EMERGENCY RESPONSE PLAN (ERP)
(BSL3 Facility)

Version (5)

School of Biological Sciences
60 Nanyang Drive
Singapore 637551

September 2011
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<table>
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<tr>
<th>S/ N</th>
<th>Plan Version</th>
<th>Date of Exercise*</th>
<th>Date of Approval</th>
<th>Name and Appointment of Approving Officer</th>
<th>Signature of Approving Officer</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>5/7/07</td>
<td>15/6/07</td>
<td>James P Tam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2/8/08</td>
<td>2/8/08</td>
<td>Alex Law Sai-Kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3/12/09</td>
<td>22/9/09</td>
<td>Alex Law Sai-Kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>10/12/10</td>
<td>27/10/10</td>
<td>Alex Law Sai-Kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Scheduled in November</td>
<td>7/9/2011</td>
<td>Mark Featherstone</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Date of Exercise – Date where the newly drafted / revised emergency plan been validated the plan. Emergency Plan should only be endorsed and approved after it has been exercised and validated with SCDF.

**Table of Records of Emergency Exercise Conducted**

<table>
<thead>
<tr>
<th>S/ N</th>
<th>Date of Exercise</th>
<th>Comments</th>
<th>Appointment of Conducting Officer</th>
<th>Signature of Conducting Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5/7/07</td>
<td>Drill has been carried out in accordance to both facility response plan as well as SCDF procedures</td>
<td>LTC Francis Ng MAJ David Chow LTA Lee LTA Diane Tiu</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2/8/08</td>
<td>Drill has been successfully conducted at 6:30 am to 7:30 am</td>
<td>MAJ Eric Chua LTA Md Ridzuan Zainal Abidin LTA Md Nurelfı Nordin</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3/12/09</td>
<td>Drill conducted at 6 am – 7:30 am. Observers- MOH Officers</td>
<td>LTC Francis Ng MAJ Eric Chua</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10/12/10</td>
<td>Drill conducted at 6 am – 7:00 am Audited by MOH Biosafety Branch</td>
<td>LTC Francis Ng CPT Ng Wee Boon SCDF Fire &amp; HAZMAT</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2011</td>
<td>Scheduled with SCDF in November</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Emergency Exercise shall be conducted at least once a year.
EMERGENCY RESPONSE PLAN (ERP)

1. SITUATION

1.1 Introduction

The Biosafety Level 3 (BSL3) Facility is operated by the Nanyang Technological University School of Biological Sciences (NTU-SBS). The BSL3 facility is applicable to biological research experiments which involve high risk biological agents. Users have specific and appropriate training to work in the laboratory safely and are supervised by competent scientists who have experience in such areas of work.

Accidents still happen in spite of safety program in a laboratory. Good safety program, training and use of precautions will help reduce the number and seriousness of accidents, but nothing can prevent all accidents.

Safety should be your highest priority if you work in high risk environments. The standard operating procedures (SOP) will only provide you basic information that can be used as a guideline and reference. It is your own responsibility to work safety in a laboratory and how well you carry out these responsibilities provides the answer to maximum safety. Your attitude to safety counts, because you are the one doing the work.

1.2 Area of Operations

1.2.1 Location of Installation and its main access road

Location of installation is 60 Nanyang Drive, Singapore 637551. There are two possible entrances for the premises from Nanyang drive – one direct entry to level 2 and the other entry to level 1, at different end of the building and through stair wells or lift, which leads to BSL3 facility at level 2. There is an underground link between SBS main building and ARF at level 1 but this route is no direct access to BSL3 facility.

1.2.2 General Description of the surroundings and neighboring premises of the installation

There are two neighboring occupancies, the School of Biological Sciences (SBS) main building and the School of Chemical and Biomedical Engineering (CBE), on the other side of Nanyang drive. (Annex 1 – Location map)
1.2.3 Layout of installation

The building is a two storey stand alone and the BSL3 laboratory occupies one room (about 50 sqm) at the second level. The maintenance engineering room is on the roof top. The rest of areas are occupied by the Animal Research Facility.  (*Annex 2*)

1.2.4 Location, storage and quantities of Hazardous products, chemicals and gases

The biological agents are stored in -80C freezer. The freezer is inside the BSL3 laboratory and the stock is controlled under lock and key.

There will be minimal use of chemicals and gases in the laboratory. Alcohol (flammable, but 70%) is used for surface decontamination. There is no bulk storage of chemicals or gases. The working and diluted chemical solutions are kept in the cupboard or shelves inside the laboratory.

1.2.5 Description of Process Areas (including summary of the Process and operations carried out)

The research experiments are carried out using chemicals or reagents at very low concentrations. Commonly used items such as cell culture media, buffer solutions, antibodies, weak staining solutions, etc may cause biohazards rather than physical hazards.

All high risk biological agents such as viruses and bacteria will be handled inside the Biological Safety Cabinet (BSC). A class II B1 BSC has been installed inside the laboratory. All wastes, solid or liquid, will be decontaminated by autoclaving before disposal.

The research experiments are planned to be carried out during normal office hours. The reason is that biosafety and biosecurity are main concerns. Off-hour working requires written permission from the Facility Director / Facility Manager.
Summary of Processes at various locations in the laboratory

<table>
<thead>
<tr>
<th>S/N</th>
<th>Operations / Activities</th>
<th>Process Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Handling of Biological Agents - unpacking, culturing, sub-culturing, diluting, opening of centrifuge buckets, waste disposal, etc (BSL3)</td>
<td>BSC (Class II B1)</td>
</tr>
<tr>
<td>2</td>
<td>Concentrating, separating the liquid, centrifugation (BSL3)</td>
<td>Centrifuge (buckets with safety covers)</td>
</tr>
<tr>
<td>3</td>
<td>Preparation, experimental steps, microscopic examination, recording, communications, etc (BSL3)</td>
<td>Working bench</td>
</tr>
<tr>
<td>4</td>
<td>Storage of biological agents – identification, quantity, responsible personnel (BSL3)</td>
<td>Freezer (Under lock &amp; key)</td>
</tr>
<tr>
<td>5</td>
<td>Decontamination of wastes – solid or liquid</td>
<td>Autoclave</td>
</tr>
</tbody>
</table>

1.3  Hazard and Risk Assessment

1.3.1 Main Areas where hazards present on site

Biological spills will be most common hazards happened in the BSL3 laboratory. Authorized users are trained in handling and clean up of biological spills. The SOP for spill managements and biological spill kit are available.

Other areas of hazards can be laboratory equipment. There is an autoclave for decontamination of hazardous materials before removal from the laboratory. The autoclave uses very high pressure (15 psi) and high temperature (121C).

High speed centrifuge is used for the experiments inside the laboratory. Improper use of centrifuge can cause accidental hazards.

Use of open fire or flame is not allowed inside the laboratory. Electrical shocks by laboratory instrument may cause fire, but safety devices such as automatic cut-off and controls are installed.

There is a minimal use of sharp items in the BSL3 laboratory. Plastic laboratory wares are applied wherever available rather than glass. Sharp items are handled with care and disposed into sharp waste boxes.

Toxic or hazardous chemicals (at low working concentrations) may be kept and used in the laboratories. The MSDS of each chemical is available.
## 1.3.2 Descriptions of ALL possible scenarios

<table>
<thead>
<tr>
<th>Emergency conditions</th>
<th>Scenarios</th>
<th>Control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biohazard Spill</td>
<td>Major spill / clean up</td>
<td>Protocols for biohazard spill (<a href="#">Annex 3</a>)</td>
</tr>
<tr>
<td></td>
<td>Small volume spill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biohazard spill in BSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biohazard spill in centrifuge</td>
<td></td>
</tr>
<tr>
<td>Chemical / Radioactive</td>
<td>Spills during experiment</td>
<td>Protocol for chemical / radioactive spill (<a href="#">Annex 4</a>)</td>
</tr>
<tr>
<td>Spill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosions</td>
<td>Centrifuge / Autoclave (Failures to follow the SOPs)</td>
<td>Protocol for explosion (<a href="#">Annex 5</a>)</td>
</tr>
<tr>
<td>Medical Emergency</td>
<td>Splash to the eyes</td>
<td>Protocols for medical emergency (<a href="#">Annex 6</a>)</td>
</tr>
<tr>
<td></td>
<td>Cuts, Abrasions and animal bites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal burns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serious medical emergency</td>
<td></td>
</tr>
<tr>
<td>Fire Emergency</td>
<td>Fire alarm</td>
<td>Protocols for Fire and Laboratory exits procedures (<a href="#">Annex 7</a>)</td>
</tr>
<tr>
<td></td>
<td>Normal Laboratory exit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evacuation exit</td>
<td></td>
</tr>
<tr>
<td>Road Traffic Accident</td>
<td>Accident during transport of biological agents</td>
<td>Protocols for Transportation and packaging (<a href="#">Annex 8</a>)</td>
</tr>
</tbody>
</table>

### 2 AIM

The aim of this emergency response plan is to detail the various preventive measures and operational actions that need to be undertaken by the NTU-SBS BSL3 facility, to contain any hazard leaks, spill and control or extinguish any fire in the event of a emergency situations that occur within the installation and so to prevent and reduce injury to personnel and minimize property damage and loss.
3 EXECUTION

3.1 Concept of Operations

The emergency operation to be conducted in phases is as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>BSL-3 staff and authorized users carry out initial response and alert SCDF / Police</td>
</tr>
<tr>
<td>II</td>
<td>SCDF / SPF predetermined turnout response to the scene for mitigation, containment, security cordonning, evacuation and rescue activities.</td>
</tr>
<tr>
<td>III</td>
<td>To conduct major operation for containment and minimize risks with other related agencies</td>
</tr>
<tr>
<td>IV</td>
<td>To clean up / decontaminate and resume normal operations.</td>
</tr>
</tbody>
</table>

3.2 Emergency Actions by installation

The initial response and the emergency actions will be carried out by the NTU-SBS personnel. In the situations of emergency beyond own controls, cooperation of other departments such as SCDF and Singapore Police Force (SPF) will be obtained.

### Emergency Services

<table>
<thead>
<tr>
<th>Phone</th>
<th>Department</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>995</td>
<td>Fire Brigade (SCDF)</td>
<td></td>
</tr>
<tr>
<td>995</td>
<td>Ambulance (SCDF)</td>
<td></td>
</tr>
<tr>
<td>999</td>
<td>Police</td>
<td></td>
</tr>
<tr>
<td>6790 5200</td>
<td>Campus Security</td>
<td>24 hours</td>
</tr>
<tr>
<td>6793 6828</td>
<td>NTU Medical Centre</td>
<td>Located in South Spine</td>
</tr>
<tr>
<td>6790 4777</td>
<td>NTU Fault Reporting Centre</td>
<td>24 hours</td>
</tr>
<tr>
<td>6514 8392</td>
<td>SBS-ERT</td>
<td></td>
</tr>
<tr>
<td>63162803</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2.1 Procedure to notify SCDF and POLICE

3.2.1.1 Notification procedure during office hour and after office hour

In the events of emergency, Site Main Controller (SMC), Site Incident Commander (SIC), Emergency Response Team (ERT), SCDF and SPF shall be notified. The notification procedures depend on the level of emergency.

Standard Operating Procedures (SOP) for various emergency situations have been adopted. (Annex 3 – Annex 9)

- Fire
- Chemical Spillage
- Biological Spillage
- Medical Emergency

Any occurrence of incident resulting in an emergency alarm, the in-house emergency response will be activated and the SIC will be notified. The SIC will inform SCDF / SPF after initial assessment of the situation. The SIC will be the liaison officer with the SCDF ground commander and will provide information and assistance

3.2.1.2 Workers population during day and night

<table>
<thead>
<tr>
<th>Location</th>
<th>Office hours</th>
<th>Occupants (office hours)</th>
<th>Off hours</th>
<th>Occupants (Off hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL3 Facility</td>
<td>8:30 – 17:30</td>
<td>2 - 5</td>
<td>17:30 – 8:30</td>
<td>0</td>
</tr>
<tr>
<td>Animal Facility</td>
<td>8:30 – 17:30</td>
<td>4 - 10</td>
<td>17:30 – 8:30</td>
<td>0 - 3</td>
</tr>
</tbody>
</table>

The research experiments are planned to conduct during normal office hours only. It is required to have special arrangements for working on off hours and public holidays.
3.3 Grouping and Tasks

SMC is the senior member of the installation management. He is the person who is overall in-charge of the emergency response operations in the installation and liaises with senior officials of government agencies such as SCDF, SPF, etc.

**SMC = Mark Featherstone (Chair of the SBS)**

SIC is a senior member of the installation supervisory staff. He is overall the actual ground response operations. He / she is to provide assistance and information to SCDF ground commander during operation.

**SIC = Tin Tun (BSL3 Facility Manager)**

Emergency responders are current laboratory users from research groups and maintenance contractors. They will actively participate in emergency response activities under the supervision of SIC or SMC.

**ERT members = SBS Emergency Team**

The Emergency Team stands for the whole school including BSL-3 facility.

Their role and responsibilities are specified. (*Annex 10*).

3.4 Coordinating Instructions

3.4.1 Key Personnel Emergency Contact Numbers

The NTU-SBS BSL 3 Facility is operated under the responsibility of the Biosafety Committee headed by the Director of the facility. The committee members are:

<table>
<thead>
<tr>
<th>Name</th>
<th>Role in BSL 3</th>
<th>Contact Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaume Torres</td>
<td>Chairperson</td>
<td>6316 2857</td>
</tr>
<tr>
<td>Kathy Luo Qian</td>
<td>Member</td>
<td>6790 4257</td>
</tr>
<tr>
<td>Sze Chun Chau</td>
<td>Member</td>
<td>6316 2872</td>
</tr>
<tr>
<td>Richard Sugrue</td>
<td>Member</td>
<td>6316 2889</td>
</tr>
<tr>
<td>Ong Teng Ting</td>
<td>Member</td>
<td>6316 8852</td>
</tr>
<tr>
<td>Joseph Chua</td>
<td>Member</td>
<td>6592 7556</td>
</tr>
<tr>
<td>Tin Tun</td>
<td>Biosafety Coordinator</td>
<td>6316 2810</td>
</tr>
</tbody>
</table>
The following key personnel are contactable in case of emergency happened in BSL 3 facility and Animal Research facility.

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Emergency Appointment</th>
<th>Telephone (Office hours)</th>
<th>Telephone (Off hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tin Tun</td>
<td>BSL 3 Manager</td>
<td>Contact 1</td>
<td>6316 2810</td>
<td>97535466</td>
</tr>
<tr>
<td>Armando Grospe Agustín</td>
<td>Animal Facility Manager</td>
<td>Contact 2</td>
<td>631602921</td>
<td>91293217</td>
</tr>
</tbody>
</table>

### 3.4.2 Contacts of Neighbors and Other Departments

In the event of the incident escalating beyond the boundaries of the installation, the neighboring occupancies must be informed.

<table>
<thead>
<tr>
<th>Neighboring building</th>
<th>Name of contact</th>
<th>Designation</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBS (Main)</td>
<td>Lim Fui Nee</td>
<td>Administration</td>
<td>63162806</td>
</tr>
<tr>
<td>SBS (FPM)</td>
<td>Ng Cheng Poh</td>
<td>Facilities Management</td>
<td>67904666</td>
</tr>
<tr>
<td>Chemical &amp; Biomedical Engineering (CBE)</td>
<td>Cheong Wee Ming</td>
<td>Administration Assist. Manager</td>
<td>6513 7687</td>
</tr>
</tbody>
</table>

It is required to inform and notify the following NTU departments. Facilities Planning & Management (FPM) officials will provide main assistance in emergency situations and take actions for contacting relevant departments and term contractors who work for the university.

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee Kien Wah</td>
<td>OHS (CHSO)</td>
<td>6313 2736</td>
</tr>
<tr>
<td>Liew Sai Weng</td>
<td>FPM</td>
<td>6790 5181</td>
</tr>
<tr>
<td>Ong Lai Seng</td>
<td>FPM</td>
<td>6790 6005</td>
</tr>
<tr>
<td>Tan Ah Lim</td>
<td>RTP (FPM)</td>
<td>6790 5615</td>
</tr>
<tr>
<td>Zaw Min</td>
<td>NIE</td>
<td>6790 3669</td>
</tr>
<tr>
<td>Linda Koh Sok Yee</td>
<td>CEE</td>
<td>6790 5325</td>
</tr>
<tr>
<td>Samantha Ang</td>
<td>Library</td>
<td>6790 5643</td>
</tr>
<tr>
<td>Wong Oi May</td>
<td>Library</td>
<td>6790 4037</td>
</tr>
</tbody>
</table>
3.4.3 Sector Boundaries

To identify the various sectors of operations so as to determine the potential hazard zones and evacuation zones.

*Note:* The incident site will be sectorised into HOT, WARM and COLD zone during emergency. The definitions of the various zones are as follows:

**Hot Zone** – This is the area around the incident that required all personnel entering to be fully protected by means of Breathing Apparatus sets and proper protective clothing and to be decontaminated upon leaving the zone.

**Warm Zone** – This is the area directly outside Hot Zone. All personnel in this zone should be equipped with Breathing Apparatus and if situation requires, done the mask for full protection against toxic hazard gas,

**Cold Zone** – This is non-hazard zone outside the Warm Zone.

3.4.4 Reporting / Alerting SCDF / SPF

The SIC will inform SCDF / SPF after initial assessment of emergency situation. To activate the SCDF / SPF the following information are required to provide.

1. Specific location of the incidents
2. Type of accident
3. Chemical involved
4. Biological agents involved
5. Leakage with or without fire
6. Casualties involved

Upon arrival of SCDF ground commander, the SIC will marry up with SCDF ground commander and provide all necessary information.

1. Location map in details
2. Incident in brief
3. Actions that ERT have done
4. Communication device & Evacuation equipment

3.4.5 Control Points

**SBS Meeting point:** *Along Nanyang Drive opposite the SBS main entrance*  
*(Assembly area / Reporting and First Aid Points)*

1. All personnel stand by for evacuation
2. Evacuate to meeting point
3. Follow the exit signs
4. Do not use lift
5. Assemble for roll call
6. Do not return to building until all clear
3.4.6 Safety and Others

2. Safety & Operations Manual (NTU-SBS)
3. Standard Operating Procedures (NTU-SBS)

These manuals of other safety measures rather than Emergency Response Plan (ERP) have been adopted by the facilities to minimize the risks involved during an emergency. In emergency situations the following procedures are also to be applied.

3.4.6.1 Emergency Procedures

1. Biological spill – Refer to Annex 3
2. Chemical / Radioactive spill – Refer to Annex 4
3. Explosion – Centrifuge / autoclave – Refer to Annex 5
4. Medical emergencies – Refer to Annex 6
5. Fire and Exit Procedures – Refer to Annex 7
6. Accident during Transportation – Refer to Annex 8
7. Notification Procedures – Refer to Annex 9

3.4.6.2 Emergency Shutdown Procedures

The SMC coordinates with Incident Manager from external emergency organizations (SCDF, SPF, NEA, etc) and works closely during consequence management activities. He authorizes the shut down of operation in the installation and instructs the facility manager to do so.

Notifying the director / Biosafety Committee immediately of any incident or problem which compromises the safety or the integrity of the facility, the BSL3 facility manager will shut down the facility until safety condition is sustained. The ARF manager will notify the IACUC immediately and shut down the facility.

3.4.6.3 Resume operations

The SMC assists the Incident Manager in determining the termination of emergency and authorizing re-entry upon complete recovery.

The facilities can resume normal operations if emergency situations will not compromise especially biosafety conditions and appropriate clean up procedures have been carried out.

The BSL3 facility may require decontamination procedures before operation. Then the professional contractor must carry out the decontamination of the laboratory in accordance with biosafety guidelines.
4 SERVICE SUPPORT

4.1 Fire Protection Systems

Description of detection system such as smoke, fire fighting monitoring and gas detection, leakage detection system, wind vane/wind sock etc available in installation and their locations are as follow.

1. Fire Command Centre

<table>
<thead>
<tr>
<th>Location</th>
<th>PA/ Intercom System</th>
<th>Main Alarm Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBS-B4N-01 (Basement 4)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

2. Fire Alarm System

<table>
<thead>
<tr>
<th>S / No</th>
<th>Location of Main Alarm Panel</th>
<th>Sub-Alarm Panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SBS-B4N-01 (Basement 4)</td>
<td>Animal Facility (Level 1)</td>
</tr>
<tr>
<td>2</td>
<td>SBS-B4N-01 (Basement 4)</td>
<td>Animal Facility &amp; BSL3 (Level 2)</td>
</tr>
</tbody>
</table>

3. Fire Suppression and Detection System

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke Detector</td>
<td>9</td>
<td>5 at level 1, 2 at level 2, 2 at roof top</td>
</tr>
<tr>
<td>Hose Reel</td>
<td>5</td>
<td>2 at level 1, 2 at level 2, 1 at roof top</td>
</tr>
<tr>
<td>Manual call point</td>
<td>9</td>
<td>4 at level 1, 4 at level 2, 1 at roof top</td>
</tr>
<tr>
<td>Fire Extinguisher</td>
<td>10</td>
<td>4 at level 1, 5 at level 2, 1 in BSL3 lab</td>
</tr>
<tr>
<td>Flasher</td>
<td>3</td>
<td>3 in BSL3 lab</td>
</tr>
<tr>
<td>Alarm Bell</td>
<td>8</td>
<td>3 at level 1, 4 at level 2, 1 at roof top</td>
</tr>
</tbody>
</table>

4.2 Containment equipment (leak control, spill control, Absorbents, etc)

Biological Spill kit, absorbent paper, disinfectant, tong or forceps, brush and dust pan, etc are available in the BSL3 laboratory.

Chemical Spill kit, absorbent paper, powder, neutralizing reagents and clean up equipment are available in the BSL3 laboratory.

4.3 Safety and First Aid Equipment

Basic First Aid kits are available inside the laboratories.

Eye wash stations and safety shower are also available inside the ante-room of BSL3 facility.
4.4 Manpower / In-house Emergency Response Team

SMC – Top Management

SIC – Appointed by Management (Facility Managers)

ERT members – SBS Emergency Team

NTU coordinators – FPM, Security and Fault Report Centre

Role and responsibilities of related personnel are specified in “Annex 10”.

5 COMMAND AND SIGNAL

5.1 Command

Incident Organization Chart

Key responsible personnel in emergency situations are SMC, SIC, ERT members, Facilities management, Campus Security and Fault Reporting Centre.

* = Campus Security, Fault Reporting Centre
5.2 Signal

Communication Flowchart

Communication flow between Site Main controller, SCDF Incident Manager, site incident commander, SCDF ground commander and in-house emergency response team members are as follow. The means of communication between each party depend on urgency and will be in various ways – Telephone, email, walkie-talkie, personal contact, etc.

Communication in ERP

References

- Biological Agents and Toxins Act, Singapore
- Biosafety and Operations manual, NTU-SBS
- Safety and Operations Manual, NTU-SBS
- SCDF Guidelines for company ERP

* = Campus Security, Fault Reporting Centre
Annex (1)

SCHEMATIC SITE MAPS OF BSL3/ARF BUILDING

Level 2 of Animal Facility / BSL 3 Facility Building

Level 1 of Animal Facility / BSL 3 Facility Building
Annex (2)

Detailed Floor Plan for BSL3 and Animal Research Facility

NTU-SBS BSL3 LABORATORY LAYOUT

FIRE ALARM AND EXTINGUISHERS LAYOUT PLAN
Annex (3)

BIOHAZARD SPILL IN THE BSL3 LABORATORY

The first step in cleaning up a biohazard spill is to follow established procedures to minimize the potential for exposure. Fill out and submit Incident Report Form (Annex 11) to BSL3 Facility Manager for all incidents.

1 Major Biohazard Spill (>10 ml)

1. Alert ALL laboratory occupants of the spill.
2. Remove contaminated clothing, turning the exposed area of the clothing inward and discard it into a biohazard bag for autoclaving. Wash all exposed skin with antiseptic/soap and water.
3. Stop all activities and prepare to leave the laboratory immediately for the ante room. Ensure door to SBS BSL-3 laboratory is closed.
4. The Emergency Door is not to be used unless the normal exit doors through the ante room are not accessible.
5. Post a “No Entry” sign on the door to the SBS BSL-3 laboratory. Allow the aerosol to settle for 30 minutes.
6. Attend to injured or contaminated personnel in the ante room.
7. Inform the Facility Manager or PI immediately. Exposed personnel will be directed by the Facility Manager, PI or a SBS BSL-3 Biosafety Committee member for first aid or post-exposure prophylaxis.

Clean-Up

8. Put on appropriate PPE (gloves, goggles, shoe covers, long-sleeved solid-front gown, N95 mask or PAPR). Assemble clean-up equipment: fresh 1% virkon / 1% sodium hypochlorite, forceps, paper towels, biohazard bags, etc. – all available in the spill kit.
9. Pick up broken sharp items with forceps and discard into sharp box. Cover the spill with paper towels to avoid forming aerosols.
10. Pour disinfectant over the paper towels initially around the edges of the spill to avoid further aerosolisation, then into the spill. Avoid splashing.
11. All spilled material should be in contact with the disinfectant for at least 20 minutes.
12. Use paper towels to wipe the spill, working from the edges into the centre.
13. Clean spill area with fresh towels soaked in disinfectant.
14. Place towels and all materials worn or used to clean up the spill in a plastic bag for autoclaving (90 minute cycle, 121C for 20min).
15. Wash hands and exposed skin areas with antiseptic.

(Biological spills are to be handled by trained person under supervision of FM/PI)
2 Small Volume Spill (<10 ml)

1. Alert all personnel inside the laboratory of spill immediately.
2. Stop all activities and prepare to leave the laboratory for the ante room.
3. Post a “No Entry” sign on the door to the SBS BSL-3 laboratory. Allow the aerosol to settle for 30 minutes.
4. Wear appropriate PPE and double layers of gloves.
5. Cover the spill with paper towels.
6. Carefully pour a freshly prepared disinfectant solution around the edges of the spill and then into the spill. The spilled material should be in contact with disinfectant for at least 20 minutes.
7. Use paper towels to wipe the spill, working from the edges into the centre.
8. Clean spill area with fresh towels soaked in disinfectant.
9. Place towels and all materials worn or used to clean up the spill in a plastic bag for autoclaving (90 minute cycle, 121C for 20min).
10. Wash hands and exposed skin areas with antiseptic soap.
11. Document the incident in details.

3 Biohazard Spill in Biological Safety Cabinets

1. Allow the BSC blower ON for at least 10 min.
2. Wear appropriate PPE and double layers of gloves and cover the spill with paper towel
3. Spray with 1% virkon solution and let the disinfectant stand for at least 20 minutes.
4. Wipe clean wall, top and underside of tray and exhaust grille.
5. Put all debris in the bag for autoclaving (90 minute cycle, 121C for 20min).
6. Wipe clean the BSC with 70% alcohol and leave for 10 min,
7. Notify the Facility Manager of spill. It may be necessary to decontaminate the interior of the cabinet.

4 Biohazard Spill in Centrifuge

1. Alert all personnel inside the laboratory of spill immediately. Stop all activities and prepare to leave the laboratory for the ante room.
2. Turn the speed to zero. Allow the aerosol to settle for 30 minutes before opening the centrifuge. Post a “No Entry” sign on the door to the SBS BSL-3 laboratory.
3. Inform PI or Facility Manager before continuing with clean-up procedure.
4. Wear protective clothing and N95 mask or PAPR.
5. Open up the safety buckets inside the BSC. Place spill contents in a jar containing 1% virkon solution for at least 20 minutes.
6. Soak the contaminated buckets in 1% virkon for at least 20 minutes
7. Rinse the bucket with water thoroughly and autoclave before re-use.
8. The entire centrifuge must be disinfected immediately with 70% alcohol.
Annex (4)

CHEMICAL / RADIOACTIVE SPILL

1. Notify all personnel in the laboratory to leave for ante-room.
2. Inform the PI / Facility Manager.
3. Leave the laboratory without any activity for 30 min.
4. Wear appropriate PPE. Use PAPR if necessary.
5. Select appropriate neutralizer / absorbent agent from the chemical spill kit.
6. Neutralize chemical spill and collect residue into bag.
7. Decontaminate the collected residue with 1% virkon / 1 % sodium hypochlorite disinfectant. Contact time is at least 20 min.
8. Radioactive waste has been left in Perspex box provided in the laboratory to decay (to negligible proportion) before disposal as hazardous waste.
9. Wipe clean the area of spill with sponge or paper towel soaked in 1 % sodium hypochlorite.
10. Dispose decontaminated waste and debris in biohazard bags. DO NOT autoclave.
11. Soak equipment used in 1 % sodium hypochlorite for at least 20 min and wash thoroughly with water.

Annex (5)

EXPLOSIONS – CENTRIFUGE / AUTOCLAVE

1. Immediately inform the PI and Facility Manager.
2. Carefully check and record all damages in details.
3. Clean up all the mess. Strictly follow the spillage clean up procedures for bio-hazardous mess involved.
4. If someone is hurt, shift the victim into anteroom. Seek medical attention or First Aid treatments.
5. Call Singapore Civil Defense Force (SCDF) Hazmat team and NTU Medical Centre for help if injury is serious
6. Document the incident (Annex 11) and organize all information as complete as possible. This document provides important information for any departmental examination later.

(If you follow the operation manuals for instruments the risk will be relatively low)
Annex (6)

MEDICAL EMERGENCIES

1 Chemical or Biological Splash to the Eye

1. Immediately flush the eye with gentle stream of water for 15 min.
2. Be careful not to wash the contaminant to the other eye.
3. Use the emergency eyewash provided in the laboratory and in the anteroom.
4. Seek medical attention if necessary.
5. Record incident (Annex 11) and report to the PI and BSL3 manager.

2 Cuts and Abrasions and Animal bites

1. Immediately cleanse the wound and surrounding skin with antiseptic soap and running water and encourage bleeding.
2. Get first aid box and hold a sterile or clean pad firmly over the wound and apply a plaster.
3. If the cut is severe keep the victim lying down (in the anteroom) and raise the bleeding part higher than the rest of the body.
4. Seek medical attention if necessary
5. Record incident (Annex 11) and report to the PI and BSL3 manager.

3 Thermal Burns

1. If skin is unbroken, submerge the burned area in clean water.
2. Do not break any blister and do not use any medication.
3. Seek medical attention if necessary
4. Record incident (Annex 11) and report to the PI and BSL3 manager.

4 Serious Medical Emergencies

(The victim is unconscious due to some medical complications such as heart attack, fall and head injury, etc.)

1. Take off all personal protected equipment (PPE).
2. Move the victim into anteroom and let him rest lying down.
3. Call NTU Medical Centre / ERT / SCDF Hazmat team for help.
4. Call the personnel who have training in Life Support courses such as Basic Cardiac Life Support (BCLS), Fundamental Critical Care Support (FCCS), Occupational First Aid (OFA), etc.
5. Inform the PI and Facility Manager.
6. Document the incident in details.
Annex (7)

FIRE

1. Anyone finding a fire will raise the alarm and summon aid by calling “FIRE” loudly.
2. Activate the nearest fire alarm.
3. Notify personnel in the immediate vicinity.
5. Initiate attack on fire with the appropriate extinguisher when safe to do so.
6. Turn off electrical equipment, shut doors and evacuate the building following the emergency exit signs. (Refer to laboratory exit procedures)
7. Use the Emergency Door ONLY if you are trapped in the SBS BSL-3 laboratory and if exit through the ante room is not possible.
8. The sounding of the fire alarm signifies a red alert. All staff who are not part of the evacuation team must evacuate.
9. Evacuate via the stair wells. DO NOT USE LIFTS.
10. Please make your way down the stairs and out of the building in a calm and quiet manner. Do not rush and keep all doors shut.
11. If it is not possible to get to the stairwells, then get onto outside balconies. If it is not possible to get to the stairs from the balcony, wait for the Fire Department to remove you by ladder.
12. Evacuate to the SBS meeting point: across Nanyang Drive opposite from the main entrance of SBS.
13. Assemble for roll call with other members of your group. Do not leave until your name has been checked off the list. Do not return to the building until the Fire Department gives the all clear.
14. If the fire started within your work area, fill out and submit Incident Notification Form (Annex 11) and submit to BSL-3 Facility Manager.
### BSL3 EXITS PROCEDURES

#### Normal Exit Procedures

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Discard gloves into Biohazard bag in the Laboratory.</td>
<td>Contaminated gloves need to be autoclaved.</td>
</tr>
<tr>
<td>2. Proceed to Ante-Room and remove PPE. Discard disposable gown, hair cover, shoe covers and face mask into biohazard bag.</td>
<td>Those used items are to be autoclaved before disposal.</td>
</tr>
<tr>
<td>3. Wash hands properly. (Take a shower if necessary) Sign the log book.</td>
<td>Personal hygiene and Biosafety</td>
</tr>
<tr>
<td>4. Proceed to Airlock Room. Final wash for hands and leave the laboratory.</td>
<td>The person may be considered clean and normal. Will not contaminate environment.</td>
</tr>
</tbody>
</table>

#### Evacuation Exit Procedures

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DO NOT open Emergency door. Try to follow normal exit procedures through Ante-Room and Airlock-Room in a fastest manner.</td>
<td>To reduce exposure of the outside environment to hazardous agents. (Biosafety)</td>
</tr>
<tr>
<td></td>
<td>The person is considered clean and normal. Will not contaminate environment.</td>
</tr>
<tr>
<td>2. If really can not use normal exit procedures (in case of Fire in Ante-Room or Airlock-Room or blockage), discard gloves, hair cover, shoe covers and gown into biohazard bag in the laboratory.</td>
<td>The PPE are not allowed to use outside BSL 3 laboratory. (Biosafety)</td>
</tr>
<tr>
<td>3. Open Emergency door and leave the laboratory. In case of fire, DO NOT use lift.</td>
<td>The person may be quarantined if the incident happened while handling a Culture of Risk Group 3 Microorganism.</td>
</tr>
</tbody>
</table>
Annex (8)

ACCIDENTS DURING TRANSPORTATION

The BATA Transportation Regulations are to be adhered to when transporting Schedule 1, 2, 3 (quantities aggregating 10 litres or more) and 5 agents on public roads.

1. The driver has undergone Hazmat training course and possessed Hazardous Materials Transport Driver Permit issued by the SCDF. It is applicable to researchers who transport BA in their own vehicles.
2. Vehicles have a biohazard label for schedules 1, 2 and 3 or a toxin label for schedule 5 toxin.
3. The driver or transporter has been provided a 24-hr emergency contact number of transferor or transferee.
4. Materials to be transported must be packed and labeled according to the regulations.
5. On the vehicle, stock safety items – gloves, absorbent materials, mask, goggle, disinfectant, tong / forceps, biohazard bags and tape / masking tape, reflective vest.

Road Traffic Accidents

6. The driver or transporter puts on reflective vest, gloves and mask.
7. Inspect the package for any damage. If the package is intact he can proceed to deliver the package.
8. Turn off the engine and seal or close doors to contain biological agent.
9. Call SCDF Hazmat team.
10. Call the responsible personnel (transferor and transferee).
11. Keep the public away from accident site and wait for rescue.
12. Carry out Cleaning and decontamination under supervision of biosafety officer.
13. Report to the MOH Biosafety branch.
Annex (9)

EMERGENCY NOTIFICATION PROCEDURES

1  Fire

1.1 The first person who discovers the fire will:

   1.1.1 activate the nearest fire alarm call point
   1.1.2 call Fault Reporting Centre (67904777) / Campus Security (67905200)
   1.1.3 confirm location of fire
   1.1.4 inform the principal investigator (PI) / BSL3 or ARF manager
   1.1.5 attempt to put out the fire if situation permits

1.2 An indication will be displayed at the Control panel as to where the alarm was activated.

1.3 A signal will automatically be transmitted via the direct line to the NTU Fire Response Centre (FRC)

1.4 The Campus Security will announce the location of the emergency and the FRC, the ERT will proceed immediately to the scene of emergency. The SIC will confirm the nature of the emergency and verify with the alarm monitoring agency.

2  Chemical / Biological Spillage

2.1 When the accidental spill happens, the users shall:

   2.1.1 inform the BSL-3 Manager / Biosafety Coordinator
   2.1.2 inform the PI

2.2 The BSL-3 Manager / Biosafety Coordinator to the scene of spillage.

2.3 The BSL-3 Manager / Biosafety Coordinator shall determine the severity of the spillage and instruct to take one or more of the following actions:

   2.3.1 contact the ERT
   2.3.2 notify the Pollution Control Department of NEA / MOH
   2.3.3 notify SCDF

3  Medical Emergency

The first person who discovers the emergency shall:

3.1 Apply first aid if he or she is trained.
3.2 Contact ERT (First Aiders) / NTU Medical Centre

3.3 inform the Principle Investigator (PI) / BSL3 or ARF Manager

3.4 summon an ambulance by calling:

(i) For non-emergency case, private ambulance at tel no. 1777.
(ii) For emergency case, SCDF ambulance at tel no. 995

3.5 Should the need arise, the BSL-3 Manager / the PI shall instruct an employee to use his private car to deliver the casualty to the NTU medical center / nearest hospital.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Address</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTU Medical Centre</td>
<td>South Spine</td>
<td>6793 6828</td>
</tr>
<tr>
<td>NUH Hospital</td>
<td>Kent Ridge Road</td>
<td>6772 5000 / 6779 5555</td>
</tr>
</tbody>
</table>
ANNEX (10)

ROLES AND RESPONSIBILITIES OF EMERGENCY RESPONSE TEAM

Site Main Controller (SMC)

SMC is the senior member of the installation management. He is the person who is overall in-charge of the emergency response operations in the installation and liaises with senior officials of government agencies such as SCDF, SPF, NEA, etc. Under circumstances whereby the SMC is unable to leave the plant, he/she may appoint another suitable representative to link up with the Incident Manager at TACT HQ.

The Key Responsibilities of the SMC includes:

(a) Coordinate the activities of external emergency organizations and work closely with the Incident Manager at TACT HQ during consequence management.

(b) Provide TACT HQ with the following information
   i) Site Layout Map
   ii) Building plan
   iii) Company emergency response plan
   iv) Company’s hazmat inventory and location of hazmat inventory
   v) Overall workers population
   vi) Incident resources available at site

(c) Provide the Incident Manager with the necessary information and decisions to any actions that concerns the company SOPs and policies

(d) Authorize the shut down of operations in the installation

(e) Authorize the release of information to the media and government agencies

(f) Assist the Incident Manager in determining the termination of the emergency and authorizing re-entry upon complete recovery

Site Incident Controller (SIC)

He/She shall be a senior member of the installation supervisory staff. He is overall of the actual ground response operations. He/She is to provide assistance and information to SCDF ground commander during operation.

The Key Responsibilities of SIC includes:

(a) Establishing the on-site emergency response team

(b) Sizing up incident situation and recommending response strategy and tactical plan

(c) Determining incident control zones
(d) Setting up field incident command post
(e) Commanding and directing emergency response team
(f) Ensuring emergency responders safety and monitor personnel fatigue and stress
(g) Deploying emergency equipment and appliances
(h) Directing rescue operations if necessary
(i) Maintaining constant communication with SMC and the emergency responders
(j) Working closely with SCDF emergency officer in charge at the incident command post
(k) Ensuring proper decontamination of equipment and responders
(l) Coordinating recovery activities

**ERT members**

The ERT members should have relevant training to act in various emergency situations.

1. On hearing the first alarm, assemble at marshalling area and put on ID Vest;
2. Attempt to put off or control the fire **without taking personal risk**;
3. Assist casualty to marshalling area for medical attention;
4. Render first aid when needed or proceed to location if called upon;
5. Deploy to contain spill, clean up and check area, if necessary;
6. Assist SCDF personnel in areas related to his specialization (if required).
# Nanyang Technological University
## School of Biological Sciences

**SBS EMERGENCY TEAM (2011)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Emergency Team</th>
<th>Contact No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tin Tun</td>
<td>LO</td>
<td>63162810</td>
</tr>
<tr>
<td>Eugene Lee Hong Yee</td>
<td>ERT</td>
<td>65148392</td>
</tr>
<tr>
<td>Ang Wei Kian Andy</td>
<td>ERT</td>
<td>65137652</td>
</tr>
<tr>
<td>Lew Yi Liang</td>
<td>ERT</td>
<td>63162803</td>
</tr>
<tr>
<td>Kalyanasundaram Nageswari</td>
<td>ERT</td>
<td>63162943</td>
</tr>
<tr>
<td>Wee Yan Ling Karen</td>
<td>ERT</td>
<td>65921644</td>
</tr>
<tr>
<td>Ong Zhi Lin Melissa</td>
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<tr>
<td>Loke Yoke Lan Geraldine</td>
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<tr>
<td>Tay Mei Xia</td>
<td>ECT</td>
<td>65921795</td>
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<tr>
<td>Armando Grospe Agustin</td>
<td>ECT</td>
<td>63162921</td>
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<tr>
<td>Eva Chua Pei Shan</td>
<td>ECT</td>
<td>65141080</td>
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<td>Wong Ming Hwa</td>
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<tr>
<td>Khun La Win Myint</td>
<td>ECT</td>
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<tr>
<td>Lin Guobin</td>
<td>FW</td>
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<tr>
<td>Myint Zu Myaing</td>
<td>FW</td>
<td>63162928</td>
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<tr>
<td>Anand Vasudevan</td>
<td>FW</td>
<td>63162927</td>
</tr>
<tr>
<td>Tetlak Monika</td>
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<td>65141034</td>
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<tr>
<td>Soon Cin Huang</td>
<td>FW</td>
<td>63162855</td>
</tr>
<tr>
<td>Abdollah Allahverdi</td>
<td>FW</td>
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<tr>
<td>Tan Mei Hua</td>
<td>FW</td>
<td>63162852</td>
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<tr>
<td>Dai Liang</td>
<td>FW</td>
<td>63162847</td>
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<tr>
<td>Ding Yingjie</td>
<td>FW</td>
<td>63162865</td>
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<tr>
<td>Sankaranarayanan Rishikesan</td>
<td>FW</td>
<td>63162926</td>
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<tr>
<td>Anuradha Vajjala Bulusu</td>
<td>FW</td>
<td>63167088</td>
</tr>
<tr>
<td>Sabrina d/o Peter</td>
<td>FW</td>
<td>63162840</td>
</tr>
<tr>
<td>Tan Ming Jie</td>
<td>FW</td>
<td>63162897</td>
</tr>
<tr>
<td>Yudi Wisantoso</td>
<td>FW</td>
<td>63162841</td>
</tr>
<tr>
<td>Eugene Seetoh Yew Choong</td>
<td>FW</td>
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<td>Tan Lay Tin</td>
<td>FW</td>
<td>63162887</td>
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<tr>
<td>Poh Si Jia</td>
<td>FW</td>
<td>65921644</td>
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<tr>
<td>Ong Wing Chi Freda</td>
<td>FW</td>
<td>65921644</td>
</tr>
<tr>
<td>Muhammad Nor Zuhaili Bin Hassan</td>
<td>FW</td>
<td>63162874</td>
</tr>
<tr>
<td>Panchatcharam Manisekaran</td>
<td>FW</td>
<td>63162943</td>
</tr>
</tbody>
</table>
# BSL 3/12: NTU-SBS BSL3 FACILITY INCIDENT NOTIFICATION FORM

Please complete Parts 1 & 2 then submit to the BSL3 Manager. Keep a copy for personal and laboratory records. Do not leave any field blank, write N/A if not applicable.

## Part 1. Details of Involved/ Injured Person

Full name (underline surname):

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Contact Phone</th>
<th>Contact Email</th>
<th>NRIC Number</th>
<th>Other (Specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Treatment provided:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Aid</th>
<th>Doctor</th>
<th>Hospital</th>
<th>None</th>
<th>Other (Specify)</th>
</tr>
</thead>
</table>

Name of medical treatment provider:  Contact email/phone:

## Part 2. Details of incident

This incident was (Circle all appropriate):

<table>
<thead>
<tr>
<th>Personal Injury</th>
<th>Property Damage</th>
<th>Environmental Damage</th>
<th>Near Miss</th>
</tr>
</thead>
</table>

Biological Agent involved:  Date:  Time:

Incident reported to:  Position:  Date:

What (task) were you doing at the time of the incident?

Describe the incident (Attach a sketch if necessary). Propose solution(s) if appropriate.  
(Try to describe exactly what happened. Include any particular Biological agent, chemical, process or equipment involved.)

For personal injuries, please describe the injury sustained:

Details of any damage to Property/ Environment:

Was there a witness? Name:  Email/Phone:

Incident was notified to:  NTU Security  Police  Fire  Other (Specify):

## Part 3. Action taken by BSL3 Facility Director, or Nominated Deputy, to prevent similar Occurrence:

Please specify action taken including dates:

Name:  Position:  
Signature:  Date: