> <li>X-ray leakage detection on regular schedule.</li> </ul>	Rare	Moderate	Low
<b>Ergonomics and Manual Tasks</b> ➤ Repetitive tasks ➤ Long duration of the same posture (e.g. standing, sitting)	Unlikely	Minor	Medium	<b>Administration</b> <ul style="list-style-type: none"> <li>Tier 3 Induction (056_L1_058B_L4_ANFF_Induction)</li> <li>Tier 2 Training, Setting up your workstation (WHSC13, Pulse)</li> <li>Tier 2 Training, Manual Tasks (WHSO22, Pulse)</li> <li>Regular movement breaks</li> </ul>	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). <i>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.</i>	Residual Risk		
	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
<b>After hours working</b> ➤ Lack of capacity to emergencies	Rare	Major	Medium	<b>Elimination</b> <ul style="list-style-type: none"> <li>Any research/experiments/procedures with a static or dynamic risk assessment and a residual risk identified as medium or higher is not permitted after hours.</li> <li>Undergrad students and visitors are not permitted in labs after hours.</li> <li>Limited access hours to the building</li> <li>No chemical work allowed.</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Safe Work Procedure: After Hours Work (SWP_058B_L1_W2.04_EME_After-hours)</li> <li>Approval from Supervisor and WHS Office</li> <li>Either               <ul style="list-style-type: none"> <li>Minimum 2 people to be present for after-hours work, or</li> <li>Check in system with another person to be established (such and ANU OK Work Alone System).</li> </ul> </li> </ul>	Rare	Moderate	Low
<b>Public Safety</b> Hazard present during Lab Tours	Unlikely	Minor	Medium	<b>Engineering</b> <ul style="list-style-type: none"> <li>No visitor permitted unless with person responsible for lab or person responsible for area.</li> </ul> <b>Administration</b> <ul style="list-style-type: none"> <li>Visitors Escorted</li> <li>Exclusion zone</li> </ul>	Rare	Minor	Low

Risk Assessment							
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	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating
COVID 19 Exposure	Likely	Catastrophic	Extreme	<p><b>Elimination</b></p> <ul style="list-style-type: none"> <li>People with COVID symptoms are to get tested in line with ACT or ANU requirements whichever is stricter.</li> <li>Workers suspecting, they may be infected are to get tested in line with ACT or ANU requirements whichever is stricter.</li> </ul> <p><b>Isolation</b></p> <ul style="list-style-type: none"> <li>Maintain physical distancing in line with current ACT requirements.</li> </ul> <p><b>Engineering</b></p> <ul style="list-style-type: none"> <li>Separation of workstations to adhere to physical distancing conditions.</li> <li>Automatic hand sanitiser stations in the foyers of all buildings.</li> <li>Handwashing facilities in building bathrooms.</li> </ul> <p><b>Administration</b></p> <ul style="list-style-type: none"> <li>Follow University Guidelines requirements.</li> <li>Maintain hygiene practices on entering and leaving buildings.</li> <li>ANU procedures for disinfection of workspace where confirm cases have been on campus.</li> </ul>	Unlikely	Moderate	Medium

Actions			
<b>The activity must not be commenced until all controls are in place.</b>			
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/Person responsible for lab	Hoe Tan  2 July 2024	Low	Supervisor	
Medium	Person responsible for area	Lan Fu  2 July 2024	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	<ul style="list-style-type: none"> <li>Remove the hazards completely</li> <li>Cease the activity</li> <li>Dispose of unwanted hazardous chemicals or plant etc</li> </ul>	<p style="text-align: center;">Most Effective</p>  <p style="text-align: center;">Least Effective</p>
Substitution	<ul style="list-style-type: none"> <li>Use less hazardous chemicals</li> <li>Use safer plant equipment</li> <li>Use handset instead of telephone</li> <li>Move smaller weight loads instead of large weight</li> </ul>	
Isolation	<ul style="list-style-type: none"> <li>Physical separation from the hazard by distance or complete shielding</li> <li>Install guard rails around edges and holes to floors</li> <li>Move workers to a new room away from hazardous noise</li> </ul>	
Engineering Control	<ul style="list-style-type: none"> <li>Use ventilation system</li> <li>Use fume cupboard when working with hazardous chemicals</li> <li>Install guarding around rotating and crushing parts</li> <li>Use trolley or hoist to lift heavy loads</li> <li>Use duress alarm system while doing home interview or offsite field work</li> </ul>	
Administrative Control	<ul style="list-style-type: none"> <li>Use Safe Work Procedures [<b>See section 3.1.3.1</b>] or instructions</li> <li>Induction and WHS information</li> <li>Training [<b>See Handbook Chapter 3.2</b>]</li> <li>Contingency Planning and Testing [<b>See section 3.1.3.2</b>]</li> <li>Permit to Work system [<b>See section 3.1.3.3</b>]</li> <li>Signage</li> </ul>	
Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> <li>Lab coat</li> <li>Safety glasses/face shield</li> <li>Gloves/cryogenic gloves</li> <li>Respirators/Masks</li> <li>Personal hearing protectors</li> </ul>	

**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 <ul style="list-style-type: none"> <li>After an incident where deficiencies in identifying or controlling hazards have been observed</li> <li>When changes to the activity need to occur</li> <li>When significant changes (e.g., renovation) to the workplace occurs</li> <li>When HSRs request a review</li> </ul>	<b>Stop work.</b> Review the control measures and introduce additional control measures to reduce the residual risk to <b>Medium</b> as a maximum.
High	1 Year		
Medium	2 Years		Review the control measures.
Low	3 Years		