



Office of Safety, Health & Environment

NUS GENERAL LABORATORY SAFETY MANUAL

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DOCUMENT AMENDMENT AND REVIEW HISTORY

	DATE	REV. NO.	AMENDMENT / REVIEW	RECORDED BY
01	1 Sept 2010	01	Inclusion of SOP into the Manual	Ms Gisela Ho
02	18 July 2012	02	<p><u>Amendment includes the following:</u></p> <p>1. Legislation Update:</p> <ul style="list-style-type: none"> • SS 58:2009 Code of Practice for Selection, Use, and Maintenance of Respiratory Protective Devices (Formerly CP 74) • SS 548:2009 Code of Practice for the Selection, Use, Care and Maintenance of Hearing Protectors (Formerly CP 76) <p>2. Incorporation of OSHE SOPs into the manual:</p> <ul style="list-style-type: none"> • Laboratory Decommissioning • Safe use of shared equipments <p>3. First Aid section updated in accordance with First Aid Manual.</p> <p>4. Web links added to Applicable Legislations on Hazardous Substances.</p> <p>All web links given in the manual have been updated.</p> <p>5. Lab decommissioning form updated to include lifting operations.</p> <p>6. Laboratory Compliance Audit updated in accordance with Laboratory Safety & Health Management System Certification Scheme.</p> <p>7. Safety videos weblinks have been included to relevant sections of the manual.</p>	Ms Gisela Ho
03	30 Aug 2013	03	<p><u>SECTION 11 - LABORATORY SAFETY & HEALTH MANAGEMENT SYSTEM CERTIFICATION SCHEME</u></p> <p>Update the change in the PI audit cycle (ie. From annual surveillance to once every 3 or 4 years)</p>	Ms Gisela Ho
04	21 Oct 2013	04	<p><u>NEW SECTION</u></p> <p>Section 7.6 – Safe use of shared equipments</p>	Ms Gisela Ho
05	15 Jan 2014	05	<p><u>NEW SECTION</u></p> <p>Section 7.7 – Safety Guidelines for Bench-Work in Shared Laboratories</p>	Mr Joel Swee
06	10 Mar 2015	06	<p><u>AMENDMENT</u></p> <p>Section 1.2.2 – Update of University Health Centre (Kent Ridge Campus) telephone number.</p>	Mr Joel Swee

1 INTRODUCTION

1.1 OVERVIEW

Under the Workplace Safety and Health Act, a laboratory is defined as a premise where the testing, examination or analysis of any article is carried out. Each laboratory is a unique environment; hence it is every laboratory personnel's duty to establish proper work practices to address site-specific hazards.

The purpose of this Manual is to provide general guidance for all users working in laboratory. This Manual addresses issues common to all laboratories, for example, commissioning and decommissioning of laboratory, labeling, physical safety, electrical safety, personal protective equipment, first aid and management of contractor.

In addition to the Appendixes, documents referenced in this manual (underlined in the text), can be directly accessed through the NUS [staff portal](#) and [student portal](#) under the section of "Safety, Security & Sustainability". Go to NUS website > Staff or student portal > safety, security & sustainability > General Safety & Health

This Manual should be used in conjunction with other laboratory safety manuals, i.e.:

- [NUS Laboratory Chemical Safety Manual](#) – provides safety and health requirements for working with chemicals in laboratories.
- [NUS Laboratory Radiation Safety Manual](#) – provides safety and health requirements for working with ionizing and non-ionizing apparatus and radioactive materials in laboratories.
- [NUS Laboratory Biorisk Management Manual](#) – provides safety and health requirements for working with materials of biological origin, including genetically modified organisms (GMOs) in laboratories.
- [NUS OH Programme](#) – structured system to address the occupational health needs of NUS staff and students.

The guidelines in this manual should be read before work in the laboratory is initiated. It is essential that laboratory personnel are trained and proficient in conducting experiments in such a manner so as not to threaten safety and health of his/her own and others in the vicinity.

All new staff and students are recommended to visit "[10 Things You Need to Know about Safety in NUS](#)"

1.2 EMERGENCY PHONE NUMBERS AND SAFETY PERSONNEL CONTACTS

1.2.1 Emergency Phone Numbers

SCDF - Ambulance/Fire	995
Police	999
Campus Security (24hrs)	x 1616 (6874 1616)
General Maintenance/ Breakdown of Services (24 hrs)	x 1515 (6516 1515)

In the event of emergency, please call Campus Security and Police or SCDF.

1.2.2 University Health Centre (UHC)

Main Clinic

Kent Ridge Campus

20 Lower Kent Ridge Road
University Health Centre, Level 1

Operating Hours

Mon –Thur 8.30am – 6pm

Fri 8.30am – 5.30pm

Closed on Sat, Sun & Public
Holidays

Closed for lunch from 12.30pm – 1.30pm

**Last registrations are 15 mins before closing
time**

General Enquiries: 6601 5035

uhc_health@nus.edu.sg

Satellite Clinic

Bukit Timah Campus

469G Bukit Timah Road
Block B, #02-01, Multipurpose
Auditorium

Operating Hours

Mon/ 8.30 – 10.30am

Wed/Fri

(during term only)

Closed on Tue, Thu, Sat, Sun &
Public Holidays

**Last registrations are 15 mins before closing
time**

General Enquiries: 6467 5492

uhc_health@nus.edu.sg

1.2.3 Nearest Hospital

In the event of critical injury/ illness after office hours, proceed to the Accident & Emergency Unit of a nearby hospital. The nearest hospital in the vicinity of the University is:

National University Hospital (NUH)

Lower Kent Ridge Road

Singapore 119074

Main Line (24hr general enquiries) Tel: (65) 6779 5555

Emergency Tel: (65) 6772 5000

1.2.4 Office of Safety, Health and Environment (OSHE)

A. OSHE

Office of Safety, Health and Environment

Ventus (University Campus Infrastructure)

8 Kent Ridge Drive, #03-02

Singapore 119246

General Enquiries: 6516 1084

Fax: 6778 6031

Email: safety@nus.edu.sg

B. Faculty/ Department Safety and Health Officers/ Coordinators

Contacts for Safety & Health Officers/ Coordinators on safety and health issues pertaining to your faculty are accessible at [Office of Safety, Health & Environment](#)

2 LABORATORY SAFETY PROGRAM ADMINISTRATION

2.1 ROLES AND RESPONSIBILITIES

The Institutional Laboratory Safety Committee (ILSC) is the University level committee to oversee laboratory safety programs, except those related to biosafety policies, which is under the purview of the Institutional Biosafety Committee (IBC). The Office of Safety, Health and Environment (OSHE) is the administrator of these safety programs.

2.1.1 NUS President

The President of the NUS represents the University as the Employer. The ultimate responsibility for safety and health in the University rests with the President. The President may delegate the authority and responsibility to the ILSC, IBC, Deans, Administrators and HODs for the effective supervision of the occupational safety and health of staff and students under his/ her management.

The ILSC, IBC and OSHE can report any incident or conditions of non-compliance to the NUS President, Senior Deputy President, provost, Deputy Presidents and Vice Presidents, who are entitled to partially or fully close the laboratories or facilities until all safety issues are addressed.

2.1.2 NUS Institutional Laboratory Safety Committees (ILSC)

The ILSC is appointed by the Provost. The Terms of Reference for the ILSC are:

- Review the university-level safety policies (except those related to biosafety policies) and recommend to the NUS President in specific action items related to general laboratory safety.
- Review the directive, manual and guidance documents related to general laboratory safety at university, faculty and departmental level and recommend revision to the Director of OSHE.
- Serve in an advisory capacity to OSHE on all laboratory-related matter.
- Review the NUS General Laboratory Safety Program, as well as any audit and inspection findings conducted by OSHE or other independent parties or faculties and departments.
- Continually review the General Laboratory Safety Program.

2.1.3 Deans and Head of Departments

All Deans and Heads of Department (HODs) of the respective departments have management responsibility for implementation of the General Laboratory Safety Program. The HOD is to evaluate, with the assistance of the Departmental Safety Committee or Faculty Safety & Health officer the risk assessment of PIs.

2.1.4 Principal Investigator and Supervisor

The Principal Investigators (PIs) and Laboratory Supervisors are primarily responsible for the conduct of risk assessment for all activities involving chemicals in the laboratory. They are responsible to ensure that all reasonably practicable control measures are implemented and the measures are effective in eliminating or minimizing the risk.

They are also responsible in communicating the laboratory hazards involved, the purpose of various control measures implemented, and emergency response plan to his/her staff and students in the laboratory. The PIs and Supervisors are to ensure that their reporting staff and students are given adequate instructions, undergone the required training, and received the necessary medical examination.

2.1.5 Staff, Students and Contractors

All staff members and students must comply with this University Laboratory General Safety Manual, as well as other university, faculty and departmental level manual, directive, standard operating procedures (SOPs), standards and guidance documents that are applicable to their area of work. All staff and students are responsible to carry out their work safely.

Supporting staff such as maintenance service personnel (include internal service staff and external contractors engaged for repair and/or maintenance of structure, facilities and equipment), waste collectors and domestic cleaning service providers who may enter the laboratory to perform work, are covered under this General Laboratory Safety Program. They must be informed of the nature of work of the laboratory, and of the health and safety regulations and procedures of the University.

2.1.6 Office of Safety, Health and Environment (OSHE)

The Office of Safety, Health and Environment (OSHE) will provide administrative support to the ILSC and IBC, maintain this Manual, manage all registration and reporting processes for the ILSC and IBC, maintain appropriate records, and serve as liaison with all faculties, departments and external agencies in the ongoing implementation of the University's General Laboratory Safety Programme.

OSHE will coordinate the provision of trainings to relevant staff and students through the NUS Structured Safety Training System (SSTS). OSHE will also administer the laboratory compliance audit. OSHE is the university body tasked to coordinate any incident or accident investigations as called for by the ILSC or the President.

2.1.7 University Health Centre (UHC)

The UHC is the medical service provider for the Occupational Health Program of the University.

2.2 UNIVERSITY SAFETY & HEALTH RELATED POLICIES

NUS has an overarching University Safety and Health Policy. In addition, there are Programme-specific policies that govern areas of biosafety, chemical safety and radiation safety. Please refer to [NUS Policies & Guidelines](#) for more information on the policies.

2.3 NUS SAFETY & HEALTH DIRECTIVES

The following NUS Safety Directives provide safety and health governance on specific laboratory issues:

- Directive 0701 - Access to and Supervision of Undergraduates in Laboratories for Project or Research Work
- Directive 0702 - Authorized Access to Laboratories
- Directive 0703 - Staff & Students working in BSL Facilities
- Directive 0704 - NUS Students Working in Non NUS Organizations
- Directive 0705 - Supervisory & Training Responsibilities for New Users of Laboratories Managed by Academic Staff (Principal Investigators & Laboratory Supervisors)

Please refer to [General Safety and Health Directives](#) for more information.

3 APPLICABLE LEGISLATION

The following information describes the requirements for all researchers in the NUS undertaking laboratory-based research projects. It is the responsibility of each PI to ensure the laboratory is in compliance.

3.1 WORKPLACE SAFETY AND HEALTH ACT

The Workplace Safety and Health Act (WSHA) stipulate the workplace safety and health obligations to be fulfilled, as well as responsibilities of every person in the workplace.

The WSH (General Provisions) Regulations stipulate provisions for statutory examination for pressure vessels, protection for working at height, lock-out procedures and safe work practices for hazardous substances. The WSH (Incident Reporting) Regulations provides requirements for notification and reporting of death, injuries, dangerous occurrences, and occupational diseases. The WSH (First Aid) Regulations require first aid resources to be provided in the workplace. The WSH (Risk Management) Regulations specifies requirements for risk management which include the conduct of risk assessment and implementation of control measures.

Details about the WSHA and the subsidiary legislation are available at the [Ministry of Manpower](#) website.

3.1.1 Fire Safety Act

The Fire Safety Act and its subsidiary legislation specify requirements for fire protection facilities in buildings, appointment of Fire Safety Manager, and provision of fire emergency response plans for the occupants. Specifically, the transport, storage and usage of petroleum and flammable materials (PFM) are regulated under the Fire Safety (Petroleum and Flammable Materials) Regulations.

Please refer to [Fire Safety Act](#) for more information.

3.1.2 Environment Protection and Management Act

The Environmental Protection and Management Act (EPMA) and its subsidiary legislation govern environmental pollution: air, water, land, and boundary noise, management of hazardous substances as well as energy conservation for refrigerators and air-conditioners.

The EPM (Hazardous Substances) Regulations require application for a Hazardous Substance Permit from the National Environment Agency (NEA) to purchase, store and/or use scheduled hazardous substances (refer to [Management of Hazardous Substances](#) for more information). The EPM (Ozone Depleting Substances) Regulations prohibit the importation from and exportation of ozone depleting substances (ODS) to certain countries. The EPM (Air Impurities) Regulations control the emission of dark smoke and other air pollutants from any trade, industry, process, fuel burning equipment or specified industrial plant. The EPM (Trade Effluent) Regulations specify the limits for discharge of trade effluent into a watercourse and controlled watercourse.

Please refer to [Environmental Protection and Management Act](#) for more information.

3.1.3 Environmental Public Health Act

The Environmental Public Health Act (EPHA) and its subsidiary legislation govern environmental health issues. Specifically, the EPH (General Waste Collection) Regulations and EPH (Toxic Industrial Wastes) Regulations provide requirements for the storage and collection of general wastes and toxic industrial wastes.

Please refer to [Environmental Public Health Act](#) for more information.

3.1.4 Sewerage and Drainage act

The Sewerage and Drainage Act (SDA) and its subsidiary legislation govern the installation and maintenance of the public sewer and connecting drainage. Specifically, the SD (Trade Effluent) Regulations regulate the discharge of wastewater into public sewers.

Please refer to [Sewerage and Drainage Act](#) for more information.

3.1.5 Chemical Weapons (Prohibition) Act

The Chemical Weapons (Prohibition) Act requires application of licence to use, develop, produce, acquire, stockpile, retain or transfer specified chemicals covered under the Chemical Weapons Convention (CWC). The Act also requires declaration of processing, consumption and storage of scheduled chemicals to be made annually to the Singapore Customs.

The list of chemicals that falls under the various schedule can be found in the [National Authority \(Chemical Weapons Convention\)](#) website.

3.1.6 Poisons Act

The Poisons Act regulates the importation, possession and sales of potent medicinal substances (poison) so as to prevent misuse/ illicit diversion of poisons. Application of Form A Poison Licence from the Health Science Authority (HSA) is required for the purpose of import, possess for sale, sell or offer for sale any poisons. However, Poison Licence is *not* required if the poisons are purchased from local vendors.

Please refer to [Poisons Act](#) for more information.

3.1.7 Arms and Explosives Act

Under the Arms and Explosives Act, application of licence from the Singapore Police Force (SPF) is required for the possession, control, import, export and manufacture or dealing with gun, arms, explosives, poisonous or noxious gas or substances, and these include explosive precursors (EP).

Please refer to [Arms & Explosives Licence](#) for more details on application for licence and for the list of EP.

3.1.8 Misuse of Drugs Act

The Misuse of Drugs Act controls the manufacture, supply and possession of precursor chemicals necessary in the manufacture of controlled drugs as well as provides regulations on the import, export and transshipment of these chemicals. Under the Misuse of Drugs (Controlled Equipment, Material and Substances) Regulations, application of permit from the Central Narcotic Bureau (CNB) is required for the import or export of controlled drugs, and controlled equipment, materials or substances useful for manufacturing controlled drugs.

For more information on the list of controlled substances, please refer to [Misuse of Drugs Act](#)

3.1.9 Radiation Protection act

The Radiation Protection Act and its subsidiary legislation regulate the manufacture, possession, use, import and export of irradiating apparatus and radioactive materials. Application of licence from the Centre for Radiation Protection and Nuclear Science (CRPNS), part of National Environment Agency, is required for lasers of certain class, ultrasound apparatus of certain power output, ionizing irradiating apparatus such as x-ray, and radioactive materials.

Please refer to [Radiation Protection Act](#) for more information.

3.1.10 Biological Agents and Toxins Act

The Biological Agents and Toxins Act (BATA) administered by the Ministry of Health (MOH) came into force on 3 January 2006 in Singapore. The BATA prohibits and otherwise regulates the possession, use, import, transshipment, transfer and transportation of biological agents, inactivated biological agents and toxins that are of public health concern.

For more information on BATA and its subsidiary legislations, refer to [Ministry of Health](#) website

3.1.11 WHO Laboratory Biosafety Manual

MOH has also adopted the Laboratory Biosafety Manual, 3rd Edition, by the World Health Organization (WHO) as the national guidelines for biosafety to supplement the BATA. The Manual provides guidance on a range of topics, including laboratory biosecurity, laboratory equipment, good microbiological techniques, biotechnology, other safety issues such as chemical, fire and electrical safety, safety organization and training, and checklist. Please refer to WHO [Laboratory Biosafety Manual](#) for more information.

3.1.12 Singapore Genetic Modification and Advisory Committee

For projects which involve genetic manipulation or research on genetically modified organisms (GMOs), the guidelines - "*The Singapore Biosafety Guidelines for Research on Genetically Modified Organisms (GMOs)*" from the Genetic Modification and Advisory Committee (GMAC) are to be adhered to. The Guidelines cover experiments that involve the construction and/or propagation of all biological entities (cells, organisms, prions, viroids or viruses, plants and animals) which have been made by genetic manipulation and are of a novel genotype and which are unlikely to occur naturally or which could cause public health or environmental hazards. The Guidelines also have provisions for the importation of GMOs and/or GMO-derived products for research purposes.

Please refer to [Singapore Biosafety Guidelines for Research on GMOs](#) for full set of guidelines.

3.1.13 Infectious Disease Act

The Infectious Disease Act (IDA) is the principle legislation for the control of outbreaks and prevention of infectious diseases in Singapore. The IDA and Infectious Disease (Notification of Infectious Disease) Regulations stipulate requirements for person(s) who know, or has reason to suspect, the existence of an infectious disease to notify the authority and take measures to prevent the exposure of other persons to the risk of infection. Please refer to [Infectious Diseases Act](#) for more information on related infectious disease guidelines.

3.1.14 IATA Dangerous Goods Regulations

The International Air Transportation Association (IATA) Dangerous Goods Regulations specify requirements for classification, marking, packing, labeling and documenting dangerous goods for air shipments.

4 RISK MANAGEMENT

The principle of risk management is to identify the safety and health hazards associated with works carried out in a laboratory, assessing the risk level, prioritizing and implement measures to control the hazards and reduce the risk to acceptable level.

PIs are responsible for the conduct of risk assessment prior to the commencement of research projects. PIs can only commence work after their risk assessment has been approved.

Where applicable, the risk assessment should cover the following hazard categories:

- Physical hazards (electrical, mechanical, noise, ergonomics, trip and fall, and etc)
- Chemical hazards (flammable substances, compressed gas and etc)
- Biological hazards (animals, infectious substances, biological agent and etc)
- Radiation hazards (ionizing and non-ionizing)

The risk assessment should cover both routine and non-routine activities in the laboratories. Routine activities include conducting experiments, handling and storage of chemicals, use of laser machines and etc. Non-routine activities include the set up and installation of machines during the commissioning phase and removal of machineries during the decommissioning.

Adequate and effective control measures shall be put in place to control the hazards identified and reduce the risks to acceptable level. The PIs and Laboratory Supervisors are responsible to ensure that all reasonably practicable control measures are implemented. When determining the type of control measures, one should always consider the hierarchy of control, i.e. elimination, substitution, engineering control, administrative control and lastly personal protective equipment. In most instances, a combination of controls is required to manage the risk effectively. For more information on operational controls, refer to [Chapter 6](#).

4.1 PROJECT RISK ASSESSMENT

All PIs undertaking laboratory-based research projects are required to complete a project risk assessment (PRA) form, which would then forwarded to OSHE's review and final approval by the ILSC (for non-life science related projects) and IBC (for life science related projects).

For more information on PRA and its submission and approval procedure, refer to [Project Risk Assessment Scheme](#).

NUS is migrating towards the Laboratory Safety & Health Management Scheme (SHMS) Certification Scheme where risk assessment is done as part of an overall safety and health management system. The Scheme was launched to certify PIs who have effectively implemented laboratory-based safety and health management system. Upon award of the certification to the NUS Occupational Safety and Health Management System Standard for Laboratories, PIs would generally not be required to submit risk assessments on a per-project basis.

Please refer to [Laboratory OSH Certification Scheme](#) for more information.

5 TRAINING

Under the Structured Safety Training System (SSTS), it is mandatory for all staff and postgraduate students working in the laboratory to undergo the General Laboratory Safety Training conducted by OSHE. OSHE also provide other training courses for chemical safety, fire safety, biological safety and radiation safety courses. Please refer to [Structured Safety Training System](#) for more information.

Notwithstanding the mandatory training, it is the responsibility of the PI and Laboratory Supervisor to ensure that his/her laboratory staff and research students received adequate instruction and proper training in managing the hazards specific to his/her laboratory and the safe conduct of the experimental procedure to be used.

At the minimum, all personnel working in the laboratory should be trained in the following areas prior to the start of their experiment:

- Understanding of this NUS Laboratory General Safety Manual and other relevant laboratory manuals
- Experimental procedures to be carried out
- Understanding of the hazards in the laboratory
- Proper operation of tools and equipment
- Safety precautionary measures to be taken
- Usage and maintenance of PPE
- Emergency response procedures (e.g. chemical spill, gas leak, fire)
- Accident/ incident reporting procedures

6 OPERATIONAL CONTROL

6.1 ELIMINATION & SUBSTITUTION

Eliminate the hazard or task where it is practicable to do so. For example, use ready-mixed solutions. This eliminates the need to weigh and mix, and the associated hazards that comes with such tasks.

If elimination is not feasible, consider using substitution method. For example, substitute toxic chemicals with something less hazardous, substitute glassware with plastic ware, substitute syringes with pipettes, and etc.

6.2 ENGINEERING CONTROL

Engineering controls can be implemented in the form of:

- automation of the process,
- isolating the hazard from the target(s) (including both the user and persons in the vicinity) by means of:
 - distance,
 - physical barriers (e.g. guarding, shield, chemical storage cabinet), or
 - containment equipment (e.g. secondary containment, fume hood, biological safety cabinet, exhaust ventilation system).

6.3 ADMINISTRATIVE CONTROL

Administrative controls are work procedures such as safety policies, rules, supervision, and standard operating procedures (SOP). The administrative controls commonly implemented in the University laboratories are; restricting access to laboratory and other hazardous areas, posting of signs and labeling to indicate the hazards present in the laboratory, development of SOPs on the safe handling of materials, equipment and machines, display of informative posters and guidelines and etc.

Refer to [Chapter 7](#) and [Chapter 8](#) for the SOPs.

6.4 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The use of PPE is necessary when feasible engineering and administrative controls are unavailable or where there is a need to supplement those controls. PPE should NEVER be considered as a first priority in minimizing exposure to hazardous substances.

Please log on to the [OSHE portal](#) for the safety video related to PPE.

6.4.1 General Requirement

The PIs are responsible to select and provide the appropriate personal protective equipment (PPE) for his/her reporting staff and students. He/she shall ensure that the staff and students are trained on the proper use, care and maintenance of the PPE. The PIs are also responsible to supervise and monitor the proper use of PPE in the laboratory.

All users bear the ultimate responsibility to learn and to use the PPE correctly. This is to ensure the PPE provides the intended and effective protection to the user. Otherwise, the PPE can give a false sense of security and in fact be a danger to the user.

The PPEs may be issued to individuals as personal belongings or shared among the users in the laboratory. Nonetheless, all users are responsible to ensure the PPEs are kept clean and properly maintained, and the faulty ones are replaced.

The subsequent sections provide a general guidance on the selection, use and maintenance of PPE as well as the training requirement for all PPE users. Consult the safety data sheet (SDS), the Chemical/ Radiation/ Biological Safety Manual, and credible dealers for more information.

6.4.2 Head Protection

Head protection such as bump cap, hard hat and helmet is required in areas where there is potential hazard of head trauma from falling, bumping the head against fixed objects or electrical shock and burns from contact with exposed electric conductors.

6.4.3 Eye and Face Protection

Suitable protectors shall be used when employees are exposed to hazards from flying particles, molten metal, acids or caustic liquids, chemical liquids, gases, vapors, bio-aerosols, or potentially injurious light radiation. Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. For employees who wear prescription lenses, eye protectors shall either incorporate the prescription in the design, or fit properly over the prescription lenses.

- Use safety glasses with side protectors when there is a hazard from flying objects.
- Use goggles and face shields when there is a hazard from chemical splash or if there is a high potential for creating aerosols. These include necropsy of infected animals, harvesting of tissues, or fluids from infected animals and manipulations of high concentrations or large volumes of infectious materials. Face shields should be worn

over additional eye protection (safety glasses or goggles).

- Use equipment fitted with appropriate filter lenses to protect against light radiation. Tinted and shaded lenses are NOT filter lenses unless they are marked or identified as such.
- Use appropriate eye and face protection when entering animal rooms housing non-human primates.

6.4.4 Respiratory Protection

Employees involved with asbestos removal, chemical emergency response, facilities maintenance, plant operations, and infectious materials may require respirators.

Selection of respiratory would depend on type and concentration of hazardous substances, the protection factors provided by the respiratory, type of respirator, medical condition of the user, job environment and comfort.

All respirator users must undergo fit test and medical examination in UHC before using one. Please refer to [NUS Respiratory Protection Programme](#) for more details.

6.4.5 Hearing Protection

Hearing protective devices such as ear plugs and ear muffs shall be used in areas with excessive noise levels, define as >85 dBA over 8 hrs. These devices should attenuate noise sufficiently to prevent hearing damage, but not to the extent that the wearer is virtually deaf to emergency warnings etc.

6.4.6 Hand Protection

Suitable gloves shall be worn when hazards from chemicals, cuts, lacerations, abrasions, punctures, burns, biological, and harmful temperature extremes are present. Glove selection shall be based on performance characteristics of the gloves, conditions, durations of use, and hazards present. Requirements may range from impervious gloves that prevent liquid penetration to thermally insulated gloves for handling cold materials.

6.4.7 Body Protection

The lab coats protect street clothing against biological or chemical spills as well as to provide some additional body protection. Additional protective clothing such as smock and impervious apron may be required in laboratories working with biological agents and hazardous chemicals. Short pants, dresses and open toed shoes are not appropriate laboratory attire.

6.4.8 Foot Protection

Safety shoes or boots with impact protection are required to be worn in work areas where carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and for other activities where objects might fall onto the feet.

Safety shoes or boots with compression protection are required for work activities involving skid trucks (manual materials handling cars) or other activities in which materials or equipment could potentially roll over an employee's feet.

Safety shoes or boots with puncture protection are required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.

For general research works in the laboratory, wear closed-toe shoes. Sandals and other types of open-toed shoes are NOT permitted in laboratories. Boots, shoe covers, or other protective footwear and disinfectant footbath may be required for work in laboratories dealing with infectious agents.

7 STANDARD LABORATORY SAFETY PROCEDURES

7.1 LABORATORY COMMISSIONING

The PI shall complete the [Laboratory Commissioning Notification & Verification Form](#) (see [Appendix A](#)) prior to the commencement of his/her laboratory research work. The Form shall be submitted to the respective Faculty Safety & Health Officer, who is responsible to conduct a physical verification.

The PI can only commence work until the Faculty Safety & Health Officer gives his/her approval.

7.2 SAFETY AND HEALTH INDUCTION PROGRAMME FOR NEW LABORATORY USERS

7.2.1 Safety and Health Induction Checklist

The PI/ Lab Supervisor shall ensure that the initial induction is to be completed within two weeks from the date the new laboratory users are authorized to work in the lab. New laboratory user refers to any NUS or external staff or student, attachment student, visiting professor, polytechnic student, etc.

“The Safety and Health Induction Checklist for New Laboratory Users” form can be found [here](#) (see [Appendix B](#))

7.2.2 Facility Access Exclusion of Liability & Indemnity

The [Facility Access Exclusion of Liability & Indemnity Form](#) (see [Appendix C](#)) is only applicable to external (non NUS) staff and students working in the laboratories within NUS. The form must be completed and returned together with the application form to the relevant department/ faculty/ school/ office in which the laboratory resides.

For general enquiries regarding this form, please contact [Office of Legal Affairs \(OLA\)](#).

7.2.3 Self-Help Safety and Health Starters' Checklist

Any laboratory user can make use of “[The NUS Self-Help Safety + Health Starters' Checklist](#)” (see [Appendix D](#)) to assess the status of safety and health compliance in his/her laboratory. This checklist acts as a simple guide to assist anyone who wants to make the laboratory a safe work place.

7.3 LABORATORY SIGN POSTING

All NUS laboratories shall use a standard form of safety signage to accurately reflect the hazards that are present in the facility. It is the responsibility of the PI and Lab Supervisors to ensure that signage are correct, legible, sufficient and prominently displayed.

7.4 LAB NOTICE AT THE LABORATORY DOOR

To decide on the signs to be posted on the Lab Notice at the laboratory doors, first conduct a risk assessment to identify the hazards present in the laboratory (see [Chapter 4](#)). Other information to be input into the Lab Notice includes types of PPE required, emergency contact numbers, and any special precautions/ procedures. A standard Lab Notice is shown in [Appendix E](#).

The Lab Notice can be generated using the [OSHE Standard Lab Sign Board Generator](#) software. The Lab Notice shall be printed in colour on a standard A4 sized paper. It must be clear and can be seen clearly from a distance of 5 meters away. It must be enclosed in a transparent plastic folder or laminated.

Post the Lab Notice at least 1.5 meters from the floor, either on the door to the laboratory or at the side wall next to the door provided that the sign is not more than 500mm from the door. If the laboratory has more than one door, all doors must also be posted with one Lab Notice. The Lab Notice must be firmly affixed on the door through suitable means.

The Lab Notice must be reviewed at least once every year or when the scope of work changes within the laboratory that necessitates a new risk assessment exercise to be done or reviewed.

7.4.1 Internal Laboratory Sign Posting

To decide on the signs to be posted inside the laboratory, first conduct a risk assessment to identify the hazards present in the laboratory, the location of these hazards and the PPE required. The hazard and PPE signage must be consistent with those posted on the Lab Notice at the laboratory door.

The sign posting must be placed in a prominent position at a height not less than 1.5 meter above the floor. The sign should be of good construction and firmly affixed to the intended surface.

First time lab users or visitors must be briefed on the meaning of the signs in the lab.

The sign posting must be reviewed at least once every year or when the scope of work changes within the laboratory that necessitates a new risk assessment exercise be done or reviewed.

7.5 CONTRACTORS MANAGEMENT

Contractors refer to non-NUS personnel who are involved in lifting operation of new equipment into the laboratories, lab cleaning, servicing of laboratory equipment and for repair works in laboratories.

7.5.1 Prior to Commencement of Work

Before commencing work at the University, the PI/Lab Supervisor Manager who is coordinating the work is to ensure that the University is receipt of:

- The Contractors Safety & Health Management Plan or other documents, where applicable, demonstrating that the Contractor has considered occupational safety and health in the work activities;
- The Induction Record, Undertaking Letter and any applicable licenses, permits, certificates etc that is required to perform the work.

Using the form [Contractor Risk Management Checklist – For Laboratory](#) (see [Appendix F](#)), the PI/ Lab Supervisor shall brief the Contractor's supervisor his/her duties and responsibilities when working in NUS laboratories. The briefing must also include the type of hazards and risks involved in the laboratory, PPE required, procedures in the event of accident/ incident and first aid measures.

The PI/ Lab Supervisor should check that the Contractor has submitted their risk assessment and has provided all the necessary PPE and appropriate equipment/ tools for his/her workers. PI/ Lab Supervisor and Contractor's Supervisor shall acknowledge the conduct and understanding of the briefing by signing off the form.

In addition to the form mentioned above, the Contractor's supervisor is required to use the [Safety & Health Rules for Cleaners Working in NUS \("Dos" and "Don't"\) – For Laboratory](#) (see [Appendix G](#)) whenever cleaners are engaged in the task for cleaning work. The Supervisor shall explain the rules in a language understood by the cleaner. Every cleaner must acknowledge the conduct and understanding of the briefing before he/she can commence work. The completed and signed copy must be submitted back to the PI/ Lab Supervisor. All the forms can be downloaded from [NUS Forms-Safety & Health](#). The PI/Lab Supervisor shall retain the records for one (1) year.

Upon receipt of the completed and signed copies, the PI/ Lab Supervisor shall issue the [Contractor Control – Hazard Notice](#) signage (see [Appendix H](#)) to the Contractor for display at their worksite. The signage can be generated using the [Contractor Control-Hazard Sign Generator](#) software available in OSHE website. The PI/ Lab Supervisor has to select the appropriate hazard signs according to the hazards present in the work site in the laboratory. Other information on the sign

has to be duly filled.

The standard sign shall be printed in colour on a standard A4 sized paper (minimum size). The sign must be clear and can be seen clearly from a distance of 5 meter away. The PI/ Lab Supervisor shall ensure that sufficient numbers of signage are posted in prominent location of the work areas. The signage must be enclosed in a transparent plastic folder or laminated. It must be firmly affixed on the intended surface area.

PI/ Lab Supervisor and Contractor are responsible to review the signage when there is change in the work activities at the particular work area or when the scope of work changes.

7.5.2 Work in Progress

While the work is in progress, the PI/ Lab Supervisor should conduct spot checks on the contract work periodically. The PI/ Lab Supervisor should spot for any unsafe acts (e.g. workers do not don their PPE while working or not using the proper tools/ equipment) and unsafe condition (e.g. haphazard housekeeping, obstruction to fire door, slippery walkway). The risk assessment submitted by the Contractor prior to the commencement of work can be used as a guiding reference to check on these unsafe practices.

7.5.3 Upon Completion of Work

When the contract work is fully completed, the PI/ Lab Supervisor will be notified to conduct a final inspection to ensure that works have been completed to the University's satisfaction. The PI/ Lab Supervisor shall ensure that the work site is free from hazards and presents no risk of injury to any person entering the completed work site. The PI/ Lab Supervisor shall check that the hazard signage, refuse and materials are removed from the site.

Should there be any wastes left at the site, the PI/ Lab Supervisor shall ensure that the Contractor have them removed from the University at their own expense in a non-hazardous environmentally friendly manner. If the Contractor fails to make a work site safe and free of hazards and waste at the completion of a contract, the Contractor may be removed from the Preferred Contractors Register.

If the Contractor, Sub-Contractor, or their employee(s) advise that the contract work is not complete and that they are leaving the University's grounds, the PI/ Lab Supervisor shall ensure that the work site is left in a clean and safe condition, free from any hazards that may affect any University staff, students and/or visitors.

7.5.4 Stop Work

If, during any stage of the contractual works, it is brought to the attention of the PI/ Lab Supervisor that the safety & health standards, organizational requirements, or legislative requirements are not being adhered to, the PI/ Lab Supervisor may stop the works until the Contractor has rectified the situation.

7.6 SAFE USE OF SHARED EQUIPMENTS

Laboratory personnel should ensure safe management and use of shared equipments, instruments, tools, etc in core, common laboratories and/or facilities (SCLF). Some common issues, hazards and risks of use of shared equipment have been listed below:

- Lack of defined roles and responsibilities for maintenance and upkeep of equipment
- Not conducting a risk assessment for this equipment
- Leaving behind samples in equipment, subsequent users are not aware of the contents and integrity of these samples
- Not cleaning up residual spills, contamination after the use of the equipment resulting in potential exposures to subsequent uses
- Not understanding the operating criteria of the equipment, resulting in operating the equipment in an unsafe manner

7.6.1 Guidelines for Safe Use of Shared Equipments

The purpose of these guidelines is to provide direction to all laboratory personnel on the safe management and use of shared equipment, instruments, tools, etc.

1. The Principal Investigator or Laboratory supervisor shall identify a laboratory staff or senior researcher to have central oversight of this shared equipment, henceforth referred to as equipment owner.
2. The equipment owner would do the following
 - a. Conduct a generic risk assessment for the use of the equipment, the equipment owner should consult the users of the equipment when developing the risk assessment.
 - b. Identify and manage applicable regulations, licenses and/or permits required for the safe use of this equipment.
 - c. Identify and manage access rights and privileges for the use of this equipment.
 - d. Identify and manage the safe operating or performance limits of this equipment and if necessary, develop a safe operating procedure for this equipment.

- e. Identify and manage the competency, training and induction procedures for new users of the equipment.
 - f. Identify and manage a maintenance regime for this equipment.
 - g. Identify and manage if a registration system for the use of the equipment is needed.
 - h. Conduct periodic inspection of the equipment.
 - i. In the event of an incident, conduct an investigation and share the findings with the users of the equipment.
3. All users of the shared equipment should
- a. Review the risk assessment associated with this equipment.
 - b. Follow the safe operating procedures, training, competencies and/or other requirements for the use of this equipment.
 - c. Perform a risk assessment if they intent to use the equipment beyond its normal operating and performance limits and communicate these new hazards and risks to the equipment owner for approval.
 - d. Be responsible in the use of the equipment.
 - e. Promptly remove samples after the use of the equipment and clean up any residual contamination from the equipment.
 - f. Notify the equipment owner of any spillage and/or damage to the equipment. Participate in the clean-up of material from the equipment.
4. To facilitate the administrative implementation of these guidelines, equipment owner can place the relevant risk assessment, procedures, and license applications on a shared website for all users to access.
5. For more information on performing risk assessments, development of safety procedures for equipment, refer to [OSHE](#) website.

7.7 SAFETY GUIDELINES FOR BENCH-WORK IN SHARED LABORATORIES

There is an increasing trend of research laboratories being designed in an “open” concept, instead of individual laboratory suites. This layout provides greater opportunities for collaboration and for monitoring of safety practices. As there might be different research groups in these laboratories, there is a need for each group to communicate their hazards and risks to the other research groups.

The guidelines are applicable to all NUS students, staff, collaborators and visitors who perform laboratory based research activities in “open” benches in shared laboratories.

7.7.1 Safety Guidelines

1. The Principal Investigator (PI) shall conduct a risk assessment of the activities and determine if the activities can be conducted in the open bench.
2. The PI shall ensure that the controls for ensuring the health and safety of the other researchers in the laboratory are in place. This should include:
 - a. Relevant hazard warning signs shall be posted to communicate the hazards to other occupiers of the shared laboratory. For example, if research activity involving animals are performed in a shared lab, a warning sign stating “Animals may be used in labs” shall be posted on the entrance to the laboratory door.
 - b. The PI shall identify possible emergency situations in the shared laboratory that may arise from the research activities conducted by their respective group. PI shall also ensure appropriate emergency response procedures are developed for such situations and these are communicated to other occupiers in the shared laboratory.
 - c. Determining if researchers in the neighboring benches require specific risk controls such as Occupational Health monitoring or specialized Personal Protective Equipment. This should be determined based on the level and duration of exposure of the hazard to the researchers working in neighbouring benches.

8 PHYSICAL & ELECTRICAL SAFETY

8.1 PHYSICAL SAFETY

8.1.1 Space and Layout

Floors, stairways, elevated platforms shall not be slippery under normal conditions. Where any process is carried out which renders the floor liable to be wet, provide effective means (e.g. a floor trap, drainage pipe) to drain off the wet.

Avoid overcrowding by providing sufficient space around individual work area or machines or equipment to allow for normal operation, adjustments and ordinary repairs. There shall be a safe and convenient access to the machine, equipment, storage cabinet, fume hood and work bench. Where necessary, provide stepladders or ladders. Similarly, there shall be sufficient space be allocated for storage of materials (tools, chemicals, cables, glassware, apparatus etc).

Do not block emergency escape pathways, exit doors and emergency windows for fireman access. Do *not* block the access to emergency response equipment (e.g. fire extinguisher, hose reel, spill

kit) and first aid kits.

8.1.2 Working at Height

Where any person is to work at a place from which he/ she will be liable to fall a distance of more than 2m, means shall be provided by fencing or otherwise, for ensuring his/her safety.

Please log on to the [OSHE portal](#) for the safety video related to “Falls in the Workplace”.

8.1.3 Machinery

Any machine part, function, or process that might cause injury must be safeguarded. Generally, there are 3 basic areas require safe guarding:

- The point of operation: that point where work is performed on the material, such as cutting, shaping, boring, drilling, etc.
- Power transmission apparatus: all components of the mechanical system that transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, coupling, cams, spindles, chains, cranks, and gears.
- Other moving parts: all parts of the machine that moves while the machine is working. These may include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

Safeguards must meet these minimum general requirements:

- Prevent contact: The safeguard must prevent hands, arms, and any other part of an operator's body from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or another worker placing parts of their bodies near hazardous moving parts.
- Secure: Operators should not be able to easily remove or tamper with the safeguard, because a safeguard that can easily be made ineffective is no safeguard at all. Guards and safety devices should be made of durable material that will withstand the conditions of normal use. They must be firmly secured to the machine.
- Protect from falling objects: The safeguard should ensure that no objects can fall into moving parts. A small tool dropped into a cycling machine could easily become a projectile that could strike and injure someone.
- Create no new hazards: A safeguard defeats its own purpose if it creates a hazard such as a shear point, a jagged edge, or an unfinished surface that could cause a laceration.

The edges of guards, for instance, should be rolled or bolted in such a way to eliminate sharp edges.

- **Create no interference:** Any safeguard that impedes an operator from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding may actually enhance efficiency since it relieves the operator's apprehensions about injury.
- **Allow safe lubrication:** If possible, workers should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance operator to enter the hazardous area.

Engineering controls that eliminates the hazard at the source and do not rely on the operator's behavior for their effectiveness offer the best and most reliable means of safeguarding. Should the engineering controls are not available or are not fully capable of protecting the operator, operators must wear PPE. However, it is important to note that PPE may create hazards, e.g. a protective glove could become caught between rotating parts. Hence, it is critical for all machine operators to select the appropriate PPE and use them correctly.

Please log on to the [OSHE portal](#) for the safety video related to "Equipment and Machine Guarding".

8.2 ELECTRICAL SAFETY

The PI and Lab Supervisor shall ensure that all personnel working with electrical equipment, apparatus or device in the laboratory are equipped with a general understanding of electrical safety. Should any staff or student is required to work with high voltage or high current electrical equipment, the PI and Lab Supervisor shall ensure that he/she received adequate supervision and undergone proper training.

Only licensed electrical worker is allowed to carry out electrical installation, maintenance and repair of equipment. Should any staff or student is required to conduct inspection, cleaning, repair or maintenance of electrical machinery, the PI and Lab Supervisor shall ensure that he/she has undergone the mandatory Lockout-Tagout training (see Section [8.2.4](#)) and is authorized to do so.

8.2.1 Usage of Electrical Apparatus

The following are the general Dos and Don'ts:

Dos:

- Use electrical equipment and apparatus that complies with local safety standards and regulations. Certified electrical equipment usually bears a 'Safety Mark'.
- Consider the electrical loading of equipment prior to purchasing and installation.
- Use electrical equipment and apparatus in accordance with the manufacturer's operating instructions.
- Ensure grounding is carried out for any electrical equipment that needs to be grounded.
- Switch off appliances when not in use. With the exception of those indicated by a notice that read "Do not switch off – equipment needs to be switched on all the time", all electrical equipment and apparatus are to be switched off when not in use.
- Post warning signs whenever there is a need to alert personnel working in the laboratory about electrical hazards that may be present.

Don'ts:

- Never handle or use any electrical equipment with wet hands.

8.2.2 Handling Electrical Components

- i. Plug
 - a. Do not use any plug that has not been approved/ certified. Certified electrical equipment usually bears a 'Safety Mark'.
 - b. When inserted into a socket, make sure that it is fully inserted.
 - c. Remove all broken or damaged plugs immediately.
 - d. Always switch off the electricity supply before taking out the plug from the socket.
- ii. Socket
 - a. All sockets are to be firmly mounted onto the wall or mounting location.
 - b. Broken sockets are to be replaced immediately.
 - c. Do not overload any electrical socket by connecting several appliances using multiple socket accessories.
- iii. Electrical cords
 - a. Electrical cords should be maintained in good condition.
 - b. Remove all frayed cords immediately. They could cause fire to start or even cause electrocution of personnel who happened to get into direct contact with the exposed wires.
 - c. Do not allow any cord to be laid along the floor where people need to walk across.
 - d. When connected to a plug, the electrical cord is to be firmly held by the cord gripper.
 - e. Do not use extension cord where permanent wiring should be installed.
- iv. Electrical wiring
 - a. Take note of the colour code used for electrical wiring:
 - Live wire – brown
 - Neutral – blue
 - Earth - green / yellow
 - b. Do not use any undersized or oversized wire.
 - c. Joining of wires using adhesive tapes is not permitted – use proper connectors.
- v. Fuse
 - a. Select the right size fuse.
 - b. Do not use a wire as an improvised fuse.
- vi. Electrical Switchboard

- a. Do not open up the cover of the main panel if you do not have the authority to do so.
 - b. Do not place any item that can obstruct accessibility to the front opening of the electrical panel.
- vii. Distribution Board (DB).
- a. Do not open up the cover of the main panel if you do not have the authority to do so.

Do not place any item that can obstruct accessibility to the front opening of the electrical panel.

Please log on to the [OSHE portal](#) for the safety video related to “Electric Hand Tools and Electrical Safety in the Workplace and Laboratory”.

8.2.3 Installation and Repair of Equipment

No one other than a licensed electrical worker is allowed to carry out any electrical installation and maintenance where there is a possibility of getting into contact with live wiring or terminal.

Report faulty electrical equipment or apparatus to the PI/ Supervisor immediately, who shall then make the necessary arrangement for repair to be carried out.

Prohibit the use of faulty equipment or apparatus by labeling it with a “**FAULTY - DO NOT USE**” tag or other means.

8.2.4 Mandatory Training on Lockout Procedures

Training shall be conducted for the following two categories of personnel (including contract personnel) in the laboratory:

- Persons who have to carry out the inspection, cleaning, repair, or maintenance of plant, machinery, or equipment:
 - Training will cover the skills to identify the energy sources and safely isolate them; to correctly apply lockout devices; and to verify the shutdown.
 - Re-training shall be carried out to keep the personnel updated on any new hazards or change in the lockout procedures.
- Persons who are NOT involved in inspection, cleaning, repair, or maintenance of plant,

machinery, or equipment:

- Training to understand the purpose of the lockout procedures and the prohibition to restart or re-energize any plant, machinery, or equipment that is locked out.

Personnel will be advised of disciplinary measures for violating the lockout procedures; they shall sign a form acknowledging that they have been briefed adequately. Records of the names of the persons trained or re-trained, and the contents of the training should be kept after such training or re-training.

Staff and students required to perform lockout procedures should undergo relevant training, this training can be provided by the Faculty Safety & Health Officer.

Please log on to the [OSHE portal](#) for the safety video related to “Lockout”.

9 OCCUPATIONAL HEALTH

9.1 NOISE MONITORING & AUDIOMETRIC EXAMINATION

PIs and Lab Supervisors shall take all practicable measures to reduce or control noise from any machinery, equipment or process such that no staff or students in the laboratory is exposed to excessive noise (see Table 9-1)

Table 9-1 Permissible Exposure Limits for Noise

Sound pressure level, dB(A)	Maximum duration per day
85	8 hours
86	6 hours 21 minutes
87	5 hours 2 minutes
88	4 hours
89	3 hours 11 minutes
90	2 hours 31 minutes
91	2 hours
92	1 hour 35 minutes
93	1 hour 16 minutes
94	1 hour
95	48 minutes
96	38 minutes
97	30 minutes
98	24 minutes
99	19 minutes
100	15 minutes
101	12 minutes
102	9 minutes
103	7.5 minutes
104	6 minutes
105	5 minutes
106	4 minutes
107	3 minutes
108	2.5 minutes
109	2 minutes
110	1.5 minutes
111	1 minute
112	56 seconds
113	45 seconds
114	35 seconds
115 or more	30 seconds

Notes:

1. No exposure to noise in excess of 140 dB(A) is allowed.
2. The duration of exposure is to be obtained by adding up the total duration of exposure per work day, whether there is one continuous exposure or a number of separate exposures.

3. All continuous, impulsive or impact noise of sound pressure levels from 80 dB(A) to 140 dB(A) must be included in the computation of noise exposure of the person.
4. The permissible exposure limit is exceeded if a person is exposed to noise at a sound pressure level listed in the Table above in excess of the corresponding duration.

Source: Workplace Safety and Health (Noise) Regulations

Where 10 or more persons are exposed or are likely to be exposed to excessive noise, the PI/ Lab Supervisor shall arrange for a noise monitoring to be carried out. For a start, all laboratories with potential excessive noise exposure should have a monitoring done for the purpose of recording the baseline data. Depending on the first monitoring result, noise monitoring shall be repeated at least once every three (3) years or earlier if there is any change in the laboratory condition that may cause laboratory personnel to be exposed to excessive noise.

The PI/ Lab Supervisor shall also arrange for the staff/ students who are exposed to excessive noise for audiometric examination once every 12 months in UHC.

Please log on to the [OSHE portal](#) for the safety video related to “Noise Induced Hearing Loss”.

9.2 RESPIRATORY PROTECTION PROGRAMME

The Respiratory Protection Programme outlines the requirements for use of respirators in laboratory-based research and teaching activities in NUS. Staff and students must undergo fit test and medical examination prior to using a respirator. They must also be trained in donning and maintaining the respirator properly to ensure effective protection to the users.

For more information on mandatory medical assessment, industrial hygiene monitoring and PPE programme, refer to [NUS Occupational Health Programme](#).

10 EMERGENCY PREPAREDNESS & RESPONSE

10.1 EMERGENCY RESPONSE PLAN

Every laboratory shall be equipped with emergency response plans commensurate with the hazards present in the facility. The emergency response plans may be established at the departmental, faculty, building or lab level.

In NUS, the emergency response plans commonly available in laboratory are fire emergency plan, chemical spill plan, biological spill plan and gas leakage plan. The more unique ones are radioactive material spill plan, hydrogen fluoride (HF) response plan, mercury spill plan and etc, which are specific to certain laboratory.

At the minimum, emergency response plans should contain the following elements:

- Provision of emergency detection equipment/ system;
- Availability and adequacy of emergency response equipment;
- Availability and competency of emergency response team;
- Immediate actions required for the witness/ informant and the injured;
- Procedures to raise alarm;
- Procedures to control the emergency and mitigate adverse consequences;
- Procedure to notify PI, campus security, OSHE, Faculty Safety & Health Officer and other NUS personnel;
- Communication with external agencies, such as Singapore Civil Defence Force (SCDF), Singapore Police Force and Ministry of Manpower;
- Training and drills.

It is the responsibility of the PI/ Lab Supervisor to ensure that emergency response plans are in place for all the foreseeable emergency scenarios that could potentially occur in the laboratory. Should the PI/ Lab Supervisor decide to establish one at the laboratory level, he/she must ensure that the procedures are consistent with the emergency response plans at the building/ departmental/ faculty/ university level, if any.

All staff and students working in the laboratory are responsible to read and understand his/her role and responsibilities in the emergency response plans, as well as the expected actions to be carried out in the event of emergency. Everyone is required to participate in drills to familiarize themselves with the emergency response procedures.

10.2 FIRST AID

In general, the number of first aid boxes required depends on the physical layout of the premises and the number of employees in a department. The NUS standard requires a minimum of one first aid box per floor.

Faculties/departments should conduct a risk assessment to decide on the required number of first aid boxes. The following factors should be considered when deciding the number of first aid boxes or contents of the boxes:

- The no. of staff and students each first aid box is serving
- The nature of activities and operations within the laboratory
- Accessibility (travel distance) to the box itself.

The exact number of first aid boxes will be determined by the faculty/departmental safety committee and if necessary in consultation with OSHE.

The minimum requirement for a first aid box for departments is detailed below.

Table 10-1 Contents of Typical First Aid Box

S/no.	Contents	Quantity
1	Individually wrapped sterile adhesive dressings	20
2	Crepe bandage (5 cm)	1
3	Crepe bandage (10 cm)	1
4	Absorbent gauze (packets of 10 pieces)	5
5	Hypoallergenic tape	1
6	Triangular bandages	4
7	Scissors	1
8	Safety pins	4
9	Disposable gloves (pairs)	2
10	Eye shield	2
11	Eye pad	2
12	Resuscitation mask (one-way)	1
13	Sterile water or saline in 100 ml disposable containers (only where tap water is available)	1
14	Torch light	1

There should be at least one first aider if there are more than 25 people employed in a particular department. The number of first aiders per department will be assigned based on the ratio of one first-aider for every 100 persons and part thereof employed in the workplace. The faculty or departmental safety committee will decide if additional first aider is necessary in the work area. The appointed first aiders must be trained and undergo re-training on a periodic basis.

Some important points to note:

- The first aid box should not contain materials other than required for first aid treatment.
- Be sure that the first aid box is stock up to the above quantity.
- Boxes should be inspected once a week, at minimal, and replenished as necessary. Used or expired items should be replaced as soon as possible
- The first aider or department-appointed personnel should frequently check the first aid box to ensure they are fully equipped and all items are usable. Used or expired items should be replaced as soon as possible (i.e., properly maintained).
- A log box should be kept indicating the quantity consumed.
- First aid box should be clearly identified in the work area. It should be labeled clearly and placed in a well-illuminated and easily accessible location (i.e., within easy reach). Employees should be informed of the location of all first aid boxes.
- First aid box must be made of sturdy material and be portable so that it can be quickly taken to the site of an accident
- A notice shall be affixed in every workplace (usually is on the first aid box) stating the names of the appointed first aider (if any).
- The first aider must keep a treatment log to record the treatment rendered by him/her.
- First aid box should also include, where necessary, appliances, antidotes for toxic or corrosive substances (Eg. Cyanide and Hydrofluoric acid). For these additional requirements of first aid box, it shall be determined based on the outcome of the risk assessment.
- The Director of Research Institute, Head of Department, or his/her designate (e.g., laboratory supervisor) should ensure that suitable facilities for quick drenching or flushing of the eyes and body are provided and properly maintained within the work area for emergency use. Please refer to [NUS Laboratory Design Standard](#) on the location requirements for eye wash and emergency showers.

Please log on to the [OSHE portal](#) for the safety video related to “Burns, CPR – Cardiopulmonary Resuscitation, Cuts and Bleeding”

11 LABORATORY SAFETY & HEALTH MANAGEMENT SYSTEM CERTIFICATION SCHEME

The Laboratory Safety & Health Management System (SHMS) Certification Scheme was launched to certify PIs who have effectively implemented laboratory-based safety and health management system. Upon award of the certification to NUS Occupational Safety and Health Management System Standard for Laboratories, PIs will not be required to submit risk assessments on a per-project basis except for animal related work research project.

All academic staff having supervisory oversight of laboratory based activities (research and/or teaching) would need to be certified to the NUS Laboratory Occupational Safety and Health Management Standard by 31 December 2011.

Prior to embarking on the scheme, the PI shall establish a safety and health management system at laboratory level according to the NUS Occupational Safety and Health (OSH) Management System Standard. The standard is an adaptation of the Occupational Health and Safety Assessment Series (OHSAS) 18001:2007 and OHSAS 18002:2000 specifications. The PI shall implement, maintain and continually improve his or her lab-based OSH Management System in a documented manner in accordance with the requirements detailed in the standard.

The PI shall submit the necessary information pertaining to his or her OSH management system to OSHE. After reviewing the information, OSHE will arrange an audit programme with the PI. The audit team will consist of OSHE staff, faculty safety and health officers and external consultants/specialists (if necessary). The audit programme will consist of opening meeting, document review, site visit and closing meeting.

During the audit, audit team will raise the following types of findings to the PIs:

- Areas for improvement (AFIs) – these are SOPs, practices or elements of the OSH management system that would need improvement.
- Category A findings - these are critical deficiencies in the OSH management system that might result in accidents or incidents in the laboratories
- Category B findings – these are notable non compliances in terms of legal compliance or not complying with University Policies or Standard Operating Procedures

For findings that are non-compliance (Cat A & B findings), PI shall take corrective actions to address these non-compliances. Subsequent surveillance audit shall be scheduled to verify implementation of corrective actions by the Faculty Safety & Health Officer. Based on the subsequent surveillance

audit, the lead auditor in OSHE would determine if the PI should be issued with the OSH certificate and the accompanying conditions (if any). PIs will be awarded with a Letter of Certification that is valid for 4 years (strong performing SMS) or 3 years (average performing SMS) from the date of issue.

The PI would be subjected to surveillance audit to ensure the sustainability of the PI's OSH management system. Instead of a 2-yearly on-site audit for every PI, OSHE would audit the PIs on a three year cycle (ie OSHE would audit only one-third of the PIs in each department/research institute. Each PI will be audited once every 3 years). This audit scheme will commence from year 2013. For new PIs, once a PI is certified, his next surveillance audit would be three years later. There would no longer be re-certification audits. The scope of surveillance audit includes Management of Change, Maintenance of Laboratory OSH system and Legal Compliances. Please refer to [Laboratory SHMS Certification Scheme](#) for more information.

12 ACCIDENT/ INCIDENT REPORTING AND INVESTIGATION

All accidents, known exposures and near misses (which do not result in injury) MUST be reported to OSHE via the online [Accident/ Incident Reporting System \(AIRS\)](#). All injuries requiring first aid treatment shall be recorded in the First Aid Log Book.

Reporting must be done within twenty-four (24) hours. It can be submitted by the informant, injured staff/ student, PI, Laboratory Supervisor or other representative if the staff/ student are unfit or unable to do the initial report.

All accidents and incidents must be investigated in order to identify the root cause(s) and contributing factor(s). The investigation team may comprise of representatives from OSHE, the Faculty/ Departmental Safety and Health Committee, the Faculty Safety & Health Officer, PI, Laboratory Supervisor or other members if required.

For more information, refer to the [SOP Incident/ Accident Reporting and Investigation](#) (OSHE/SOP/GL/02)

13 REFERENCES

1. Control of Contractors Working in Laboratories and Hall of Residence (OSHE/SOP/GL/04)
2. SS 98: 2005 Industrial Safety Helmets
3. SS 513: 2005 (Part I) Personal Protective Equipment – Footwear – Safety Footwear
4. SS EN 420: 2003 Protective Gloves – General Requirements and Test Methods
5. SS 58:2009 Code of Practice for Selection, Use, and Maintenance of Respiratory Protective Devices (Formerly CP 74)
6. SS 548:2009 Code of Practice for the Selection, Use, Care and Maintenance of Hearing Protectors (Formerly CP 76)
7. Princeton University Environmental Health and Safety website.

14 LIST OF APPENDICES

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APPENDIX A: LAB COMMISSIONING NOTIFICATION & VERIFICATION FORM

	NUS Safety & Health Manual	Procedure No:	OSHE/SOP/GL/07
Title: Laboratory Commissioning Checklist		Rev No:	03
		Issue date:	11-06-2012
		Page:	1 of 3

Laboratory Commissioning Notification & Verification Form

Details of Principal Investigator		
Name	Contact No. (office)	Designation
Department/Organization/Institution	Location of laboratory or laboratory space	Email
Key Contact Person of Laboratory (i.e. LO,RF,RA) Name & Contact No.:		

Department:	Block /Room No : & PI's name	Date Commissioned:			
General Safety & Health					
Work Environment / Housekeeping	Yes	No	NA	Comments	
1. Bench tops clean & organized?					
2. Heavy items stored on lower shelves?					
3. Items stored on top of shelves have a distance of at least 50cm clearance from the ceiling/sprinklers (unobstructed)?					
4. All communication devices (phone, fax machines, etc.) are operational?					
Personal Hygiene					
5. Eating, drinking prohibition notice posted?					
6. Laboratory refrigerators prohibiting food storage notice posted on refrigerator doors?					
7. Hangers/ hooks for lab coats available?					
8. Towels & liquid soap present at designated sink?					
9. PPE signs posting available?					
Laboratory Equipment					
10. Logbooks for maintenance of equipment available? (i.e. Autoclaves, centrifuges, fume hood, BSC, etc)					
11. Is Faculty Safety and Health Officer notified for lifting of heavy equipment?					
Safety Showers & Eye Washes					
12. Safety showers & approved eye washes provided and accessible?					
13. Inspection tags available?					
14. Adequate signage present?					
Compressed Gas Cylinder					
15. Each compressed gas cylinder marked with the identity of its contents?					
16. Gas cylinders are secured and chained individually so that they will not tip over or fall?					
Cryogenics					
17. Storage containers in well ventilated places? (i.e. not to be kept in cold rooms)					

 NUS Safety & Health Manual	Procedure No:	OSHE/SOP/GL/07
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Electrical Safety				
18. Tool, appliance and instrument earthed correctly?				
19. Electrical outlets not overloaded?				
20. Cords not placed in pathways or other areas which obstruct pathways/cause tripping hazards?				
Biological Safety				
21. Access to lab limited or restricted?				
22. Entrance signage includes biosafety level, & any special requirements for entry?				
Chemical Safety				
Storage				
23. Chemicals kept in proper storage cabinets (eg. Corrosive & Flammable safety cabinet)?				
24. Controlled hazardous substances & poisons kept under log, lock & key?				
Flammable Liquids				
25. Flammable & combustible liquids kept in approved Flammable Safety Cabinets (FSC)?				
26. Flammable liquids and gases are kept within the maximum allowable limit (MAQ)?				
27. Flammable liquids not stored near hot plates or other ignition sources?				
Radiation Safety				
Radioactive work area				
28. Designated area/room meant for radioactive work proper marked & labeled? Proper signage?				
29. Access to work area limited & restricted?				
Laser Safety				
30. Laser area identified by proper signage?				
Emergency Preparedness				
Emergency Planning & Procedures				
31. Emergency telephone numbers posted near telephones?				
32. First Aid box available? Staff & students know where to locate?				
33. Spill control materials available? Staff & students know where to locate?				
34. Fire extinguishers available? Staff & students know where to locate?				
35. Sprinkler system, fire hose, extinguishers, calls points, etc. unobstructed?				
Escape Route				
36. All pathways free from obstruction?				
37. Staff & students aware of exit doors/evacuation routes?				
Security				
38. Doors to the lab operational, close & lock properly?				
Staff Awareness				
39. Do staff know who is the Faculty Safety & Health Officer?				
40. Do staff know Campus Security contact number?				

 NUS Safety & Health Manual	Procedure No:	OSHE/SOP/GL/07
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41. Do staff know where to locate and how to use the OSHE Lab sign generator? https://wvs.nus.edu.sg/workplacesign/labsign.aspx				
--	--	--	--	--

_____ Responsible Party (i.e., Principal Investigator or Head of Department)	_____ Date
--	---------------

Physical Verification by Faculty Safety and Health Officer		
_____ Name	_____ Signature	_____ Date

APPENDIX B: SAFETY AND HEALTH INDUCTION CHECKLIST FOR NEW LABORATORY USERS

		Safety and Health Induction Checklist For New Laboratory Users Guidelines for Laboratory Supervisors/Principal Investigators		
<p>Initial induction should be completed within two weeks of starting. Emergency procedures should be covered in the first day. When induction health and safety training is completed, the relevant box(es) should be ticked. For items not covered, comments should be recorded giving reasons and date for completion. The new user and person providing the induction should both sign the form and keep a copy. New laboratory user could be NUS or External staff or student, attachment student, visiting professor, polytechnic student, etc</p>				
Name of New Lab. User:		Job Title:		
Faculty/Department/Research Institute :		Start date:		
Laboratory Name:		Laboratory location no. :		
1. Health and Safety Policy & Information		Yes	No	Comments
1.1	Has the <i>University's Health and Safety Policies</i> been explained to the new lab user?	<input type="checkbox"/>	<input type="checkbox"/>	Available on OSHE website http://www.nus.edu.sg/osh/policies.htm
1.2	Has the user been told who their key Laboratory Health & Safety Co-ordinator is?	<input type="checkbox"/>	<input type="checkbox"/>	
1.3	Has the user been made aware of the following services, and how to contact them if advice is needed: <ul style="list-style-type: none"> ▪ Campus Security Number/All emergencies – tel. 6874 1616 ▪ OSHE main contact line – 65161084 ▪ Medical assistance service (tel. 6776 1631 / 6516 2880) 	<input type="checkbox"/>	<input type="checkbox"/>	
1.4	University Counselling Service (tel. 6516 7777 (24-hrs))	<input type="checkbox"/>	<input type="checkbox"/>	
1.5	Has the user been told where their nearest Health and Safety Notice Board is?	<input type="checkbox"/>	<input type="checkbox"/>	
1.6	Have you explained the University/Departmental policy on work outside normal working hours?	<input type="checkbox"/>	<input type="checkbox"/>	Two directives can be found in OSHE website: https://www.nus.edu.sg/osh/nus_manuals/policies/directive0701.pdf https://www.nus.edu.sg/osh/nus_manuals/policies/directive0702.pdf
1.7	Staff and students must display their staff ID / badge prominently all the time while they are at laboratories.	<input type="checkbox"/>	<input type="checkbox"/>	
1.8	Has the user undergone the necessary occupational health medical assessment?	<input type="checkbox"/>	<input type="checkbox"/>	
1.9	Has the user completed the "Facility access exclusion of liability and indemnity form"? This is applicable to external (non NUS) staff and students.	<input type="checkbox"/>	<input type="checkbox"/>	Available on OSHE website: https://www.nus.edu.sg/osh/manuals/indemnityform.pdf

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1.10 Has the user been informed of the NUS requirements for insurance requirements for international students if applicable?	<input type="checkbox"/>	<input type="checkbox"/>	Available on NUS website: http://www.nus.edu.sg/registrar/edu/ng-internationalinfo.html#insurance
2. Risk Assessments & Training	Yes	No	Comments
2.1 Where appropriate, has the user been briefed on which work activities they are not permitted to undertake, equipment they are not authorised to use, substances they must not handle and any restricted locations?	<input type="checkbox"/>	<input type="checkbox"/>	
2.2 Has the user been briefed on the relevant risk assessment pertaining to their research activities.	<input type="checkbox"/>	<input type="checkbox"/>	
2.3 Has the user been taught procedures for conducting risk assessments of their laboratory activities?	<input type="checkbox"/>	<input type="checkbox"/>	
2.4 Have the safety and health training needs of the staff or students been identified?(lease record in section 6 below).	<input type="checkbox"/>	<input type="checkbox"/>	Details of OSHE training courses available can be found in OSHE Training Prospectus or Training Page of the website http://www.nus.edu.sg/osh/training/safety.htm
3. Personal Protective Equipment	Yes	No	Comments
3.1 Have you informed them of any activities for which personal protective equipment or other safety equipment is required (and why it must be used)?	<input type="checkbox"/>	<input type="checkbox"/>	
3.2 Has the necessary personal protective equipment (PPE) been issued and its proper use, storage and maintenance explained?	<input type="checkbox"/>	<input type="checkbox"/>	
3.3 Have you explained the procedure for reporting defective or damaged PPE and obtaining replacements?	<input type="checkbox"/>	<input type="checkbox"/>	
4. Emergencies and Fire Arrangements	Yes	No	Comments
4.1 Has the lab user been informed of the procedure to follow upon discovering a fire or hearing the fire alarm, including where the fire escape routes and fire exits are in the building?	<input type="checkbox"/>	<input type="checkbox"/>	
4.2 Has the lab user been briefed on where the fire assembly point is and the role of the Fire Evacuation Officer and Fire Wardens?	<input type="checkbox"/>	<input type="checkbox"/>	
4.3 Has the lab user been explained where the fire extinguishers & fire blankets are positioned, how they operate and what type of fires they are suitable for extinguishing?	<input type="checkbox"/>	<input type="checkbox"/>	
4.4 Have you pointed out the location of the toilets, washing facilities, kitchen & rest areas, lockers, emergency showers etc (as appropriate)?	<input type="checkbox"/>	<input type="checkbox"/>	
4.5 Has the lab user been briefed on the use of eyewash and safety shower?	<input type="checkbox"/>	<input type="checkbox"/>	
4.6 Has the lab user been briefed on the location of the nearest first aid box, first aid room (if provided) and informed of who the local first-aiders are (and how to contact them)?	<input type="checkbox"/>	<input type="checkbox"/>	
5. Accidents and Hazard Reporting	Yes	No	Comments
5.1 Has the lab user been briefed on incident / accident reporting procedure and how to report a hazard?	<input type="checkbox"/>	<input type="checkbox"/>	Available on OSHE website http://nus.edu.sg/osh/services/airs.htm

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6. List here any health and safety training needs identified (including timescales for attendance) and any additional safety and health information required by / for the staff or student:

Declaration

I certify that the above health and safety induction subjects have been explained:

Name of the inductor: Signature: Date:
(please include job title)

Name of New Laboratory User: Signature: Date:

For general enquiries on safety and health matters, please refer to the following website
<http://www.nus.edu.sg/osh/aboutus/staff.htm>

APPENDIX C: FACILITY ACCESS EXCLUSION OF LIABILITY & INDEMNITY

THIS MUST BE COMPLETED AND RETURNED TOGETHER WITH YOUR ACCEPTANCE FORM TO THE RELEVANT DEPARTMENT/FACULTY/SCHOOL/OFFICE IN WHICH THE FACILITY RESIDES. VISITORS BELOW 18 YEARS OF AGE ARE REQUIRED TO HAVE THEIR PARENT COMPLETE THIS FORM*.



EXCLUSION OF LIABILITY AND INDEMNITY FORM FOR ACCESS TO FACILITY

I, _____ (Name of *visitor/parent/guardian)
_____, (Passport/Identity Card No.), *parent/guardian of
_____, (Name of visitor) _____
(Passport/Identity Card No.), hereby request that *I/my child/my ward be granted access to
_____, (Name of laboratory,
workshop or animal facility) ("Facility"). In consideration of *I/my child/my ward being granted access
to the Facility by _____
(Department/Faculty/School/Office), National University of Singapore, I, for myself, *and my child/my
ward, my successors, personal representatives and assigns, hereby agree as follows:

- (a) I acknowledge that access to the Facility involves an inherent risk, including risk of personal injury, ill-health and/or exposure to disease or infection, and that *I/my child/my ward will have access to hazardous facilities, equipment, and materials. I further acknowledge that *I/my child/my ward make(s) use of such access, facilities, equipment and materials of *my/his/her own free will and volition and *am/is aware of and accept(s) the risks involved.
- (b) I/my child/my ward* will abide by the applicable written and verbal rules (including safety rules), regulations, policies, procedures, guidelines, protocols and instructions established or prescribed from time to time by the University or its departments, faculties, schools, offices or relevant units regarding the use of the Facility and the facilities, equipment and materials therein, failing which, the University shall be entitled to immediately withdraw access to the Facility and any and all privileges arising therefrom.
- (c) I will not hold the University, its officers, any of its full-time or part-time staff (including student assistants), agents or volunteers responsible or liable in any way for, and no action shall arise from, any loss or damage (including, without limitation and to the extent permissible by law, personal injury, loss of life or property damage) caused by or sustained as a result of *my/my child's/my ward's access to the Facility or use of the facilities, equipment and/or materials therein.
- (d) I will indemnify and indemnified, save and hold harmless the University its officers, any of its full-time or part-time staff (including student assistants), agents or volunteers against all losses, claims, demands, actions, proceedings, damages, costs or expenses, including legal fees, and any other liability arising in any way from *my/my child's/my ward's access to the Facility or use of the facilities, equipment or materials therein, or resulting from any breach of the undertakings herein.

Signature of *visitor/parent/guardian: _____

Name (please print): _____

Passport/Identity Card No.: _____

Relationship to visitor, if applicable: _____

Telephone (Residence): _____ (Office): _____

Mobile Telephone: _____ Fax: _____

Email Address: _____

Postal Address: _____

Date: _____

* Delete as applicable.

* Where parents are deceased, a visitor below 18 years of age should provide the name of a legal guardian or any other person who has legal authority over, and responsibility for, the visitor.

APPENDIX D: NUS SELF-HELP SAFETY + HEALTH STARTERS' CHECKLIST

OSHE

Compliance Assistance Toolkit (CAT) Programme

NUS Self-Help Safety + Health Starters' Checklist – Part I

No one knows your workplace better than you do!!!

This checklist acts as a simple guide to assist you in making your laboratory a safer place. You can discuss your findings with your Faculty Safety Officer.

	YES	NO	Remarks (Put N/A if not applicable)
Housekeeping/General Safety			
Are aisles, paths of egress, and exits kept clear from obstructions (1.5 meter wide)?			
Do you store boxes below your workbenches or stack boxes to the ceiling?			
Are your safety and emergency equipment obstructed? Do you have clear access to them in the event of an emergency?			
Machinery, Equipment and Electrical			
Are machine guards in place and in use?			
Are electrical cords frayed?			
Are electrical outlets overloaded?			
Do you need to extend your cord beyond 3 meters from the outlet?			
Do you have water source near electrical outlets?			
Personal Protective Equipment (PPE)			
Is Personal Protective Equipment readily available for specific hazards in your lab/workshop?			
Have lab/workshop staff and students been trained on correct use, care, donning, and doffing of Personal Protective Equipment?			
Does staff or students use the PPE when required?			
Radiation Safety (ionizing and non-ionizing)			
Are all containers of radioactive material properly labeled and kept securely?			
Are the records for radioactive material use, area surveys, and inventory up to date and kept by the principal investigator?			
Appropriate shielding material is used			
Chemical Safety			
Chemicals (and chemical waste) are stored in an orderly, segregated manner, not in the walking and working floor areas,			

OSHE

Compliance Assistance Toolkit (CAT) Programme

with liquids at or below eye level.			
Fume hoods that are maintained at least annually and not used as chemical storage area.			
Domestic fridges are not used to store flammable chemicals.			
Gas cylinders are secured properly, and incompatible gases are segregated.			
Secondary containment is used.			
Flammable chemicals and corrosives are stored in flammable cabinets and corrosive cabinets respectively.			
Biological Safety			
Proper sharps bins are used, kept closed at all times and not placed on the floor			
Secondary containment is used when transporting biohazards			
Aerosol generating work are done in the Biological Safety Cabinet (BSC) which are maintained at least annually			
Liquid nitrogen are stored in a well ventilated area			
Emergency Preparedness			
Appropriate spill kits are kept and maintained in the lab and staff are trained on handling hazardous material spills			
First aid kit well stocked up			
Weekly testing of eye shower and monthly testing of safety shower			
Is there a list of emergency contact numbers in your workplace and you have a Fire Emergency Plan written up?			
Hazard Communication			
Are hazard specific signage posted at the entrance to your workplace? (https://aserv.nus.edu.sg/osh/doorsign)			
Do you refer to Material Safety Data Sheet (MSDS) in planning out work involving hazardous substances in your workplace?			
Are all hazardous substances appropriately labeled with clear hazard symbols and name of hazardous substances?			
All staff members and students have received both relevant classroom and on-the-job safety and health training			

APPENDIX E: LAB NOTICE



LAB NOTICE

Hazards in the Lab



Personal Protection Required



Special Procedures or Precautions for Entry

This is a BSL 2 lab. DO NOT enter without permission/ authorization.

ADMITTANCE TO AUTHORIZED PERSONNEL ONLY

NOTICE	CALL OR SEE	OFFICE TEL	CONTACT AFTER OFFICE HOUR
For Entry or Advice	OSHE OSHE	6516 1084	6516 1084
In Emergency	OSHE OSHE	6516 1084	6516 1084

EMERGENCY CONTACT NUMBERS

POLICE	999	AMBULANCE/FIRE	995
University Health and Wellness Centre	x2880 (6516 2880)	Campus Security	6874 1616
Faculty Safety & Health Officer	Syam Kumar - Fac of Science, 65161310		

Name of Lab : OSHV4
 Department : OSHE
 Biosafety Level : Biosafety Level 2

Laboratory No : 1-1, NUS
 Date Posted : Tuesday, July 14, 2009

APPENDIX F: CONTRACTOR RISK MANAGEMENT CHECKLIST – FOR LABORATORIES

NATIONAL UNIVERSITY OF SINGAPORE CONTRACTOR RISK MANAGEMENT CHECKLIST

DUTIES AND RESPONSIBILITY FOR CONTRACTOR’S SUPERVISOR (For Laboratory)

Scope of Work: _____

Contractor Supervisors are to:

1. Submit risk assessment for the work activities to be conducted prior to start work and their workers brief on the risk involved.
2. Give adequate instruction to their workers on the possible dangers in the labs and keep a record showing that the contractor has briefed their workers before they commence work.
3. Monitor and supervise their worker’s safety and health regularly.
4. Inform departments / OED immediately of all accidents / incidents to their staff or any third party within NUS.
5. Instruct their workers not to start hot work without permit.
6. Provide all necessary personal protective equipments such as but not limited to gloves, safety spectacle, mask etc. to every single worker.

The above MUST be complied with to prevent accidents and injuries to contractors, staff and students.

I, _____ (name of supervisor) acknowledge that I have received, read and understand the duties and responsibility for Supervisor. I agree to abide by these rules to the best of my ability while working in NUS.

Contractor Supervisor’s Signature

Date

Name and signature of representative
of NUS contract awarding party

Date

**NATIONAL UNIVERSITY OF SINGAPORE
CONTRACTOR RISK MANAGEMENT CHECKLIST**

HAZARD NOTIFICATION/ BRIEF RECORD

Name of contractor	
NRIC/ PP. No:	
Company:	
Date of work start and completion:	

The above contractor was briefed on _____ (date) on the following points involved and protection measures to prevent potential and existing hazards:

1. Type of hazards and risks involved;
2. Personal Protective Equipment required
3. Procedures in the event of any accident/ incident
4. First aid measures

(Include below any specific hazard identified and measures taken to eliminate or minimize hazard)

5. _____
6. _____
7. _____
8. _____

Name/Signature of the Lab Officer	Name and Signature of Contractor Supervisor
Date:	Date:

14.1 APPENDIX G: SAFETY & HEALTH RULES FOR CLEANERS WORKING IN NUS (DO'S AND DON'TS) – FOR LABORATORIES

NATIONAL UNIVERSITY OF SINGAPORE SAFETY & HEALTH RULES FOR CLEANERS WORKING IN NUS ("DOs" AND DON'Ts") (For Laboratory)

Cleaners are to:

1. Report to their Supervisors immediately if :
 - a. There is any accident resulting in personal injury.
 - b. They unintentionally disrupt experimental setups.
 - c. They accidentally cause spills.
 - d. There are any unusual wastes they have encountered during their waste collection.
2. Wear proper protective gloves when clearing the rubbish.
3. Sign in and out and report to the laboratory Officer when entering the laboratory.
4. Empty the waste paper basket along the corridor (ONLY)

Cleaners are **NOT** to:

1. Clean any lab workbenches, shelves, cupboards, instruments, refrigerators, equipment or chemical bottles.
2. Move or touch any experimental set up, chemical bottles on any work benches, equipment or instrument in the labs.
3. Be involved in the chemical or broken glass disposal, this job is to be handled by the lab staff only.
4. Enter into the labs without the approval from the lab staff.
5. Sweep or mop the labs without the approval and supervision of the lab supervisor.

The above **MUST** be strictly complied with to prevent accidents and injuries to contractors, staff and students.

I, _____ (name of Cleaner) acknowledge that I have received, read and understand the above Safety & Health Rules for cleaners. I agree to abide by these rules to the best of my ability while working as a cleaner in NUS laboratory.

Cleaner's Signature

Date

Explained to Cleaner by the Contractor Supervisor in:

* English Malay Mandarin Tamil

Contractor's Supervisor Name & Signature

Date

*Please tick one

Rev 01: 07-May-08

14.2 APPENDIX H: CONTRACTOR CONTROL – HAZARD NOTICE



Contractor Control - Hazard Notice

Hazards in the General Workplace



Personal Protection Required



Special Procedures or Precautions

None

ADMITTANCE TO AUTHORIZED PERSONNEL ONLY

NOTICE	PERSON-IN-CHARGE	OFFICE TEL	CONTACT AFTER OFFICE HOUR
Contract Awarding Party	XXX OSHE	6516 XXXX	9XXX XXXX
Contractor	Lee XXX XXX XXX Pte Ltd	6XXX XXXX	9XXX XXXX

EMERGENCY CONTACT NUMBERS

POLICE	999	AMBULANCE/FIRE	995
University Health and Wellness Centre	x2880 (6516 2880)	Campus Security	6874 1616

Project Description Alteration & Addition Work to OSHE Office
 Project Location Alumni Basement, OSHE NUS
 Project Period 03 Jun 2008 - 12 Jun 2008

Date Posted: 09 Jun 2008

LABORATORY DECOMMISSIONING NOTIFICATION & VERIFICATION FORM

Did you make any structural modifications to the laboratory space, or move/store any fixtures or casework?

YES **NOT APPLICABLE**

If **yes**, what were they? Where are they located?

Do you share any storage or laboratory space with another researcher?

YES **NOT APPLICABLE**

If **yes**, with whom? Where?

Decommissioning Certification Procedures

In preparation to vacate the laboratory listed above, I certify that:

Biological

- All biological materials have been destroyed or transferred to another laboratory appropriately.
- Any biological safety cabinets have been emptied and decontaminated with an appropriate disinfectant
- All stocks and media solutions have been decontaminated with an appropriate disinfectant
- All biological materials have been removed from freezers and refrigerators. The freezers and refrigerators have been decontaminated with an appropriate disinfectant
- All laboratory surfaces used for infectious materials have been decontaminated with an appropriate disinfectant
- All solid infectious materials and used supplies have been disposed in an infectious waste container.
- All sharps have been placed into sharp containers and the sharp containers disposed in infectious waste containers.

Chemical

- All chemical waste has been disposed off through licensed waste collectors
- All useful chemicals have been redistributed to other departments
- All compressed gas cylinders have been returned to vendors
- All laboratory surface areas used for chemicals have been adequately decontaminated
- All fume hoods have been emptied and decontaminated accordingly.

Radiation

APPENDIX J: NUS EQUIPMENT DECONTAMINATION/ DISPOSAL RECORD STICKER



NUS EQUIPMENT DECONTAMINATION/DISPOSAL RECORD

Principal Investigator _____
Name Phone Date

This piece of equipment was used with the following:

No Hazardous Materials Biologicals

Chemicals _____
Initials Date

Radiation _____

Other Hazardous (specify) _____

Decontaminated with _____

By (Name) _____ Date _____

Equipment OK for removal/disposal: ____ Yes ____ No

PI Signature

REMOVE THIS LABEL BEFORE REUSING EQUIPMENT

NUS/OSHE 2005