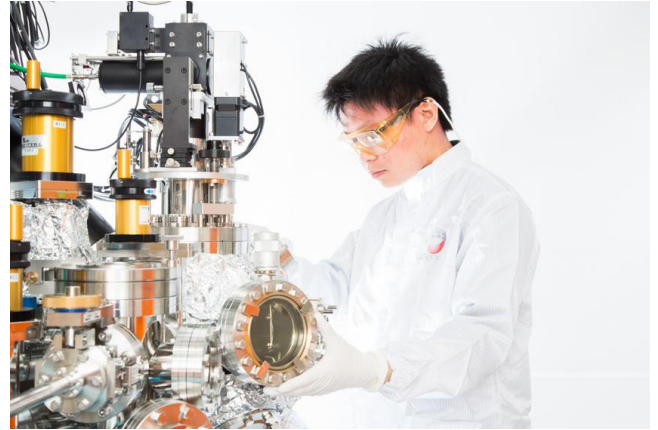
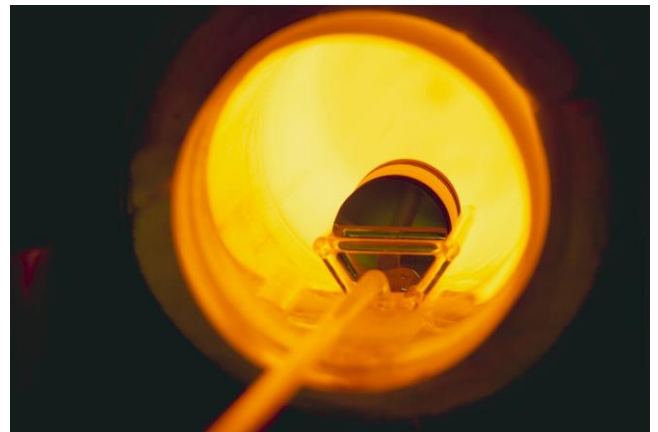




**Australian National
Fabrication Facility**



ANFF-NSW Health and Safety Guidelines



**Document release date: March 2023
Version 9.6**

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Definitions

ANFF: Australian National Fabrication Facility

ANFF-NSW: New South Wales Node of the Australian National Fabrication Facility

EE&T: Electrical Engineering & Telecommunications

EWIS: Emergency Warning and Intercommunication System

HF: hydrofluoric acid

HSMS: Health and Safety Management System

LSI: Laboratory Safety Induction

LSS: Life Safety System

MBE: molecular beam epitaxy

MOS: metal-oxide-semiconductor

PDT: Personal Duress Transmitter

PPCE: Personal Protective Clothing and Equipment

RM: Risk Management

SDS: Safety Data Sheet

SGS: Specialty Gas System

SWP: Safe Work Procedure

TMAH: tetramethylammonium hydroxide

UNSW: University of New South Wales

WHS: Work Health and Safety

Review History			
Reviewer Name	Date	Version	Major Amendment
Gordon Bates	23/11/18	9.1	Edit conditions under which users can enter labs to “observe” lab processes, 4.1.2 “Lab Access-Researchers”
Gordon Bates	24/5/19	9.2	Update Org Chart, entire doc re-read, test web links
Gordon Bates/Ute Schubert	28/10/19	9.3	Further overhaul: added headhones, new materials, up-dated UNSW policy statement, waste and some ER etc.
Matt Boreland	17/01/20	9.4	Annual review and updates wrt to lab refurb
Gordon Bates	1/7/20	9.4	Added Matts changes and updated Lab Maps in Appdx 1 after looking thru with Ute in June. Checked against updated SGS document from June
Gordon Bates	15/3/22	9.5	Update UNSW emergency Ph number. Update undergrad supervision, lab access and added access pathways table. Update ANFF/UNSW staff changes in Org Chart.
Gordon Bates / Matt Boreland	1/8/22	9.5	Added UNSW ‘core value’ re safety at Sect 1.2. New Director added in Org Chart. Fixed spelling and grammar throughout. Change ‘WorkCover NSW’ to ‘SafeWork NSW’ throughout, to reflect updated name of regulator. Updated tool listing and general review. Fixed missing items in lab maps in Appdx 1.
Gordon Bates	6/3/23	9.6	Update UNSW WHS policy statement

Background

The ANFF-NSW labs contain many potentially hazardous processes and hazardous areas, which require robust safety controls and protocols to ensure safe and successful research.

The ANFF-NSW laboratories comprise the following areas:

Lower East Labs:	50 m ² of 'White Area' cleanroom (ISO5/Class 100) 30 m ² of 'Grey Area' cleanroom (ISO7/Class 10,000) 60 m ² of plant
Upper East Labs:	50 m ² of 'White Area' cleanroom (ISO5/Class 100) 90 m ² of 'Grey Area' cleanroom (ISO7/Class 10,000) 50 m ² of plant
West Labs:	80 m ² of 'White Area' cleanroom (particle count equivalent to ISO5/Class 100) 110 m ² of 'Grey Area' cleanroom (ISO6/Class 1,000) 100 m ² of plant
South Labs:	160m ² of laboratory space, 60 m ² Characterisation (ISO5/Class 100), 50 m ² Veeco MBE, 50 m ² Laser MBE
Ion Implanter Lab:	50 m ² of laboratory space
Rooftop Gas Shed:	30 m ² of plant

Floor plans of the ANFF-NSW laboratories are given in Appendix 1 and a list of all equipment operating within the ANFF-NSW laboratories is given in Appendix 2.

All ANFF-NSW laboratories and the equipment are covered by the UNSW Work Health and Safety (WHS) Policy and associated Procedures.

The ANFF-NSW Health and Safety guidelines detail how the UNSW Health and Safety Management System (HSMS) is implemented at ANFF-NSW. All users of the ANFF-NSW laboratories are required to be familiar with these guidelines and with the UNSW WHS Policy and associated Procedures.

The rules and procedures detailed in these guidelines have been put in place to ensure the health and safety of all users of the ANFF-NSW laboratories. **Any breach of these rules and procedures is unacceptable and may lead to the suspension or withdrawal of laboratory access, or to more serious legal proceedings.**

If in doubt about any aspect of safety in the ANFF-NSW laboratories, users should seek assistance from the Laboratory Manager or relevant Area Supervisor.

1. Commitment

1.1 WHS Plan

ANFF-NSW seeks to provide a safe and healthy work environment for staff, students and visitors by operating within the UNSW WHS Plan and complying with all associated Policies and Procedures. The UNSW WHS Plan can be accessed at the UNSW WHS website (www.ohs.unsw.edu.au).

1.2 WHS Policy

The UNSW WHS Policy Statement is reproduced here:

The health and safety of all staff, contractors, students and visitors is considered of utmost importance. Workers and students are provided with a safe and healthy place in which to work or study, and our work practices must not compromise the health or safety of others present on our campuses or when attending another workplace. This commitment to health and safety allows UNSW to teach, conduct research and promote scholarship at the highest international level through the attraction and retention of high-quality staff, students and other partners. The following principles inform UNSW's health and safety policy objectives:

- Workers and students will be provided with a safe and healthy place in which to work or study.
- Our work practices must not compromise the health or safety of others present on our campuses or when attending another workplace.
- Health and safety considerations are included in organisational plans, procedures, programs, courses, and job instructions.
- Health and safety is both an individual and shared responsibility.
- Promote a positive and proactive culture of Health and Safety across all aspects of UNSW operations.
- We make every effort, where reasonably practicable, to eliminate or control risks from hazards, including psychosocial hazards associated with the workplace and the work performed by workers.
- UNSW has an integrated suite of procedures, plans, resources, and online systems, to form comprehensive Safety Management System (SMS).
- Communication and consultation are central to working together for a safer workplace.

The UNSW WHS Policy and associated Procedures comply with the Work Health and Safety Act 2011 and the Work Health and Safety Regulation 2011 which can be accessed via the New South Wales Government website (www.legislation.nsw.gov.au).

The UNSW WHS Policy is implemented via the UNSW Health & Safety Management System (HSMS) based on *AS/NZS 4804:2001 Occupational health and safety management systems – General guidelines on principles, systems and supporting techniques*, with guidance also taken from *AS/NZS 4801:2001 Occupational health and safety management systems – Specifications with guidance for use*.

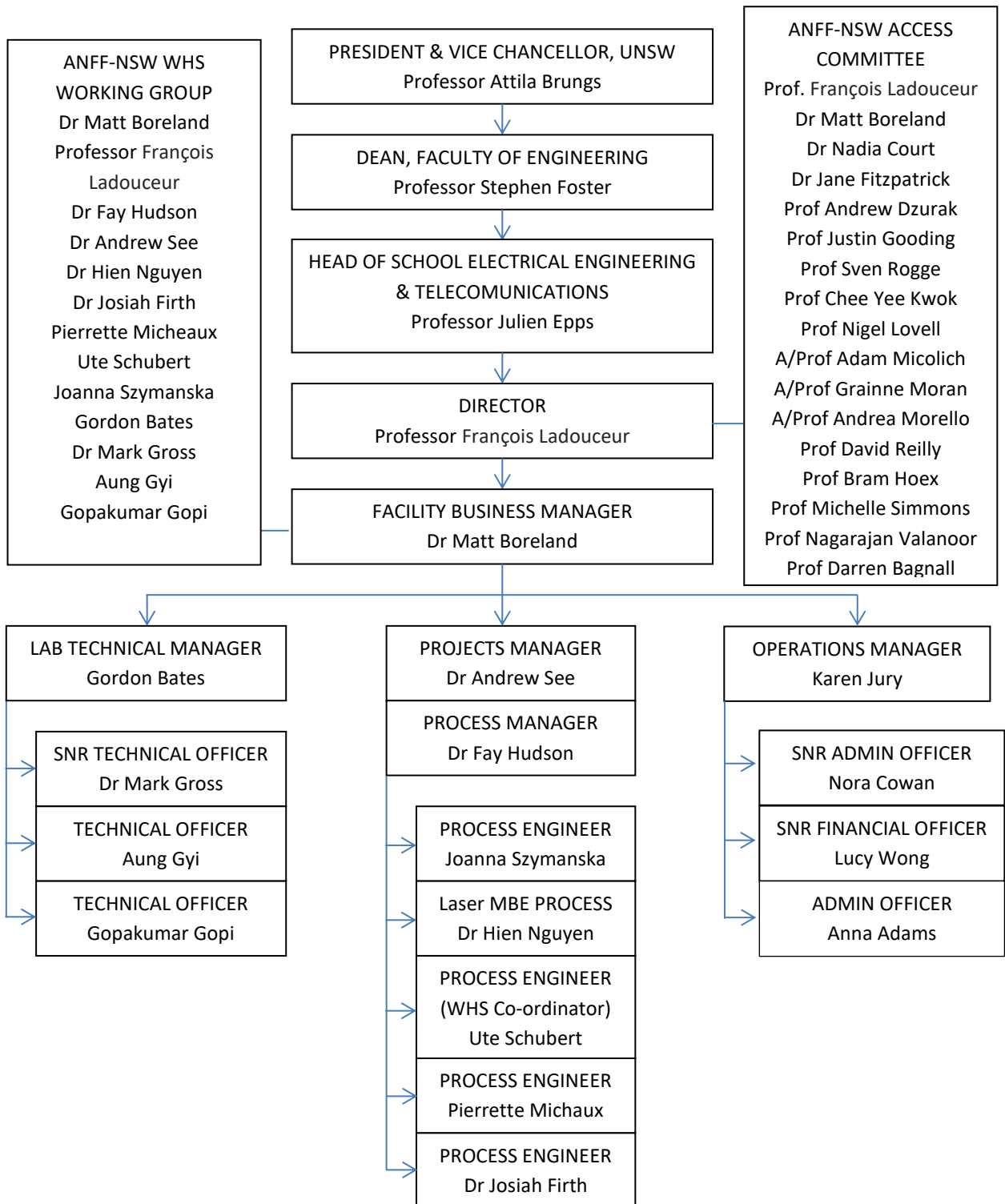
The full UNSW WHS Policy and details of the HSMS can be accessed at:

<https://www.unsw.edu.au/content/dam/pdfs/governance/policy/2022-01-policies/ohspolicy.pdf>

The effective implementation of the UNSW HSMS is a requirement of the SafeWork NSW workers compensation self-insurer licence held by UNSW and is the subject of regular audits of UNSW by SafeWork NSW.

1.3 WHS Responsibility, Authority and Accountability

The University Council is ultimately responsible for providing a safe and healthy work environment at UNSW for staff, students and visitors. The Council's obligations are achieved by delegation of clearly defined WHS responsibility, authority and accountability throughout a hierarchical committee structure. The line of responsibility, authority and accountability relevant to ANFF-NSW is represented below:



1.3.1 UNSW WHS Committee (Level 1)

The President and Vice-Chancellor of UNSW is responsible for establishing WHS strategic objectives and targets in line with the requirements of the UNSW WHS Policy, and for ensuring that these targets are met. These responsibilities are met in consultation with the UNSW WHS Committee. The Faculty of Engineering is represented on this Committee by the Faculty Dean.

1.3.2 Faculty of Engineering OHS Committee (Level 2)

The Faculty Dean is responsible for meeting the WHS objectives and targets set by the Vice-Chancellor and President and making regular progress reports to the Level 1 Committee. These responsibilities are met in consultation with the Faculty of Engineering WHS Committee. The School of Electrical Engineering & Telecommunications (EE&T) is represented on this Committee by the Head of School and the Chair of the School of EE&T WHS Committee.

1.3.3 School of EE&T OHS Committee (Level 3)

The Head of School is responsible for establishing and monitoring the implementation of the HSMS within the School and making regular progress reports to the Level 2 Committee. These responsibilities are met in consultation with the School of EE&T WHS Committee. ANFF-NSW is represented on this Committee by the ANFF-NSW Facility Manager.

1.3.4 WHS Responsibilities of ANFF-NSW Staff

Staff in supervisory roles are responsible for implementing the HSMS within their local work area, identifying and eliminating or controlling hazards following the UNSW Risk Management Program, and ensuring that effective consultation on WHS matters takes place within their local work area. Such staff have a 'duty of care' to ensure their own safety and the safety of others in the workplace and to avoid adversely affecting the health or safety of any other person through any act or omission.

Implementation of the HSMS within the ANFF-NSW local area is oversighted by the ANFF-NSW Director and achieved via consultation with the ANFF-NSW WHS Working Group comprising the Facility Business Manager, Laboratory Manager, Process Manager, Area Supervisors and WHS Coordinator.

Some local level WHS responsibilities are delegated to the special roles detailed in sections 1.3.5 through 1.3.7.

1.3.4 ANFF-NSW WHS Working Group Meeting

ANFF-NSW holds regular weekly meetings to review operation, technical, strategic and safety matters. WHS is included as a standing item in ANFF-NSW weekly meetings, which convenes the ANFF-NSW WHS Working Group to maintain high levels of WHS awareness and vigilance. All ANFF-NSW laboratory users are welcome to attend these meetings or may request that issues be raised on their behalf by ANFF-NSW staff members.

Extraordinary meetings of the ANFF-NSW WHS Working Group may be convened by the Lab Manager &/or Facility Business Manager for safety matters requiring additional focus (e.g. incident response, significant changes etc)

1.3.5 Area Supervisors

Each area within the ANFF-NSW laboratories has been appointed an Area Supervisor as per the list below:

- Lower East Lab: Dr Fay Hudson and Dr Andrew See
- Upper East Lab*: Ute Schubert and Joanna Szymanska
- West Lab – White Area: Joanna Szymanska and Dr Fay Hudson
- West Lab – Grey Area: Joanna Szymanska and Pierrette Michaux
- Ion Implanter Lab – Dr Mark Gross and Jos Firth
- Special Gases System*: Aung Gyi and Gopakumar Gopi
- South Labs: Laser MBE Staff and Gordon Bates

* Note: lab equipment making use of hazardous gases via the Special Gases System is contained within a limited access area indicated by floor markings and signage in the Upper East Lab (Grey Area). This limited access area is considered part of the Special Gases System (along with plant contained in the Rooftop Gas Shed) for the purposes of Area Supervisors' responsibilities.

Area Supervisors' responsibilities include: liaising with laboratory users with regard to process and safety issues; performing a daily safety check throughout their area; and ensuring that corrective actions arising from workplace inspections are carried out in a timely manner.

1.3.6 Equipment and Process Wardens

Each piece of equipment and process in the ANFF-NSW laboratories has been appointed an Equipment or Process Warden as shown on the Scheduler (the ANFF-NSW on-line booking system) available via the ANFF-NSW website (www.anff-nsw.org).

Equipment and Process Wardens' primary responsibility is to ensure that equipment and processes are maintained in good order. **This does NOT diminish the responsibility of all users to keep equipment in a safe operating state.** Users should promptly report any problems with equipment or processes and ask for assistance when required.

Equipment and Process Wardens' other responsibilities include: completing regular reviews of hazards and risk control measures (as documented via Risk Management forms) and Safe Work Procedures; and performing certification assessments for newly trained users.

1.3.7 Authorised Trainers

Training to use equipment or processes in ANFF-NSW laboratories may only be provided by *Authorised Trainers* and must fall within the scope of existing Safe Work Procedures.

ANFF-NSW staff who are Authorised Trainers are available to provide training to all users. Requests for training by ANFF-NSW staff must be formalised via an ANFF Proposal as per the ANFF-NSW Access and Pricing Policy (available at www.anff-nsw.org).

Some experienced laboratory users have been made Authorised Trainers for specific pieces of equipment or processes, following assessment by ANFF-NSW staff and written confirmation of their Authorised Trainer status. Authorised Trainers who are not ANFF-NSW staff can only provide training to members of their own research group and are under no obligation to train other users.

Details of Authorised Trainers available to provide training for specific pieces of equipment or processes can be provided by the Projects Manager.

1.3.8 WHS Responsibilities of ANFF-NSW Laboratory Users

Staff, students and visitors making use of ANFF-NSW laboratories are responsible for following the UNSW WHS Policy and associated Procedures and ensuring that their conduct does not endanger themselves, others or the environment.

All users must adhere to the policies and rules specified in the ANFF-NSW Health and Safety guidelines and must follow the directions of the Laboratory Manager and Area Supervisors with regard to safety and laboratory use.

The Facility Business Manager, Laboratory Manager and Area Supervisors are authorised to ask any staff, student or visitor to leave the ANFF-NSW laboratories if they fail to obey laboratory rules. UNSW Security will be summoned for assistance should any user refuse to leave the laboratories when asked.

Serious or repeated breaches of ANFF-NSW policies and rules may result in the removal of laboratory privileges and swipe card access. Further action may also be taken by the University or other authorities as applicable.

If in doubt about any aspect of safety in the ANFF-NSW laboratories, users should seek assistance from the ANFF-NSW Laboratory Manager or relevant Area Supervisor.

2. Planning

2.0 Planning for WHS Implementation

The ANFF-NSW Health and Safety guidelines detail how the UNSW HSMS is implemented at ANFF-NSW. Regular reviews allow for continual improvement to HSMS implementation at ANFF-NSW.

2.1 Planning for WHS Risk Management

2.1.1. Risk Management

All tasks in must be assessed and approved by ANFF's Risk Management procedures before implementation in the ANFF Labs.

Risk management at ANFF-NSW follows the procedures of the UNSW Risk Management Program which aims to reduce risks as far as reasonably practical via the following steps:

- the identification of hazards (events which may cause harm);
- the assessment of associated risks (considering the consequence and likelihood of a hazardous event occurring) following the UNSW Risk Rating Matrix;

UNSW Risk Rating Matrix		Consequence				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood	Almost certain	Medium	High	High	Very high	Very high
	Likely	Medium	Medium	High	High	Very high
	Possible	Low	Medium	High	High	Very high
	Unlikely	Low	Low	Medium	Medium	High
	Rare	Low	Low	Medium	Medium	Medium

- the implementation of risk control measures following the Hierarchy of Risk Controls;

Hierarchy of Risk Controls - applied in the following order:

1. Elimination – hazard is removed by performing the task in a different way
2. Substitution – e.g. hazardous chemicals are replaced with less hazardous alternatives
3. Engineering controls – e.g. Life Safety Systems, fume extraction; guards around hotplates
4. Administrative controls – e.g. signage used to warn of hazardous areas, training/inductions
5. Personal Protective Clothing and Equipment (PPCE) – e.g. gloves used to protect against contact with hazardous chemicals

In practice, a combination of the above controls will most often be used.

- the review of the effectiveness of risk control measures.

Risk management procedures are completed for all tasks performed in the ANFF-NSW laboratories and documented in a **Risk Management (RM) form**. When risks have been reduced to as low a level as practically possible for a particular task, a **Safe Work Procedure (SWP)** document is completed. SWPs give detailed, step-by-step instructions for the approved way to perform the task. SWPs also contain details of: PPCE requirements; clean-up and waste disposal requirements; emergency shutdown instructions; and first aid measures. SWPs may refer to other documents, such as: tool manufacturers' instructions; Australian standards; or Codes of Practice.

The UNSW Risk Management Program and associated documents (including templates and guidelines for completing RM forms and SWPs) may be accessed at the UNSW WHS website (www.ohs.unsw.edu.au).

UNSW Emergency - Phone 93856666 - Ambulance, Fire, Police, Chemical and Gas Emergencies

RM forms and SWPs for all tasks performed in the ANFF-NSW laboratories are available via the ANFF-NSW website (www.anff-nsw.org) or by request to the ANFF-NSW WHS Coordinator.

Where a new task or material is required, a risk assessment process (documented via a RM form) must be completed (usually by ANFF-NSW staff working in close collaboration with the user who has requested the new task or material). If use of the new task or material is approved by the ANFF-NSW WHS working group, a new (or modified) SWP will be put in place prior to the work proceeding.

2.1.2 New Material/Process Request Procedure

All new materials/processes must be assessed and approved by ANFF before being used in the ANFF Labs.

A procedure for documenting and assessing requests for new materials and/or processes was implemented in early 2015. Guided by a New Material/Process Request form, which can be downloaded from the ANFF NSW website, researchers making a request to use a new material and/or process are encouraged to give due consideration to potential hazards when planning the work they intend to perform in the ANFF-NSW laboratories. For each New Material/Process Request, a thorough risk assessment process is completed by ANFF-NSW staff following the UNSW Risk Management Procedure. The assessment considers hazards which may impact:

- the health and safety of the researcher using the new material and/or process.
- the health and safety of other researchers working in the same laboratory.
- the health and safety of staff who may be exposed to new materials or reaction by-products during equipment maintenance and cleaning.
- health and safety within the broader environment.
- process integrity.
- equipment functionality; and
- lifecycle implications

New material/process request are discussed and considered for approval in the weekly meeting.

2.2 Design Control

All building design projects in which ANFF-NSW is involved are co-ordinated by UNSW Facilities Management.

Any new plant or equipment design or modification projects in which ANFF-NSW is involved follow the Design Control section of UNSW Plant and Equipment Procedure and the UNSW Design & Modification Guideline which may be accessed at www.ohs.unsw.edu.au.

2.3 Purchasing and Acquisition

The purchasing and acquisition of goods and services by ANFF-NSW follows the UNSW Purchasing Guideline which may be accessed at www.ohs.unsw.edu.au.

Any goods posing a WHS risk are identified prior to purchase and a risk management procedure completed allowing appropriate control measures for the safe delivery, storage and usage of the goods to be considered in advance.

2.4 Emergency Preparedness

2.4.1 UNSW Emergency Procedures

UNSW emergency procedures are detailed on posters located near telephones in each of the ANFF-NSW laboratories. All laboratory users must be familiar with these emergency procedures.

UNSW Security should be telephoned on **93856666 for all emergencies**, and will arrange for fire brigade, ambulance or other emergency services as required. All phone handsets throughout the ANFF-NSW laboratories are labelled with Unibeat stickers providing the emergency phone number **93856666**. The UNSW StaySafe@UNSW app also provides a useful reference for general campus safety including

UNSW Emergency - Phone 93856666 - Ambulance, Fire, Police, Chemical and Gas Emergencies

contacting security (<https://www.estate.unsw.edu.au/security/staysafeunsw-app>)

It is important to note that UNSW Security and emergency services personnel **WILL NOT** enter any laboratory until someone familiar with the specific hazards present has assessed the situation and confirmed that it is safe to enter.

Depending on the nature of the emergency, it may also be necessary for users to take one or more of the following actions:

- phone staff (eg Laboratory Manager, Area Supervisor, Facility Business Manager) – phone numbers are displayed near telephones in each of the ANFF-NSW laboratories and inside the main entry door to each lab.
- phone a first aid officer – phone numbers are located near telephones in each of the ANFF-NSW laboratories and inside the main entry door to each lab.
- notify other laboratory users
- use safety shower or eye-wash station
- use chemical spill kits (available inside the main entry door to the West lab, in the West lab White Area and in each White Area gowning room)
- evacuate the area

All users are required to demonstrate an understanding of emergency procedures detailed throughout section 2.4 before being granted access to the ANFF-NSW laboratories.

Safe Work Procedures (SWPs) also contain specific emergency information for situations that may arise while performing a particular task. All users must be familiar with the emergency procedures described in the SWP for the processes they perform.

2.4.2 Personal Duress Transmitters

UNSW Security may also be summoned by activating a Personal Duress Transmitter (PDT). PDTs are available inside the main entry door to the West and South lab, and in each White Area gowning room.

2.4.3 Emergency Warning and Intercommunication System (EWIS)

Emergency announcements and evacuation alerts for ANFF-NSW laboratories and office areas are made via the **Newton building** Emergency Warning and Intercommunication System (EWIS). All ANFF-NSW users are required to respond to its alert and evacuation tones and any announcements made.

In alert mode, a **'beep-beep-beep' alert tone** will sound throughout the Newton building and ANFF-NSW laboratories. At this tone, all occupants of the Newton building and ANFF-NSW laboratories should put tools and equipment into a safe state in case an evacuation is needed.

In evacuate mode, a rising **'whoooop-whoooop' evacuate tone** will sound throughout the Newton building and ANFF-NSW laboratories. At this tone, all occupants of the Newton building and ANFF-NSW laboratories must evacuate the building and make their way to the assembly point on the Village Green to the west of the Newton Building. The building may not be re-entered until Emergency Services or the Chief Fire Warden advise it is safe.

Alert and evacuation tones can be activated by anyone at break-glass panels located throughout the building, or by UNSW Security, emergency personnel or floor wardens at the EWIS panel. The EWIS also allows communication between UNSW Security, emergency services and floor wardens to assist in managing emergency situations.

ANFF-NSW participates in regular evacuation drills for the Newton building.

2.4.4 First Aid

Should first aid be required, assistance should be summoned by calling UNSW Security on 93856666, calling first aid officers using the emergency contact list (displayed near each telephone, on the first aid kits and inside the main entry door to each lab) or seeking assistance from other lab users, as appropriate.

UNSW Emergency - Phone 93856666 - Ambulance, Fire, Police, Chemical and Gas Emergencies

Except in life-threatening situations, first aid must only be rendered by qualified first aid officers (as per the emergency contact list). In all cases, assistance should only be offered to the injured person if it is safe to do so.

First aid kits (including calcium gluconate gel for treating HF exposure) are located inside the main entry door to each lab. Fire blankets are located near fume cupboards throughout the ANFF-NSW laboratories.

2.4.5 Chemical Spills

All chemical spills are hazardous and must be reported. Even unidentified puddles on the floor or in fume cupboards should not be assumed to be harmless. In such cases, the Laboratory Manager or an Area Supervisor should be alerted immediately.

In the event of a chemical being spilt on a lab user, the following procedure should be followed:

- **CALL FOR HELP**
 - Press **duress alarm** and phone **UNSW Security** on 93856666 &/or the **Lab Manager** on 93856224 to summon medical assistance including ambulance/paramedics as required
 - Alert nearby labs users of the chemical spill hazard
- **WASHDOWN**
 - Immediately proceed to the eyewash/shower and wash the affected area taking care to minimize the spread of surface contamination to other parts of the body. Safety showers and eye wash stations are provided for this purpose in all laboratory areas where chemical processing is carried out.
 - Remove contact lens. Lab users who wear contact lenses must be aware of the risk that chemicals splashed in the eyes may be trapped by the lenses. Contact lenses must be removed to ensure that first aid treatment is effective.
 - SPECIFIC MEASURES FOR HF & ACID/BASES:
 - 5 minutes washdown for HF exposure,
 - 15 mins washdown for other acids or bases
- **REMOVE CONTAMINATED CLOTHING**
 - Clothing should be removed from the affected area while under the shower. Remove chemical safety goggles last.
- **FIRST AID**
 - First aid instructions for chemicals may also be found in SDSs available inside the main entry door to the West lab, in each White Area gowning room (East and West labs) and in the South labs (both RM233 and RM234).
 - ADDITIONAL MEASURES FOR HF EXPOSURE: **calcium gluconate gel** must be applied liberally to the affected skin area. Calcium gluconate gel is available in tubes stored on the handles of each fume cupboard. Other users rendering assistance with first aid in the event of a HF spill must ensure they are wearing gloves to avoid possible cross-contamination. Calcium gluconate gel needs to be reapplied every 15 mins until medical help is present.
- **SEEK MEDICAL ASSISTANCE**
 - UNSW Security will call the ambulance/paramedics as required
 - Additional medical assistance is available at PoW Hospital Emergency
 - A '**HF hospital pack**' containing an additional tube of calcium gluconate gel, a SDS and additional information about HF is located inside the main entry doors to the Upper East and West laboratories. This pack must be taken to hospital with any lab user who has been affected by a HF spill.

LARGE SPILLS: In the event of a large spill of any chemical, other users in the immediate vicinity should be alerted and the laboratory should be evacuated. The Laboratory Manager, an Area Supervisor or UNSW Security should be notified to co-ordinate further emergency procedures as required. If safe to do so, the area should be cordoned off. Chemical spill kits (including half face respirators) are available inside the main entry door to the West lab and in each White Area gowning room. SDSs available in these areas also

UNSW Emergency - Phone 93856666 - Ambulance, Fire, Police, Chemical and Gas Emergencies

provide instructions for how to deal with a spill.

2.4.6 Special Gases System Alarms

Gas monitoring and safety interlocks are employed throughout the **Special Gases System (SGS)** via the labs' **Life Safety System (LSS)**. Further information about the LSS is available in the SGS Policies and Procedures document.

A '**Non-Critical**' SGS alarm will automatically trigger the following:

- All gas cylinders in the rooftop gas shed will be closed at the source.
- A red flashing light will be illuminated outside the rooftop gas shed, inside the Upper East lab (Grey Area) and inside the West lab (Grey Area). If the red light is flashing, please notify the Laboratory Manager or Special Gases Officer immediately.
- UNSW Security will be alerted and will co-ordinate any further action required.

A '**Critical**' SGS alarm will automatically trigger the following:

- All gas cylinders in the rooftop gas shed will be closed at the source.
- An audible and visual alarm will sound outside the rooftop gas shed, inside the Upper East lab (Grey Area) and inside the West lab (Grey Area).
- Users should evacuate the lab
- UNSW Security will be alerted and will co-ordinate any further action required.

All ANFF-NSW Laboratories must be EVACUATED when a 'Critical' SGS alarm sounds - do not wait for the evacuation tone to sound from the EWIS system before evacuating the area. When an evacuation is required, hazardous processes should be made safe if this can be achieved without delaying your exit from the laboratory.

In addition to the automatic safety interlocks, each process tool connected to the SGS has an emergency stop button which can be used to manually trigger a 'Critical' SGS alarm.

There is also a SGS emergency shutdown button located in the Upper East Grey Area below the SGS alarm light. In the case of an emergency, this button may be pressed by any user to manually trigger a 'Critical' SGS alarm.

2.4.7 Fire Suppression Systems

As many pieces of equipment would suffer serious damage from water sprinklers, the first line of defence against fires in most of the ANFF-NSW laboratories is a gas fire suppression system. Water sprinklers are installed as a backup in these areas and will be deployed if the gas fire suppression system fails or is deactivated when a fire is present. Areas without a gas fire suppression system are protected by water sprinklers only.

In addition to the automatic gas fire suppression systems (described in more detail below), CO₂ fire extinguishers are located throughout the ANFF-NSW laboratories (see Appendix 1). Fire blankets are located near fume cupboards throughout the laboratories.

2.4.7.1 East Labs (grey) Water Sprinkler

The Grey Areas in the ANFF-NSW East Labs are protected by water sprinklers only.

2.4.7.2 East Labs (white) FM2000 Fire Suppression System

The white Areas in the ANFF-NSW East Labs are protected by a **FM200 Fire Suppression System** which is automatically activated by a pair of smoke detectors in each laboratory.

FIRE ALARM MODE: If smoke is registered by **only one smoke detectors** in a particular laboratory, the FM200 system will enter 'Fire Alarm' mode and following alarms will be automatically triggered:

- a "ding-a-ling" style fire bell will sound inside the main entry door to the laboratory;
- a "beep-beep-beep" style alarm will sound inside the White Area;

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- a sign above the White Area door will be illuminated, displaying 'Do Not Enter' on the outside and 'Fire Alarm' on the inside; and
- UNSW Security will be alerted.

NOTE: FM200 gas will NOT be released in 'Fire Alarm' mode.

EVACUATE AREA MODE: If smoke is registered by both of the smoke detectors in a particular laboratory, the FM200 system will enter 'Evacuate Area' mode and the following alarms will be automatically triggered:

- the "ding-a-ling" style fire bell inside the main entry door will continue to sound;
- the "beep-beep-beep" style alarm inside the White Area will continue to sound;
- the sign above the white area door will be illuminated, displaying 'Do Not Enter' on the outside and 'Evacuate Area' on the inside; and
- **FM200 gas WILL be released after a delay of approximately 30 seconds.**

If there is no sign of fire when the FM200 system triggers in either 'Fire Alarm' or 'Evacuate Area' mode, the system may be deactivated by pressing one of the 'Stop Gas' buttons located throughout the White Areas (see Appendix 1).

'STOP GAS' OVERRIDE: In the event that there is a fire, but a person is unable to evacuate the White Area (for example, due to injury), the FM200 system should be deactivated by pressing one of the 'Stop Gas' buttons. In this case, the secondary fire protection system will activate water sprinklers.

Even in the absence of fire, the area should be evacuated in response to either of these alarms and the Laboratory Manager should be notified. **Do not wait for the evacuation tone to sound from the EWIS system before evacuating the area.**

2.4.7.3 West Labs VESDA Fire Suppression System

The White and Grey Areas: The ANFF-NSW West Labs are protected by a **VESDA Fire Suppression System** (using 'argonite' gas) which is automatically activated by a pair of smoke detectors in each laboratory. It is important to note that the VESDA system may be deployed in **either** the white **or** the Grey Area, but **not both areas simultaneously**. A fire in both areas will result in gas deployment in one area and sprinkler activation in the other area.

FIRE ALARM MODE: If smoke is registered by only one of the smoke detectors in a particular laboratory, the VESDA system will enter 'Fire Alarm' mode and following alarms will be automatically triggered:

- a "beep-beep-beep" style alarm will sound inside the affected area;
- a sign above the door to the affected area will be illuminated, displaying 'Do Not Enter' on the outside and 'Fire Alarm' on the inside; and
- UNSW Security will be alerted.

NOTE: argonite gas will not be released in 'Fire Alarm' mode.

EVACUATE AREA MODE: If smoke is registered by both of the smoke detectors in a particular laboratory, the VESDA system will enter 'Evacuate Area' mode and the following alarms will be automatically triggered:

- the "beep-beep-beep" style alarm inside the affected area will continue to sound;
- the sign above the door to the affected area will be illuminated, displaying 'Do Not Enter' on the outside and 'Evacuate Area' on the inside; and
- **argonite gas will be released after a delay of approximately 30 seconds.**

If there is no sign of fire when the VESDA system triggers in either 'Fire Alarm' or 'Evacuate Area' mode, the system may be deactivated by pressing one of the 'Stop Gas' buttons located throughout the white and Grey Areas (see Appendix 1).

'STOP GAS' OVERRIDE: In the event that there is a fire, but a person is unable to evacuate the White Area (for example, due to injury), the VESDA system should be deactivated by pressing one of the 'Stop Gas' buttons. In this case, the secondary fire protection system will activate water sprinklers.

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Even in the absence of fire, the area should be evacuated in response to either of these alarms and the Laboratory Manager should be notified. **Do not wait for the evacuation tone to sound from the EWIS system before evacuating the area.**

2.4.7.4 South Water Sprinkler

The ANFF-NSW South labs are protected by water sprinklers system only.

2.5 Legislation

The Work Health and Safety Act 2011 and the Work Health and Safety Regulation 2011 may be accessed via the New South Wales Government website (www.legislation.nsw.gov.au). The UNSW WHS Plan, WHS Policy and associated Procedures may be accessed via the UNSW WHS website (www.ohs.unsw.edu.au).

3. Consultation

3.1 Consultation Structure and Processes

All UNSW staff and students are encouraged to engage in consultation on WHS issues. The UNSW WHS Consultation Procedure may be accessed at www.ohs.unsw.edu.au.

3.2 Other Consultation Processes

WHS is included as a standing item in ANFF-NSW weekly meetings, which convenes the ANFF-NSW WHS Working Group to maintain high levels of WHS awareness and vigilance. All ANFF-NSW laboratory users are welcome to attend these meetings or may request that issues be raised on their behalf by ANFF-NSW staff members.

Extraordinary meetings of the ANFF-NSW WHS Working Group may be convened by the Lab Manager &/or Facility Business Manager for safety matters requiring additional focus (e.g. incident response, significant changes etc)

4. Implementation

4.1 Risk Management Program

The ANFF-NSW-specific rules and procedures detailed in this section have been put in place to ensure the health and safety of all users of the ANFF-NSW laboratories. **Any breach of these rules and procedures is unacceptable and may lead to the suspension or withdrawal of laboratory access, or to more serious legal proceedings.**

If in doubt about any aspect of safety in the ANFF-NSW laboratories, users should seek assistance from the Laboratory Manager or relevant Area Supervisor.

4.1.1 Risk Management and Safe Work Procedures

Risk management procedures (as described in section 2.1) are completed for all tasks performed in the ANFF-NSW laboratories and documented in a Risk Management (RM) form.

RM and Safe Work Procedure (SWP) documents are available to all users via the ANFF-NSW website (www.anff-nsw.org) or by request to the ANFF-NSW WHS Coordinator.

SWP/RM documents are reviewed annually by ANFF staff. Lab users are responsible to ensure that they are familiar with the current SWP/RM before undertaking a task. ANFF recommends that users review safety documents before each day of processing.

Where a new task or material is required, a risk assessment process (documented via a RM form) must be completed (usually by ANFF-NSW staff working in close collaboration with the user who has requested the new task or material). If use of the new task or material is approved by the ANFF-NSW WHS working group, a new (or modified) SWP will be put in place prior to the work proceeding.

Certain tasks require the presence of more than one user (“buddy system”). The number of users required for each task will be clearly stated in the relevant SWP and must be strictly adhered to.

4.1.2 ANFF-NSW Laboratory Access – Researchers

The facilities of the ANFF-NSW laboratories are available to staff and student researchers from UNSW and external research organisations (both publicly funded and privately funded). Access procedures are detailed in the ANFF-NSW Access and Pricing Policy (available at www.anff-nsw.org).

Direct access to ANFF-NSW laboratories involves researchers entering the laboratories to:

- participate in training with ANFF-NSW staff or other Authorised Trainers; or
- undertake independent work, once certified to do so (see section 4.3.3).

Researchers wishing to gain direct access to the ANFF-NSW laboratories must first attend a local **Laboratory Safety Induction (LSI)** course run by ANFF-NSW staff. Following the LSI, participants must complete a safety quiz and to demonstrate an understanding of safety policies and emergency procedures to the satisfaction of the Laboratory Manager before being allowed direct access to the laboratories. Swipe card access to the ANFF-NSW laboratories is not granted until the additional conditions specified in section 4.1.5 have been met.

Indirect access to ANFF-NSW laboratories involves ANFF-NSW staff (or other suitably qualified lab users) performing processing on behalf of a researcher who does not enter the laboratories.

Researchers may request to observe processing being performed by ANFF-NSW staff or other certified users only where the process is demonstrably non-hazardous and there are extraordinary circumstances. Other conditions e.g. a safety briefing or WHS Working Group approval may also be applied. In the first instance, requests should be made to the ANFF Projects Manager, and may need escalation to the ANFF Lab Manager or Facility Business Manager.

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Researchers wishing to access the ANFF-NSW laboratories indirectly need not complete an LSI. However, it is necessary for work in this category to be covered by an ANFF Proposal as per the ANFF-NSW Access and Pricing Policy (available at www.anff-nsw.org).

4.1.3 ANFF-NSW Laboratory Access – Contractors

Any contractors requiring access to the ANFF-NSW laboratories or plant areas to make deliveries, or to perform installations, repairs or maintenance work must first undertake a safety briefing with the Laboratory Manager in compliance with the UNSW Contractor Safety Management Guideline (available at www.ohs.unsw.edu.au). During this briefing, the Laboratory Manager will specify the areas the contractors may access, the times they may work, and any additional access or supervisory requirements.

4.1.4 ANFF-NSW Lab Access - Visitors, Tour Participants and Undergraduate Students

Visitors and Tour Participants

Prior to entering the laboratory, any visitors or participants on a tour of the ANFF-NSW laboratories must complete a safety briefing with the Laboratory Manager or an approved tour leader in compliance with the UNSW Visitors Guideline (available at www.ohs.unsw.edu.au). **Visitors and tour participants must be accompanied by an authorised tour leader at all times whilst in the laboratories.**

Visitors and tour participants must not take part in any training, perform any processing, or operate any equipment. If process training and task certification is later required, the ANFF Projects Manager should be contacted to make initial arrangements.

Anyone wishing to arrange a tour or bring visitors into the ANFF-NSW laboratories should discuss this request with the Projects Manager or the Facility Manager, well in advance.

Undergraduate Students

Regardless of their starting or desired final status, **undergraduate students** (from UNSW or external organisations) must complete a three month 'probationary period' following their Lab Induction and passing the Safety Quiz. **During this time, undergraduate students must be supervised by a certified user at all times whilst in the ANFF-NSW laboratories.**

The supervising certified user should be: Post Graduate level or higher, certified on the tool/task, a frequent user the tool/task, highly familiar with ANFF safety systems and a frequent user of the ANFF Laboratories. The supervisor cannot be another undergraduate.

Undergraduates should not observe high-hazard processes (ie full-clean, TMAH, HF processes) and the supervision is for demonstration/observing process only, *not for training* purposes. In select cases, the ANFF Projects Manager can be contacted to request process training and task certification to upgrade an undergraduate to 'direct access' level to undertake independent work, further arrangements. Such requests will be considered on a case-by-case basis.

Undergraduate students may only apply to the Laboratory Manager for swipe card access when they have completed their three-month probationary period AND completed sufficient training and certifications to allow independent work to be performed.

4.1.5 Swipe Card Access

Lab users may apply to the Laboratory Manager for swipe card access to the ANFF-NSW laboratories when they have completed sufficient training and certifications (see sections 4.3.2 and 4.3.3) to allow independent work to be performed. The time required to achieve certification for independent work depends on many factors, including: process requirements, previous experience and aptitude for learning fabrication skills.

Users must not allow anyone without ANFF-NSW swipe card access to gain entry into the laboratory, by opening the door for them, by lending swipe cards or by any other means. The only exceptions to this are:

- Authorised Trainers allowing access to a user they will be training
- Certified users allowing access to a visitor or tour participant, who have previously arranged the tour request with the Project Manager or the Facility Manager.
- Certified users (PG or higher) allowing supervised access to an undergraduate student they have agreed to accept responsibility for supervising, within the undergraduate student's three-month probationary period
- Authorised tour leaders allowing access to tour participants.

PLEASE NOTE: you become legally responsible for the safety of any person you provide with access to a hazardous environment such as the ANFF-NSW laboratories. In the event of an incident involving a person you allowed into the ANFF-NSW laboratories, there are legal ramifications for yourself, your supervisor, ANFF-NSW and UNSW.

Anyone without swipe card access who requests entry to the ANFF-NSW laboratories should be directed to the ANFF-NSW Facility Manager.

ANFF Lab Access Pathways - Summary

This table shows a *summary* of lab users' status and the relevant pathway to gain access to the ANFF laboratories and tools as per sections 4.1.2 - 4.1.5.

There are three levels of lab access: Direct, Indirect and Supervised.

Your Status	Access Level Sought	Who to Contact	ANFF Safety Requirements	User Swipe Access	Lab Tool Use
Researcher	Direct (Be trained to perform Lab work independently)	Projects Manager	-ANFF Proposal Form -Lab Safety Induction & Quiz -Scheduler Login -Process Training & Certification by ANFF -Task Cert Sheet signoff by ANFF	Yes on 'as needed' basis for each lab, after tool training and certification	Yes
Researcher	Indirect (No training, ANFF undertakes processing as a service)	Projects Manager	-ANFF Proposal Form -Scheduler Login ('invitation' mode only) -Supervision at all times and safety briefing if visiting	None	No Observe only
Contractor	Supervised (by Lab Manager or ANFF Staff)	Lab Manager	-UNSW Site Induction -Local ANFF safety briefing by lab manager -Supervision at all times	None	No Limited exceptions subject to approval, e.g. for commissioning new tools
Visitors/Tour Participants	Supervised (by Tour Leader)	Facility Manager, Project or Lab Manager	Local ANFF Safety Briefing by tour leader or lab manager -Supervision at all times	None	No
Undergraduate "Taste of research" or similar program	Supervised (by certified PG level or higher)	Projects Manager	-Lab Safety Induction & Quiz -Supervision at all times	None	No Observe only
Undergraduate upgrading to "Researcher" status	Supervised (by certified PG level or higher) Then eventually, Direct Access	Projects Manager	-ANFF Proposal Form -Lab Safety Induction & Quiz -Scheduler Login -Process Training by ANFF -Task Cert Sheet signoff by ANFF	Conditional Only after 3 months "probation period" and after tool training and certification. Lab by lab 'as needed'	Conditional Only after 3 months "probation period" and after tool training and certification

4.1.6 Removal of Lab Access

All ANFF-NSW laboratory users are expected to adhere to the policies and rules specified in the ANFF-NSW Health and Safety guidelines. Laboratory users are also expected to behave in accordance with the UNSW Code of Conduct (available at www.gs.unsw.edu.au) in all dealings with ANFF-NSW staff and other laboratory users.

The Facility Manager, Lab Manager and Area Supervisors have the right to ask any staff, student or visitor to leave the ANFF-NSW laboratories if they fail to meet the access requirements set out in sections 4.1.2 - 4.1.6 inclusive, if they fail to obey other laboratory rules, or if their behaviour is deemed inappropriate. UNSW Security will be summoned for assistance should any user refuse to leave the laboratories when asked to do so.

Serious or repeated breaches of ANFF-NSW policies and rules may result in the removal of laboratory privileges and swipe card access. Further action may also be taken by the University or other authorities as applicable.

4.1.7 Standard Working Hours

The Standard Working Hours in the ANFF-NSW laboratories are 8am -6pm Monday to Friday, excluding public holidays and any other periods during which the Laboratory Manager declares the laboratory closed (indicated as promptly as possible by signage posted at laboratory entry points and by broadcast email).

During Standard Working Hours, lab users may perform tasks for which they have been certified, following the relevant Safe Work Procedure. If working alone (where this is allowable under the relevant Safe Work Procedure), a Personal Duress Transmitter (PDT) must be worn.

4.1.8 Extended Working Hours

Extended Working Hours in the ANFF-NSW laboratories are 6am-8am and 6pm-midnight Monday to Friday, and 6am to midnight on Saturdays, Sundays and public holidays, excluding any periods during which the Laboratory Manager declares the laboratory closed (indicated as promptly as possible by signage posted at laboratory entry points and by broadcast email).

Due to limited technical support and longer response times in the event of an emergency, some processes are not permitted during Extended Working Hours, or may only be performed under certain conditions specified in the relevant Safe Work Procedure. During Extended Working Hours, lab users may perform tasks for which they have been certified only when any additional conditions specified in the relevant Safe Work Procedure are met. A PDT must be worn by one lab user during extended hours, even if multiple lab users are working in the area.

Where there is a pressing need for work to take place during Extended Working Hours and the conditions specified in the relevant Safe Work Procedure cannot be met, this should be discussed in advance with the Laboratory Manager. Approval for the work to take place may be granted if appropriate risk mitigation strategies can be put in place.

4.1.9 Exceptional Working Hours

Exceptional Working Hours in the ANFF-NSW laboratories are midnight to 6am seven days, excluding any periods during which the Laboratory Manager declares the laboratory closed (indicated as promptly as possible by signage posted at laboratory entry points and by broadcast email).

Due to extremely limited technical support and longer response times in the event of an emergency, only a limited number of processes are permitted during Exceptional Working Hours under additional conditions specified in the relevant Safe Work Procedure. During Exceptional Working Hours, lab users may perform tasks for which they have been certified only when the additional conditions specified in the relevant Safe Work Procedure are met. A PDT must be worn by one lab user during exceptional hours, even if multiple lab users are working in the area.

Where there is a pressing need for work to take place during Exceptional Working Hours and the conditions specified in the relevant Safe Work Procedure cannot be met, this should be discussed in advance with the Facility Manager, who may refer to the WHS Working Group for discussion. Approval for the work to take place may be granted if appropriate risk mitigation strategies can be put in place.

4.1.10 Safety Escort

Outside Standard Working Hours, users are strongly encouraged to make use of free safety escorts offered by UNSW Security. Safety escorts may be requested by phoning the Security Services Control Room on 93856000.

4.1.11 Equipment Booking

All processing and equipment use in ANFF-NSW laboratories must be booked in advance. Bookings are managed via the Scheduler (the ANFF-NSW on-line booking system) which is accessed via the ANFF-NSW website (www.anff-nsw.org). Once certified, users may make equipment bookings directly or (for some tools and processes) via the ANFF-NSW process engineering team.

4.1.12 ANFF-NSW Electronic Lab Entry Logging System (Tap-in/Tap-out)

An electronic tap-in/tap-out has replaced the previous paper-based logbooks for lab access. All users must tap-in and tap-out using their UNSW access card at the e-login point, provided at each laboratory entry. This lab entry logging assists ANFF to be aware of lab occupancy levels, especially in case of emergency.

In the case of out-of-hours lab access, users must also nominate their buddy on the “buddies board” (white board) located at the entry to each lab.

4.1.13 Equipment Log Books

Where log books are provided for specific pieces of equipment, these must be completed by users for each instance of use.

4.1.14 Ticket system

If users encounter any issues in the ANFF-NSW laboratories, where they don't require immediate assistance, they can send a ticket via e-mail to anff@unsw.edu.au. The ticket system can be used e.g. in case of consumables or resits running low, minor equipment issues or training requests.

For emergencies or major equipment failure or breakdown call the Laboratory Manager or Area Supervisor using the phone lists in the lab and on the entry doors.

4.1.14 Hazard and Incident Reporting

Users are encouraged to remain vigilant at all times whilst working in the ANFF-NSW laboratories and to immediately report any unusual conditions (e.g. smells, elevated temperature, unusual sounds) to the Laboratory Manager or an Area Supervisor who will investigate and initiate further action as required. Phone numbers can be found on the emergency contact list displayed near each telephone throughout the ANFF-NSW laboratories and inside the main entry door to each lab.

Any concerns or questions relating to ANFF-NSW laboratory use and safety are best discussed directly with the Laboratory Manager or an Area Supervisor in the first instance to ensure a quick response. If necessary, issues can be raised at weekly ANFF-NSW meetings for further discussion. Users are welcome to attend these weekly meetings or may request that issues be raised on their behalf by ANFF-NSW staff members.

Where required, formal reports are made following the UNSW Hazard and Incident Reporting Procedure (available at www.ohs.unsw.edu.au). This Procedure allows all UNSW staff, students and visitors to report hazards and incidents for investigation and action.

4.1.15 Repair of Equipment

Any faults, failures or safety concerns with laboratory equipment **must** be reported immediately to the Laboratory Manager, Area Supervisor or Equipment Warden.

Lab users must never attempt to repair faulty equipment.

Equipment that is under repair will be clearly tagged out and is not to be used. **Lab users must never remove tags from tagged out equipment, or reconnect such equipment to services** as such actions could cause a serious injury or death (eg. from electrocution) and lead to severe legal consequences.

4.1.16 'No Entry to Lab' Closure

At certain times, the Laboratory Manager may declare a 'No Entry to Lab' closure due to an emergency situation or maintenance requirements. Users should note that some hazards which would lead to such a closure (eg. gas leaks or electrical faults) may not be evident from outside the lab.

'No Entry to Lab' closures will be indicated (as promptly as possible) by signage posted at the main entry doors to the labs and by broadcast email.

Lab users (including ANFF-NSW staff members) must never enter the ANFF-NSW laboratories during a 'No Entry to Lab' closure without direct instruction from the Laboratory Manager. This rule must be strictly adhered to at all times, even when no hazard can be seen from outside the lab.

4.1.17 Cleanroom Garments

All people entering the ANFF-NSW laboratories (all areas) must adhere to the following dress code:

- **Shoes** - Fully enclosed, non-porous footwear must be worn - no bare feet, thongs, sandals, canvas or mesh trainers, or shoes with high heels.
- **Overshoes** - Blue plastic booties must be worn over street shoes and are disposed of after single use.
- **Eye Protection** - Safety glasses must be worn and are returned to the gowning room on departure.
 - As regular glasses do not provide adequate eye protection, safety glasses must be worn in addition to regular glasses.
 - Safety glasses may be removed when using microscopes or electron-beam lithography systems.
- Long hair must be tied back.
- Long trousers are recommended.

In Grey Areas in the ANFF-NSW East laboratories, additional requirements are:

- **Gloves** are provided and may be worn where required for specific tasks. They are disposed of after single use (or replaced immediately if holes or contamination are suspected).
- **Surgical masks** are provided and may be worn where required for specific tasks. They are disposed of after single use.

In Grey Areas in the ANFF-NSW West laboratories, additional requirements are:

- **Lab coats** must be worn if working in the Grey Area, but are not required if transiting to the White Area. Lab coats are re-used and should be hung up in the gowning room on departure.
- **Hairnets** must be worn and are disposed of after single use.
- **Gloves** must be worn and are disposed of after single use (or replaced immediately if holes or contamination are suspected).
- **Surgical masks** are provided and may be worn where required for specific tasks. They are disposed of after single use.

In White Areas in both ANFF-NSW East and West laboratories, additional requirements are:

- **Full cleanroom garments** must be worn.
 - Regular long-term users of the White Areas in the ANFF-NSW laboratories will be allocated their own set of cleanroom garments (hood, coverall and boots) which must not be worn by other laboratory users.

- Infrequent and new users of the White Areas in the ANFF-NSW laboratories may wear visitors' garments (microgard suits and boots) which are reused and should be returned to the change room on departure from the cleanroom. Torn or damaged microgard suits should be disposed of. New microgard suits and boots are available in the gowning rooms.
- **Hairnets** must be worn and are disposed of after single use.
- **Gloves** must be worn and are disposed of after single use (or replaced immediately if holes or contamination are suspected).
- **Surgical masks** must be worn and are disposed of after single use.

In the South laboratories, additional requirements are:

- **Lab coats** must be worn.
- **Gloves** are provided and may be worn where required for specific tasks. They are disposed of after single use (or replaced immediately if holes or contamination are suspected).
- **Surgical masks** are provided and may be worn where required for specific tasks. They are disposed of after single use.
- **Hairnets** must be worn and are disposed of after single use.

Additional items of personal protective equipment (PPE) such as safety goggles or aprons are required for some tasks – see section 4.1.18.

4.1.18 Personal Protective & Equipment (PPE)

In addition to the cleanroom garments specified in section 4.1.17, some tasks require additional items of personal protective clothing and equipment (PPE). Examples of additional PPE requirements include:

- Safety goggles required for all tasks which include the handling of chemicals;
- Acid apron and sleeve protectors are required for more hazardous task
- UV-blocking laser goggles required during operation of the excimer laser.
- ALWAYS Refer to the SWP for the process, to clarify exactly what PPE is required in each case.

The correct use of cleanroom garments and any additional PPE required will be taught during training sessions. PPE requirements are also specified in SWPs.

4.1.19 Working with headphones

In compliance with the UNSW policy on the Use of audio/media devices with earphones in the workplace, "the use of audio/media devices with earphones is prohibited" in the ANFF laboratories.

https://safety.unsw.edu.au/sites/default/files/documents/HS735_Protocol_audio_media_devices.pdf

4.2 WHS Record Control

Details of local records maintained by ANFF-NSW are given below:

Document	Manager	Location	Availability
ANFF-NSW Meeting minutes	Project Manager & Facility Manager	ANFF-NSW website	All ANFF-NSW users
ANFF-NSW Health and Safety guidelines	Facility Manager & Laboratory Manager, WHS Coordinator	ANFF-NSW website	All ANFF-NSW users
SGS Policies and Procedures	Laboratory Manager	ANFF-NSW website	All ANFF-NSW users
ANFF-NSW Access and Pricing Policy	Facility Manager	ANFF-NSW website	Open access
ANFF-NSW Proposals	Facility Manager & Project Manager	Facility Manager's files	ANFF-NSW staff & Access Committee (Note: users personal Proposals are available upon request)
ANFF-NSW User Agreements	Project Manager	Facility Manager's files	ANFF-NSW staff (Note: users personal Agreements are available upon request)
ANFF-NSW Payment Forms	Facility Manager	Facility Manager's files	ANFF-NSW staff (Note: users personal Forms are available upon request)
Laboratory Safety Induction Attendance Records	Laboratory Manager	WHS Coordinator's files	ANFF-NSW staff
Task Certification Checklists	WHS Coordinator	WHS Coordinator 's files	ANFF-NSW staff (Note: users personal checklists are available upon request)
Visitor/Tour Group Lab Induction Forms	Laboratory Manager	WHS Coordinator's files	ANFF-NSW staff
SDS database	WHS Coordinator	ANFF-NSW website & labs	All ANFF-NSW users
RA database	WHS Coordinator	ANFF-NSW website	All ANFF-NSW users
SWP database	WHS Coordinator	ANFF-NSW website & labs	All ANFF-NSW users
Chemical inventory	WHS Coordinator	Jaggaer (UNSW based database)	Lab Manager/ WHS Coordinator, Tech Team
Chemical waste disposal Record	WHS Coordinator	UNSW Online Chemical Waste Disposal System	Facilyt Manager, WHS Coordinator, Lab Cleaner, Process Engineers
Hazard and Incident Reports	WHS Coordinator	myUNSW	ANFF-NSW staff
Workplace Inspection reports	WHS Coordinator	WHS Coordinator's files and myUNSW	ANFF-NSW staff
Plant register	Laboratory Manager	Laboratory Manager's files	ANFF-NSW staff
Equipment test & maintenance certificates	Laboratory Manager	Laboratory Manager's files	ANFF-NSW staff

4.3 WHS Training

4.3.1 Laboratory Safety Induction

Users wishing to gain direct access to the ANFF-NSW laboratories (as defined in section 4.1.2) must first attend a local Laboratory Safety Induction (LSI) course run by ANFF-NSW staff. LSIs are usually offered once a month.

Following the LSI, participants must complete a safety quiz and demonstrate an understanding of safety policies and emergency procedures to the satisfaction of the Laboratory Manager before being allowed direct access to the laboratories. Swipe card access to the ANFF-NSW laboratories is not granted until the additional conditions specified in section 4.1.5 have been met.

4.3.2 Equipment and Process Training

All users must complete training and certification for each process they wish to use independently in the ANFF-NSW laboratories. Training may be provided by ANFF-NSW staff or by other Authorised Trainers (see section 1.3.7). Details of Authorised Trainers available to provide training for specific pieces of equipment or processes can be provided by the Projects Manager.

Requests for training by ANFF-NSW staff follow the procedures outlined in the ANFF-NSW Access and Pricing Policy (available at www.anff-nsw.org).

Users are encouraged to request 'refresher' training whenever they feel this is required, particularly after an extended period of absence from the ANFF-NSW laboratories.

4.3.3 Equipment and Process Certification

Once training is complete, users must demonstrate their competency in operating a piece of equipment or process to the satisfaction of the Equipment or Process Warden in order to gain certification to perform the process independently. Details of Equipment and Process Wardens for each piece of equipment and process in the ANFF-NSW laboratories are available via the ANFF-NSW website (www.anff-nsw.org) or by request to the Projects Manager.

Certifications are officially recognised when the Equipment or Process Warden signs the user's Task Certification Checklist. Task Certification Checklists are maintained by the Laboratory Manager and WHS Coordinator. Users may view their own Task Certification Checklist by arrangement with the Laboratory Manager or WHS Coordinator. Only certified users will be provided booking access to the tools via the lab Scheduler software.

Users MUST NOT independently perform processes for which they have not been certified.

The Laboratory Manager reserves the right to revoke certifications following a 12 month period during which a piece of equipment or process has not been used, or at any other time when there is good reason to suggest that a user may be in need of 'refresher' training.

4.3.4 Other WHS Training

ANFF-NSW staff with WHS responsibilities will complete internal UNSW training courses or other appropriately accredited courses according to their roles.

4.4 Specific Hazards Management

4.4.1 Working with Chemicals

Unless stated otherwise in the Safe Work Procedure (SWP) all chemicals in ANFF-NSW Labs must be used within a fume cupboard. Fume cupboards must also be used safely:

- You should always lower the sash, as far as practical, to protect yourself and other lab users.
- Do not sit at the fume cupboard. Your escape will be delayed from any chemical spill or flash-up. You may trip-over the stool and fall, as you attempt to move out of the way of danger.
- Never put your head inside the fume cupboard. You will be exposed to the chemical fumes.
- Do not block the opening with your body or too much equipment. The fumes can come back out, affecting yourself and other lab users, as the lab air circulates.

Safety Data Sheets (SDSs) for each chemical used and stored in the ANFF-NSW laboratories are available via the ANFF-NSW website (www.anff-nsw.org). Hard copies of SDSs are also available inside the main entry door to the West lab, in each White Area gowning room (East and West labs) and in the South labs (both RM233 and RM234). Information available from a SDS includes: chemical composition and properties; hazard identification; toxicological information; first aid and emergency measures; and handling, storage and disposal requirements.

All chemicals used in ANFF-NSW laboratories, including supplies decanted from stock bottles, must be labelled according to the UNSW Labelling of Hazardous Substances Guideline (available at www.ohs.unsw.edu.au). Chemical bottle carriers must be used at all times when moving chemical bottles around the laboratory. Safety goggles (providing greater protection than safety glasses) must be worn at all times when handling chemicals (including working with chemicals in fume cupboards and moving chemicals around the laboratory).

All chemical use in ANFF-NSW laboratories must follow the relevant Safe Work Procedure (SWP). Unattended chemical processes are only allowed where the relevant SWP includes instructions for unattended processing. In such cases, the chemical must be labelled with the chemical name, user's name, contact number and date. Under no circumstances may unidentified chemicals (including minor or major spills) be left unattended. Fume cupboards must be left clean and all water splashes cleaned up after use.

If a laboratory user wishes to introduce a new chemical (or chemical mixture) into any of the ANFF-NSW laboratories they need to provide the WHS Coordinator with a copy of the SDS for the new chemical and a completed *new material/process request form* (available from ANFF web site), which includes details of the proposed use of the chemical. A risk assessment process following the procedure described in section 2.1 will be completed (usually by ANFF-NSW staff working in close collaboration with the user). If use of the new task or material is approved by the ANFF-NSW WHS working group, a new (or modified) SWP will be put in place prior to the work proceeding.

Chemical storage: ANFF-NSW East, West and South Laboratories all contain ventilated storage cabinets for flammables, corrosives and oxidising agents. Spark-proof chemical refrigerators and a freezer are also available for chemical storage in ANFF-NSW East Laboratories.

Disposal of solvents: Due to their flammability and compliance requirements for waste water, solvents **must not** be disposed of down the trade waste drain (ie. fume cupboard sink). Solvents (including solvent-based chemicals such as photoresists) must be disposed of in the marked solvent waste bottles with funnels provided in wet-bench fume-cupboards. Solvent waste bottles must not be filled beyond the shoulder of the bottle (approx. 80% full). The Laboratory Cleaner will arrange for solvent waste to be disposed of via the UNSW waste program.

Solid waste including solvents (eg. wipes used to clean up solvent drips, plastic pipettes used for photoresist application) must be disposed of in the marked outgas bins provided in all spinner fume-cupboards for outgassing prior to disposal in the marked 'contaminated waste' garbage bins. The Laboratory Cleaner will arrange for 'contaminated waste' garbage bins to be disposed of via the UNSW

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waste program.

Solid waste contaminated with acids or alkalis (eg. wipes used to clean up chemical drips, gloves contaminated with chemicals) must be disposed of in the marked outgas bins provided in all wet fume-cupboards for outgassing prior to disposal in the marked 'general laboratory waste' garbage bags. The Laboratory Cleaner will arrange for 'general laboratory waste' garbage bags to be disposed of via the UNSW contaminated waste program.

Disposal of acids and alkalis: Separate waste containers are supplied for chemical waste containing:

- hydrofluoric acid (HF);
- tetramethylammonium hydroxide (TMAH), including photoresist developer; and
- RCA1 etchant.

The Laboratory Cleaner will arrange for this waste to be disposed of via the UNSW waste program.

All other acid and alkali solutions may be diluted, then flushed down the trade waste drain (ie. fume cupboard sink). Trade waste is neutralised on site before disposal.

4.4.2 Working with Hazardous Gases

The Special Gases System (SGS) comprises all plant for the storage and distribution of hazardous (ie. toxic, corrosive or flammable) gases to the ANFF-NSW laboratories. A gas storage shed is housed on the roof of the ANFF-NSW East Laboratory along with exhaust extraction and treatment units. Access to the roof-top gas shed is only available by arrangement with the Laboratory Manager. Lab equipment making use of hazardous gases via the SGS is contained within a limited access area indicated by floor markings and signage in the ANFF-NSW Upper East Laboratory (Grey Area) and West labs (Grey Area).

In addition to completing the usual training and certification procedure, users of the SGS and associated process tools must be familiar with the Special Gases System Policy and Procedures document available from the Laboratory Manager.

The SGS is monitored by the lab's Life Safety System (LSS) which automatically shuts the system down if an unsafe condition is detected. All users are required to be familiar with SGS related alarms and emergency procedures including the location of emergency shutdown buttons for the SGS system and individual process tools (see section 2.4.6).

4.4.3 Working with Nanoscale Materials

The term 'nanotechnology' can refer to an extremely wide range of science and engineering research efforts with an interest in particles, materials, structures or devices with nanoscale dimensions. Traditionally, the ANFF-NSW laboratories have focussed on lithography-based fabrication of electronic devices with micro- and nano-scale features. However, as the scope of work supported by ANFF-NSW broadens, and research interests evolve, there is increasing interest from ANFF-NSW users in applying different fabrication methods to produce a range of different samples and devices.

Definitions (based on ISO/TS 27687:2008)

Nanoscale: the size range from approximately 1nm to 100nm

Nano-object: an object with one, two or three external dimensions in the nanoscale

- **Nanoparticle:** a nano-object with all three external dimensions in the nanoscale
- **Nanofibre:** a nano-object with two similar external dimensions in the nanoscale and the third dimension significantly larger
- **Nanoplate:** a nano-object with one external dimension in the nanoscale and two other external dimensions significantly larger

A thorough risk management procedure (as described in section 2.1) must be undertaken to identify potential hazards and put appropriate control measures in place prior to the introduction of any new material or fabrication process into the ANFF-NSW laboratories. For work involving nano-objects (as per the definitions above), the risk management procedure is very often hindered by the absence of any standards regarding safe exposure limits. It is emphasised that nano-objects often exhibit very different properties to their bulk counterparts, hence safe exposure limits defined for bulk materials do not automatically apply to the same materials on the nanoscale.

In the absence of any standards regarding safe exposure limits, a precautionary approach must be taken to all work involving nano-objects (including processes that may generate nano-objects as deliberate or accidental by-products). This involves minimising human exposure to nano-objects in the laboratory and appropriately disposing of waste containing nano-objects to minimise human exposure to nano-objects outside the laboratory.

The primary human exposure routes to protect against are inhalation, ingestion and direct skin contact.

Inhalation: Inhaled nano-objects may accumulate in the lungs, or be absorbed into other organs, potentially leading to serious illness or death. Possible control measures to protect against inhalation of air-borne nano-objects include restricting work to a glove-box or suitably rated fume cupboard.

Surgical masks such as those worn in the ANFF-NSW laboratories (White Areas) do not provide protection against the inhalation of nano-objects. The fume cupboards currently in operation in the ANFF-NSW laboratories do not provide adequate levels of particulate capture or isolation from other processes to provide a safe working environment for processes involving a risk of inhalation of nano-objects. Further, ANFF-NSW laboratories are maintained at positive pressure, providing no containment mechanism for air-borne nano-objects. As such, most work involving loose nano-objects cannot be accommodated in the ANFF-NSW laboratories at present. Exceptions may include nano-objects which pose no risk of becoming air-borne, or nano-objects for which standards regarding safe exposure limits have been defined and are met by the proposed safe work procedure.

Ingestion: Ingested nano-objects may be absorbed into the body, potentially leading to serious illness or death. Ingestion of nano-objects may occur via inhalation (control measures as above) or by contaminated gloves, hands or other objects coming into contact with the mouth. Possible control measures to protect against ingestion via contact with the mouth include wearing gloves and a surgical mask (ensuring that gloves are disposed of prior to removal of the surgical mask).

Direct skin contact: Nano-objects may be absorbed into the body through cuts in the skin (and possibly through unbroken skin), potentially leading to serious illness or death. Possible control measures include wearing appropriately rated gloves.

Disposal of Nano-Objects: Disposal of waste containing nano-objects must be considered as part of the risk management procedure.

Exhaust from process areas involving air-borne nano-objects should pass through appropriately rated HEPA filters before being expelled or re-circulated. Currently, ANFF-NSW laboratories are set up for HEPA filtering of intake and recirculated air only and expelled air is not filtered. ANFF-NSW laboratories are therefore not adequately equipped at this time to handle the processing or disposal of exhaust waste containing air-borne nano-objects.

In some cases, it may be appropriate for liquid or solid waste containing nano-objects to be disposed of via the UNSW contaminated waste program.

Where waste containing nano-objects may contain reactive components, additional levels of waste treatment may be required.

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4.4.4 Working with Cryogenic Liquids

The Veeco III-V molecular beam epitaxy (MBE) system in the ANFF South lab (room 233) makes use of liquid nitrogen (LN2) supplied via a closed loop system. In normal operation, users are not exposed to liquid nitrogen. However, in the Edwards 306 Tool, LN2 can be used from a Dewar in room 233a (Test Lab). All users in the area must be aware of the liquid nitrogen usage and the risk of asphyxiation and cold burns in the event of a leak. The ANFF South labs are fitted with oxygen sensors which will sound an alarm should a significant level of oxygen depletion be registered. Should the oxygen depletion alarm sound, or a nitrogen leak be suspected for any reason, users should leave the laboratory immediately and notify the Laboratory Manager or Area Supervisor.

4.4.5 Working with Lasers

The Pascal laser-molecular beam epitaxy (MBE) system in the ANFF South lab makes use of an 8W KrF excimer ultraviolet ablation laser and a 120W solid state infrared heating laser. The laser MBE lab safety systems have been assessed and approved by the UNSW Radiation Safety Committee (RSC)

In normal operation, the lasers are fully enclosed within appropriate shielding, and are classified as Class 1 lasers presenting minimal risk to users. However, certain procedures may require the removal of laser shielding, in which case the laser is classified as a Class 4 laser. For the excimer ultraviolet laser, risks include burns to skin and permanent corneal damage to the eye. For the solid-state infrared laser, risks include first to second degree burns and permanent retinal damage to the eye. Mitigation strategies in place include chamber and room interlocks, in compliance with the Australian/New Zealand Standard AS/NZS IEC 60825.1:2011 laser safety code. Laser safety goggles are also provided for users of the laser-MBE system.

5. Measurement

5.1 Inspection, Testing and Monitoring

Temperature and humidity throughout the ANFF-NSW laboratories is monitored constantly, with technical staff able to view the environmental status of the laboratories online at any time. Constant gas sensing is employed throughout the air handling and special gases systems to ensure performance and safety, with automatic alerts to technical staff and UNSW security where required. As an additional precautionary measure, oxygen sensors with an independent alarm system are also installed in critical areas throughout the laboratories.

Area Supervisors conduct daily safety checks throughout their area of responsibility and liaise closely with users working within their area regarding safety issues and equipment and process performance.

Workplace inspections following the UNSW Inspection, Testing and Monitoring Procedure (available at www.ohs.unsw.edu.au) are conducted once each year throughout the ANFF-NSW laboratories and office areas.

Other regular test, maintenance and certification activities follow the schedule below:

RO/DI water system	Test/maintenance	Different checks performed weekly and quarterly
Chillers/air handling systems	Test/maintenance	Different checks performed monthly, six monthly and annually
SGS & LSS	Test/maintenance	Different checks performed monthly, six monthly and annually
FM200 and VESDA fire suppression systems	Test/maintenance	Different checks performed monthly, six monthly and annually
First aid kits	Replacement	Annually
Eye wash & showers	Test	As per UNSW guideline weekly & monthly respectively
Fire extinguishers	Test/replacement	Six monthly
Laser interlocks	Test	Six monthly
Fume cupboards	Test/certification	Annually
Portable electricals	PAT testing	Annually
Duress Alarms	Test	Annually
Laser goggles	Quality inspection	Annually

5.2 Health Surveillance

The need for health surveillance of laboratory users is considered as part of the risk management procedure completed for each process running in the ANFF-NSW laboratories, with appropriate monitoring put in place as required.

5.3 HSMS Auditing

ANFF-NSW participates in scheduled audits of the UNSW HSMS as required.

6. Review

6.1 Monitoring the UNSW WHS Plan

ANFF-NSW contributes to the continual improvement of WHS procedures in order to achieve the objectives of the UNSW WHS Plan via active participation in WHS committees (as per the structure shown in section 1.3) and associated reporting processes.

6.2 HSMS Review

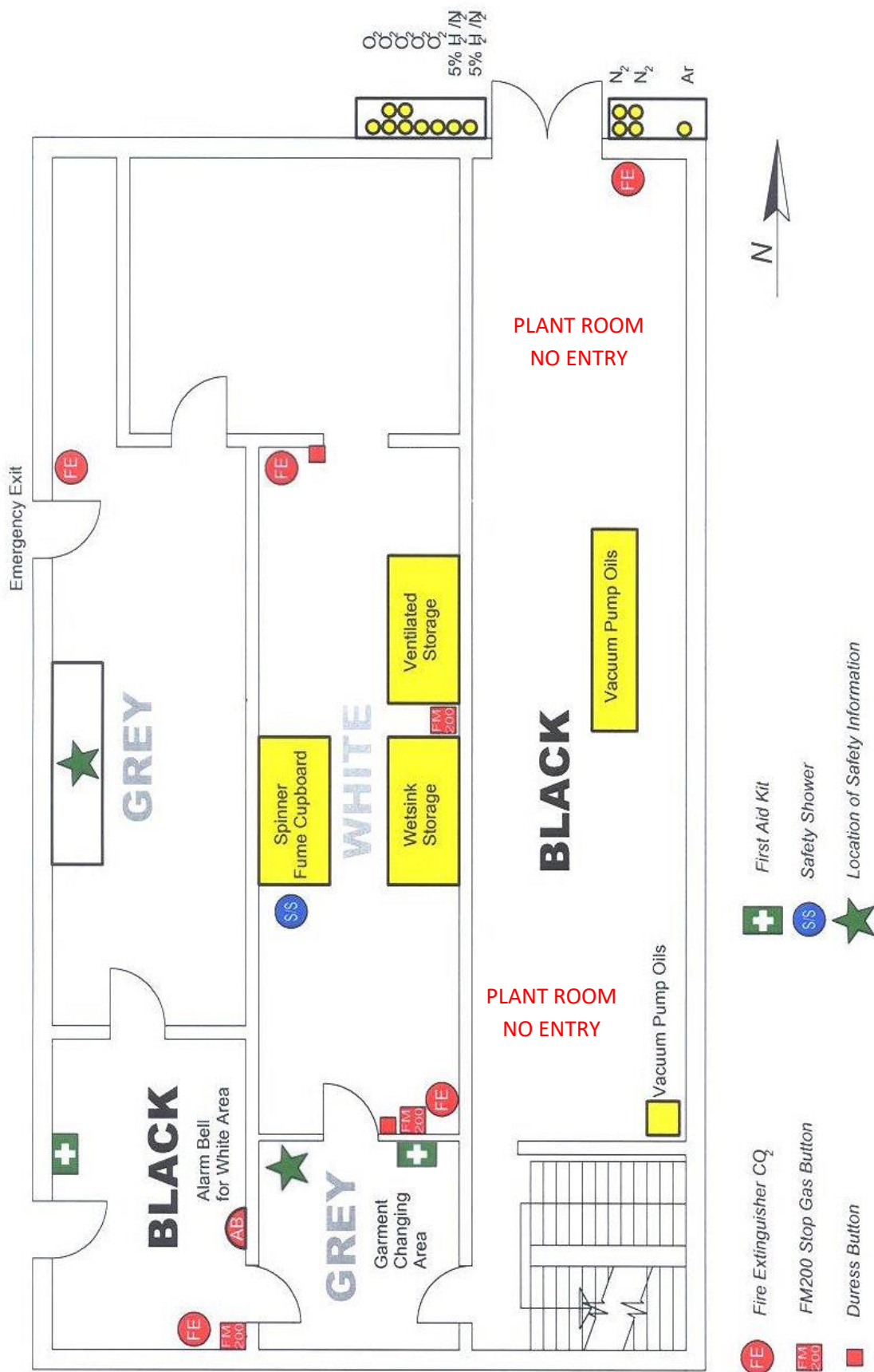
The ANFF-NSW Health and Safety guidelines describe the implementation of the UNSW HSMS at ANFF-NSW. These guidelines are regularly reviewed to ensure compliance with legislation and UNSW WHS Policy and Procedures. Updates to the guidelines may also arise as a result of:

- process changes following reviews of RAs and SWPs
- corrective actions following workplace inspections
- changes to the plant, equipment and processes operating in ANFF-NSW laboratories
- other recommendations of the ANFF-NSW WHS Working Group; and
- laboratory user feedback.

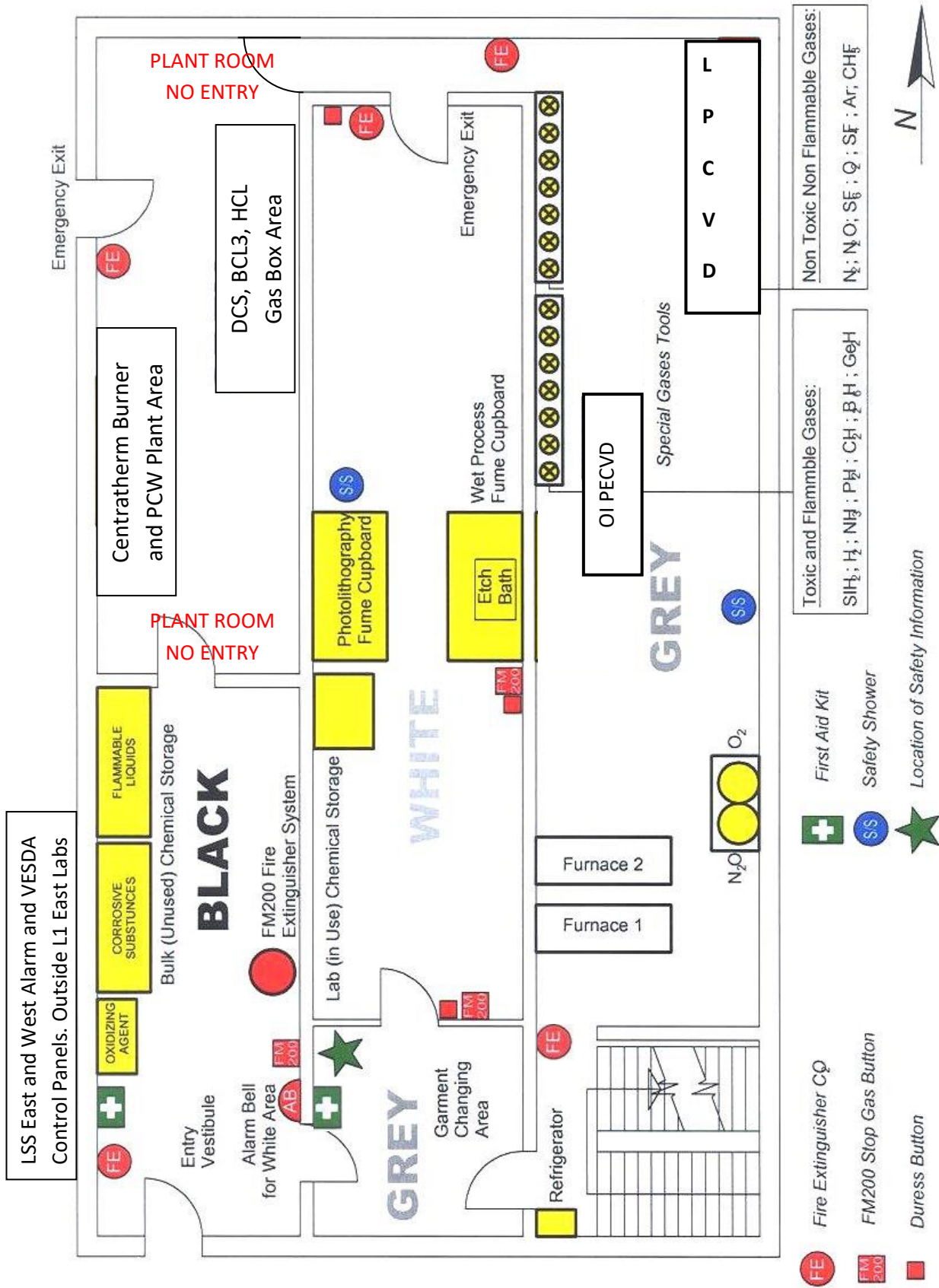
Appendix 1

Inside ANFF-NSW laboratories showing chemical and safety items

SAFETY ITEMS INSIDE ANFF-NSW LOWER EAST LABORATORIES

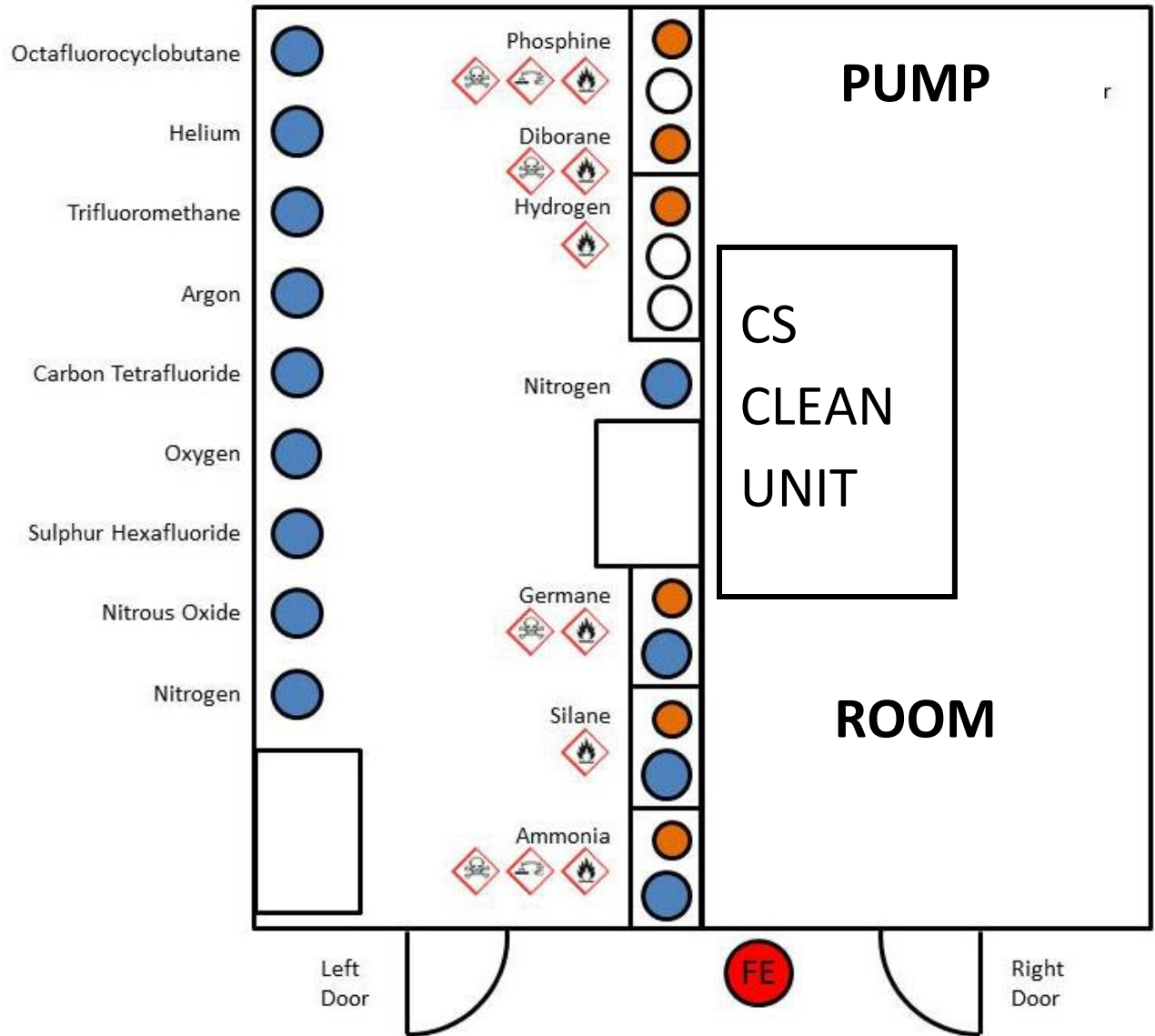


SAFETY ITEMS INSIDE ANFF-NSW UPPER EAST LABORATORIES

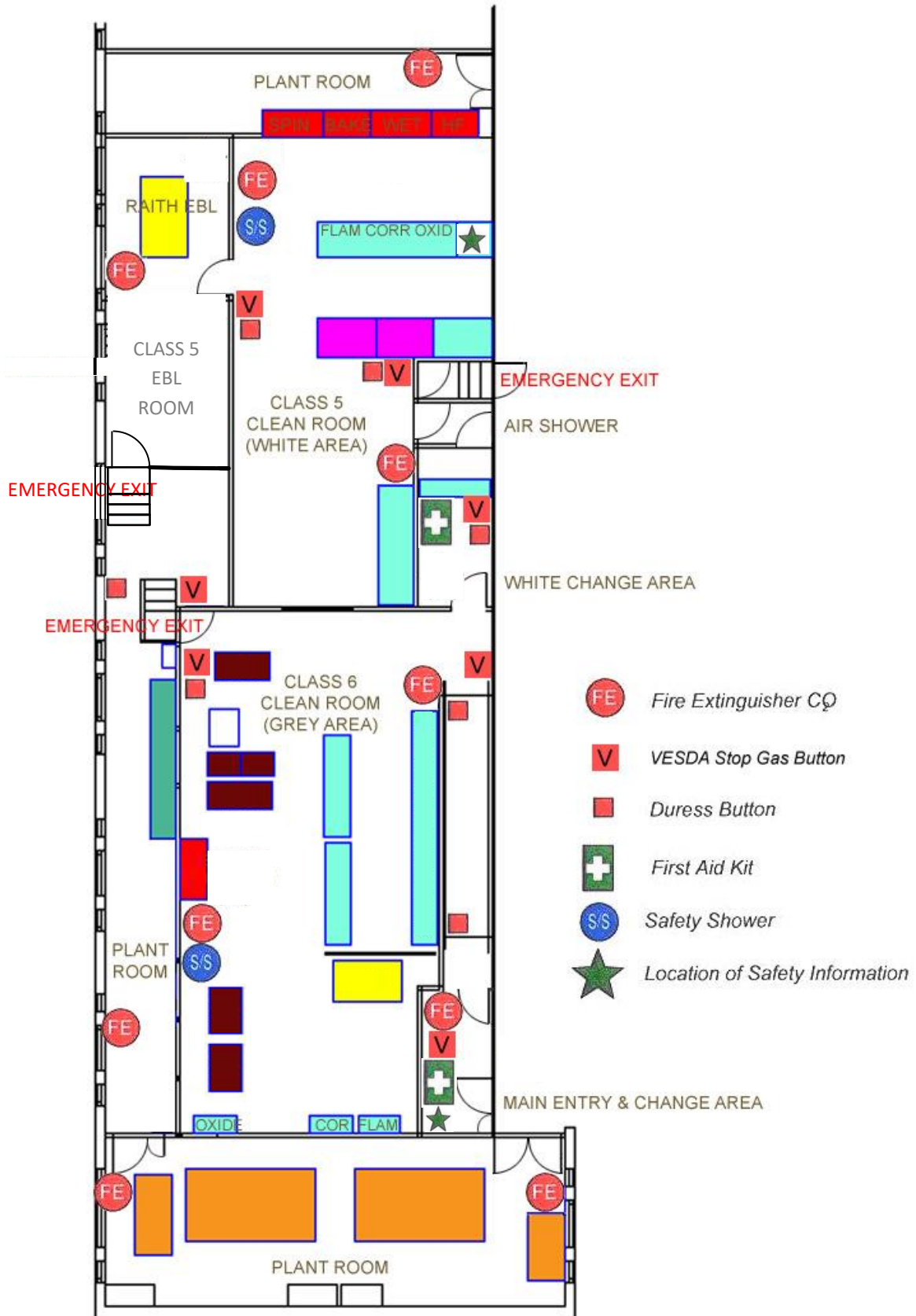


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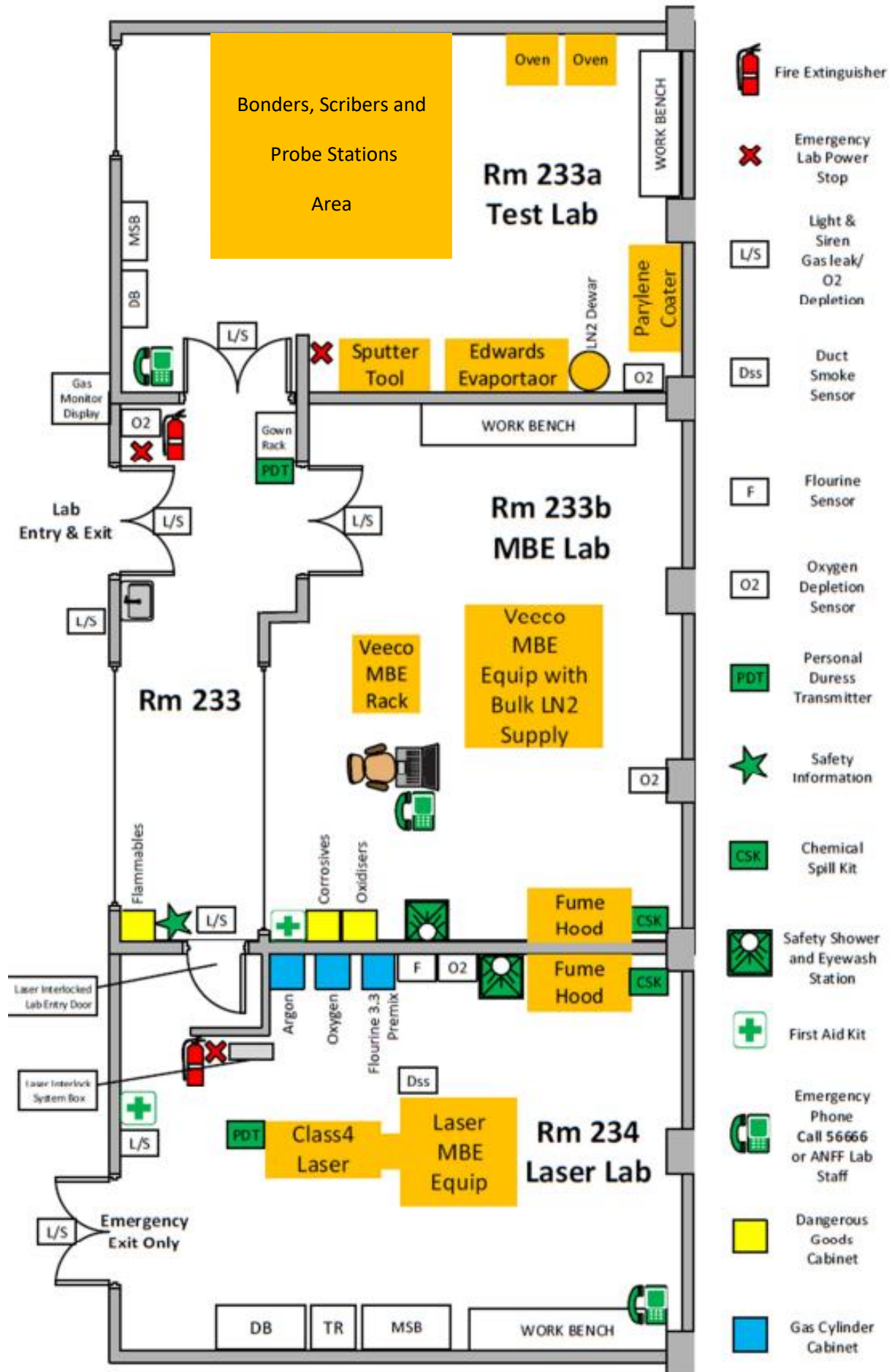
SAFETY ITEMS ANFF-NSW SPECIAL GASES SYSTEM ROOFTOP GAS SHED



SAFETY ITEMS INSIDE ANFF-NSW WEST LABORATORIES



SAFETY ITEMS INSIDE ANFF-NSW SOUTH LABORATORIES



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Appendix 2

List of equipment in ANFF-NSW laboratories

Capability	Tool
Electron Beam Lithography (EBL)	Raith 150TWO EBL system
	FEI XL30 EBL system
	FEI Sirion/NPGS EBL system
	Suite of resist processing tools (spinners and hotplates)
UV Lithography	DMO MicroWriter ML3 Pro direct-write/maskless aligner
	Karl Suss MA6/BA6 mask aligner
	Suite of resist processing tools (spinners and hotplates)
Dry etching	STS ICP-RIE system
	Oxford RIE system
	GP RIE system
	AlphaPlasma microwave asher
	O ₂ plasma ashers (two available)
Deposition	Tystar LPCVD
	Lesker PVD75 e-beam evaporator (general purpose)
	Lesker PVD75 e-beam evaporator (MOS)
	Lesker thermal evaporator
	Edwards thermal evaporator (MOS)
	HHV sputtering system
	Edwards sputtering system
	Picosun R-200 ALD system
	CNT Savannah S200 ALD system
	Oxford PECVD tool
	Edwards thermal evaporator (GP)
	Curtis-Wright Parylene coater
Epitaxial growth	Veeco III-V molecular beam epitaxy system
	Pascal laser-molecular beam epitaxy system (limited materials)
	Pascal laser-molecular beam epitaxy system (general purpose)
Thermal processing & Ion Implantation	IBS Ion Implanter
	UDOX oxidation furnace (MOS)
	GP oxidation furnace (general purpose)
	Boron diffusion furnace
	Phosphorus diffusion furnace
	GP anneal furnace (general purpose)
	Clean anneal furnace (MOS)
	Jipelec rapid thermal annealer (MOS)
	ULVAC furnace (GaAs)
	ULVAC furnace (general purpose)
	Muffle furnace
Wet Processing	Suite of fume cupboards
	HF constant temperature bath
	NMP bath
	TMAH bath
Metrology	Raith 150TWO EBL system (SEM capability)
	FEI XL30 SEM
	FEI Sirion SEM
	Bruker Dimension Edge AFM

	JA Woollam spectroscopic ellipsometer
	Olympus DSX1000 Digital Microscope
	Suite stylus profilometers: DektakXT, Dektak 150, Dektak 2A
	Suite of optical microscopes: : Olympus, Kyowa, Nikon
Electrical testing	Four point probe
	Cascade probe station (with Keithley semiconductor characterisation electronics)
	Micromanipulator probe station
Packaging and bonding	DAD3240 dicing saw
	OEG MR200 scriber
	Karl Suss wafer scriber
	F and S Bondtech 53XX-BDA wire bonder
	K&S Au ball bonder
	TPT Au ball bonder