Centre for Life Sciences	**SOP No:**	**LSI/SOP/004**
Title: **CeLS Biosafety Standard Operating Procedures**	**Effective Date:**	**17th August 2007**
Prepared by: Biological Safety Subcommittee	**Revision No:** **Revision Date:**	**6** **18th October 2013**
Approved by: CeLS safety Committee	**Pages**	**8**

1.0 OBJECTIVE

The objective of this document is to standardize procedures for the safe handling, storage and disposal of biological materials in the Centre for Life Sciences (CeLS).

2.0 SCOPE

This Standard Operating Procedure (SOP) is applicable to all laboratories in CeLS and covers safety and health issues that are unique to CeLS.

3.0 RESPONSIBILITIES

3.1 Principal Investigator (PI)

The PI is responsible for ensuring that this SOP (and other applicable NUS-wide and nation-wide guidelines, SOPs and regulations) are adopted in his/her research laboratory; ensuring that his/her staff know where to obtain a copy of this SOP; determining the necessary training needs, supervising and providing on-the-job training for all the research staff and students in his/her research group; and preparing specific SOPs when required for selected research protocols and equipment use.

3.2 Laboratory personnel

All laboratory personnel (staff and students) working with biological materials must be aware of potential hazards; must be knowledgeable of this SOP and its contents (and other applicable NUS-wide and nation-wide guidelines, SOPs and regulations); must obtain necessary training and work under supervision until proficient in the practices and techniques required to handle such material safely.

3.3 CeLS Biosafety Subcommittee

The members of the Biological Safety Subcommittee, representing individual research Programmes located in CeLS, are responsible for preparing the CeLS-wide biosafety SOP and reviewing it least annually or more frequently if required.

3.4 CeLS Safety Committee

CeLS Safety Committee which has representation from all the relevant Programmes/units/offices located in CeLS, is responsible for ensuring that the occupants of CeLS are in compliance with the applicable safety regulations; serving as liaison body between OLS EXCO and the occupants of CeLS, OSHE and any other body as required; ensuring that safety issues are addressed adequately; and conducting periodic inspections of the laboratories. Appendix A contains the CeLS Safety Committee organization structure and the Terms of Reference.

3.5 Safety and Health Officer

The Safety and Health Officer should serve as the resource person for all occupants of CeLS in matters pertaining to laboratory safety and occupational safety and health matters as well as the liaison person between OSHE and/or other administrative departments and CeLS in matters pertaining to safety. He/she should promote safety awareness and conduct safety orientation for all new comers.

3.6 Safety Technologist

The Safety Technologist assists the Safety and Health Officer in coordinating all safety related activities in CeLS. He/ she also serves as the resource person for all occupants of CeLS pertaining to laboratory safety and health matters together with the Safety and Health officer.

4.0 DEFINITIONS

4.1 "Biosafety", or biological safety, is a concept that promotes safe laboratory practices, procedures, and proper use of containment equipment and facilities by laboratory workers in the biomedical environment to prevent occupationally-acquired infections or release of organisms to the environment. Biosafety is the responsibility of all persons who handle pathogenic microorganisms and recombinant DNA molecules or biohazardous material.

4.2 "Biohazards" are infectious agents or biologically derived infectious materials that present a risk or potential risk to the health of humans or animals, either directly through infection or indirectly through damage to the environment. Infectious agents have the ability to replicate and give rise to the potential of large populations in nature when small numbers are released from a controlled situation.

4.3 "Infectious waste" or "biohazardous waste" includes cultures and stocks of infectious agents and associated biological material, human pathological wastes, human blood, blood products and body fluids, contaminated animal wastes and carcasses, human and animal isolation wastes, contaminated sharps and consumables (sharps or consumables that have been in contact with infectious agents or that have been used in animal or human patient care or treatment, at medical, research, or industrial laboratories).

5.0 RISK ASSESSMENT

5.1 As per the requirement of the Workplace Safety and Health Act (WSHA) which came into effect on 1 March 2006, all laboratory–based activities require risk management before commencing the activity. The objective of risk assessment is to put in place measures to contain the risks. PIs are responsible for completing the risk assessment exercise BEFORE any new project or task is commenced, or when there are changes that may affect the safety and health aspects of the project / task or as and when required by the University. If there are any significant changes to the scope of the work, the applicable risk assessment should be amended accordingly or a new risk assessment will have to be conducted to cover any new hazards and OSHE should be consulted about the mitigation (risk reduction) strategies proposed to address the new hazards. Risk assessments must be documented, including the appropriate risk control measures being implemented. Details of the process can be found on the OSHE website.
https://wws.nus.edu.sg/osh/nus_manuals/sop/SOP_U05_Risk_Assessment.pdf

5.2 Unless the PI is covered under the Lab Certification Scheme, grant-funded projects require OSHE approval before commencement of the project and release of grant funding. For PIs who have been certified under the Lab Certification Scheme, OSHE just needs to be informed of the new grant funded project via completion of an iORC form.
https://wws.nus.edu.sg/iorc/

5.3 Research involving genetically modified organisms requires special attention details of which are available at the Singapore Genetic Modification Advisory Committee. http://www.gmac.gov.sg/

5.4 It is the responsibility of individuals to inform their Principal Investigators (PIs) of any changes in their health status that might alter their susceptibility to potential hazards. They should discuss their job scope with their Principal Investigator and Risk Assessments should be reviewed before they continue with their work.

- Pregnant women or persons who are uncomfortable with working with any particular biohazard are advised to discuss their concerns with their respective PI, SH officer or NUS Occupational Health.

- Individuals suffering from any long-term illness that may affect their immune status, who are working with potentially immuno-compromising agents, are advised to discuss this with their PI, H&S Officer or NUS Occupational Health.

- If in doubt as to whether their health status might increase their risk, personnel are advised to discuss their concerns with their PIs.

6.0 Risk Management:

6.1 Personal Protective Equipment

- Gloves, laboratory coats, head and foot coverings, face shields or masks, eye protection are to be worn when appropriate.
- Other PPE should be used as appropriate, refer to OSHE website for more details. https://wws.nus.edu.sg/osh/nus_manuals/guidelines/U_GL_01_PPE.pdf

6.2 Training Requirements:

- All personnel (staff and students) handling bio-hazardous material (e.g. human samples, animal samples, bacterial /viral cultures) must be familiar with the university guidelines and have had the appropriate training and departmental approval before participating in such research activities.
- All new comers to the building will be given a CeLS Orientation by the Safety Health Officer.
- It is compulsory for all laboratory personnel (staff, students including short-term) in CeLS to complete the online biological safety course.
  https://inetapps.nus.edu.sg/osh/portal/training-reg-info.html
  Refresher biosafety courses should be completed online every two years by all laboratory personnel including the PIs.
- Vendors, contractors and short term visitors should be oriented about the biological safety issues in the laboratory by an experienced member of the laboratory, who will take responsibility for their safety during their visit to the laboratory.

6.3 Use of Biological Safety Cabinets (BSC)

- All biologically hazardous work involving human blood, tissue or cell-lines as well as any BSL2 pathogens / biological material should be performed in BSC.
- The class of BSC should be commensurate with the biological agent. Advice should be sought from the Health and Safety Officer or OSHE if in doubt.
- Personnel are to follow strict operating procedures when working in the BSC in compliance with OSHE guidelines
  https://wws.nus.edu.sg/osh/nus_manuals/guidelines/BS_GL_02_BSC.pdf

6.4 Medical requirements

- Immunization for Hepatitis B is mandatory for everyone who is handling any material of human origin.
- Immunization for tetanus is mandatory for everyone who is working with live animals.
- Immunization against other potential diseases associated with work in the laboratory is required on a case-by-case basis.
- Further information on occupational health matters is available at the OSHE website:
  https://inetapps.nus.edu.sg/osh/portal/oh/intro.html

6.5 Safe Practices

- Biological hazards are potentially present in all human and animal tissues and body fluids. The research activities carried out in CeLS may expose workers to human blood, urine, sweat, semen, saliva and muscle and other tissue.
- For the purpose of assessing risk, we assume that all material of human origin could be a potential source infection.
- We must remain aware at all times that better knowledge of disease transmission and occupational hazards may result in situations currently considered safe to be reclassified as having higher risk.
- Each laboratory should have a copy of the applicable Safety Manual and Material Safety Data Sheet (MSDS). Each laboratory should prepare additional SOPs specific to their work as required.
- Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in laboratories.
- Food and drink should not be stored in refrigerators, freezers, or cabinets within the laboratories.
- Laboratory materials should not be stored even for short term in pantry or office areas.
- Open-toed sandals or slippers are not to be worn in the laboratory.
- The work site should be maintained in a clean and sanitary condition. All equipment, environmental enclosures and working surfaces should be properly cleaned and disinfected after contact with blood or other potentially infectious materials
- Work surfaces should be decontaminated with an appropriate disinfectant for suitable contact time (70% ethanol, 10% bleach, hospital disinfectant, or others as required) after completion of work; when surfaces are contaminated; and immediately after a spill of blood or other potentially infectious materials. https://share.nus.edu.sg/corporate/procedures/safety_and_health/Biological-Safety-Procedures/GD-choosing-a-disinfectant-for-hard-surfaces.pdf
- All lab personnel must be familiar with biological spills procedure and have been trained in handling a biological spillage. For reference they should refer to their own programme' s SOPs and /or OSHE's Biorisk Management Manual: https://share.nus.edu.sg/corporate/procedures/safety_and_health/Biological-Safety-Manuals/Manual-lab-biorisk-management.pdf
- Users of flow cytometers for cell sorting should be familiar with the following guidelines detailed in OSHE's Biorisk Management Manual, Chapter 7.6, Flow cytometers.
- Rotors with sealable lids must be used when centrifuging bio-hazardous material. OSHE's Biorisk Management Manual, Chapter 5.6.5 Working with Hazardous materials. Vacuum systems used for aspiration of infectious biohazardous material must be fitted with an inline HEPA filter: see OHSE Biorisk Management Manual, Chapter 5.2.2 Preparing to work in a Class II BSC. Lab door signs with biohazard symbol and relevant information on hazards, personnel contact and required PPE should be printed from the OSHE lab signposting generator and posted in appropriate locations.
  https://wws.nus.edu.sg/osh/labsign/default.aspx

- Each laboratory should complete and document a safety 'self-assessment' on a quarterly basis or more frequently if required. This document should be available for inspection as and when required by the CeLS Safety Committee. (Appendix B gives the template for the quarterly assessment).
- Each laboratory should maintain a list of all the BSL2 agents that are being handled or stored in their laboratory together with the MSDS (suggested website for reference http://www.phac-aspc.gc.ca/msds-ftss/). This list should be provided to the CeLS Safety and Health Officer whenever it is updated.
- Research projects that use highly hazardous biological agents will be flagged by OSHE at the risk assessment stage. OSHE, in discussion with the PIs, may require that special SOPs and conditions be implemented. These SOPs and conditions should be documented and strictly adhered to.

6.6 Sharps handling and disposal

- All sharps (e.g. needles, broken glass, glass pipettes) must be disposed into yellow sharps bins. They must never be thrown into any waste bins: only into the yellow biohazard sharps bins.
- In general, yellow sharps bins should be disposed through licensed collectors and not autoclaved.
- Do not overfill the yellow sharp bins
- Needles must NOT be recapped before disposal into a sharps bin. Report any needle-stick injuries to OSHE via AIRS :

  https://wws.nus.edu.sg/airs/report.aspx

6.7 Biohazard Waste Disposal

- All infectious solid waste must be autoclaved prior to disposal into the designated Semb-Waste bins for collection by the medical waste collectors. Infectious liquid waste to be autoclaved must be placed in autoclavable containers. Non-infectious waste need not be autoclaved. Infectious biological liquid waste may also be inactivated using the appropriate disinfectant with a final concentration that is effective in decontaminating the waste.
- All biohazard waste destined for disposal shall be placed in closable, leak-proof containers or appropriately color-coded bags and labeled. Place these biohazard yellow bags only into the designated Semb-Waste bins.
- Biological waste that is also a chemical waste should be disposed of in accordance with the chemical waste SOPs. All waste of this type must be non-infectious or have been inactivated prior to disposing as chemical waste.
- Biohazard waste that is also radioactive shall be treated according to requirements for both biohazard and radioactive waste. Radioactive waste requirements will take precedence.
- Non-infectious liquid biological waste (cell suspension, cell culture medium, blood etc.) should be treated with 10% bleach at a final concentration (or other disinfectants) for at least one hour before disposing into the laboratory sink diluted with copious quantities of water. Untreated liquid biological waste should NEVER be disposed into the laboratory sink.

- Untreated and non-infectious solid biological waste (contaminated pipettes, tips, gloves, etc.) should be disposed in the yellow biohazard bags and NEVER be disposed into the general waste bin.
- The interior of contaminated reusable items should be filled with a 10% bleach (0.5% sodium hypochlorite) solution. Moreover, the item should be soaked in 10% bleach (0.5% sodium hypochlorite) if the exterior is potentially contaminated. After a minimum of one hour, the bleach can be removed. If the bleach is to be discarded, it can be poured down the sink followed by copious quantities of water. The item can then be returned to general laboratory use following normal cleaning procedures.
- All laboratories shall evaluate their waste disposal to ensure that all biohazard wastes are treated in a manner as described in this SOP before disposal.
- Biohazard bags should be labeled with the PI name/ lab name, phone number and date and placed in the Semb-waste bins, which will be collected by a licensed contractor. Do not place biohazard bags outside the bin, in the corridors or labs. If the Semb-waste bins are full find another empty bin and alert your lab manager.

6.8 Transport & Transfer of Biological Agents

Transport and transfer of biological agents should be done in accordance with the relevant OSHE SOP. Refer to OSHE Biorisk Management Manual, Chapter 9 Transport of Biological materials.
https://share.nus.edu.sg/corporate/procedures/safety_and_health/Biological-Safety-Manuals/Manual-lab-biorisk-management.pdf

7.0 Incident reporting

All accidents and injuries must be reported within 24 hours to your PI, the Lab Manager, the CELS Officer and to OSHE. More details can be obtained from OSHE Biorisk Management Manual, Chapter 12 Emergency response due to exposure to potentially infectious materials.
https://share.nus.edu.sg/corporate/procedures/safety_and_health/Biological-Safety-Manuals/Manual-lab-biorisk-management.pdf

8.0 REFERENCES

- The University Safety Manual has several sections relevant to biosafety. Members of the department are encouraged to access the Safety Manual on OSHE's web site. http://www.nus.edu.sg/osh/manuals/sop.htm#biological

- In line with NUS's recommendations on Biosafety, NUS will be adopting the WHO Laboratory Biosafety Manual (3rd Edition) to govern life science research work. This edition of the Biosafety Manual is one of the most comprehensive, covering risk assessment, biosecurity and facility commissioning/certification. A copy of the manual is available at (http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_CSR_LYO_2004_11/en/)

- The Workplace Safety and Health Act (WSHA) came into effect on 1 March 2006 and is an essential part of the new framework to cultivate good safety habits in a individuals so as to engender a strong safety culture in our workplace. A copy can be obtained at http://www.mom.gov.sg/publish/momportal/en/legislation/Occupational_Safety_and_Health/workplace_safety_and.html

- Biological Agents and Toxins Act is an Act to prohibit or otherwise regulate the possession, use, import, transhipment, transfer and transportation of biological agents, inactivated biological agents and toxins, to provide for safe practices in the handling of such biological agents and toxins. A copy can be obtained at http://statutes.agc.gov.sg/

9.0 APPENDIX

A. CeLS Safety Committee Organization Structure and Terms of Reference
B. Template for quarterly assessment

Dr Lina Lim
CeLS Biosafety Subcommittee Chair on behalf of CeLS biosafety committee

Dr Gavin Dawe
CeLS Safety Committee Chair

Appendix A: CeLS Safety Committee Organization Structure and Terms of Reference

For CeLS Safety Committee Organization chart refer to
https://share.nus.edu.sg/lsi/cels_matters/Safety%20Information/Forms/AllItems.aspx

Terms of Reference:

1. Shall consist of representatives of both the employees (i.e. laboratory officers or research assistants and the management (i.e. PIs)
2. To promote cooperation between management and employees in achieving and maintaining safe and healthy working conditions.
3. To develop policies, general guidelines, procedures and practices to improve the safety of the work environment.
4. To be in compliance with the University Policies, Standard Operating Procedures (SOPs) & Guidelines. (i.e. adhering to MOM, MOH, SCDF regulations, OSHE directives)
5. Conducting periodic safety inspections/ audits.
6. Monitoring the follow-up on all reported incidents and accidents concerning breach of safety issues.
7. Monitoring the effectiveness of safety programs and procedures.
8. Participate in development and implementation of programs to protect the employee.
9. Set up and promote programs to improve employee's training and education.
10. Make recommendations to management for accident prevention and safety program activities.
11. Ensuring the maintenance and monitoring of injury and work hazard records.

Appendix B: Template for quarterly assessment

Biological Safety checklist (to be carried out by LO and filed in Laboratory for inspection by CeLS Safety Committee)

Laboratory: _____

Reviewer: _____

Biological Agents	**Yes**	**No/give reasons**
List of BSL2 agents updated?	[ ]	[ ]
List of MSDS updated?	[ ]	[ ]
Appropriate hazard stickers in place?	[ ]	[ ]

Risks identified and corrective actions taken

1.
2.
3.

Accidents/incidents

Any accidents/incidents from biological agents reported?	[ ]	[ ]
Written report sent to CeLS safety team?	[ ]	[ ]

List Corrective action taken

1.
2.
3.
4.
5.

_____

Signature

_____

Name of person performing the assessment