COVERSHEET

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Faculty of Engineering, Computing and Mathematics

Assignment, Report & Laboratory Coversheet for Individual & Group Assignment

SUBMITTING STUDENT		
SURNAME Joppich	**GIVEN NAMES** Serena	**STUDENT NUMBER** 22721338
UNIT NAME Electrical and Electronic Design Project 2		**UNIT CODE** ELEC5552
TITLE/TOPIC OF ASSIGNMENT Safety Analysis		**NAME OF LECTURER/TUTOR** Dilusha Silva
DATE/TIME DUE Friday 11/08/23 at 5pm	**DATE/TIME SUBMITTED** Friday 11/08/23	

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By signing this document, I further assert that the length (word count) of my dissertation is within the maximum allowed length governed by the project unit I am enrolled in. Penalties, as outlined on this website, will be applied for over length dissertations.	

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Unless other arrangements have been made it will be assumed that all group members have contributed equally to group assignments/laboratory reports

DECLARATION

I/We are aware of the University's policy on academic conduct (see over) and I/We declare that this assignment/project is my own/my group's work entirely and that suitable acknowledgement has been made for any sources of information used in preparing it. I/We have retained a hard copy for my/our own records.

SIGN: Serena Joppich	**SIGN:** Seb
SIGN:	**SIGN:** Kelly
SIGN:	**SIGN:**
SIGN:	**SIGN:**

NOTE: No assignment will be accepted without the declaration above being signed and dated

SEE OVER FOR INFORMATION ON REFERENCING & PLAGIARISM

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REFERENCING

Information on appropriate referencing (citation) styles can be found under “Manage Your References” at: www.is.uwa.edu.au/information-resources/guides

Note that:
Each drawing, picture, photograph, quotation or block of text copied from a source must be acknowledged individually. This can be done using a referencing style (see above) or by including the full reference in the text or in a footnote. It is not sufficient to simply list sources in a bibliography at the end without including the individual references to the sources in the main text.

The same rules apply to materials taken from the web. The authorship and source must be traceable.
The boundaries between your original work and copied work must be clear. Use quotes, indentation and/or font style to make the distinction clear.

PLAGIARISM

“The appropriation or imitation of another’s ideas and manner of expressing them to be passed off as one’s own”.

(The Macquarie Dictionary, 1981)

Synonyms:

Piracy, copying, forgery, lifting, expropriation, appropriation

“Plagiarism is the unattributed use of someone else's words, creations, ideas and arguments as one's own. Within university policies it is usually further extended to include the use of 'too close' or extensive paraphrasing. For example, cutting and pasting text from the Web without attributing it to the author is plagiarism and therefore dealt with as cheating. Similarly, substituting a few words of copied text without changing the structure of the piece also constitutes plagiarism. There is a range of penalties for academic misconduct, depending on the seriousness of the cheating, from loss of credit to expulsion from the University.” (UWA Handbooks 2013)

The University of Western Australia treats plagiarism as serious academic misconduct. The University can impose severe penalties, including expulsion. Refer to Statue 17 Student Discipline and the associated Regulations for Student Conduct and Discipline at www.uwa.edu.au/current/information/discipline

See also

Faculty Policy on Plagiarism:

www.ecm.uwa.edu.au/students/exams/dishonesty

UWA’s policy statement on Ethical Scholarship, Academic Literacy and Academic Misconduct: www.handbooks.uwa.edu.au/postgraduate/policies

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METHOD STATEMENT

LOCATION:	Private UWA Workshop (Maker's Lab), Lycopodium Lab (MILC building room 1.51)
TASK/ACTIVITY:	Construction of MEMS testing power supply

PREPARED BY	**PERMISSION FOR TASK/ACTIVITY TO PROCEED**
Name: Team 14	**Name:** Dilusha Silva
	Signature:
Date: 06/08/2023	**Date:**

	TICK
This document is part of a Job Safety Analysis (JSA) and reflects the findings of an associated risk assessment which is attached.	X
OR	
JSA Waiver - There are no identifiable hazards associated with this activity which warrant further risk assessment or description.	

Purpose

The purpose of this document is to outline the hazards and risks that are present when conducting the construction and validation of the project. The construction and validation phases will take place in the Lycopodium Lab. It comprises of a scope of work (SoW), which outlines the work that will be performed. This is followed by related information, whereby important standards that members will utilise throughout the project are outlined and the document concludes with the project's instructions, which articulate the processes involved in each phase of the project and the responsible members. Appended to this document is a safety risk assessment which provides a broad description of the risks and hazards inherent in each phase of the project and the mitigation strategies for them.

Scope

The scope of this method statement pertains to all processes required to perform the construction and validation of the power supply. The key areas of the SoW are:

1. Risk Assessment: A detailed and ongoing risk assessment shall be conducted throughout the project to bring awareness to hazards and to formalise appropriate mitigation strategies.

2. Design Prototyping: After simulation, the power supply design will be prototyped using breadboards to ensure that all desired parameters and functions are met and that the client is satisfied with the project's direction. This section will run in tandem with code construction.

3. Design Construction: Following the completion of designing the schematic, the physical construction of the power supply will involve the assembly of components onto the designed PCB. This will involve an inspection of all parts prior to assembly. This will conclude with an initial "Factory Acceptance Test" (FAT) which will contain details of the expected and actual outputs.

4. Design Validation: After assembly, the power supply will be rigorously tested under UWA's supervision to ensure functionality and adherence to the design requirements. This will involve broad parameter testing to ensure power supply functionality. This phase will run in tandem with code validation. This will conclude with a "Site Acceptance Test" (SAT) which will involve the client confirming that all parameters satisfy the design's objectives.

5. Documentation: All testing, results and scope developments made will be documented for handover to the client. The project's code will be compiled to GitHub as per the client's wishes.

The scope does not directly address the design simulation phase as this section is theory-based and requires no physical interaction, however, this phase will follow all relevant procedures outlined in the *Related Information* section.

Related Information

For specific phases of the project, individual standards will be studied as a group. These include: ISO 45001 (OHS Management Systems), ISO 9001 (Quality Management), ISO 14001 (Environment Management), AS/NZS 3820 (Essential Safety Requirements for Electrical Equipment) and ISO 31000 (Risk Management).

Before any work is conducted, team members are required to be well acquainted with UWA's Electrical Safety and Electrical Work Procedure, AS/NZS 3000 Electrical Installations and to have completed all the relevant modules for entry into the Lycopodium Lab.

	Instruction
1	**Risk Assessment Instructions** • Deliberate as a team how ISO 45001 and ISO 31000 will inform the ongoing risk assessment process. • Identify potential risks prior to beginning any physical prototyping or construction (Take 5 or JSA structure). • Create a risk assessment document (attached) with mitigation controls and calculated risk ratings. Update iteratively. • Complete all safety inductions and read the UWA safety documentation. • Go through risk assessment and check off all mitigations, including: 1. Working with a buddy at all times in the lab. 2. Wearing appropriate PPE for a given task and updating recommended PPE in response to OHS developments.
2	**Design Prototyping Instructions** • Ensure prototyping and construction adheres to AS/NZS 3000, AS/NZS 3820 and ISO 9001. • Simulate with LTspice (or derivative) prior to any physical construction to ensure design should function as desired. • Unpack components, inspect for defects and check for shorted components with a multimeter. • Ensure all tools and components, including design components (IC's, diodes etc), breadboards, jumper wires, multimeters and power supplies are stored safely and neatly after use. • Review SOP for soldering equipment before soldering (example SOP here). • Prior to using any other equipment, all equipment provided by the university will adhere to their standards, have SOP's and be visually inspected. This includes checking for correct and in-date tagging. • Check lab space is in line with the risk assessment and that there are no additional hazards. • Prototyping may be used to test the function generation and microcontroller functions, but not high voltage (>30V) systems. If that is necessary, additional supervision will be present. • Connect the components on the protoboard in line with the schematic, and test in line with the design validation instructions below. • Report any near misses.
3	**Design Construction Instructions** • Follow all applicable Design Prototyping Instructions. • Assume design is live unless immediately tested. • Conduct FAT test to validate construction trajectory and that all parameters meet project requirements, using an oscilloscope and under supervision.
4	**Design Validation Instructions** • Conduct SAT test to finalise design phase of the project and ensure requirements have been satisfactorily met with supervision. • Perform more rigorous test continuity with multimeters. • Test serial communication. • Validate upper voltage boundary and interlock feature.

	• Validate sine and wave generators, voltage changes, fault check LEDs.
5	**Documentation Instructions** • Ensure all safety and risk information including this document is stored in the Safety folder within the team's OneDrive and follows the correct naming procedure. • Ensure all updates and amendments made in individual phases are known by the entire team, well-documented and included in final report delivery. • Following simulation, prototyping and the final design construction, test results will be recorded in the form of a basic SAT document, including visual inspection, continuity, as well as function-specific tests that will be outlined within the document. These will be included in the tendered items of the final report and stored in the design folder in the team's OneDrive.

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GENERAL SAFETY RISK ASSESSMENT

TAB BETWEEN FIELDS MAKING ENTRIES BY TYPING INTO THE GREY HIGHLIGHTED BOXES. WHEN CLICKED NUMERIC FIELDS OFFER DROP-DOWN SELECTIONS

PART 1 – ACTIVITY / TASK DESCRIPTION - Use additional sheets if necessary - Peer check must be by person familiar with the planned activity

Location	**Assessment Date**	**Expiry Date** (max. 5 years)	**Assessor**	**Peer checked by**
Lycopodium (MILC 1.51)	11/08/23	21/10/23	Dilusha Silva	

Task / Activity / Project Title
ELEC5552 Project 2 - Power Supply Assembly and Testing

How many persons will be involved? 6

Description (alternatively, a separate METHOD STATEMENT or equivalent detailed description may be referenced from here if a copy is attached)

Refer to attached Method Statement.

Workplace conditions (describe layout, access/egress, physical conditions [e.g. on a public thoroughfare, crowded room, outside enclosed by barrier], containment [e.g. ventilation, fume cupboards, safety cabinets, open bench-work] and other key factors impacting on the activity/ task).

The construction and testing activities will take place in the UWA Lycopodium Lab during normal office hours (8am-6pm weekdays). Prior to accessing the lab, all group members must complete the UWA safety induction and the lab-specific induction. To work in the lab at least two team members need to be present. No food or drinks are to be consumed in the lab and no chemicals or dangerous goods are allowed in the lab without specific written approval.

The lab is a medium-sized room with carpeted floors - its layout can be seen in the attached Evacuation Diagram. Movable workbenches will be set up to accommodate multiple groups working simultaneously. One workbench is sufficiently large for up to four people to work side by side without issues. There will be dedicated soldering fume extractors provided on the workbench to ensure sufficient ventilation. Insulated silicone soldering mats will be placed on the floor to cover the carpet and mitigate the potential fire risk. The lab is generally tidy with few trip hazards present. There are three egress points from the lab in case of emergency, two of which are currently locked and will be unlocked prior to commencing work in the lab. Please see attached Evacuation Diagram for details.

There is a CO2 fire extinguisher and a first aid kit located on the same floor as the lab. The room containing the first aid kit requires swipe card access, which team members do not currently have. The attached Evacuation Diagram is located at the lab entry. There is also a defibrillator located in the adjacent Physics building.

For after-hours tasks or construction requiring equipment not available at the Lycopodium Lab, the Maker's Lab will be used. Access to the Maker's Lab requires the same guidelines as the Lycopodium Lab and an induction carried out by the Maker's club. The lab has two exits, adequate lighting, PPE, a first aid kit and good ventilation. The lab contains two rows of workbenches with access to soldering irons, 3D printers, power tools, power supplies and power measurement equipment. The high-risk space with larger equipment is isolated from the main laboratory and will not be accessed by the team.

Related Documentation / Guidance (this may include referenced articles, legislation, standards or codes which must be specifically highlighted)

Method Statement:	Method-statement Template_V0
SOPs (for equipment):	SOP for soldering station (link provided in the method statement)
Other:	Evacuation Diagram

RISK CALCULATOR - when completing Part 2, refer to the variable definitions to determine Risk Rating and Control Strategies

CONSEQUENCES (the most probable outcome of exposure to the hazard)		**C**
Catastrophe	Multiple fatalities	**100**
Disaster	A fatality	**50**
Very serious	Permanent disability or ill health	**25**
Serious	Non-permanent injury or ill health	**15**
Important	Medical attention needed	**5**
Noticeable	Minor cuts, bruises, sickness	**1**

LIKELIHOOD (that an individual, being exposed to the hazard, will result in the identified consequence)		**L**
Almost certain	The most likely outcome if the event occurs	**10**
Likely	Not unusual and quite possible to occur	**6**
Unusual	Possible but doubtful	**3**
Remotely possible	A possible coincidence	**1**
Conceivable	Has never happened in years of exposure, but possible	**0.5**
Practically impossible	Not known to ever have happened anywhere	**0.1**

EXPOSURE (can be regularity of activity or a simultaneous, collective attendance)				**E**
REGULARITY			ATTENDANCE	
Continuous	Many times daily	OR	**A crowd of people all of whom** will be exposed to the hazard (e.g. public event, theatre, cinema)	**10**
Frequent	Approximately once daily	OR	**A crowd of people some of whom** will be exposed to the hazard (e.g. public event, theatre, cinema)	**5**
Occasional	Once a week to once a month	OR	**A small group of people** involved (e.g. classroom, lecture, laboratory, meeting)	**3**
Infrequent	Once a month to once a year	OR	**Several people** involved	**2**
Rare	Has been known to occur	AND	**A person** carrying out a single task	**1**
Unheard of	Not known to have occurred	AND	**A one-off task by one person**	**0.5**

RISK SCORE **C** x **L** x **E** =	**RISK RATING**	**CONTROL STRATEGIES** (to mitigate risk from the identified hazard)
>600	VERY HIGH	• Immediate action required.

		• Do not proceed with task/activity until control measures have been implemented. • Notify Supervisor, Safety & Health Representative and Head of School. • Arrange continuous review and monitoring.
>300 to 600	HIGH	• Consider not carrying out task/activity until control measures have been implemented as soon as practicable. • Notify Supervisor and Safety & Health Representative. • Action plan to reduce risk. • Monitor every subsequent exposure in addition to any other regular monitoring regime.
>90 to 300	MEDIUM	• Implement immediate action to minimise potential for injuries. • Notify Supervisor to organise remedial action before commencing activity.
90 or Less	LOW	• Required action to be agreed with Supervisor. • Remedial action to be taken as soon as practicable and within a month.

PART 2 – IDENTIFY HAZARDS, ASSOCIATED RISK RATINGS AND CONTROL STRATEGIES

1. Pick out the hazards which are relevant for this task or activity.
2. Click entry fields for drop-down selection of inherent risk values for C, L and E.
3. In the comments box, describe when and where the hazard is present and other notes.
4. Specify the control measure type from the Hierarchy of Control (top right)
5. Under Control Measures give a description of the control to be implemented.
6. Click entry fields for drop-down selection of residual risk values for C, L and E.

HIERARCHY OF CONTROL

Elimination……. EL
Substitution…… SU
Engineering….. EN Isolation…. IS Guarding…. GD
Administrative… AD Training…. TR Inspection.... IN
Personal Protective Equipment = PPE

IDENTIFIABLE HAZARDS(editable)	INHERENT RISK C	L	E	=	COMMENTS (when and where hazard is present)	CTRL	CONTROL MEASURES	RESIDUAL RISK C	L	E	=
GENERIC - associated with the activity											
Slip and trips	25	6	5	750 VH	Trip hazards such as power cords or dropped objects may be present as people outside the team utilise the space.	**AD, IN**	Workspace to be inspected prior to use and any identified hazards are to be removed or highlighted. Workspace to be kept tidy during work and upon completion.	25	1	2	50 L
Manual handling	15	1	2	30 L	Some manual handling of moderately heavy testing equipment such as power supplies may be required.	**AD, TR**	Correct lifting technique to be instructed and utilised when required. Aids such as trolleys or help from other team members to be sought when required.	15	0.5	1	8 L
Becoming stuck, crushed,entangled	15	3	3	135 M	There are potential pinch points such as doorways, as well as the risk of entanglement with equipment wiring during contruction and testing. There is also the potential to drop heavy equipment on feet.	**PPE, AD**	No loose cloting to be worn and hair to be tied back to avoid potential entanglements. Cables to be kept tidy to reduce risk of entanglement. Enclosed shoes to be worn at all times when in the lab.	15	0.5	1	8 L
Sustaining cuts or abrasions	5	6	3	90 L	Sharp tools such as scissors, wire cutters and strippers will be required, which pose a potential hazard for cuts.	**PPE, TR**	UWA safe work procedure to be followed when undertaking activities. General care to be taken and gloves to be worn where practicable.	5	1	2	10 L
Vibration	15	1	2	30 L	Vibrations from other equipment in the Maker's Lab may lead to unfastened items tipping and landing on team members.	**EL,AD, IN**	Ensure items are fastened appropriately and tools do not hang off benches, as well as require team members to practice a Take 5 of their immediate vicinitiy.	15	0.5	1	8 L
Burns	25	6	3	450 H	Soldering requires high heat. Worker is exposed to the hot soldering iron as well as the solder itself and the component being soldered. Heat guns may also be utilised to test components. Finally, equipment may be hot due to heat losses during operation.	**TR, PPE**	Gloves to be worn where practicable. Soldering training/induction is also required for any team member undertaking soldering tasks. Locations of first aid equipment and water to be identified prior to commencing work.	15	3	2	90 L
Projectiles	25	3	2	150 M	Projectiles from activities such as wire cutting, stripping and soldering may lead to eye injury.	**PPE, TR**	All team members carrying out these tasks to undertake basic tool training and utilise eye protection in the form of safety glasses. First aid kit and running water is available.	15	1	2	30 L
Asphyxiation	0	0	0	0 -	N/A			0	0	0	0 -
ELECTRICAL											
High voltage equipment	0	0	0	0 -	N/A			0	0	0	0 -
240V equipment	25	3	5	375 H	The power supply to be constructed is required to provide 200V AC and DC. This could present an electric shock hazard if faulty and/or isolation/earthing is disconnected. The power supplies provided for testing are powered from the mains and may present a similar hazard.	**AD, EN**	Equipment to be visually inspected and electrically tested for faults prior to energisation. Equipment to be tested at low voltages initially, with testing of higher voltages to be conducted under supervision.	25	1	2	50 L
CHEMICALS OR SUBSTANCES											
Carcinogens	25	6	3	450 H	Team members will be exposed to solder flux.	**AD, TR, PPE**	Soldering to only be conducted by trained team members and safety glasses and gloves to be worn to reduce exposure when working. Extraction fans are also to be utilised. First aid and running water is availabe.	25	3	2	150 M
Toxic (poisons)	0	0	0	0 -	N/A			0	0	0	0 -
Radioactivity	0	0	0	0 -	N/A			0	0	0	0 -
Flammable	50	3	2	300 M	Cleaning products for the PCBs can potentially ignite, resulting in fires that may not be extinguishable by certain fire extinguishers.	**AD, TR. GD**	Ensure chemical fire extinguishers are easily accessible and strict handling controls are in place when cleaning chemicals are in use.	15	3	1	45 L
Explosive	0	0	0	0 -	N/A			0	0	0	0 -
Infectious material	0	0	0	0 -	N/A			0	0	0	0 -
Biological	0	0	0	0 -	N/A			0	0	0	0 -

Corrosive	0	0	0	0 -	N/A			0	0	0	0 -
Solvents	0	0	0	0 -	N/A			0	0	0	0 -
Emissions	0	0	0	0 -	N/A			0	0	0	0 -
WORKING ENVIRONMENT											
Dust	15	1	3	45 L	Dust from the lab (Maker's) may inadvertly worsen other hazards as well as cause respiratory issues.	**TR**	Ensure members are trained to clean stations at the commencement of work and at the conclusion of work.	5	1	1	5 L
Noise	5	6	3	90 L	Noise from power tools may cause deafness in cases of long term exposure.	**PPE**	Ensure adequate PPE is worn when loud equipment is in use. Maker's lab has a dB reader to indicate when this is necessary.	5	1	2	10 L
Extremes of temperature	15	6	3	270 M	Long term equipment use may lead to heated surfaces and result in burns. Poor ventilation may result in an unsafe lab environment.	**EN, TR**	Ensure airconditioning is operational during hot periods and train members on hot spots from tools used.	15	0.5	1	8 L
Inadequate light	15	0.5	2	15 L	Poor lighting can lead to injuries due to lab members being less able to identify imminent hazards.	**EL**	Banning lab work if lighting is not functioning eliminates this risk.	15	0	1	0 -
UV or other radiation exposure	0	0	0	0 -	N/A			0	0	0	0 -
OTHER HAZARDS											
COVID or other illness	15	6	2	180 M	Team members may contract a virus or other illness during the project.	**IN, IS**	Team members are to monitor themselves for symptoms and stay home if feeling unwell.	5	3	0.5	8 L
Ergonomics	15	6	5	450 H	The benches and chairs available in the lab are not adjustable and may not provide the ideal ergonomic position for the group members. This could lead to poor posture and other ergonomic issues.	**AD, EL, TR**	Ensure eronomic hazards are highlighted and adjustments made where possible. Ensure regular breaks are taken throughout the process, work is allocated to the most suited team member and work is shared where possible.	15	0.5	1	8 L
Fatigue	15	3	3	135 M	The project's stringent deadlines coupled with potential delays in receiving the required components could require extended work hours to ensure timely completion. This could lead to the occurrence of fatigue-related incidents.	**IN, AD**	Work load to be shared and team members to ensure they do not take on excessive work loads. Expectations to be regulated and regular breaks to be taken. Ensure good communication within the team.	5	1	2	10 L
Mental health or burnout	25	3	2	150 M	Mental health issues and burnout may occur due to stress from performance pressure and stringent deadlines.	**IN, AD**	Ensure good communication within team. Team members are to ensure that relevant team members obtain the required support.	15	1	1	15 L
Energy release	50	3	5	750 VH	Components such as capacitors are required in the design. These components store and release energy, posing an energy release hazard for people working on and in the vicinity of the equipment.	**IN, AD, PPE**	All team members to be aware that capacitors may be live for a period of time after disconnecting the system. Components to be inspected and tested for faults prior to use. Electrically rated gloves to be worn when handling components.	50	1	2	100 M
Workspace tampering	15	3	3	135 M	Unattended workspaces may be tampered by other teammates. This could potentially result in members returning to their work stations and falsely assuming components are not live or have not been altered, leading to injuries.	**AD, TR**	Mandate the use of "No Tampering" signs for stations which are occupied for long periods of time, as well as train team members to perform a Take 5 each time they return to their station to mitigate the risk of tampering injuries.	5	1	1	5 L

PART 3 – IMPLEMENTATION / ESCALATION PLAN

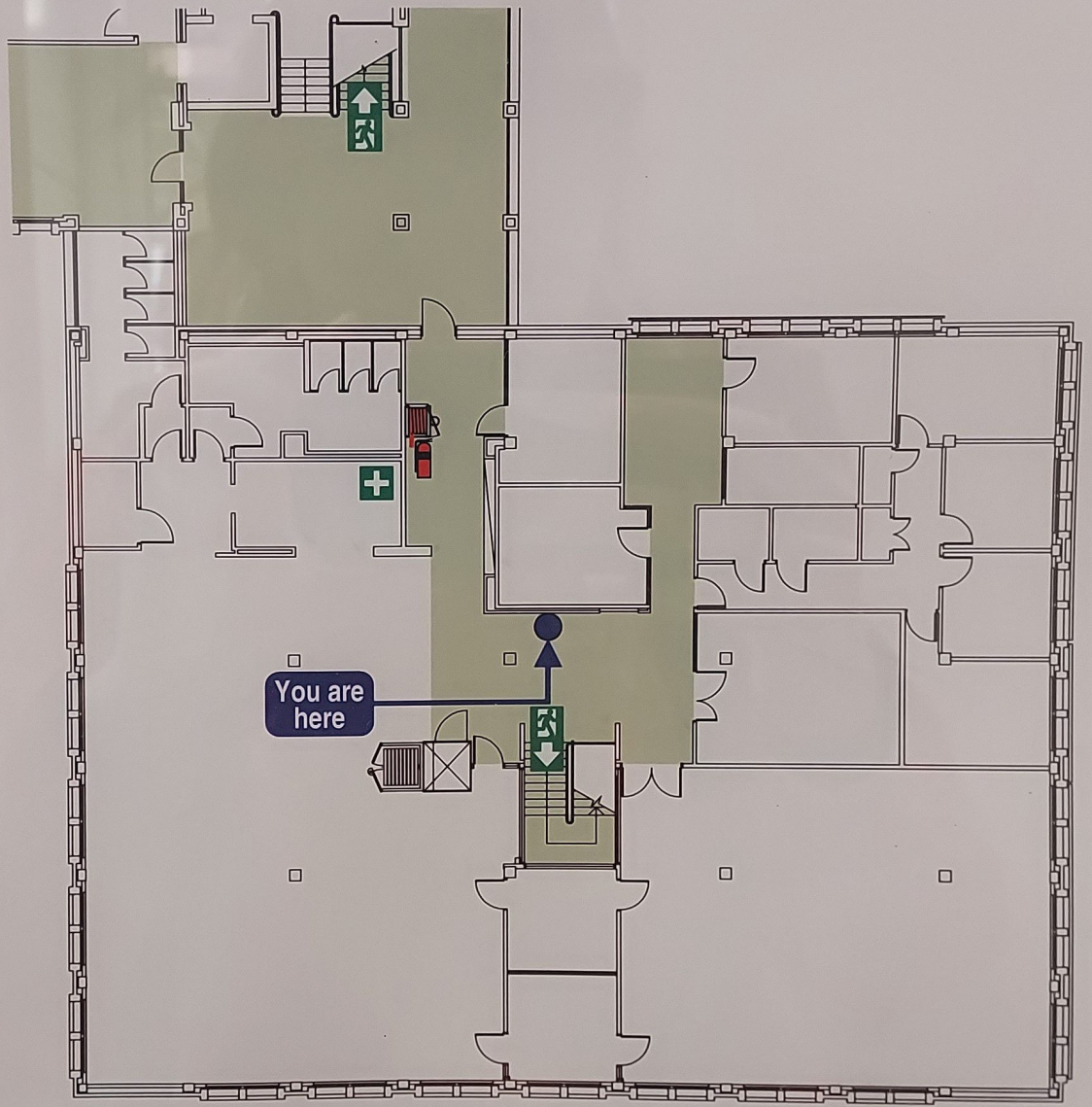
I have reviewed this risk assessment and agree that the control measures will be implemented as described above.

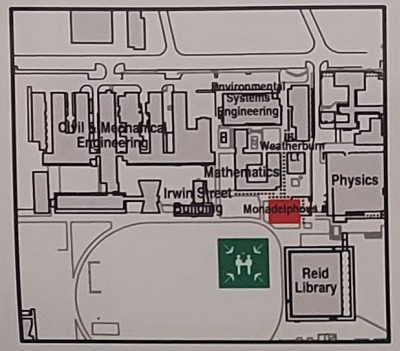
If other than a one-off activity, monitoring and review of their effectiveness will be carried out and recorded every . (enter period)

	NAME	SIGNATURE	DATE
SUPERVISOR:			
HEAD OF SCHOOL, DIRECTOR, EQUIVALENT or FORMALLY DELEGATED SIGNATORY:			

ANY SIGNATORY AUTHORITY MUST BE RECORDED AND ONLY DELEGATED TO COMPETENT PERSONS OR AN AUTHORISING COMMITTEE RETAIN RISK ASSESSMENTS FOR REFERENCE

EVACUATION DIAGRAM





Assembly Area

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In An Emergency

DIAL 2222

2222 from internal phones

6488 2222 from other phones

(Should '000' be called, always follow up with a phone call to UWA Security on 2222)

Monadelphous
First Floor

Evacuation Procedures

- Raise the alarm (if not already sounding).
- Ensure the safety of self and others.
- Contact Security (2222 or local procedure) and the Building Warden.
- Evacuate to the Assembly Area.
- Close doors.
- Do not use lifts.
- Follow instructions of Wardens.
- Remain in Assembly Area.
- Do not re-enter until All Clear is given by the building Warden or DFES.

Legend

- CO_2 Extinguisher
- Fire Hose Reel
- First Aid Kit
- Exit
- Assembly Area
- Path of Travel

VALIDATION DATE:	30/6/16
VALIDATION EXPIRY DATE:	30/6/21
DRAWING No:	223/ED/011