2024

CAMBRIDGE CARES

EMERGENCY RESPONSE PLAN

For: CAMBRIDGE CENTRE FOR ADVANCED RESEARCH AND EDUCATION IN SINGAPORE LTD.

Venue: 1 CREATE Way
#07-06/07/08 Research Wing
Singapore 138602

NOTE: This Emergency Response Plan (ERP) has been prepared by Cambridge Centre for Advanced Research and Education in Singapore Ltd. (CARES) for its laboratory facility at the above address in accordance with Clause 27 of Singapore's Fire Safety (Petroleum and Flammable Materials) Regulations (2008) and the Emergency Response Plan guidelines (2014) of the Singapore Civil Defence Force (SCDF).

It is CARES's policy that all personnel working within CARES shall be familiar with this ERP. Each revision of the ERP shall be submitted to SCDF for approval and each submitted ERP shall be valid for 12 months only. Re-submission of the ERP on an annual basis is required even if no changes have been made.

This ERP is applicable to CARES's laboratory facility at the above address ONLY.

NOTE: This Emergency Response Plan shall be handed over to SCDF responders during an emergency.

VERSION 1.20

CAMBRIDGE CARES

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TABLE OF RECORDS OF EMERGENCY PLAN REVISION

S/N	Plan Version	Date of Approval*	Name and Appointment of Approving Personnel**	Signature of Approving Personnel	Remarks
01	1.0	07/03/16	Prof. Markus Kraft		
03	1.3	31/05/16	Hugo Gerald Schmidt		Following board meeting, suggestion was made to amend section 3.2.1. On revision, it has been concluded that section is in accord with good ERP practices
04	1.4	28/02/16	Hugo Gerald Schmidt		Instructions on how to deal with contractors
06	1.6	15/03/17	Hugo Gerald Schmidt		Update of SIC responsibilities and contractor evacuation
07	1.7	22/11/17	Hugo Gerald Schmidt		Update of Annex I
		16/5/18	CARES Governing Board		Oversight and endorsement of changes to date
08	1.8	21/10/18	Hugo Gerald Schmidt		Update of ERT / First Aider Personnel
09	1.9	12/09/19	Hugo Gerald Schmidt		Update of ERT / First aider personnel and waste disposal service
10	1.10	21/04/20	Hugo Gerald Schmidt		Updated to include PIPS and eC02; revise C4T to fit Phase 2.
11	1.11	04/02/21	Hugo Gerald Schmidt		Updated to reflect Nick Jose & Divya Nagaraj's departures from CARES & include details of Emergency Exercise. Updated dates of next table-top exercise
12	1.12		Hugo Gerald Schmidt		Updated to reflect end of EC02, staff changes, and updated emergency procedures in light of Covid-19
13	1.13	28/04/21	Hugo Gerald Schmidt		Updated to reflect departure of Simon Sung
14	1.14	1/10/22	Joy Haughton		Updated to reflect Hugo Schmidt's departure
15	1.15	22/12/22	Sim Chun Siong		Update on the ERT Team structure and Chemical Inventory and locations. Include Emergency Exercise for FY2022. Update of backup contact of gas vendor
16	1.16	3/04/23	Sim Chun Siong		Update on chemical inventory list category with HS licence and permit no. Include the layout plan of the location of HS materials. Added external ERT resources and HS permit holder in emergency contact. Include list of Toxic Industrial waste and biohazardous waste collectors.
17	1.17	8/05/23	Sim Chun Siong		Include a separate HS chemical inventory table from the overall inventory table to

					allow ease of tracking of HS materials during renewal after discussion with NEA licencing department. Update the list of chemical inventory table, the location of the Pilot room and HS cabinets chemical storage. Included new research project requirement for the increase storage quantity for potassium and sodium hydroxide.
18	1.18	16/06/23	Sim Chun Siong		Update on the new Irradiating apparatus D2 phaser XRD to be installed and used in CARES lab at TGF Room.
19	1.19	4/8/2023	Sim Chun Siong		Update on the Fire Drill assessment conducted on 12 June 2023. Revisit the inventory on flammable materials used in the lab and update changes to the quantity.
20	1.20	22/2/2024	Sim Chun Siong		Update on the new first aider into CARES ERT structure. Removal of H&S/CWC chemical Phosphorous Trichloride from the chemical inventory as CARES is longer using this chemical and at the same time update the chemical inventory list. Update on the Fire drill summary carried out in Dec 2023.

* All dates in DD/MM/YY

** The Emergency Response Plan should be endorsed and approved by CARES's senior management.

*** The updated Emergency Response Plan shall only be issued after it has been approved by SCDF via online submission (http://www.scdf.gov.sg/content/scdf_internet/en/building-professionals/e-services.html)

TABLE OF RECORDS OF EMERGENCY EXERCISES CONDUCTED

S/N	Date of Exercise	Name and Appointment of Conducting Personnel	Signature of Conducting Personnel	Comments
01	15/08/2016	Hugo Gerald Schmidt		Good attendance and performance
02	02/05/2017	Hugo Gerald Schmidt		Good attendance. Some needed additional instruction to perform their duties, but the lessons were absorbed
03	27/03/2018	Hugo Gerald Schmidt		Admirable performance. The lessons from previous session were absorbed well.
04	11/06/2019	Hugo Gerald Schmidt		Good performance – the sole failure to perform correctly was corrected.
05	08/12/2020	Hugo Gerald Schmidt		Good Performance – all staff performed appropriately and evacuation was conducted in best time.
06	03/06/2021	Hugo Gerald Schmidt		Good Performance – all staff performed appropriately.
07	19/12/2022	Sim Chun Siong		Collaboration with Building Management in Fire & Evacuation drill. Good Performance rating by FSM.
08	12/06/2023	Sim Chun Siong		Collaboration with Building Management in Fire & Evacuation drill. Good Performance rating by FSM.
09	19/12/2023	Sim Chun Siong		Collaboration with Building Management in Fire & Evacuation drill. Better Performance rating by FSM.

Note:
Emergency Exercise shall be conducted at least once a year in order to validate this Emergency Response Plan. Exercise shall include familiarity with emergency evacuation route, location of emergency evacuation assembly area, spill control protocols, documents upkeep, etc.

Glossary of Terms

ABC Fire Extinguisher: Powder based fire extinguisher that can be used on combustible materials (e.g. wood, paper etc.), liquid flammables (e.g. petroleum products) and electrical fires

CERT: Company Emergency Response Team

ERP: Emergency Response Plan

Fire, Class A: Combustible materials (wood, paper, refuse etc.)

Fire, Class B: Flammable liquids and flammable gas

Fire, Class C: Gas Fire

HAZMAT: Hazardous Materials

IPP: In Place Protection

IRP: Interdisciplinary Research Project

LEL: Lower Explosive Limit, the lowest concentration of a gas or vapour in air capable of exploding in the presence of an ignition source (heat, fire, spark)

MAQ: Maximum Allowable Quantities

MOM: Ministry of Manpower

NEA: National Environment Agency

NRF: National Research Foundation

PFM: Petroleum & Flammable Materials

PPE: Personal Protective Equipment

SCDF: Singapore Civil Defence Force

Scheduled Premise: CARES's R&D laboratory on level 7 of CREATE Way

SDS: Safety Data Sheet

EMERGENCY RESPONSE PLAN

1 AIM

This emergency response plan details the operational actions that designated staff of Cambridge Centre for Advanced Research and Education in Singapore Ltd. ("CARES") shall take during an occurrence of a fire or hazmat emergency with the aim of minimising injury to personnel and damage to property and the environment.

It has been specifically developed to address potential emergency situations arising from the use of hazardous chemicals, gases and substances and scheduled petroleum and flammable materials (PFM) within CARES's R&D laboratory at 1 CREATE Way, #07-06/07/08 Research Wing, Singapore 138602 (**Scheduled Premise**).

Hazardous chemicals/substances are those defined in the Singapore's Workplace Safety and Health Act and/or listed in the Environmental Protection and Management Act and the Environmental Protection and Management (Hazardous Substances) Regulations. Petroleum and Flammable Materials (PFM) are flammable chemicals and gases listed in the Second Schedule of the Fire Safety (Petroleum & Flammable Materials) Regulation 2008. Explosive precursors are chemicals defined in Singapore's regulated explosive precursor list maintained by the Singapore Police Force. Sources of Ionising Radiation are defined in the Singapore Radiation Protection Act.

This Plan shall be read in conjunction with the Emergency Response Plan implemented by the National Research Foundation (NRF) for the CREATE campus.

2 SITUATION

This section details CARES's background information which includes its nature of business, location, neighbours and its inherent risks and hazards.

2.1 INTRODUCTION

Cambridge Centre for Advanced Research and Education in Singapore Ltd. ("CARES") is a private limited company incorporated in Singapore. It is a wholly owned subsidiary of University of Cambridge in the United Kingdom. The company was created to administer the CREATE programme of the University of Cambridge in Singapore (funded by the National Research Foundation), which hosts a number of research collaborations with local academic institutions and industrial partners.

The CARES laboratory at the CREATE campus brings together researchers from multiple disciplines to undertake research projects in materials sciences, including the development of energy efficient chemical processes with the aim of reducing carbon footprint and energy demand.

The research centre focuses on 5 areas:

IRP 1: Multi-Scale Studies of Catalytic and Adsorption Technologies (MUSCAT)
IRP 2: Electrochemical Multi-Scale Science, Engineering and Technology (EMSET)

IRP 3: Carbon Abatement in the Petroleum Refining Industry: A Control and Optimisation Research Network (CAPRICORN)

IRP 4: Better, Cleaner Heat Usage

PIPS: Pharma Innovation Programme Singapore. New approaches to process development

Experiments that will be performed involves chemical reactions from room temperature up to 1200°C and atmospheric pressure to 200 bar, naked flames, nano-particles, fabrication and testing of micro/nano-devices and electrodes for batteries. Varying quantities of hazardous and flammable chemicals, including toxic and flammable gases, are used in support of the various research activities. The respective quantities are denoted in Annex C of this ERP.

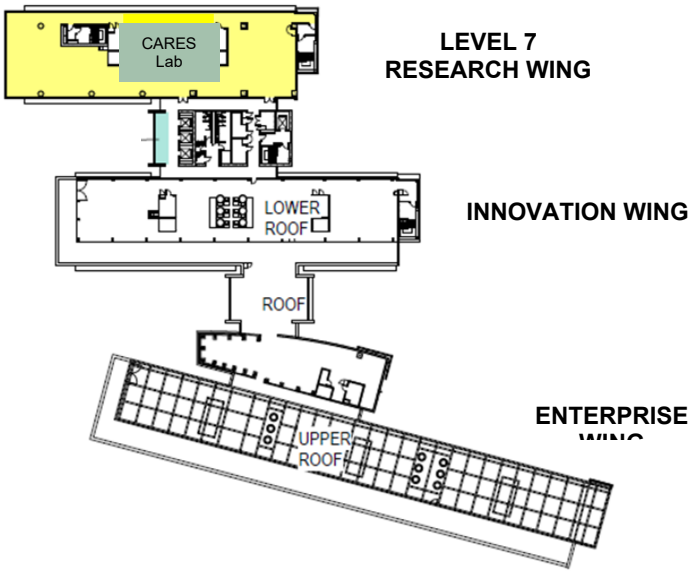
2.2 AREA OF OPERATIONS

2.2.1 LOCATION OF PREMISES AND ITS MAIN ACCESS ROAD

CARES's R&D laboratory is located at 1 CREATE Way, #07-06/07/08 Research Wing, Singapore 138602. The main vehicle access to the Research Building is via CREATE Way. Please refer to **Annex A** for the Site Plan.

2.2.2 GENERAL DESCRIPTION OF THE SURROUNDINGS AND NEIGHBORING PREMISES

The Research Wing building within the CREATE Campus is a 7-storey building with 846 square metres space on level 7. Adjacent to the space are the lower roofs of the Innovation and Enterprise wings of the CREATE Campus. The CREATE campus is administered by the National Research Foundation (NRF), which also oversees the other research institutes in its CREATE programme.



2.2.3 LAYOUT OF PREMISES

The detailed layout plan of the Scheduled Premise is shown in Annex B with the locations of the flammable chemical storage cabinets and flammable gas cylinder storage cabinets highlighted.

The list and maximum quantities of petroleum & flammable materials (PFM) and hazardous materials (HAZMAT) stored within the Scheduled Premise is shown in Annex C. Updated inventory of the different chemicals is maintained by the designated personnel within CARES.

The Safety Data Sheets (SDS) of the various petroleum & flammable materials and hazardous materials used / stored at the Scheduled Premise are maintained by CARES and will be handed over to the SCDF responders in times of emergencies.

2.3 SPECIAL HAZARD & RISK ASSESSMENT

The main hazards within the R&D laboratory are summarized in the Premise Emergency Data Sheet (Annex D). Specifically, these hazards include:

a. Pressure vessels

i. Hazards

A number of chemical reactors within the Company will be operated at elevated pressure (>0.5barg) and become pressure vessels. In the presence of engineering defects, damage or reaction run away, pressure vessels may rupture, accompanied by an uncontrolled release of substances and energy stored within, especially when the pressurised

substances are compressible, e.g. gases. Rupture of pressure vessels will lead to damage of equipment, personnel injuries, gas leakage and chemical spills.

ii. Emergency / Mitigation Measures

a. Pressure run-away

Pressure relief valves are installed on all professionally certified pressurised reactors. In case all pressure relief valves fail close in the event of a pressure run-away, the operator must close all gas and electrical supplies in the first instance, leave the room unoccupied and locked, inform lab manager, and alert all occupiers of the situation. Wait for 24 hours before re-entrance to the room. Follow the evacuation procedure (see sections below for evacuation procedure) if an evacuation alarm is triggered.

In case the pressure runaway takes place during unattended running, a rupture is immanent. If the rupture triggers an evacuation alarm, then the evacuation procedure should be followed. If the rupture does not trigger an evacuation alarm, the operation should report the incident to the lab manager in the first instance.

b. Mechanical defects

Mechanical defects of the pressure vessel may result in a rupture prior to any pressure relief or alert. If the rupture causes personnel injuries, the first aiders on duty should be informed immediately and any first aid actions should take place if it is safe to do so. Call 995 or 999 if the injury appears severe. Shut off all gas and electrical supplies if it is safe to do so, evacuate and lock the room with the pressure vessel. Report the incident to the lab manager.

iii. Safety Control Measures

All pressure vessels should be tested and certified by qualified professional engineers. During operation, pressure vessels should be isolated inside the high pressure hutches with all doors kept shut. All emergency shut down procedures should be clearly displayed near the pressure vessels. All operator of pressure vessels should be trained to qualify for the permit-to-work. Modification of commercial pressure vessels should only be performed by those with a professional certificate and any modification must be reported to and recorded by the lab manager. All pressure relief valves should be checked on an annual basis. Prior to every operation, the pressure vessel must be leak checked and tested at 0.5 barg using an inert gas.

b. Fire / Chemical Exposure from spilled chemicals

i. Hazards

A number of chemicals used within the Company are highly flammable chemical classified as a CLASS 3 flammable liquid with low flash points. They are reactive with oxidising agents, acids and alkalis. These chemicals may ignite or explode in the presence of open flames, heat or sparks and in the presence of oxidising materials. The chemical may burn, potentially with near invisible flame. Other chemicals may be corrosive or toxic and pose exposure hazards when inhaled, ingested or in contact with skin.

ii. Emergency / Mitigation Measures

In the event of small fire, the Type ABC fire extinguisher found within the lab should be used to fight Class A and B fires. Alternatively, the carbon dioxide (CO_2) fire extinguisher may be used to extinguish Class B fires. The respective researchers shall be responsible for performing risk assessment to ascertain the proper type of fire extinguisher to use and to ensure that the proper type of fire extinguisher is available before use of any hazardous chemical. Specifically, AB dry chemical extinguishing agents are incompatible with strong alkalis (bases), magnesium, strong oxidisers such as calcium hypochlorite and isocyanuric acids. Furthermore, the CO_2 extinguishers do not work well on Class A fires.

Small spills should be diluted with water and mopped up, or absorbed using a chemical sorbent. The sorbents should be placed in a chemical waste container for off-site disposal by a licensed toxic industrial waste collector.

For larger spill, personnel shall first don the appropriate respirator prior to the clean-up to minimise chemical exposure. Respirators shall be fit tested prior to use. The correct type of chemical resistant personal protective equipment (PPEs) shall also be used (e.g. appropriate type of gloves). All chemical waste shall be collected for off-site disposal by a licensed toxic industrial waste collector.

iii. Safety Control Measures

a. Water sprinklers are installed within the Scheduled Premise to fight all fires. These sprinklers shall be maintained on a periodical basis. Researchers should note that water sprinklers could be automatically triggered at elevated temperature (68°C) and measures should be taken to prevent water reactive chemicals or reactions from coming into direct contact with the sprinkler water.

b. Flammable chemicals shall be stored within the flammables storage cabinet when not in use.

c. The company shall not store excessive quantity of hazardous chemicals within the Scheduled Premise. Instead, it shall arrange for more frequent delivery with chemical vendors.

d. The bottle size of all hazardous chemicals shall be ≤18 litres.

e. Care shall be taken when using acids or alkalis in the presence of flammable chemicals to minimise chance of undesired reaction
f. All new experiments shall be risk assessed and appropriate control measures put in place prior to execution. Researchers shall always verify if additional safety gears not already provided for are required for the safe handling of new hazardous materials and experiments.

g. Hazardous chemicals shall only be handled within ventilated outlets (e.g. fume hoods, canopy hoods or local fume extractors).

h. Appropriate personal protective equipment shall be used when handling hazardous chemicals as recommended in the respective chemical's SDS.

c. Compressed gas cylinders

The compressed gas cylinders used at the lab include:

1. hydrogen (H_2),
2. methane (CH_4),
3. acetylene (C_2H_2).
4. ethylene (C_2H_4),
5. ethane (C_2H_6),
6. propane (C_3H_8),
7. carbon monoxide (CO)
8. carbon dioxide (CO_2)
9. oxygen (O_2)
10. hydrogen sulfide (100ppm H_2S in N_2)
11. helium (He)
12. argon (Ar)
13. nitrogen (N_2)
14. gas mixtures containing one of the hazardous gases above in inert carrier gas

i. Hazards

A variety of compressed gas cylinders are used within the lab facility. The hazards associated with these gases may be broadly classified into 5 main areas:

a. High pressure – all compressed gases are stored in cylinders at high pressure. Furthermore, they are delivered to the various points of use at varying pressures ranging from 3 bars to 50 bars.

b. Flammable – a number of compressed combustible gases, including hydrogen (H_2), methane (CH_4), acetylene (C_2H_2). ethylene (C_2H_4), ethane (C_2H_6), propane (C_3H_8), carbon monoxide (CO) and gas mixtures containing these gases may be highly flammable and can

readily form explosive mixtures with air over a very wide concentration range. When involved in a fire, these gases may also decompose to produce toxic gases, including carbon monoxide and carbon dioxide.

c. Toxic Gases – Carbon monoxide (CO) and hydrogen sulfide (H_2S) are toxic gases handled within the facility. Inhalation of high levels of these gases can lead to toxic effects.

d. Oxidising gas – The oxygen gas used is an odorless, colourless, nonflammable gas. It is an oxidising gas and vigorously accelerates combustion. Breathing air containing high concentration of oxygen or oxygen at higher pressure may also cause breathing difficulty or lung damage.

e. Corrosive gas – Hydrogen sulfide gas is a corrosive gas and may cause corrosion to some metals when wet or at elevated temperature. Hydrogen sulfide can also attack a number of plastics and care should be taken to select proper tubings and containers when handling this gas.

f. Asphyxiants – All gases noted above as well as the other inert gases used in the lab [helium (He), argon (Ar) and nitrogen (N_2)] are asphyxiants and can cause suffocation when concentrations are sufficient to reduce oxygen levels below 19.5%.

ii. Emergency / Mitigation Measures

During an emergency, the preferred mitigation approach for compressed gases is to minimise contact with fugitive gas emission, thereby reducing exposure to the ill-effects of these gases.

This can be achieved by both a) increasing lab ventilation to discharge the fugitive gases from the lab and b) terminating the supply of the compressed gases within the lab.

Ventilation in the lab is organised such that there are at least 8 changes of fresh air into the lab per hour. Higher air change rates may be achieved when the fume hood sashes are drawn up, when the exhaust rates on variable speed fume extractors or canopy hoods are increased or when a fume hood exhaust purge button is pressed. Ventilation may also be temporarily elevated by increasing the exhaust set point through the building management software system.

Furthermore, all gas distribution lines are installed with solenoid valves near to the gas cylinders that would automatically close and terminate ALL gas supplies to the lab facility when:

a. The lab exhaust system is non-operational (i.e. exhaust fans are not running);

b. The respective solenoid valve control buttons at the gas system control panel outside the lab facility (along the main corridor) are pressed;

c. A gas leak detector has detected elevated level of the hazardous gas or reduced level of oxygen (during stage 2 detector alarm);

d. All hazardous gases are carried in coaxial piping system with the inner pipe carrying the hazardous gases and the outer pipe filled with nitrogen gas to 3 bar. A rupture or leak in the inner pipe would result in elevated pressure in the interstitial space. When this happens, an alarm would sound and the solenoid valves to all gas cylinders would close; or

e. One of the gas emergency panic buttons around the lab is pressed.

The respective researchers shall be responsible for performing risk assessment to ascertain the appropriate emergency measures as well as the proper type of fire extinguisher to use and to ensure that the proper type of fire extinguisher is available before use of any hazardous chemical.

The Singapore Standards for Use and Maintenance of Portable Fire Extinguishers (SS578) discouraged the fighting of Class C (flammable gas) & D (flammable metals) fires by untrained individuals. The fire extinguishers found within the facility are not rated for use on Class C or Class D fires. The Singapore Standards recommends that flammable gas fires be extinguished by closing the gas valves or plugging the gas leak.

All personnel shall be evacuated from the lab during a gas emergency. No one shall re-enter the premise until the concentration of fugitive gas within the space is deemed too low to pose a health hazard. Prior to re-entry, the space shall first be inspected by a designated and trained CARES personnel using a portable multi gas detector and wearing a fitted self-contained breathing apparatus.

If a leak has been detected, the source of the leak should be identified and rectified before the specific gas supply is re-activated.

iii. Safety Control Measures

a. All flammable gas cylinders shall be stored within 90 minutes rated gas cylinder storage cabinets. These cabinets shall be kept closed at all times and care shall be taken when opening any of the cabinet doors during a gas emergency.

b. All gas cylinders shall be secured using brackets.

c. The lab shall limit the quantities of gas cylinders stored within the Scheduled Premise to no more than the Maximum Allowable Quantities (MAQ) as denoted in Annex C.

d. Existing gas piping shall not be used for delivery of any other gas without prior detailed risk assessment and approval from CARES Director. The entire gas piping shall be re-labelled to denote the new gas prior to delivery.

e. The gas cylinder regulator and gas delivery piping and tubing shall be checked on a periodical basis against defects and leaks.

f. The integrity of the coaxial piping system shall be checked periodically - the pressure of the nitrogen gas in the interstitial space shall be verified and proper functioning of the high/low pressure gauges checked periodically.

g. The Lower Explosive Limit (LEL), carbon monoxide, carbon dioxide, oxygen and hydrogen sulfide gas detectors shall be periodically inspected and calibrated to ensure their continual performance.

h. The proper functioning of the solenoid valves shall be checked periodically.

i. The lab facility is the property of the National Research Foundation (NRF). No gas line modification work is permitted without the prior written consent of NRF. The gas system design has also been validated by a Qualified Person and no modification of the design is permitted without prior written consent of the Qualified Person/Professional Engineer and new design plan submission to the Singapore Civil Defence Force (SCDF).

j. Additional safety features in the gas piping system include control valves and these valves shall be physically checked and pressure tested on a periodical basis to ensure proper functioning:

    i. Piping material is high quality SS316 and orbital welded to ensure high weld integrity.

    ii. Flame arrestors are installed at both the cylinder and point of use ends of all flammable gas lines.

    iii. Check valves are installed to ensure unidirectional flow of all gases from the cylinder to the points of use.

    iv. Excess flow valves are installed at each cylinder end of the gas line to limit maximum gas flow rate and to cut gas flow during a major gas line rupture.

    v. Pressure release valves are installed to prevent unwarranted pressure build-up along the delivery line.

    Ball valves are installed to control direction of gas delivery.

d. Ionising Radiation Sources and Irradiating Apparatus
Sources of ionising radiation used in the lab include:

Americanum-241 and D2 Phaser (Sealed Cr/Co/Cu Tube) XRD

a. Hazards

i. Radiation poisoning. Though unlikely to be harmful if ingested, an alpha particle source could lead to radiation poisoning
ii. Teratogenic effects. Ingestion of alpha particle emitter could lead to spontaneous abortion or foetal abnormalities.
iii. Theft or sabotage. Radioactive materials are sought by terrorist or extremist factions for use in terrorist activities.

b. Emergency / Mitigation measure

The alpha-particle emitter is solid state and so can be more easily contained than comparable gaseous state emitters. In the event of a breach of the containment of the radiation emitter, the source will immediately be confined in a vessel capable of containing of alpha particles. All staff that have been exposed will be immediately referred to medical checkup to ensure their health. A verbal report is to be made to the NEA chief within 24 hours and a written report within 10 days.

Breaches of containment are detected by either the daily inspection of the source and storage area with a Geiger Radiation Counter or by the wearable dosimeters that all radiation workers must wear while engaging in radiation work.

c. Safety Control Measures

i. The radiation source is kept in a locked cupboard, and examined daily for loss or removal. The cabinet is subject to 24 hour CCTV monitoring. Any absence of the radiation source results in an immediate report to the Singapore Police Force, and a review of the CCTV footage. The CCTV footage is stored in a separate building to the radiation source, making tampering very difficult.
ii. The storage location and the radiation source are tested daily with a Geiger radiation counter for leaks.
iii. All laboratories and work areas where radiation work is being carried out are clearly marked as such.

d. Approved and trained personnel under R1 Radiation Registration worker (NEA) is allowed to work on radiation material and apparatus.

3 EXECUTION

This section highlights all main credible scenarios (such as fire or Hazmat incident) and the necessary actions to be taken by the company during the emergency.

3.1 CONCEPT OF OPERATIONS

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

Phase		Actions
I		To notify building Fire Command Centre and thereafter SCDF and SPF for all emergency and mass casualty (10 or more casualties) incidents. To notify other related agencies (NEA, MOM, etc.) and surrounding companies if necessary.
II	a	Company personnel to conduct evacuation operations. Receives confirmation of evacuation from contractors.
	b	Company personnel to initiate emergency actions to mitigate or contain the emergency and coordinate with SCDF personnel upon SCDF's arrival.
III		To clean up / decontaminate and/or drain leaking gas piping containing hazardous gases and ventilate area prior to resuming normal operations. For gas emergency, the safety committee shall convene an on-site meeting to discuss and execute the most appropriate recovery measure prior to allowing the rest of staff back into the lab.

Note:
Phase II (a) and (b) should be conducted simultaneously or as directed by the Site Controller / Site Incident Controller and representative/s from the Building Fire Command Centre, including the Building Fire Safety Manager.

3.2 EMERGENCY ACTIONS TO BE TAKEN

3.2.1 (PHASE I) PROCEDURE TO NOTIFY SCDF, SPF. TO NOTIFY OTHER RELATED AGENCIES AND SURROUNDING COMPANIES

During office hour, any personnel who discover a fire or emergency situation shall immediately raise the Fire Alarm by activating the nearest Fire Alarm "Break Glass" Call Point located both within and outside the lab. The Site Controller shall be informed at the earliest possible time.

Note that the Gas Emergency Buttons located at various lab exits would ONLY trigger the closure of the solenoid valves to all piped gases into the lab. They would also activate the Gas Emergency Alarm and buzzer within the lab but this would not activate the building Fire Alarm.

Additional room specific gas emergency buttons that would only stop gas delivery to the respective rooms are located at the far end of Lab 1. These room specific buttons would not trigger the Gas Emergency Alarm.

The following table summarises the actions to be taken during the different emergency events:

Type of emergency	Gas Emergency Alarm	Fire Alarm
Gas Emergency within lab	Activate Gas Emergency button. Gas solenoid valves for all gases will close. Gas Evacuation Alarm (RED alarm) and buzzer will be triggered. Evacuate lab and report to Assembly Area. Contact Gas Safety contractor.	Assess if Fire Alarm shall also be activated. When in doubt, activate Fire Alarm via the fire alarm call point to alert the building Fire Command Centre. Building Fire Safety Manager shall decide if rest of building shall also be evacuated.
Gas leak within lab	Stage 1 gas alarm (ORANGE Alarm) and buzzer will be automatically triggered when low level of fugitive gas is detected. The designated CARES personnel shall investigate the source of the leak. No evacuation is required. Gas solenoid valves for all gases will be automatically closed when Stage 2 gas detector alarm is triggered or when high pressure (>3.5 bar) is detected within the coaxial piping interstitial space. Gas Evacuation Alarm (RED Alarm) and buzzer will be automatically triggered. Evacuate lab and report to	The Fire Alarm will not be activated but a gas leak alarm on the gas detector panel at the building Fire Command Centre will be triggered. The building Fire Safety Manager shall decide if rest of building is to be evacuated.

	Assembly Area. Contact Gas Safety Contractor	
Fire Emergency within lab	Activate Gas Emergency button. Gas solenoid valves for all gases will close. Gas Evacuation Alarm and buzzer will be triggered. Evacuate lab and report to Assembly Area	Activate Fire Alarm. Evacuate lab and report to Assembly Area. Building Fire Safety Manager shall decide if rest of building shall also be evacuated.
Large solid or liquid biological or chemical spill within lab	Assess if Gas Emergency button shall be pressed. When in doubt, press Gas Emergency button to shut off all gases. Evacuate lab and report to Assembly Area	Activate Fire Alarm. Evacuate lab and report to Assembly Area. Building Fire Safety Manager shall decide if rest of building shall also be evacuated.

Alternatively, if one hears the Fire Alarm and know that it has NOT been activated by anyone from within the facility, he/she shall first check the premise to see if the emergency originates from within. The Fire Alarm signal may be automatically raised when there is an activation of the water sprinkler system.

If an emergency within the lab is confirmed, the first person shall report the emergency to the building's Fire Command Center and note the following:

i. Location of fire / LARGE biological or chemical spill / Gas Emergency
ii. Size of fire / type of chemical / biological agent spilled / Gas Emergency details
iii. Injury to personnel, if known
iv. Extent of the affected area

Key Contact Directory	Tel
NUS Fire Command Centre	6601 2630 (Main) 6684 0616 (Backup)
Building Management Office	6684 0963
Security Center @ Level 2 Tower Block	6601 2633
Safetech Gas Safety Contractor	9690 3885 (main) 6745 5455 (backup)

Once the Fire Alarm has been triggered, the Fire Alarm bell on all floors will ring for about one minute before they are isolated. An indication will also be displayed on the building's fire alarm panel at level 7 and at the Fire Command Centre in the basement to indicate the location where the Fire Alarm has been activated. Note that the lab Gas Emergency Alarm is not interlinked with the building Fire Alarm. The activation of one alarm will not automatically trigger the other alarm.

The first person shall also assess if the Gas Emergency Button shall be pressed to terminate supply of all gases within the lab. When in doubt, the Gas Emergency Alarm shall be activated to reduce risk associated with compressed and hazardous gases. The Gas Emergency Alarm within the lab will then be activated and all gas solenoid valves closed.

All lifts will return to the ground floor with doors opened and the building's security personnel on duty will broadcast a general alert announcement via the building's Public Address System. This shall be known as the **1st stage alarm**.

The Building Fire Safety Manager shall serve the role of liaison officer for the CREATE building to communicate with SCDF's Ground Commander. CARES appointed Site Controller shall represent CARES and provide company-specific information and render assistance, when required, to the Building Fire Safety Manager and SCDF Ground Commander.

The Building Fire Safety Manager shall assess and decide if other tenants in neighbouring buildings shall also be evacuated. If so, the Building Fire Safety Manager shall coordinate the evacuation.

The number of staff and researchers within the Scheduled Premise during operating hours (9:00am to 6:00pm) is **36**. However, given that this is a research lab facility, we expect researchers to work outside of the normal operating hours on a frequent basis. The number of researchers during the normal operating hours may however be less.

The Company Site Controller shall notify the Pollution Control Department of the National Environment Agency (NEA) at Tel: 1800-CALL NEA (1800-2255 632) should a large chemical spill situation with potential environment pollution concerns occur.

The Company Site Controller shall also notify the Commissioner for Workplace Safety and Health at the Ministry of Manpower (MOM) immediately at Tel +65 6317 1111 should an incident result in fatality or if the incident is classified as a Dangerous Occurrence as defined by MOM. All work accidents causing death or injury, incidence of occupational disease and dangerous occurrence shall also be reported to MOM via the MOM's i-report portal (www.mom.gov.sg/ireport).

If medical attention is required and if the casualty is conscious and is able to move on his/her own, the Site Controller may instruct an employee to deliver the casualty to the nearest hospital. The nearest hospital is the

National University Hospital at 5 Lower Kent Ridge Road, Singapore 119074 (Tel: 6779 5555) – located less than 5 minutes away by car. Else, an ambulance should be summoned by dialling 995.

In the event of an emergency during after office hour and when no CARES researcher is present, the security personnel on duty shall inform the Fire Command Centre immediately. The latter shall then notify SCDF of the emergency. The Fire Command Centre will also contact CARES representative via CARES's duty phone to obtain company-specific information if the fire or emergency is thought to have originated from within the Scheduled Premise. CARES's duty personnel shall assess the need to return to the facility without delay to investigate the emergency.

3.2.2 (PHASE II A) PROCEDURE FOR EMERGENCY EVACUATION

On hearing the 1st stage Fire Alarm, all staff shall lock up their respective important files and shut down the various machineries and lab equipment. All chemicals shall be returned to their respective storage cabinets (e.g. flammables in flammable storage cabinet). Works at the Biological Safety Cabinet shall be terminated and all biohazardous materials secured. All doors and windows shall be closed to contain possible fire and smoke.

Upon confirmation of the emergency situation, the duty personnel at the Fire Command Centre will activate the 2nd stage alarm to initiate the evacuation of all personnel within the building. The Fire Alarm will ring continuously on all floors.

Separately, on hearing the Gas Evacuation Alarm (RED Alarm), all staff shall shut down the various machineries and lab equipment, secure the chemicals and biological agents and evacuate from the lab immediately. The Gas Evacuation Alarm is different from and not interlinked with the Fire Alarm. Evacuation is not required during the Stage 1 Verify Gas Leak Alarm (ORANGE Alarm).

During an evacuation, all personnel, including visitors, shall exit the facility via the nearest exit stairway in an orderly manner as guided by the Fire Warden in accordance with the Fire Evacuation Plan (**Annex B-1**). The lift shall not be used at any time. No personnel shall return to the premise to collect an item or personal belongings during an evacuation. The Fire Warden shall check to ensure that there is no one still remaining within the Scheduled Premise.

All personnel shall then proceed to the Assembly Area (**Annex B-2**) and wait there for further instruction. The Company Representative shall mark the attendance of all company staff and visitor at the Assembly Area and report attendance to the Building Fire Safety Manager. The SCDF ground commander and Building Fire Safety Manager shall be notified of any unaccounted personnel.

All personnel shall remain at the Assembly Area until instruction to return to the building has been given by the Building Fire Safety Manager or SCDF

Ground Commander for fire emergency and the Site Controller for gas emergency.

Throughout the evacuation, all staff shall remain proper social distancing from each other, in line with the Covid-19 safety measures.

3.2.2.1 Non-CARES personnel

Non-CARES personnel present on CARES site are either visitors or contractors. In the event of an evacuation, visitors will be following the instructions of their CARES host. Contractors are to be handled as described in the CARES contractor procedures. Briefly, a designated responsible person represents the contractors, who will ensure their complete evacuation and confirm this evacuation to the Site Incident Controller (Lab manager).

3.2.3 (PHASE II B) EMERGENCY ACTIONS TO MITIGATE OR CONTAIN THE EMERGENCY

3.2.3.1 Emergency Shutdown Procedure

All lab equipment in operation shall be shut down during an emergency prior to an evacuation. Attempt shall be made to either quench or contain chemical reactions that are still in progress. All biohazardous materials shall be secured. All flammable chemicals shall be returned to the flammables storage cabinets and the doors of the cabinets closed.

The gas solenoid valves for the various gas lines should be closed to stop delivery of gases to the respective points of use. However, while attempts have been made to install the gas solenoid valves close to the respective gas cylinders, gas leaks may still occur along the short lengths of pipings and valves between the gas cylinders and the solenoid valves. A more failsafe approach is to turn off the gas cylinder valves. However, this should only be attempted when the designated person has assessed the situation and deemed that this operation would not lead to increased risk or delay the prompt evacuation of all personnel.

3.2.3.2 Fire Fighting, Hazmat Monitoring, Containment and Rescue

The company Site Incident Manager shall lead the emergency response effort for emergencies occurring within the Scheduled Premise only. Trained Company Emergency Response Team (CERT) personnel shall provide support.

In the event that the Site Incident Manager is not available, his responsibilities shall be filled by the CERT.

During a fire emergency, the CERT personnel shall assess the suitability of the firefighting media (dry powder in Type ABC fire extinguishers, CO_2 fire extinguishers, and water in hose reel) before attempting to use the media to fight the fire. The fire extinguishers on site are not suitable for Class C fires. One should terminate the flammable gas supply to extinguish the fire.

In the event of a chemical spill, the CERT personnel shall contain and clean up the spill by applying the Spill Containment Protocol as detailed in **Annex H**.

During a gas leak emergency, the CERT personnel shall ensure that delivery of all gases is promptly terminated. The team shall then take steps to identify the source of the leak and if possible to perform simple repair of the leak. A leaking gas line containing flammable or toxic gases shall be purged with inert gases (e.g. nitrogen (N_2) gas) for at least 10 mins prior to the commencement of any repair operation.

The following emergency equipment is located at the Scheduled Premise:

S/N	Equipment	Capacity	Quantity	Location
1.	Type AB fire extinguisher	4.0 kg	4	Lab 1 – High pressure rooms
			1	Lab 1 - Gas Cylinder Room 2
			1	Lab 1 - Particle Processing Room
			1	Lab 1 - Particle Technology Lab
			1	Gas Cylinder Room 1
			1	M&E Plant Room
			1	Dry Lab
			1	Lab 2 - Bio-Sustainability Lab
		6.0 kg	1	Lab 1 – Chemical Prep Area
			2	Lab 1 - Wet Chemistry Lab
			1	Lab 1 - Control Area
			1	Lab 2 – Advanced Microtechnology Lab
			1	Lab 2 – Electrochemical Analysis Lab
2.	Carbon dioxide (CO_2) fire extinguisher	5.0 kg	1	Lab 1 – Chemical Prep Area
			2	Lab 1 - Wet Chemistry Lab
			1	Lab 1 - Control Area
			1	Lab 1 - Particle Processing Room
			1	Lab 1 - Particle Technology Lab
			1	M&E Plant Room
			1	Lab 2 – Advanced Microtechnology Lab

			1	Lab 2 – Electrochemical Analysis Lab
			1	Lab 2 - Bio-Sustainability Lab
3.	Hose reel	-	1	Lab 1 – Control Area
			1	Outside facility along corridor
			1	Lab 2 – Electrochemical Analysis Lab
4.	Spill containment kit	For Chemical	1	Within Lab 1
			1	Within Lab 2
		For Biological	1	Within Lab 2 - Bio-Sustainability Lab
5.	Fire hydrant	-	1	Outside building along CREATE Way
			1	Outside Enterprise wing on the building (near bus stop)
6.	First Aid Box	-	1	Within Lab 1
			1	Within Lab 2
7.	Fire Blanket	-	11	Within Lab 1 and 2

For emergency occurring outside the Scheduled Premise, the company shall only be responsible for performing emergency shutdown of its equipment, secure its chemicals, terminating its gas supplies and evacuating all its personnel from the Scheduled Premise. Firefighting and other emergency response duties shall be solely coordinated by the Building Fire Safety Manager.

3.2.3.3 Procedure to Implement In-Place Protection (IPP)

Note: The signal for IPP will be broadcast over radio or TV after the sounding of important message signal through the Public Warning System. The authorities may also conduct a door-to-door notification.

All personnel shall familiarise themselves with the various signals under the SCDF Public Warning System. In the event that the “Important Message” siren is triggered, personnel shall tune in immediately to any local FM radio station to hear the important broadcast.

Should an IPP be initiated, the Company Site Controller shall assume the role of IPP Coordinator and take lead role in coordinating the IPP effort. All personnel shall stop all activities immediately and gather at the open lab area in Lab 2. All equipment shall first be shut down and valves of all gas cylinders turned off.

To minimise the infiltration of any toxic fumes present in the environment, the air-conditioning and mechanical ventilation system for the premise shall be turned off immediately. Furthermore, the gaps around the windows, perimeter entrance doors as well as the doors leading into the lab shall be

sealed using masking tape. All fume hood openings and local fume extractor outlets shall be sealed using plastic wraps and masking tape.

The IPP Coordinator shall establish a communication channel with the Building Fire Safety Manager to update each other of the situation and to implement further actions as required. The radio shall be kept on at all times so that the group may listen for further instructions.

Upon termination of the IPP, the doors shall be opened and the air-conditioning and mechanical ventilation system turned on to ventilate the area.

3.2.4 (PHASE III) TO CLEAN UP / DECONTAMINATE AND RESUME NORMAL OPERATIONS.

3.2.4.1 Clean up Operations

The Type AB fire extinguishers contain ammonium phosphate and/or ammonium sulfate powders that can be irritating to the eyes, skin and lungs. Caution should thus be observed to avoid breathing in the chemical dust during use as well as during clean-up of the discharge residues. The ABC powders shall be swept up, bagged and placed in a dumpster. The use of water for clean-up should be avoided as the powder becomes pasty and more difficult to pick up when wet. The wet paste can also be mildly corrosive.

The carbon dioxide used in CO_2 fire extinguisher is an asphyxiant and may cause asphyxiation when a person is exposed to high level of it. However, carbon dioxide does not leave any residue and no clean-up is required.

For chemical spill, the clean-up shall be performed in accordance with the Emergency Spill Containment Protocol as detailed in Annex H. Contaminated adsorbent materials and Personal Protective Equipment (PPE) shall be bagged and placed within the designated enclosed chemical waste container for collection by licensed toxic industrial waste collector.

Similarly, biological spill clean-up shall be performed in accordance with the Emergency Spill Containment Protocol as detail in the SOP (Annex A). Materials used for biological spill clean-up shall be bagged and disinfected, either using chemical disinfectant or steam sterilisation. This waste shall also be collected by licensed toxic industrial waste collector (pathogenic waste).

For gas leak incidents, the safety committee shall convene an on-site meeting to discuss and execute the most appropriate recovery measure prior to allowing the rest of staff back into the lab.

Our appointed waste collector is Aroma Chemical Pte. Ltd. No. 6, Tuas View Lane Singapore, 637566 Singapore (Tel: 68618591)

3.2.4.2 Other Emergency Plans

No other emergency plan is deemed necessary at this time (**Annex E**).

3.3 GROUPING AND TASKS

The roles and responsibilities of the various appointment holders of this Emergency Response Plan are tabled in **Annex F**.

3.4 KEY PESONNEL EMERGENCY CONTACT NUMBERS

The contact numbers of the key appointment holders are listed in **Annex D**.

4 SERVICE SUPPORT

This section describes the facilities and equipment that are available to assist the Company in mitigating an emergency.

4.1 FIXED INSTALLATIONS

4.1.1 FIRE / HAZMAT PROTECTION FACILITIES

4.1.1.1 Detection System

Lower Explosive Limit (LEL), carbon monoxide, carbon dioxide, oxygen and hydrogen sulphide gas detectors are installed within the premise to check for gas leaks.

Smoke detectors are installed inside the electrical room to guard against fire.

4.1.1.2 Extinguishment System

The building is sprinkler protected and is equipped with water hose reels located at strategic locations (see Annex B-1 for locations). Multiple fire hydrants are strategically located outside the building. The building is equipped with dry risers at the fire fighting and smoke stop lobbies. No other fixed extinguishment system is present. Type ABC and CO_2 fire extinguishers are located within the Scheduled Premise.

4.1.2 SAFETY AND FIRST AID EQUIPMENT

S/N	Item	Qty	Location
1.	First Aid Box (Box A)	1	Lab 1
		1	Lab 2
2.	Safety eyewash	2	Lab 1
		1	Lab 2
		1	Inside Advanced Microtechnology Lab (Class 1,000 Cleanroom; Lab 2)
		1	Bio-Sustainability Lab (Lab 2)
3.	Safety shower	2	Lab 1
		1	Lab 2
4.	Chemical spill kit	1	Lab 1
		1	Lab 2
5.	Biological spill kit	1	Lab 2
6.	Personal Protective Equipment (e.g. gloves, masks, lab coat)	-	At entrance to both Labs 1 and 2

4.1.3 OTHER PROTECTION AND GENERAL EQUIPMENT

Chemical fume hoods, canopy hoods and local fume extractors are located within the lab area for handling of volatile hazardous chemicals.

Biological safety cabinets are installed at the Bio-Sustainability Lab for handling of biohazardous materials.

Safety showers and eyewashes are installed to facilitate rinsing during chemical / biological exposure scenarios.

Self Contained Breathing Apparatus is located at the M&E Plant Room for use during investigation of gas leak event.

Potable multi-gas detector is located at the M&E Plant Room for use during investigation of gas leak event.

No other protection equipment is deemed necessary at this time.

5 COMMAND AND SIGNAL

This section describes the command and communication structure of the Company during an emergency.

5.1 COMMAND STRUCTURE

5.1.1 INCIDENT ORGANISATION CHART

During an emergency that occurs within the Scheduled Premise, the **Site Incident Controller** shall assume lead role in organising the response (firefighting, gas leak event investigation or spill clean up).

The **Site Controller** shall be responsible for reporting the incident to the **Building Fire Safety Manager**. The Building Fire Safety Manager shall be the main party to liaise with SCDF Ground Commander for the building emergency effort. The Site Controller shall provide company specific information and render support when called upon. The specific roles and responsibilities of the various appointment holders are tabled in **Annex F**. The structure of the Company Emergency Response Team is presented in **Annex I**.

5.1.2 LOCATION AND COMPONENT OF COMMAND CENTRE

The Fire Command Centre is located at the basement level of the CREATE building (at Tower block area).

6 PLAN REVIEW & MAINTENANCE

This section details the plan review process. The plan review is to be conducted on an annual basis.

6.1 COMMUNICATION OF PLAN

The Site Controller shall be responsible for keeping this Emergency Response Plan current and for communicating the emergency procedures to all staff within the Company and may delegate practical tasks to Site Incident Controller or others as needed. An annual review of the Emergency Response Plan shall be conducted regardless of whether any change has been made.

6.2 TABLE TOP EXERCISE

A regular table top exercise between Site Controller and Site Incident Controller should be scheduled every six months.

6.3 CONDUCT OF EMERGENCY DRILL

Key findings from the emergency drills are as follows:

- All evacuation exercises exceeded expectations, with full evacuation of the laboratories occurring in under 20 seconds and assembly at the assembly point in under 2 minutes.
- Spill emergency exercises highlighted the necessity to provide support to casualties during decontamination, and to allow for privacy if a casualty needs to disrobe (to remove contaminated clothing). For this reason, emergency clothes were located on site and the importance of evacuating and providing a staff member of the same sex to provide support during decontamination were incorporated in the drills. These lessons were absorbed well by the staff.

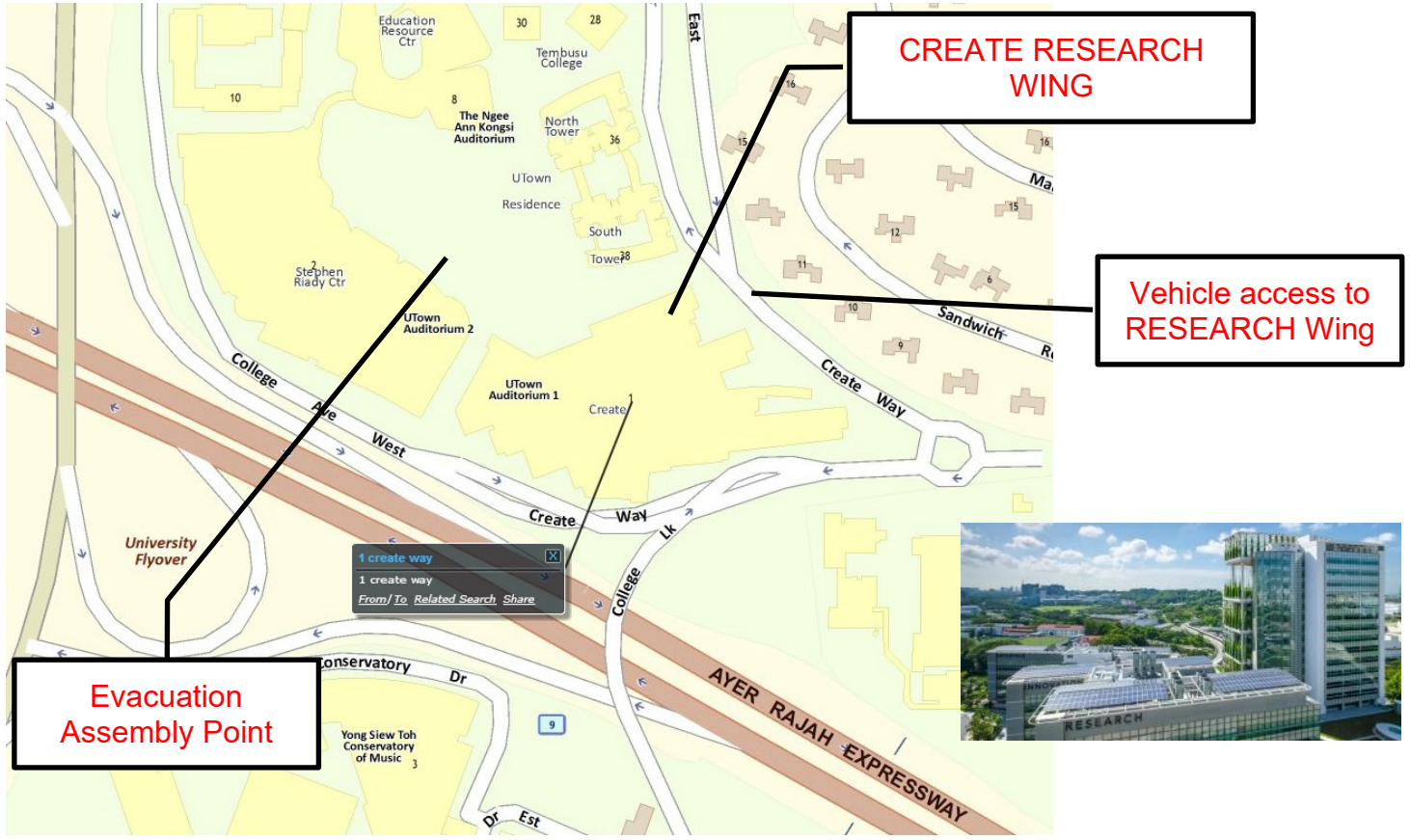
6.4 REVIEW OF HAZARD RISK ASSESSMENT

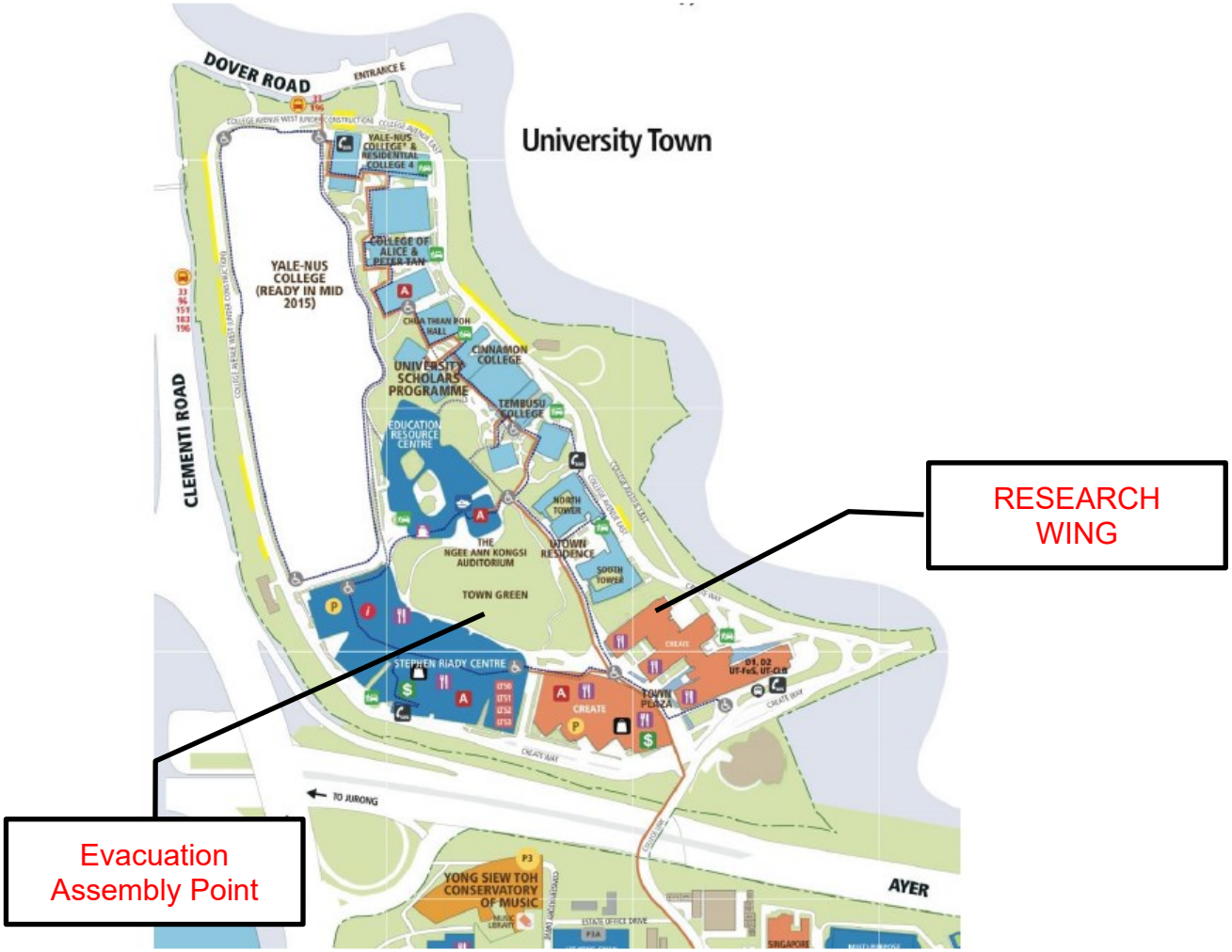
Current versions of the respective lab activities risk assessments were reviewed during the preparation of this Emergency Response Plan. All required control measures have been highlighted in this ERP.

Attempts shall be made to review all risk assessment on a periodical basis and key findings from future review shall be recorded here for reference and improvement. Gaps in the current plan shall also be identified and addressed.

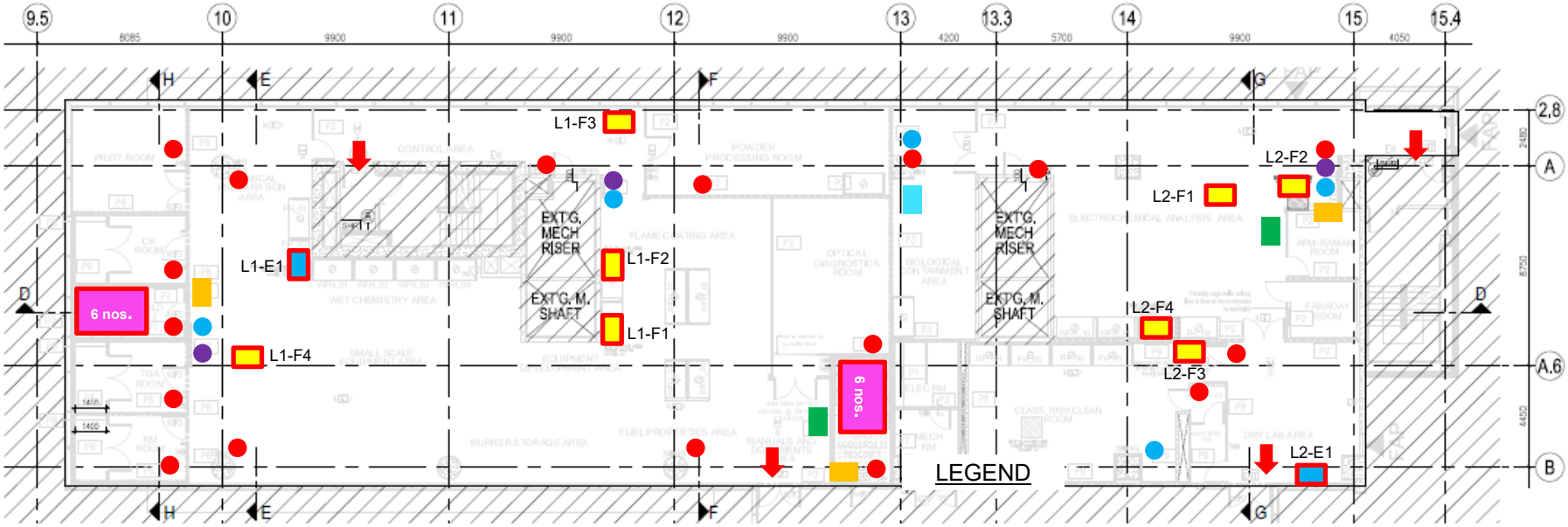
CAMBRIDGE CARES

ANNEX A – CREATE BUILDING SITE PLAN



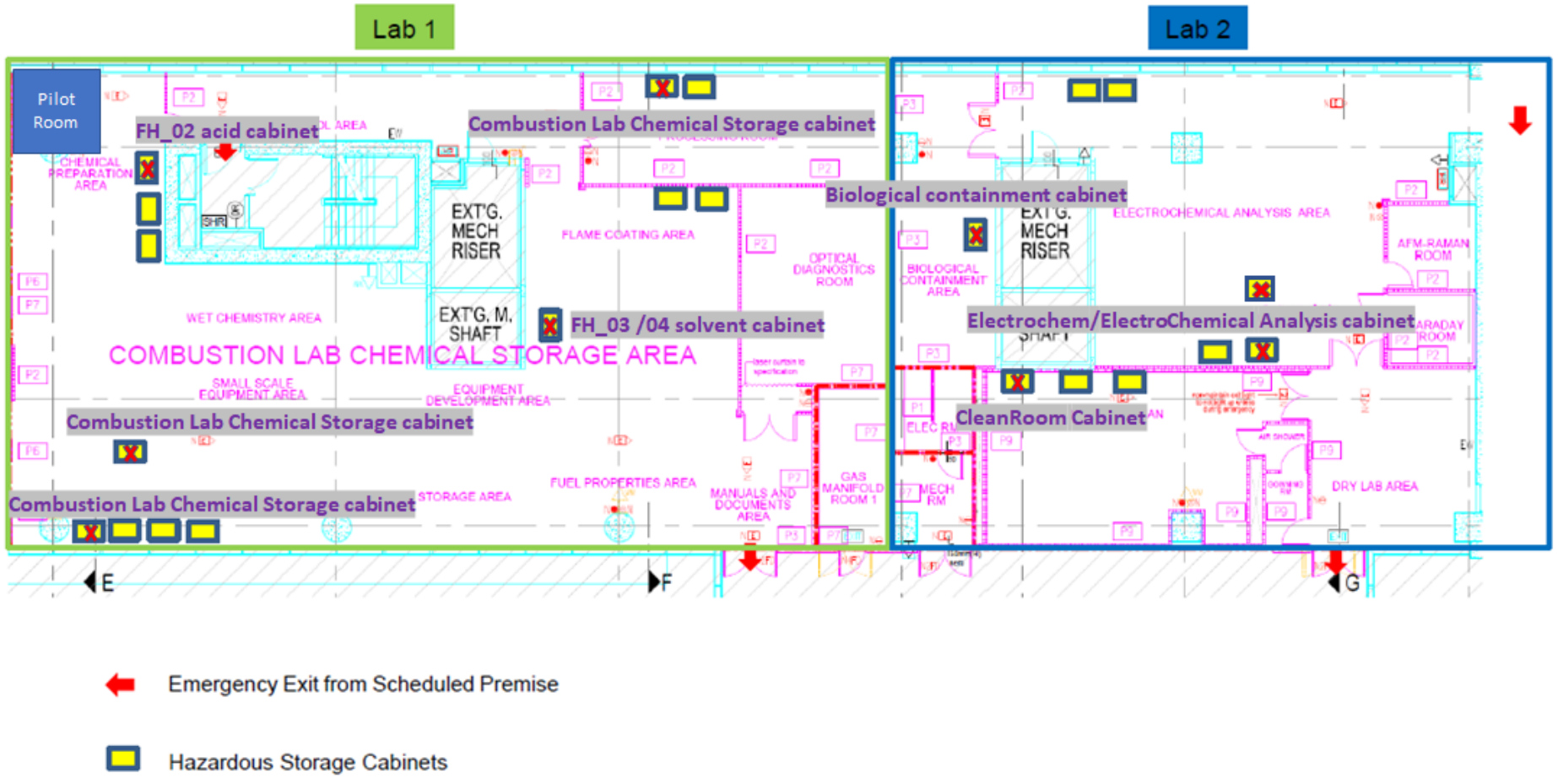

DOVER ROAD
ENTRANCE E
University Town
YALE-NUS COLLEGE* & RESIDENTIAL COLLEGE 4
COLLEGE OF ALICE & PETER TAN
YALE-NUS COLLEGE (READY IN MID 2015)
CHUA THIAN POH HALL
CINNAMON COLLEGE
UNIVERSITY SCHOLARS PROGRAMME
TEMBUSU COLLEGE
EDUCATION RESOURCE CENTRE
CLEMENTI ROAD
NORTH TOWER
THE NGEE ANN KONGSI AUDITORIUM
UTOWN RESIDENCE
SOUTH TOWER
TOWN GREEN
STEPHEN RIADY CENTRE
CREATE
TOWN PLAZA
01, 02 UT-FoS, UT-CLB
CREATE WAY
TO JURONG
P3
YONG SIEW TOH CONSERVATORY OF MUSIC
ESTATE OFFICE DRIVE
AYER
RESEARCH WING
Evacuation Assembly Point

ANNEX B-1 – a. CREATE BUILDING RESEARCH WING LEVEL 7 PLAN

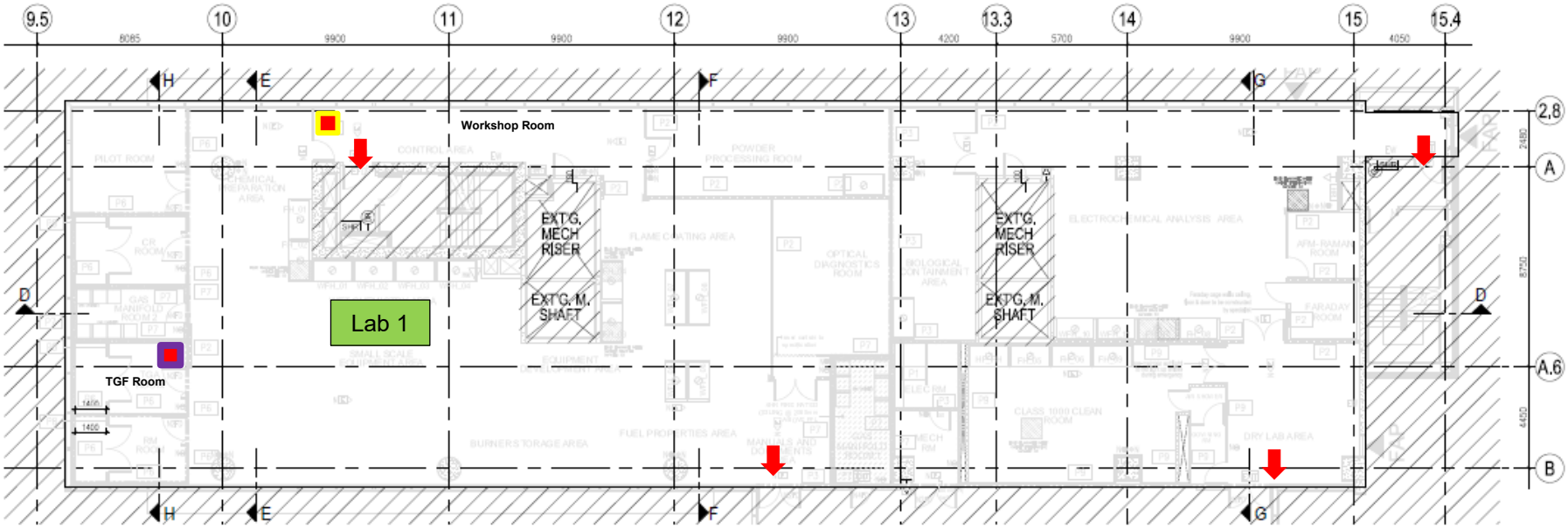


- Emergency Exit from Scheduled Premise
- Fire Extinguishers (Type ABC/CO2)
- Safety Shower
- Safety Eyewash
- Chemical Spill Kit
- First Aid Kit
- Bio Spill Kit
- 90 mins rated Flammable Gas Cabinets (6 nos. at each location)
- Explosive Cabinets
- Flammables Safety Cabinet

b. CREATE BUILDING RESEARCH WING LEVEL 7 - HS MATERIAL STORAGE LOCATIONS



c. CREATE BUILDING RESEARCH WING LEVEL 7 – RADIATION MATERIAL & APPARATUS

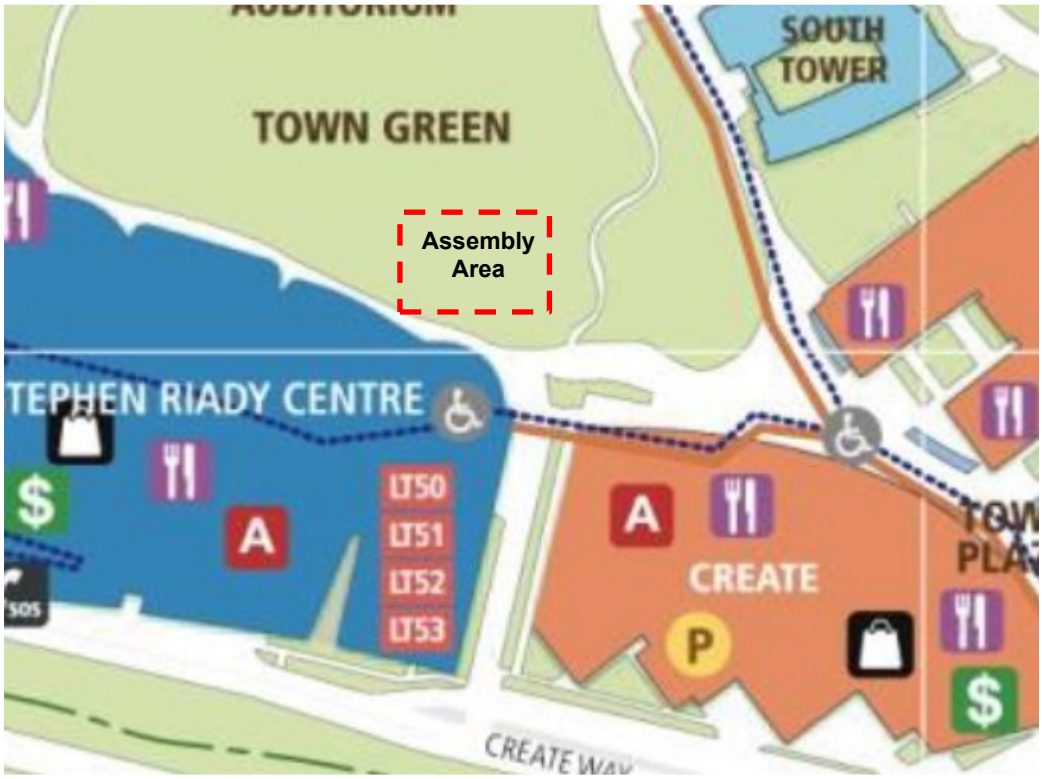


Emergency Exit from Scheduled Premise

Radiation Material – Americanum 241

Radiation Apparatus – D2 Phaser XRD

ANNEX B-2 – LOCATION OF ASSEMBLY AREA



ANNEX C – CHEMICAL INVENTORY AND LIST OF HAZARDOUS SUBSTANCE MATERIALS

Liquid

IRP	Chemical	Physical Form	Lab	Cabinet location	Unit Capacity of Packaging / Container (Litres)	Total No. of Packaging / Container	Maximum Qty Stored On-Site (Litres)
1	32% HCl	Liquid	1	FH_02 acid cabinet	1	1	1
1	Aluminium isopropoxide	Liquid	1	FH_01 solvent cabinet	1	1	1
1	Aluminium isopropoxide 98+%	Liquid	1	FH_01 solvent cabinet	0.5	1	0.5
1	Aluminium sec-butoxide 98%	Liquid	1	FH_01 solvent cabinet	0.5	1	0.5
1	Aluminium tri-sec-butoxide 97%	Liquid	1	FH_01 solvent cabinet	0.5	1	0.5
1	Citric acid	Liquid	1	FH_02 acid cabinet	1	1	1
1	Dilute HCl	Liquid	1	FH_02 acid cabinet	1	1	1
1	Ethanol	Liquid	1	FH_01 solvent cabinet	1	2	2
1	Magnesium ethoxide	Liquid	1	FH_01 solvent cabinet	1	1	1
1	Methanol	Liquid	1	FH_01 solvent cabinet	1	2	2
1	n-Heptane	Liquid	1	FH_01 solvent cabinet	1	1	1
1	Nitric acid	Liquid	1	FH_02 acid cabinet	1	1	1
1	pH 4 buffer solution	Liquid	1	FH_02 acid cabinet	1	1	1
1	Propan-2-ol	Liquid	1	FH_01 solvent cabinet	1	2	2
1	Tetraethyl orthosilicate 98%	Liquid	1	FH_01 solvent cabinet	0.5	1	0.5

1	Toluene	Liquid	1	FH_01 solvent cabinet	1	1	1
1	Universal indicator solution	Liquid	1	FH_02 acid cabinet	1	1	1
1	Various NaOH and HNO3 stock solutions	Liquid	1	FH_01 solvent cabinet	1	2	2
1	Zirconium isobutoxide, 80% solution in isobutanol	Liquid	1	FH_01 solvent cabinet	0.5	1	0.5
2	(3-Aminopropyl)trimethoxysilane * 3	Liquid	2	Electrochem	0.1	3	0.3
2	(3-Glycidoxypropyl)trimethoxysilane	Liquid	2	Electrochem	1	20	20
2	1,1,2-trichloroethane	Liquid	2	Electrochem	1	1	1
2	1,2-Dibromoethane	Liquid	2	Electrochem	0.01	2	0.02
2	1,2-Dichloroethane	Liquid	2	Electrochem	0.1	10	1
2	1,2-Dichlorobenzene	Liquid	2	Electrochem	1	5	5
2	1-Butanethiol	Liquid	2	Electrochem	0.25	1	0.25
2	1-Butanol	Liquid	2	Electrochem	1	1	1
2	1-Dodecanethiol	Liquid	2	Electrochem	0.1	1	0.1
2	1-Dodecanethiol	Liquid	2	Electrochem	0.5	1	0.5
2	1-Dodecanol	Liquid	2	Electrochem	0.5	1	0.5
2	1-Methoxy-2-propanol acetate	Liquid	2	Electrochem	1	1	1
2	1-Methyl-2-pyrrolidinone	Liquid	2	Electrochem	1	1	1
2	1-Octanethiol	Liquid	2	Electrochem	0.25	1	0.25
2	1-Octanol	Liquid	2	Electrochem	2.5	1	2.5
2	1-Thioglycerol	Liquid	2	Electrochem	0.1	1	0.1
2	2,2,4-Trimethylpentane	Liquid	2	Electrochem	0.5	1	0.5
2	2-Methyl-2-propanol	Liquid	2	Electrochem	1	1	1
2	3-(Trimethoxsilyl)propyl methacrylate	Liquid	2	Electrochem	0.1	4	0.4
2	3-Aminopropyltriethoxysilane	Liquid	2	Electrochem	0.1	1	0.1

2	Acetone	Liquid	2	Electrochem	4	12	50
2	Acetonitrile	Liquid	2	Electrochem	4	12	50
2	Allyltrimethoxysilane	Liquid	2	Electrochem	1	1	1
2	Ammonia solution	Liquid	2	Electrochem	2.5	1	2.5
2	Ammonium hydroxide	Liquid	2	Electrochem	1	1	1
2	Benzyl chloride	Liquid	2	Electrochem	0.1	1	0.1
2	Bisphenol A glycerolate (1 glycerol/phenol) diacrylate	Liquid	2	Electrochem	0.5	1	0.5
2	Brandford reagent	Liquid	2	Biological Containment Area	0.5	1	0.5
2	Butan-1-ol	Liquid	2	Electrochem	1	5	5
2	Butylferrocene	Liquid	2	Electrochem	0.05	1	0.05
2	Chloroform	Liquid	2	Electrochem	1	5	5
2	Chlorotrimethylsilane	Liquid	2	Electrochem	0.1	1	0.1
2	Chlorotrimethylsilane	Liquid	2	Electrochem	0.25	1	0.25
2	Crystal violet	Liquid	2	Electrochem	0.5	1	0.5
2	Cyclohexane	Liquid	2	Electrochem	1	1	1
2	Dichloroacetic acid	Liquid	2	Electrochem	0.01	1	0.001
2	Dichloromethane	Liquid	2	Electrochem	1	5	5
2	Efhard	Liquid	2	Electrochem	1	1	1
2	Ethylene glycol	Liquid	2	Electrochem	0.5	1	0.5
2	Formic acid	Liquid	2	Biological Containment Area	1	1	1
2	Glycerol	Liquid	2	Biological Containment Area	1	5	5

2	Gold chloride solution 200 mg/dL	Liquid	2	Biological Containment Area	0.5	1	0.5
2	HEADSTOCK LUBRICANT	Liquid	2	Electrochem	1	4	4
2	Hexane	Liquid	2	Electrochem	1	5	5
2	HY 219 (an epoxy glue)	Liquid	2	Electrochem	1	1	1
2	Hydrochloric acid 37%	Liquid	2	Electrochemical Analysis Area/Biological Containment Area/Class 1000 Clean Room	1	10	10
2	Isopropanol	Liquid	2	Electrochem	4	12	50
2	LUDOX® HS-40 colloidal silica	Liquid	2	Electrochem	1	1	1
2	LUDOX® HS-40 colloidal silica	Liquid	2	Electrochem	1	1	1
2	Methanol	Liquid	2	Class 1000 Clean Room	4	12	50
2	Mineral oil	Liquid	2	Electrochem	1	5	5
2	Mineral oil	Liquid	2	Electrochem	1	5	5
2	Minimum essential medium eagle	Liquid	2	Electrochem	0.05	1	0.05
2	N, N, N', N'-tetramethylethylene diamine	Liquid	2	Electrochem	0.05	1	0.05
2	N,N-dimethylformamide	Liquid	2	Electrochem	0.5	1	0.5
2	Nitric acid	Liquid	2	Electrochem	1	5	5
2	Nitrobenzene	Liquid	2	Electrochem	1	5	5
2	Octadecylmercaptan	Liquid	2	Electrochem	0.05	1	0.05
2	Olive oil	Liquid	2	Electrochem	0.5	1	0.5
2	o-Tolidine solution	Liquid	2	Biological Containment Area	0.5	1	0.5
2	Paraffin oil	Liquid	2	Electrochem	0.5	1	0.5

2	Phenolphthalein	Liquid	2	Electrochem	0.05	1	0.05
2	Phosphoric acid	Liquid	2	Electrochem	0.5	1	0.5
2	Poly(ethylene glycol)	Liquid	2	Electrochem	0.25	1	0.25
2	Polytetrafluoroethylene	Liquid	2	Electrochem	0.05	1	0.05
2	Propan-2-ol	Liquid	2	Electrochem	2.5	3	7.5
2	Proplyene carbonate, 99.5%	Liquid	2	Electrochem	0.5	1	0.5
2	Pyrrole	Liquid	2	Electrochem	0.05	1	0.05
2	Siliocne elastomer curing agent	Liquid	2	Electrochem	1	5	5
2	Sodium silicate solution	Liquid	2	Electrochem	1	1	1
2	Sodium sulfate standard solution	Liquid	2	Electrochem	1	1	1
2	Span 80	Liquid	2	Electrochem	0.25	1	0.25
2	SU-8 2000 thinner	Liquid	2	Class 1000 Clean Room	1	5	5
2	SU-8 2002	Liquid	2	Class 1000 Clean Room	1	5	5
2	SU-8 2025	Liquid	2	Class 1000 Clean Room	1	5	5
2	SU-8 2100	Liquid	2	Class 1000 Clean Room	1	5	5
2	SU-8 3025	Liquid	2	Class 1000 Clean Room	1	5	5
2	Sulfuric acid	Liquid	2	Electrochemical Analysis Area/Biological Containment Area/Class 1000 Clean Room	1	10	10
2	TBAH	Liquid	2	Electrochem	0.1	1	0.1
2	tert-Butanol	Liquid	2	Electrochem	1	5	5
2	Tetra(ethylene glycol) diactrylate	Liquid	2	Electrochem	0.02	1	0.02
2	Tetraethyl orthosilicate	Liquid	2	Electrochem	1	1	1

2	Tetraethyl orthosilicate	Liquid	2	Electrochem	1	1	1
2	Tetrahydrofuran	Liquid	2	Electrochem	1	10	10
2	Thymine	Liquid	2	Electrochem	1	1	1
2	Toluene	Liquid	2	Electrochem	1	5	5
2	Tricine	Liquid	2	Electrochem	0.1	1	0.1
2	Tris-methylamine	Liquid	2	Electrochem	0.5	1	0.5
2	Zetasperse 2100	Liquid	2	Electrochem	0.5	1	0.5
2	Zinc sulfate heptahydrate	Liquid	2	Electrochem	1	1	1
2	α,α,α-Trifluorotoluene	Liquid	2	Electrochem	0.1	1	0.1
3	(Methylcyclopentadienyl)manganese(I) tricarbonyl	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	1,2,3,4-Tetrahydronaphthalene 99%	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	1,2,4-Trimethylbenzene,98%	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	1-Butanol	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	1-Methylnaphthalene,ampule of 100 mg	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	1-Phenyldecane,puriss. p.a., standard for GC, >=99.5% (GC)	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	2,2,4,4,6,8,8-Heptamethylnonane,98%	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	2,2,4-Trimethylpentane,anhydrous, 99.8%	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Acetic acid	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Acetone	Liquid	1	FH_03/04 solvent cabinet	1	4	4
3	Acetylacetone	Liquid	1	FH_03/04 solvent cabinet	2.5	1	2.5
3	Aluminum tri-sec butoxide	Liquid	1	FH_03/04 solvent cabinet	1	1	1

3	Biodiesel	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Butylbenzene,>=99%	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Cyclohexane	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Decahydronaphthalene, mixture of cis + trans98%	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Diacetone alcohol	Liquid	1	FH_03/04 solvent cabinet	2.5	1	2.5
3	Diesel	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Diethyl ether	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Ethanol	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Ethyl acetate	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Gasoline	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Germanium(IV) chloride	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Heptane	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Hexadecane	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Hexadecane, 100 ml	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Hexamethyldisilazane(HMDS)	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Hexane	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Iron(0) pentacarbonyl	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Isopentane	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Isopropanol	Liquid	1	FH_03/04 solvent cabinet	2	2	4
3	Lauric acid,natural, >=98%, FCC, Kosher	Liquid	1	FH_03/04 solvent cabinet	1	1	1

3	Methanol	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Methyl ethyl ketone (MEK)	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Methyl glycol ether	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Methyl isobutyl ketone (MIBK)	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Methylcyclohexane >=99.5% (GC)	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Myristic acid,Sigma Grade, >=99%	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	nPentane	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	n-propyl alcohol	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Palmitic acid,SigmaUltra, >=99%	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Phenylcyclohexane,>=97%	Liquid	1	FH_03/04 solvent cabinet	0.5	2	1
3	Polyethylene glycol	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Stearic acid,reagent grade, 95%	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Tetradecane	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Tetraethyl orthosilicate (TEOS)	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Tin(IV) chloride	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Titanium (IV) butoxide	Liquid	1	FH_03/04 solvent cabinet	0.5	1	0.5
3	Titanium tetrachloride (TiCl4)	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Titanium tetraisopropoxide (TTIP)	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Toluene,anhydrous, 99.8%	Liquid	1	FH_03/04 solvent cabinet	1	2	2
3	Undecane	Liquid	1	FH_03/04 solvent cabinet	1	1	1

3	VANADIUM(V) OXYTRICHLORIDE	Liquid	1	FH_03/04 solvent cabinet	1	1	1
3	Waste solvent waiting for disposal	Liquid	1	FH_03/04 solvent cabinet	1	4	4
*NA	Oleum 30%	Liquid	1	FH_03/04 solvent cabinet	1	10	10
*NA	Ortho-dichlorobenzene	Liquid	1/2	FH_03/04 Solvent Cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet	1	5	5
*NA	Boron Trichloride	Liquid	1/2	FH_02 acid cabinet / Electrochemical Analysis cabinet/ Electrochem cabinet	1	1	1
*NA	Boron Tribromide	Liquid	1/2	FH_02 acid cabinet / Electrochemical Analysis cabinet/ Electrochem cabinet	1	1	1

*NA – These chemicals are depleted and will order if the research activities needed.

Solid

IRP	Chemical	Physical Form	Lab	Cabinet location	Unit Capacity of Packaging / Container (Litres)	Total No. of Packaging / Container	Maximum Qty Stored On-Site (kg)
1	Aluminium acetate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Aluminium chloride hexahydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Aluminium nitrate nonahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Aluminium oxide	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Ammonium carbonate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Ammonium chloride	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Ammonium iron (III) sulphate dodecahydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Ammonium metavanadate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Ammonium molybdate tetrahydrate	Solid	1	Combustion Lab Chemical storage	1	1	1

1	Ammonium niobate (V) oxalate hydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Bentonite powder	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Benzenetricarboxylic acid	Solid	1	Oxidising Agent Storage	1	1	1
1	Calcium bentonite	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium carbonate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium chloride	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium hydroxide	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium nitrate tetrahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Calcium oxide	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium sulphate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium sulphate dihydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Calcium titanate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Carbon black	Solid	1	Combustion Lab Chemical storage	0.1	2	0.2

1	Cerium chloride heptahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Cerium nitrate hexahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Chromium nitrate nonahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Citric acid monohydrate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Cobalt nitrate hexahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Copper (II) acetate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Copper (II) acetylacetonate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Copper chloride hihydrate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Copper nitrate hemipentahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Copper oxide	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Croconic acid	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Cupric sulphate	Solid	1	Oxidising Agent Storage	1	2	2
1	Electrode storate solution	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Epoxy resin kit	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Gadolinium (III) chloride	Solid	1	Combustion Lab Chemical storage	1	1	1

1	Gallium nitrate hydrate	Solid	1	Oxidising Agent Storage	1	1	1
1	Graphite powder	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Hexadecanediol	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Hydrogen peroxide	Solid	1	Oxidising Agent Storage	1	2	2
1	Iron (II) chloride	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron (III) chloride anhydrous	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron (III) chloride hexahydrate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron (III) oxide powder	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron (III) sulphate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron acetate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Iron acetylacetonate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Iron nitrate nonahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Iron oxide (magnetite)	Solid	1	Combustion Lab Chemical storage	1	2	2

1	Iron powder	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Iron wire	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Iron-chrome based high temperature gas shift catalyst	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Kaolin	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Magnesium acetate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Magnesium carbonate hydrate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Magnesium formate dihydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Magnesium nitrate hexahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Magnesium oxide	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Manganese nitrate hydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Nickel nitrate hexahydrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Oleylamine	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Oxalic acid	Solid	1	Combustion Lab Chemical storage	1	1	1

1	Palladium acetate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Phthalic acid	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Polyethylene oxide	Solid	1	Oxidising Agent Storage	1	1	1
1	Potassium bromide	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Potassium carbonate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Potassium chloride	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Potassium hydroxide	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Potassium nitrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Rubidium chloride	Solid	1	Combustion Lab Chemical storage	0.5	1	0.5
1	Ruthenium chloride hydrate	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Silica (chromatography grade)	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Silica (precipitated)	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Silica nanoparticles	Solid	1	Combustion Lab Chemical storage	1	1	1

1	Silica-alumina catalyst	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Silver chloride	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Soda lime	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Sodium bicarbonate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Sodium carbonate	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Sodium chloride	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Sodium hydroxide	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Sodium nitrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Sodium sulphate (anhydrous)	Solid	1	Combustion Lab Chemical storage	1	2	2
1	Titania nanoparticles	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Titanium (IV) chloride	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Titanium (IV) ethoxide	Solid	1	Combustion Lab Chemical storage	1	1	1
1	Urea	Solid	1	Combustion Lab Chemical storage	1	2	2

1	Yttrium nitrate hexahydrate	Solid	1	Oxidising Agent Storage	1	1	1
1	Zirconium nitrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Zirconyl (IV) nitrate	Solid	1	Oxidising Agent Storage	1	2	2
1	Zirconyl chloride octahydrate	Solid	1	Oxidising Agent Storage	1	1	1
2	(-)-Riboflavin	Solid	2	Electrochemical Analysis Area			0.01
2	(-)-Riboflavin	Solid	2	Electrochemical Analysis Area			0.01
2	1,10-Phenanthrolin	Solid	2	Electrochemical Analysis Area			0.002
2	11-Mecraptoundecanoic Acid	Solid	2	Electrochemical Analysis Area			0.005
2	1-Hydroxycyclohexyl phenyl ketone	Solid	2	Electrochemical Analysis Area			0.05
2	1-Naphthyl phosphate calcium salt trihydrate	Solid	2	Electrochemical Analysis Area			0.002
2	2,2’-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt	Solid	2	Electrochemical Analysis Area			0.001
2	2,2-Bipyrimidine	Solid	2	Electrochemical Analysis Area			0.001
2	2,2-Dimethoxy-2-phenylacetophenone	Solid	2	Electrochemical Analysis Area			0.01
2	2,2'-Dipyridyl	Solid	2	Electrochemical Analysis Area			0.005

2	2,4-Dinitrofluorbenzol	Solid	2	Electrochemical Analysis Area			0.005
2	2,4-Dipyridyl	Solid	2	Electrochemical Analysis Area			0.005
2	2,5-Dichloro-1,4-benzoquinone	Solid	2	Electrochemical Analysis Area			0.0002
2	2,6-Dichlorophenolindophenol	Solid	2	Electrochemical Analysis Area			0.005
2	2-Benzyl-2-2(dimethylamino)-4'-morpholinobutyrophenone	Solid	2	Electrochemical Analysis Area			0.02
2	2-Naphthol (β)	Solid	2	Electrochemical Analysis Area			0.005
2	3-(N-morpholino propanesulfonic acid)	Solid	2	Electrochemical Analysis Area			0.25
2	3,3'-(Ethylenedioxyl)diphenol	Solid	2	Electrochemical Analysis Area			0.02
2	3,6-Di-2-pyridyl-1,2,4,5-tetrazine	Solid	2	Electrochemical Analysis Area			0.001
2	3-Aminophthalhydrazide	Solid	2	Electrochemical Analysis Area			0.005
2	4,4'-Bipyridyl	Solid	2	Electrochemical Analysis Area			0.003
2	4,4'-Dipyridyl	Solid	2	Electrochemical Analysis Area			0.005

2	4-Cyanopyridine	Solid	2	Electrochemical Analysis Area			0.005
2	4-Iodophenol	Solid	2	Electrochemical Analysis Area			0.005
2	6-Aminofluorescein	Solid	2	Electrochemical Analysis Area			0.001
2	8-Anilino-1-naphthalenesulfonic acid	Solid	2	Electrochemical Analysis Area			0.002
2	Acrylamide	Solid	2	Electrochemical Analysis Area			0.1
2	Activated carbon	Solid	2	Electrochemical Analysis Area			0.3
2	Adenosine 5'-triphosphate disodium salt hydrate	Solid	2	Electrochemical Analysis Area			0.001
2	Agar	Solid	2	Electrochemical Analysis Area			1
2	Agarose	Solid	2	Biological Containment Area			1
2	Aldrithiol 4	Solid	2	Electrochemical Analysis Area			0.003
2	Aluminium oxide	Solid	2	Electrochemical Analysis Area			0.01
2	Aluminium potassium sulphate dodecahydrate	Solid	2	Biological Containment Area			0.5

2	Ammonium bicarbonate	Solid	2	Biological Containment Area			0.5
2	Ammonium chloride	Solid	2	Electrochemical Analysis Area			0.5
2	Ammonium ferric citrate green	Solid	2	Biological Containment Area			0.5
2	Ammonium hydrogenphosphate	Solid	2	Electrochemical Analysis Area			0.025
2	Ammonium molybdate tetrahydrate	Solid	2	Electrochemical Analysis Area			0.05
2	Ammonium oxalate monohydrate	Solid	2	Electrochemical Analysis Area			2
2	Ammonium persulfate	Solid	2	Electrochemical Analysis Area			0.5
2	Ammonium sulphate	Solid	2	Electrochemical Analysis Area			0.5
2	Ammonium tetrachloropalladate	Solid	2	Electrochemical Analysis Area			0.001
2	Aniline	Solid	2	Electrochemical Analysis Area			0.5
2	Aniline	Solid	2	Electrochemical Analysis Area			0.001
2	Anthracen	Solid	2	Electrochemical Analysis Area			0.005

2	Anthracene-9-carbonyl chloride	Solid	2	Electrochemical Analysis Area			0.001
2	Arthrospira maxima	Solid	2	Biological Containment Area			0.2
2	Barium carbonate	Solid	2	Electrochemical Analysis Area			0.5
2	bathophenanthroline	Solid	2	Biological Containment Area			0.5
2	Biotin	Solid	2	Electrochemical Analysis Area			0.0001
2	Biotin	Solid	2	Biological Containment Area			0.5
2	Bis-(diphenylphosphino)methane	Solid	2	Electrochemical Analysis Area			0.001
2	Bispentamethylcyclopentadienyiron	Solid	2	Electrochemical Analysis Area			0.0005
2	Boric acid	Solid	2	Biological Containment Area			0.5
2	Bromine	Solid	2	Electrochemical Analysis Area			0.01
2	Cadmium acetate dihydrate	Solid	2	Electrochemical Analysis Area			0.08
2	Caffeine	Solid	2	Electrochemical Analysis Area			0.1

2	Calcium chloride	Solid	2	Electrochemical Analysis Area			1
2	Calcium chloride dihydrate	Solid	2	Biological Containment Area			0.5
2	Calcium hydride	Solid	2	Electrochemical Analysis Area			0.02
2	Calcium ionophore A23187	Solid	2	Electrochemical Analysis Area			0.000005
2	Calcium nitrate tetrahydrate	Solid	2	Electrochemical Analysis Area			1
2	Calcium pantothenate	Solid	2	Biological Containment Area			0.5
2	Carbon Black	Solid	2	Electrochemical Analysis Area			0
2	Carbon Black	Solid	2	Electrochemical Analysis Area			1
2	Carbon Graphite	Solid	2	Electrochemical Analysis Area			1
2	Carbon NanoTubes	Solid	2	Electrochemical Analysis Area			0.5
2	Carmine	Solid	2	Electrochemical Analysis Area			0
2	Chlorella vulgaris	Solid	2	Biological Containment Area			0.2
2	Chrome	Solid	2	Class 1000 Clean Room			0.5

2	Chroogloeocystis siderophila	Solid	2	Biological Containment Area			0.2
2	Citric acid	Solid	2	Biological Containment Area			0.5
2	Cobalt (II) chloride hexahydrate	Solid	2	Electrochemical Analysis Area			0.05
2	Cobalt (II) nitrate hexahydrate	Solid	2	Biological Containment Area			0.5
2	Cobalt chloride hexahydrate	Solid	2	Biological Containment Area			0.5
2	Cobaltocenium hexafluorophosphate	Solid	2	Electrochemical Analysis Area			0.001
2	Copper (II) nitratehemipentahydrate	Solid	2	Electrochemical Analysis Area			0.015
2	Copper (II) Sulfate	Solid	2	Electrochemical Analysis Area			0.1
2	Copper (II) sulfate pentahydrate	Solid	2	Electrochemical Analysis Area			0.1
2	Copper sulfate pentahydrate	Solid	2	Biological Containment Area			0.5
2	Copstone	Solid	2	Electrochemical Analysis Area			0
2	Cupferron	Solid	2	Electrochemical Analysis Area			0.015

2	Cupriavidus metallidurans	Solid	2	Biological Containment Area			0.2
2	CY 219	Solid	2	Electrochemical Analysis Area			1
2	cyanocobalamin	Solid	2	Electrochemical Analysis Area			0.1
2	Cyanocobalamin	Solid	2	Biological Containment Area			0.5
2	Cytochrome C	Solid	2	Electrochemical Analysis Area			0.00001
2	D-(+)-Glucose	Solid	2	Electrochemical Analysis Area			1
2	DILUTED ETHANOL*2	Solid	2	Electrochemical Analysis Area			0.1
2	Dioctylsulfosuccinate calcium salt	Solid	2	Electrochemical Analysis Area			0.03
2	Dioctylsulfosuccinate sodium salt	Solid	2	Electrochemical Analysis Area			0.03
2	Disodium Phosphate	Solid	2	Biological Containment Area			0.5
2	Disodium tetraborate	Solid	2	Electrochemical Analysis Area			0.5
2	Diuron	Solid	2	Electrochemical Analysis Area			0.1

2	DL-dithiothreitol	Solid	2	Electrochemical Analysis Area			0.01
2	DL-Malic acid	Solid	2	Electrochemical Analysis Area			0.1
2	DL-Malic acid	Solid	2	Biological Containment Area			0.5
2	Dodecylamine	Solid	2	Electrochemical Analysis Area			0.05
2	D-pantothenic acid hemicalcium	Solid	2	Electrochemical Analysis Area			0.005
2	DY 219	Solid	2	Electrochemical Analysis Area			3
2	Erythromycin	Solid	2	Electrochemical Analysis Area			0.015
2	Ethylene glycol-bis(2-amino-ethylether)-N,N,N',N'-tetraacetic acid	Solid	2	Electrochemical Analysis Area			0.1
2	Ethylenediaminetetraacetic acid disodium salt dihydrate	Solid	2	Biological Containment Area			0.5
2	Europium (III) Chloride hexahydrate	Solid	2	Electrochemical Analysis Area			0.001
2	Ferric chloride hexahydrate	Solid	2	Biological Containment Area			0.5
2	Ferric citrate	Solid	2	Biological Containment Area			0.5

2	Ferric citrate	Solid	2	Biological Containment Area			0.5
2	Ferrocene	Solid	2	Electrochemical Analysis Area			0.1
2	Ferrocenecarboxylic acid	Solid	2	Electrochemical Analysis Area			0.0002
2	Ferrocenemethanol	Solid	2	Electrochemical Analysis Area			0.0005
2	Ferrocenium hexafluorophosphate	Solid	2	Electrochemical Analysis Area			0.005
2	ferrous sulphate heptahydrate	Solid	2	Biological Containment Area			0.5
2	Fluorescein	Solid	2	Electrochemical Analysis Area			0.03
2	Folic acid	Solid	2	Biological Containment Area			0.5
2	Gold	Solid	2	Class 1000 Clean Room			0.5
2	Gold (III) Chloride trihydrate	Solid	2	Electrochemical Analysis Area			0.001
2	Graphene	Solid	2	Electrochemical Analysis Area			0.5
2	Hexaaminеruthenium (II) chloride	Solid	2	Electrochemical Analysis Area			0.001
2	Hexaaminеruthenium (III) chloride	Solid	2	Electrochemical Analysis Area			0.001

2	hexaflurophosphoric ferric citrate	Solid	2	Electrochemical Analysis Area			0.25
2	Hydrazine	Solid	2	Electrochemical Analysis Area			0.1
2	Hydrogen hexachloroplatinate (IV) hydrate	Solid	2	Electrochemical Analysis Area			0.001
2	Hydroquinone	Solid	2	Electrochemical Analysis Area			0.025
2	Hydroquinone	Solid	2	Electrochemical Analysis Area			0.05
2	Hydroxyl naphthol blue	Solid	2	Electrochemical Analysis Area			0.001
2	hydroxylamine hydrichloride	Solid	2	Biological Containment Area			0.5
2	Inositol	Solid	2	Biological Containment Area			0.5
2	Iron (II) sulfate heptahydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Iron (III) Chloride hexahydrate	Solid	2	Electrochemical Analysis Area			0.25
2	Iron (III) ionophore IV	Solid	2	Electrochemical Analysis Area			0.00005
2	L-ascorbic acid	Solid	2	Electrochemical Analysis Area			0.1

2	L-Cysteine	Solid	2	Electrochemical Analysis Area			0.25
2	Lead (II) carbonate	Solid	2	Electrochemical Analysis Area			0.5
2	Lithium chloride	Solid	2	Electrochemical Analysis Area			0.005
2	Lithium fluoride	Solid	2	Electrochemical Analysis Area			0.002
2	Magnesium chloride	Solid	2	Electrochemical Analysis Area			0.05
2	Magnesium sulfate heptahydrate	Solid	2	Biological Containment Area			1
2	Manganese (II) chloride tetrahydrate	Solid	2	Biological Containment Area			1
2	Manganese (II) sulfate monohydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Manganese (II) Sulfate Morohydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Manganese sulfate monohydrate	Solid	2	Biological Containment Area			0.5
2	Meat extract	Solid	2	Electrochemical Analysis Area			0.1
2	Meat extract	Solid	2	Biological Containment Area			0.5

2	MES hydrate	Solid	2	Electrochemical Analysis Area			0.05
2	Methyl viologen dichloride hydrate	Solid	2	Electrochemical Analysis Area			0.001
2	Methylene blue hydrate	Solid	2	Electrochemical Analysis Area			0.1
2	Methyltrioxorhenium(VII）	Solid	2	Electrochemical Analysis Area			0.0001
2	Metolat 392	Solid	2	Electrochemical Analysis Area			0.05
2	Molecular sieve dehydrate fluka with indicator for drying solvents	Solid	2	Electrochemical Analysis Area			0.15
2	Molecular sieve UOP type 3A	Solid	2	Electrochemical Analysis Area			0.2
2	Molecular sieves 4 A	Solid	2	Electrochemical Analysis Area			0.25
2	Molybdenum haxacarbonyl	Solid	2	Electrochemical Analysis Area			0.005
2	Monopotassium Phosphate	Solid	2	Biological Containment Area			0.5
2	MOPS	Solid	2	Electrochemical Analysis Area			0.025
2	Myo-inositol	Solid	2	Electrochemical Analysis Area			0.1

2	N-(3-dimethylaminopropyl)-N'-ethyl-carbodiimide hydrochloride	Solid	2	Electrochemical Analysis Area			0.001
2	N,N,N',N'-tetramethyl-p-phenylenediamine	Solid	2	Electrochemical Analysis Area			0.002
2	N,N,N',N'-tetramethyl-p-phenylenediamine	Solid	2	Electrochemical Analysis Area			0.02
2	N,N'-bis(3-methylphenyl)-N,N'-diphenylbenzidine	Solid	2	Electrochemical Analysis Area			0.001
2	N,N'-bis(salicylidene)-ethylenediamino-colbat (II)	Solid	2	Electrochemical Analysis Area			0.001
2	N,N'-dicyclohexylcarbodiimide	Solid	2	Electrochemical Analysis Area			0.1
2	N,N'-dimethyl-9,9'-biacridinium dinitrate	Solid	2	Electrochemical Analysis Area			0.001
2	N,N'-methylenebisacrylamide	Solid	2	Electrochemical Analysis Area			0.05
2	N-hydroxysuccinimide	Solid	2	Electrochemical Analysis Area			0.02
2	Nicotinamide	Solid	2	Electrochemical Analysis Area			0.1
2	Nicotinamide	Solid	2	Biological Containment Area			0.5
2	Nicotine acid	Solid	2	Electrochemical Analysis Area			0.05

2	Nicotinic acid	Solid	2	Biological Containment Area			0.5
2	Nikel (II) sulfate hexahydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Nile blue	Solid	2	Electrochemical Analysis Area			0.02
2	Nitroacetic Acid	Solid	2	Biological Containment Area			0.5
2	Nitroacetic Acid	Solid	2	Biological Containment Area			0.5
2	Palladium (II) chloride	Solid	2	Electrochemical Analysis Area			0.005
2	Penicillin G	Solid	2	Electrochemical Analysis Area			0.01
2	Pepstatin A	Solid	2	Electrochemical Analysis Area			0.000025
2	Peptone	Solid	2	Electrochemical Analysis Area			0.1
2	Peptone	Solid	2	Biological Containment Area			0.5
2	Periodic acid	Solid	2	Electrochemical Analysis Area			0.025
2	Peroxidase	Solid	2	Electrochemical Analysis Area			0.000005

2	Perylene	Solid	2	Electrochemical Analysis Area			0.002
2	Phenanthrene	Solid	2	Electrochemical Analysis Area			0.1
2	Phenol	Solid	2	Biological Containment Area			0.5
2	Phosphate buffered saline tablets	Solid	2	Electrochemical Analysis Area			0.05
2	Phosphorus pentoxide	Solid	2	Electrochemical Analysis Area			0.5
2	Platinum	Solid	2	Class 1000 Clean Room			0.5
2	Poly(9-vinylcarbazole)	Solid	2	Electrochemical Analysis Area			0.005
2	Poly(Vinyl butyral-co-vinyl alcohol-co-vinyl acetate)	Solid	2	Electrochemical Analysis Area			0.25
2	Potassium bromide	Solid	2	Electrochemical Analysis Area			0.25
2	Potassium chloride	Solid	2	Electrochemical Analysis Area			1
2	Potassium dihydrogen phosphate	Solid	2	Biological Containment Area			0.5
2	Potassium dihydrogenphosphate	Solid	2	Electrochemical Analysis Area			0.2
2	Potassium Ferricyanide	Solid	2	Electrochemical Analysis Area			0.5

2	Potassium Hexacyanoferrate(III)	Solid	2	Electrochemical Analysis Area			0.005
2	Potassium Hexacyanoferrate(III)	Solid	2	Electrochemical Analysis Area			0.5
2	Potassium hydroxide	Solid	2	Electrochemical Analysis Area			0.5
2	Potassium iodide bioxtra	Solid	2	Electrochemical Analysis Area			0.1
2	Potassium nitrate	Solid	2	Electrochemical Analysis Area			0.5
2	Potassium Permanganate	Solid	2	Electrochemical Analysis Area			0.5
2	Potassium phosphate dibasic	Solid	2	Biological Containment Area			0.5
2	Potassium phosphate dibasic anhydrous	Solid	2	Biological Containment Area			0.5
2	Potassium phosphate dibasic trihydrate	Solid	2	Biological Containment Area			0.5
2	p-Toluene sulfonic acid monohydrate	Solid	2	Electrochemical Analysis Area			0.25
2	Pyrazine	Solid	2	Electrochemical Analysis Area			0.001
2	R. Palustris	Solid	2	Biological Containment Area			0.2

2	Rhodamine	Solid	2	Electrochemical Analysis Area			0.005
2	Rhodamine 110 chloride	Solid	2	Electrochemical Analysis Area			0.00025
2	Rhodamine B	Solid	2	Electrochemical Analysis Area			0.02
2	Riboflavin	Solid	2	Electrochemical Analysis Area			0.01
2	Rodamine 123	Solid	2	Electrochemical Analysis Area			0.000005
2	Rubrene	Solid	2	Electrochemical Analysis Area			0.0001
2	Sea salt	Solid	2	Biological Containment Area			1
2	sea salt (synthetic)	Solid	2	Electrochemical Analysis Area			1
2	Sea Salts	Solid	2	Electrochemical Analysis Area			1
2	Shewanella oneidensis	Solid	2	Biological Containment Area			0.2
2	Silica particles	Solid	2	Electrochemical Analysis Area			0.2
2	Silicon Dioxide	Solid	2	Class 1000 Clean Room			0.5
2	Silver	Solid	2	Class 1000 Clean Room			0.5

2	Silver nitrate	Solid	2	Electrochemical Analysis Area			0.005
2	Silver nitrate	Solid	2	Electrochemical Analysis Area			0.025
2	Silver powder	Solid	2	Electrochemical Analysis Area			0.05
2	Sodium bicarbonate	Solid	2	Electrochemical Analysis Area			1
2	Sodium bis(2-ethylhexyl) sulfosuccinate	Solid	2	Electrochemical Analysis Area			0.05
2	Sodium borate decahydrate	Solid	2	Biological Containment Area			0.5
2	Sodium carbonate anhydrous	Solid	2	Biological Containment Area			1
2	Sodium chloride	Solid	2	Biological Containment Area			10
2	Sodium dihydrogen phosphate	Solid	2	Biological Containment Area			0.5
2	Sodium dodecyl benzenesulfonate	Solid	2	Electrochemical Analysis Area			0.5
2	Sodium dodecyl sulfate	Solid	2	Electrochemical Analysis Area			1
2	Sodium fluoride	Solid	2	Electrochemical Analysis Area			0.005

2	Sodium hexafluorophosphate	Solid	2	Electrochemical Analysis Area			0.001
2	Sodium Hydrogen Phosphate	Solid	2	Electrochemical Analysis Area			0.25
2	Sodium hydroxide	Solid	2	Biological Containment Area			0.5
2	Sodium hypophosphite monohydrate	Solid	2	Electrochemical Analysis Area			0.25
2	Sodium L-lactate	Solid	2	Electrochemical Analysis Area			0.002
2	Sodium L-lactate	Solid	2	Biological Containment Area			0.5
2	Sodium metaborate tetrahydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Sodium molybdate dihydrate	Solid	2	Biological Containment Area			0.5
2	Sodium nitrate	Solid	2	Biological Containment Area			1
2	Sodium orthovanadate	Solid	2	Electrochemical Analysis Area			0.01
2	Sodium perchlorate	Solid	2	Electrochemical Analysis Area			0.1
2	Sodium phosphate dibasic	Solid	2	Electrochemical Analysis Area			0.1

2	Sodium phosphate dibasic dihydrate	Solid	2	Electrochemical Analysis Area			1
2	Sodium phosphate dibasic dihydrate	Solid	2	Electrochemical Analysis Area			0.5
2	Sodium pyruvate	Solid	2	Electrochemical Analysis Area			0.015
2	Sodium thiosulphate	Solid	2	Biological Containment Area			0.5
2	Spherical silica	Solid	2	Electrochemical Analysis Area			0.002
2	Stearic acid calcium salt	Solid	2	Electrochemical Analysis Area			0.2
2	Sudan black B	Solid	2	Electrochemical Analysis Area			0.01
2	Sudan III	Solid	2	Electrochemical Analysis Area			0.025
2	Surfynol DF 58	Solid	2	Electrochemical Analysis Area			0.05
2	Synechococcus elongatus	Solid	2	Biological Containment Area			0.2
2	Synechococcus sp.	Solid	2	Biological Containment Area			0.2
2	Tannic acid	Solid	2	Electrochemical Analysis Area			0.1

2	TES	Solid	2	Biological Containment Area			0.5
2	Tetrabutylammonium chloride	Solid	2	Electrochemical Analysis Area			0.5
2	Tetrabutylammonium hexafluorophosphate	Solid	2	Electrochemical Analysis Area			0.5
2	Tetrabutylammonium perchlorate	Solid	2	Electrochemical Analysis Area			0.5
2	Tetrabutylammonium tetraphenylborate	Solid	2	Electrochemical Analysis Area			0.5
2	Tetrachlor-p-benzochinon	Solid	2	Electrochemical Analysis Area			0.02
2	Tetracycline	Solid	2	Electrochemical Analysis Area			0.025
2	Tetraethylammonium tetrafluoroborate 99%	Solid	2	Electrochemical Analysis Area			0.5
2	Tetrakis (hydroxymethyl)phosphonium chloride solution	Solid	2	Electrochemical Analysis Area			0.5
2	Tetramethylammonunium chloride	Solid	2	Electrochemical Analysis Area			0.5
2	Thiamine hydrochloride	Solid	2	Biological Containment Area			0.25
2	Thianthrene	Solid	2	Electrochemical Analysis Area			0.02

2	Thymine	Solid	2	Biological Containment Area			0.5
2	Titanium	Solid	2	Class 1000 Clean Room			0.5
2	Trans-1,2-di-(4-pyridyl)-ethylene	Solid	2	Electrochemical Analysis Area			0.005
2	Trans-1,2-dibromocyclohexane	Solid	2	Electrochemical Analysis Area			0.05
2	Trichloroacetic acid	Solid	2	Electrochemical Analysis Area			0.05
2	Tricine	Solid	2	Biological Containment Area			0.5
2	Triethylamine	Solid	2	Electrochemical Analysis Area			0.001
2	Tris(2,2'-bipyridyl)ruthenium(II) chloride hexahydrate	Solid	2	Electrochemical Analysis Area			0.01
2	Tris-4-bromophenylamine	Solid	2	Electrochemical Analysis Area			0.005
2	Tris-4-bromophenylamminium hexachloroantimonate	Solid	2	Electrochemical Analysis Area			0.005
2	Tryptone soya broth	Solid	2	Biological Containment Area			1
2	Tryptone soya yeast extract broth	Solid	2	Electrochemical Analysis Area			0.5
2	Vitamin B12	Solid	2	Biological Containment Area			0.5

2	Yeast extract	Solid	2	Biological Containment Area			0.25
2	Zetasperse 2300	Solid	2	Electrochemical Analysis Area			0.1
2	Zinc Chloride	Solid	2	Biological Containment Area			1
2	Zinc sulfate heptahydrate	Solid	2	Biological Containment Area			0.5
3	Ammonium nitrate	Solid	1	Combustion Lab Chemical storage			0.5
3	Cadmium chloride	Solid	1	Combustion Lab Chemical storage			0.1
3	Cadmium nitrate	Solid	1	Combustion Lab Chemical storage			0.5
3	Cellulose acetate	Solid	1	Combustion Lab Chemical storage			0.5
3	Cobalt(II) chloride	Solid	1	Combustion Lab Chemical storage			0.5
3	Ethyl cellulose ether	Solid	1	Combustion Lab Chemical storage			0.5
3	Glass ballotini (< 70 micron)	Solid	1	Powder Processing Room			2
3	Glass ballotini (≈200 micron)	Solid	1	Powder Processing Room			2
3	Glass ballotini (≈500 micron)	Solid	1	Powder Processing Room			1
3	Granulac 140 (lactose)	Solid	1	Powder Processing Room			50

3	Granulac 230 (lactose)	Solid	1	Powder Processing Room			50
3	Granulac 70 (lactose)	Solid	1	Powder Processing Room			50
3	Maltodextrin	Solid	1	Combustion Lab Chemical storage			0.5
3	Methyl orange	Solid	1	Combustion Lab Chemical storage			0.1
3	Naphthalene,scintillation grade, >=99%	Solid	1	Powder Processing Room			0.25
3	Nickel(II) chloride	Solid	1	Combustion Lab Chemical storage			0.5
3	Niobium (V) chloride	Solid	1	Combustion Lab Chemical storage			0.05
3	Poly (vinyl alcohol)	Solid	1	Combustion Lab Chemical storage			0.5
3	Polystyrene	Solid	1	Combustion Lab Chemical storage			1
3	Potassium perchlorate	Solid	1	Combustion Lab Chemical storage			0.5
3	Silica nanoparticles	Solid	1	Powder Processing Room			1
3	Sulphur	Solid	1	Combustion Lab Chemical storage			0.5
3	Titania nanoparticles	Solid	1	Powder Processing Room			1
3	Titanium (IV) oxysulfate	Solid	1	Combustion Lab Chemical storage			0.5

3	Titanium (IV) sulfate	Solid	1	Combustion Lab Chemical storage			0.5
3	Tungsten (VI) chloride	Solid	1	Combustion Lab Chemical storage			0.01
3	Yttrium (III) chloride	Solid	1	Combustion Lab Chemical storage			0.05
3	Zinc nitrate hexahydrate	Solid	1	Combustion Lab Chemical storage			0.5
3	Zirconium(IV) chloride	Solid	1	Combustion Lab Chemical storage			0.5

GAS							
	Chemical	Properties	Physical Form	Gas Cylinder Room	Unit Capacity of Packaging / Container (Litres)	Total No. of Packaging / Container	Maximum Qty Stored On-Site (Litres)
LP Cylinder Air	Air (22 atm)	Inert	Gas	1	50	1	50
LP Ar	Ar	Inert	Gas	1	50	1	50
LP He	He	Inert	Gas	1	50	1	50
LP N_2	N2	Inert	Gas	1	50	1	50
LP O_2	O2	Oxidiser	Gas	1	50	1	50
LP H_2	H_2	Flammable	Gas	1	50	1	50
LP CH_4	CH_4	Flammable	Gas	1	50	2	100
LP C_2H_2	C_2H_2 == acetylene	Flammable	Gas	1	50	1	50
LP C_2H_4	C_2H_4 == ethylene == ethene	Flammable	Gas	1	50	3	150
LP C_2H_6	C_2H_6 == ethane	Flammable	Gas	1	50	1	50
LP C_3H_8	C_3H_8 == propane	Flammable (liquified)	Gas	1	9	1	9
LP CO	CO	Toxic & Flammable	Gas	1	20	1	20
LP CO_2	CO_2	Inert	Gas	1	50	1	50
LP H_2S	100ppm H_2S in N_2	Toxic & Corrosive	Gas	1	10	1	10
LP O_2 Special (5% in He)	5% O_2 in He	Inert	Gas	1	50	1	50

LP H_2 Special (4.5% in He)	4.5% H_2 in He	Inert	Gas	1	50	1	50
LP O_2 Special (5% in N_2)	5% O_2 in N_2	Inert	Gas	1	50	1	50
LP H_2 Special (5% in N_2)	5% H_2 in N_2	Inert	Gas	1	50	1	50
LP CH_4 Special (5% in N2)	5% CH_4 in N_2	Inert	Gas	1	50	1	50
LP C_2H_6 Special (4.4% in N_2)	4.4% C2H6 in N_2	Inert	Gas	1	50	1	50
LP CO Special (10% in N_2)	10% CO in N_2	Toxic	Gas	1	20	1	20
LP CO2 Special (20% in N_2)	20% CO2 in N_2	Inert	Gas	1	50	1	50
HP1 CO	CO	Toxic & Flammable	Gas	2	20	1	20
HP1 Inert 1	One of: Ar (Inert) N_2 (Inert)	Inert	Gas	2	50	1	50
HP1 CO_2	CO_2	Inert	Gas	2	50	1	50
HP1 Inert 2	One of: N_2 (Inert) He (Inert) Ar (Inert)	Inert	Gas	2	50	1	50
HP1 H_2	H_2	Flammable	Gas	2	50	1	50
HP1 Flammable 1	One of: CH_4 (Flammable) C_2H_4 (Flammable) C_2H_6 (Flammable)	Flammable	Gas	2	50	1	50

HP2 CO Special 1	One of: CO (Toxic & Flammable) 10% CO in N_2 (Toxic)	Toxic & Flammable	Gas	2	20	1	20
HP2 O_2	O_2	Oxidiser	Gas	2	50	1	50
HP2 Cylinder Air	One of 5% O_2 in N_2 (Inert) Air (Inert)	Inert	Gas	2	50	1	50
HP2 CO_2	CO_2	Inert	Gas	2	50	1	50
HP2 Inert 1	One of: Ar (Inert) N_2 (Inert)	Inert	Gas	2	50	1	50
HP2 H_2 Special 1	One of H_2 (Flammable) 5% H_2 in N_2 (Inert)	Flammable or Inert	Gas	2	50	1	50
HP2 Flammable 1	One of: CH_4 (Flammable) C_2H_4 (Flammable) C_2H_6 (Flammable) 5% CH_4 in N_2 (Inert) 5% C_2H_4 in N_2 (Inert) 5% C_2H_6 in N_2 (Inert)	Flammable or Inert	Gas	2	50	1	50
HP3 CO	CO	Toxic & Flammable	Gas	2	20	1	20
HP3 Inert 1	One of: Ar (Inert) N_2 (Inert)	Inert	Gas	2	50	1	50
HP3 CO_2	CO_2	Inert	Gas	2	50	1	50

HP3 Inert	One of: N_2 (Inert) He (Inert) Ar (Inert)	Inert	Gas	2	50	1	50
HP3 H_2	H_2	Flammable	Gas	2	50	1	50
HP3 Flammable 1	One of: CH_4 (Flammable) C_2H_4 (Flammable) C_2H_6 (Flammable)	Flammable	Gas	2	50	1	50
LP (PP) CO Special 1	One of: CO (Toxic & Flammable) 10% CO in N_2 (Toxic)	Toxic & Flammable	Gas	2	20	1	20
LP (PP) O_2	O_2	Oxidiser	Gas	2	50	1	50
LP (PP) Cylinder Air	One of: Air (Inert) 5% O_2 in N_2 (Inert)	Inert	Gas	2	50	1	50
LP (PP) CO_2	CO_2	Inert	Gas	2	50	1	50
LP (PP) Inert 1	One of: Ar (Inert) N_2 (Inert)	Inert	Gas	2	50	1	50
LP (PP) H_2 Special 1	One of H_2 (Flammable) 5% H_2 in N_2 (Inert)	Flammable or Inert	Gas	2	50	1	50

LP (PP) Flammable 1	One of: CH_4 (Flammable) C_2H_4 (Flammable) C_2H_6 (Flammable) 5% CH_4 in N_2 (Inert) 5% C_2H_4 in N_2 (Inert) 5% C_2H_6 in N_2 (Inert)	Flammable or Inert	Gas	2	50	1	50

LIST OF HAZARDOUS SUBSTANCE MATERIALS

Type of Hazardous Substance	Purity (%)	Physical State	Location Stored	Unit Capacity of All Packaging / Container (Metric Tonnes/KG)	Maximum Qty Permitted to Store On-site (Metric Tonnes / Kg)	Licence/Permit no
Ethylene Dichloride(1,2-Dichloroethane)	99.99	Liquid	Electrochemical Analysis cabinet/ Electrochem cabinet	250mL to 1L	1L	C0766P200281
Hydrochloric acid	37	Liquid	FH_02 acid cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet/ Clean Room cabinet	250mL to 2.5L	10L	
Lab reagents except those in Annex I • Potassium Hydroxide • Sodium Hydroxide • Boric acid • Bromine • Ferric Chloride Hexahydrate • Hydroquinone • Phenol • Sodium Fluoride	100	Solid	Combustion Lab chemical storage cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet/ Biological Containment cabinet/Pilot Room	10g to 25Kg	300Kg	
Lab reagents except those in Annex I • 1,2-dibromethane	100	Liquid	Combustion Lab chemical storage cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet/ Biological Containment cabinet/Pilot Room	100mL to 4L	166L	

• 1,2-dichloroethane • Nitric acid • Ammonium hydroxide/Solution • Formic acid • Nitrobenzene • Phosphoric acid • Acetic acid • Titanium tetrachloride • Sodium Hydroxide						C0766P200281
Oleum	30	Liquid	FH_03/04 Solvent Cabinet	25mL to 2L	10L	
Ortho-dichlorobenzene	99	Liquid	FH_03/04 Solvent Cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet	50mL to 2L	5L	
Sulphuric Acid	99	Liquid	FH_02 acid cabinet/ Electrochemical Analysis cabinet/ Electrochem cabinet/ Clean Room cabinet	100mL to 2.5L	15L	
Boron Trichloride	20	Liquid	FH_02 acid cabinet / Electrochemical Analysis cabinet/ Electrochem cabinet	25mL to 1L	1L	
Boron Tribromide	90	Liquid	FH_02 acid cabinet / Electrochemical Analysis cabinet/ Electrochem cabinet	25mL to 1L	1L	

List of Toxic Industrial Waste and Biohazardous Waste Collectors

The list of Toxic Industrial Waste Collectors (TIWCs) are listed below. CARES will engage these licensed TIWCs on as and when required basis for disposal of hazardous waste.

Company	Address and Contact
Aroma Chemical Pte Ltd	6 Tuas View Lane, Singapore 637566 Tel: 6861 8591 Email: biohazard@aromakem.com.sg
Chem-Solv Technologies Pte Ltd	29/31 Pioneer Sector 2, Tuas Singapore 628385/628387 Tel: 6861 4277 Email: collection@chemsolvtech.com

ANNEX D - PREMISES EMERGENCY DATA

Name of Premise: Cambridge Centre for Advanced Research and Education in Singapore Ltd.

Address of Premise: 1 CREATE Way #07-06/07/08 Research Wing Singapore 138602

Date of Last Survey: 23/2/24 **Conducted By:** Sim Chun Siong

1. THREAT ASSESSMENT

HRI Class: ☐HFLP ☐ISP ☒FMP ☒BAP ☐RAP ☐Non-HRI

Risks present:	☐ Sensitive Installations	☒ Flammable Materials	☒ TICs	
	☒ Biological Agents	☐ Radiological Agents	(Tick where applicable)	

Abbreviations:

1. **HFLP = High Fire Load Premises**
2. **ISP = Important & Sensitive Premises**
3. **TICP = Toxic Industrial Chemical Premises**
4. **FMP = Flammable Material Premises**
5. **BAP = Biological Agent Premises**
6. **RAP = Radiological Agent Premises**
7. **TIC = Toxic Industrial Chemical**

2. OCCUPANCY LOAD

Location (eg. Blk 1, Main Building etc)	**Peak Hrs** (eg. 0800hrs-1700hrs)	**No. of Occupants (Peak Hrs)**	**Non-Peak Hrs** (eg. 1700hrs-0800hrs)	**No. of Occupants (Non-Peak Hrs)**
Laboratory	0900 – 1800	25	1801 – 0859	0*
Total Premises Occupancy	0900 – 1800	25	1801 – 0859	0*

***** Researchers may work overtime periodically.

3. OCCUPANCY USAGE & KEY ACTIVITIES

Block / Tower	**Level**	**Usage & Key Activities**
Research Wing	7 (Unit #07-06/07/08)	Chemical engineering research

4. KEY PERSONNEL CONTACT DIRECTORY

Name	**Designation**	**Emergency Appointment**	**Tel No. (Day)**	**Tel No. (Night)**	**H/P No.**
-	Security Office	-	6601 2633	-	-
-	NUS Fire Command Centre	-	6601 2630 6684 0616	-	-
Markus Kraft	Director	Company Site Controller	6601 5441	-	9633 6709
Sim Chun Siong	Lab Manager / Hazardous Substances Permit Holder	Site Incident Controller	9018 2051	-	9018 2051

5. IN-HOUSE ERT RESOURCES

S/No	**Manpower**	**H/P No.**	**Capabilities**
1.	Sim Chun Siong	9018 2051	Trained in gas delivery system safe handling, certified as Fire Warden and attended Occupational First Aid with CPR+AED course
2.	Wu Mudi	8356 6430	Trained in gas delivery system safe handling and certified as Fire Warden.

3	Dai Chen Cheng	8425 2150	Trained in gas delivery system safe handling and certified as Fire Warden.
4	Khatijah Binte Yusof	9237 6923	Attended Occupational First Aid with CPR+AED course
5	Susithra Lakshmanan	9382 4727	Attended Occupational First Aid with CPR+AED course

S/No	Equipment	Quantity
1.	Fire extinguishers (Type ABC; 4.0 kg)	11
2.	Fire extinguishers (Type ABC; 6.0 kg)	6
3.	Fire extinguishers (CO_2; 5.0 kg)	10
4.	First Aid Kit (Box A)	2
5.	Chemical Spill Kit	2
6.	Biological Spill Kit	1
7.	Safety Eyewash cum Shower	3
8.	Safety Eyewash	2
9.	Self contained breathing apparatus	2
10.	Portable multi-gas detector	1

S/No	Appliances	Capabilities
1.	None	

6. EXTERNAL ERT RESOURCES

S/No	Agency	Contact No	Capabilities
1.	SCDF	995	To provide firefighting, rescue and emergency medical services; mitigating hazardous materials incidents, as well as formulate, implement and enforce regulations on fire safety and civil defence shelter matters.
2.	NEA	6225 5632 / 1800 2255632	To provide support on the control of toxic and environmentally hazardous chemicals under the Environmental Protection and Management Act and the Environmental Protection and Management Regulation. This includes controlled of Radioactive substances regulated by the Radiation Protection and Nuclear Science Division of NEA.

7. FIRE RISKS

Location	Description	Contents & Quantity	UN No. & Hazchem Code	Key Protection Systems
Lab	Flammable chemicals	Please refer to chemical list in Annex C	Please refer to Annex C	Stored within flammables storage cabinets
Gas Cylinder Rooms 1 & 2	Flammable gases	Please refer to gas list in Annex C	Please refer to Annex C	Stored within 90 min fire rated gas cabinets

8. FIRE PROTECTION SYSTEMS

A FIRE COMMAND CENTRE

Location	PA/Intercom System	Main Alarm Panel in FCC
Basement	Yes	Yes

B FIRE ALARM SYSTEM

S/No.	Locations of Main Alarm Panel	Locations of Sub-Alarm Panels
1.	Within Fire Command Centre	At Fireman Lift Lobby

C EMERGENCY RESPONSE PLAN (ERP)

S/No.	Location of ERP	Assembly Area	No. of Fire Wardens
1.	Within office area	Town Green	2
2.	Building Fire Emergency Plan at FCC	Town Green	N/A

D FIRE SUPPRESSION SYSTEMS

S/No	Detector Type	Availability	Location
1	Sprinkler	Yes / ~~No~~	Throughout building
2	CO / Halon / Fm200 System	~~Yes~~ / No	NA
3	Sprinkler Pump Room	Yes / ~~No~~ (Centralised)	-
4	Water Tank	Yes / ~~No~~	-
5	Other systems	~~Yes~~ / No	NA

E RISING MAINS

Dry Risers			
S/No	Location of Inlet	Inlet No.	Floor Served

1	Staircase SE-2 landing	5-7	All floors
2	Staircase SE-3 landing	6-7	All floors
3	Staircase SE-1 landing	7-7	All floors
Wet Risers			
1	NONE	N/A	N/A

F FIRE LIFTS / STAIRCASES

S/No	Lift No.	Staircase No.	Location	Floor served
1	EF-2	SE-3	Research Wing	All floors

G OTHER LIFTS / STAIRCASES

S/No	Lift No.	Staircase No.	Location	Floor served
1	EP4	-	Between Research Wing and Innovation Wing	Basement to 7
2	EP5	-	Between Research Wing and Innovation Wing	Basement to 7
3	EP6	-	Between Research Wing and Innovation Wing	Basement to 7
4	-	SE-1	Research Wing	Basement to 7
5	-	SE-2	Research Wing	Basement to 7

8. TIC RISKS – STATE NA IF NOT APPLICABLE

Location	Description	Contents & Quantity	Protection System
Lab	General chemical laboratory waste including hazardous chemicals and flammable solvents	100 L	Sprinkler; Stored in carboy within flammables safety cabinet
Lab	Pathogenic biological waste	20 L / 1 dumpster for solid waste	Secondary containment

9. MITIGATION & CONTAINMENT SYSTEMS – STATE NA IF NOT APPLICABLE

S/No	Mitigation & Containment System	Location	Remarks
1.	Chemical spill kit	Lab 1	
2.	Chemical spill kit	Lab 2	

10. BIOLOGICAL AGENTS – STATE NA IF NOT APPLICABLE

Location	Description	Contents & Quantity	Protection System
Lab	Risk groups 1 & 2 agents will be used	< 500 ml at any one time	Biological spill kit

11. BIOLOGICAL PROTECTION SYSTEMS – STATE NA IF NOT APPLICABLE

S/No	Biological Protection	Location	Remarks
1	Biological spill kit	Lab 2	

12. RADIOACTIVE AGENTS – STATE NA IF NOT APPLICABLE

S/No	Radiological Protection	Location	Remarks
1	NA		

13. RADIOLOGICAL PROTECTION SYSTEMS – STATE NA IF NOT APPLICABLE

Location	Description	Half-Life	Protection System
	NA		

14. SENSITIVE INSTALLATIONS – STATE NA IF NOT APPLICABLE

Location	Description	Occupancy	Usage
	NA		

15. ADJACENT BUILDINGS / INSTALLATIONS

Name of Installation	Risk Type	PED Reference No.
The CREATE campus houses many laboratories that use and store various hazardous materials.	☒ Sensitive Installations ☒ Flammable Materials ☒ TIC ☒BA ☒RA	

ANNEX E – OTHER PLANS

1) EVACUATION PLAN*

The evacuation routes from the Scheduled Premise are plotted in **Annex B-1**. This evacuation plan shall be read in conjunction with the Emergency Response Plan published by the National Research Foundation.

2) ARSON PREVENTION PLAN*

Not available

3) In Place Protection Plan (IPP)

The procedures for In Place Protection have been described in Section 3.2.3.3.

ANNEX F – ROLES AND RESPONSIBILITIES

Note: The CREATE campus at University Town, National University of Singapore houses various office and research laboratories under the National Research Foundation CREATE programme. It consists of a CREATE Tower with offices and an interlinked research laboratories building denoted as the Research, Innovation and Enterprise wings. The CREATE campus Fire Safety Manager shall be the overall in-charge for all emergency response operation for the CREATE campus.

The Company shall separately appoint the Site Controller, Site Incident Controller and Fire Warden to address emergency situations within the Scheduled Premise only.

ROLES AND RESPONSIBILITIES OF CERT

SITE CONTROLLER (SC)

The SC is a senior member of the installation management. He or she 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 SC is unable to leave the Scheduled Premise, he/she may appoint another suitable representative to link up with the Incident Manager at TACT HQ.

The SC shall liaise with the Building Fire Safety Manager (appointed by the National Research Foundation) and provide the necessary Company specific information required for the emergency response.

THE KEY RESPONSIBILITIES OF THE SC INCLUDES:

(a) Coordinate the activities of external emergency organizations and work closely with the SCDF Incident Manager at SCDF's Tactical Headquarter (TACT HQ) during consequence management;
(b) Approve the release of the following information to the TACT HQ:
    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 SCDF Incident Manager with the necessary information and decisions to any actions that concerns the Company SOPs and policies;
(d) Authorise the shutdown of operations in the installation;
(e) Authorise the release of information to the media and government agencies; and
(f) Assist the Site Incident Manager in determining the termination of the emergency and authorizing re-entry upon complete recovery.

SITE INCIDENT CONTROLLER (SIC)

The Company's Site Incident Controller shall be a senior member of the installation supervisory staff. He or she is overall in-charge of the actual ground response operations for emergency occurring within the Scheduled Premise only. 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) Commanding and directing emergency response team;
(e) Informing the Site Controller as soon as evacuation has occurred (**note that this is the case even if only the SIC has evacuated**)
(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 SC and the emergency responders;
(j) Working closely with SCDF ground officer;
(k) Ensuring proper decontamination of the equipment and responders; and
(l) Coordinating recovery activities.

EMERGENCY RESPONSE TEAM (ERT)

The ERT consists of personnel trained in basic emergency response actions such as firefighting, HazMat mitigation and other supporting activities such as security, evacuation, first aid etc.

In the event that the emergency occurs outside the Scheduled Premise and is not caused by any activities associated with the Company operation, the ERT shall have no role in the building level ground response operation.

THE KEY RESPONSIBILITIES OF ERT INCLUDES:

(a) Be familiar with the operation of the fire alarm system and use of first aid, firefighting equipment;
(b) Conduct basic emergency response actions such as firefighting, HazMat mitigation and termination of gas supplies under the command of SIC for emergency occurring within the Scheduled Premise only;
(c) Assist in emergency notification of neighbouring premises and conduct public protective actions under the command of SIC;
(d) Assist SIC / SC to Implementing In-Place protection (IPP) within the workplace under the command of SIC;
(e) First Aid personnel should perform basic first aid on any casualty;
(f) Conduct investigation of gas leak incidents and implement recovery measures approved by the SIC and SC.
(g) In the event that the Lab Manger / Site Incident Controller is unavailable, the ERT shall assume those responsibilities

OTHER APPOINTMENT HOLDERS

FIRE SAFETY MANGER / ASSISTANT FIRE SAFETY MANGER

(To be appointed by the building owner)

THE KEY RESPONSIBILITIES OF FSM / ASSISTANT FSM INCLUDES:

(a) Ensure at all times that fire safety requirements contained in the building's Emergency Response Plan are complied with;
(b) Supervise the maintenance of all fire safety works in the building;
(c) Ensure at all times that the occupant load of any part of any building does not exceed the capacity prescribed under the Fire Code;
(d) Conduct daily checks within the building common area and remove or cause to be removed any fire hazard that is found within the common area;
(e) Prepare an Emergency Response Plan for the premises and conduct fire drills for the occupants annually as may be stipulated in FIRE SAFETY (FIRE SAFETY MANAGERS) REGULATIONS;
(f) Ensure that all occupants are familiar with the means of escape located within the premises;
(g) Co-ordinate and supervise the occupants within the premises in firefighting and in evacuation in the event of fire or other emergencies;
(h) Supervise the operation of the Fire Command Centre in the event of fire or other emergencies;
(i) Notify the SCDF immediately upon the occurrence of any fire or other emergencies and fire related mass casualty incident in the premises.

FIRE WARDENS / ASSISTANT FIRE WARDENS

THE KEY RESPONSIBILITIES OF FIRE WARDENS / ASSISTANT FIRE WARDENS INCLUDES:

(a) During an evacuation, the Fire Warden shall direct all staff to evacuate the facility via the nearest exit stairway;
(b) Check to ensure that there is no one still remaining within the Scheduled Premise before leaving;
(c) Ensure on the smooth and orderly evacuation of all Company employees by guiding them to designated Evacuees Assembly Area (EAA);
(d) Mark attendance at Assembly Area and account for all personnel inside and outside of the hazard risk zone. Report status to Building Fire Safety Manager.
(e) If the Lab Manager is not around or is occupied with emergency response action within the premise, the Fire Warden shall be responsible for delivering the emergency docket containing the staff name list and contact info, MSDS of all chemicals within facility, Emergency Response Plan, chemical list, facility layout plans, and all other documents deemed useful for SCDF to plan its operation. The emergency docket shall be located at a prominent location within the lab at all times.

LAB MANAGER

THE KEY RESPONSIBILITIES OF LAB MANAGER INCLUDES:

(a) Represent CARES in CREATE safety committee;
(b) Be familiar with the Emergency Response Plan and means of escape of the building;
(c) Acquaint any new employee with the Emergency Response Plan including his specific role (if any) during an emergency;
(d) Be familiar with the operation of the fire alarm system and use of first aid, firefighting equipment.
(e) Ensure that all fire-fighting equipment within the Scheduled Premise is maintained.
(f) Maintain the emergency docket and ensure that all documents within are up-to-date;
    a. Maintain updated list of Company Chemical Inventory;
    b. Maintain updated list of all personnel authorised to use the lab, including their contact info for attendance checking
    c. Ensure proper documentation of risk assessments of all chemicals used and experiments performed at the lab by relevant parties
    d. Maintain updated facility layout plan
(g) Develop and implement Chemical Spill Control Measures;
(h) Organise chemical and gas safety and emergency response trainings for all staff; Ensure that all spill kits located within the Scheduled Premise are maintained;
(i) Ensure the proper maintenance of all emergency equipment within the facility;
(j) Ensure periodical maintenance and calibration of all gas detectors within facility;
(k) Ensure periodical maintenance of gas delivery system, including pressure check for coaxial pipings interstitial sheath gas and working conditions of valves in particular solenoid valves;
(l) Ensure periodical maintenance and check of all gas emergency call buttons.

ANNEX G – DETAILED GROUPING AND TASKS

S/NO	GROUPING	GENERAL TASKS	PHASE	DETAILED TASKS	REMARKS
1	Site Controller	Overall In-charge of emergency response operations and liaise with building Site Main Controller and government agencies.	I	- Carry out initial Response & call SCDF / SPF - Notify NEA and/or MOM when required - Summon ambulance if employee is injured - Notify Building Fire Safety Manager of emergency - Activate evacuation	
			II	- Authorise shutdown of equipment	
			III	- Liaise with SCDF and Building Fire Safety Manager for re-entry instruction	
2	Site Incident Controller	Overall In-charge of actual ground response operations.	I	- Activate on-site CERT	The SIC shall be the leader of the CERT
			II	- Supervise evacuation of Company personnel; Supervise on-site emergency response & coordinate operation with SCDF team	
			III	- Supervise on-site cleanup and recovery operation	
3	Emergency Response Team	Responsible for fire fighting, rescue & first aid.	I	- Respond to CERT activation	
			II	- Conduct basic emergency response such as firefighting, Hazmat mitigation, containment & first aid.	
			III	- Perform cleanup operation	
4	Building Fire Safety Manager	Overall In-charge of Evacuation procedure & liaise with SC	I	- Carry out initial Evacuation Procedure	Appointed by building owner
			II	- Liaise with SCDF on emergency response for building	
			III	- Liaise with SCDF on recovery operation for building	

ANNEX H – EMERGENCY SPILL CONTAINMENT PROTOCOLS

Emergency Spill Containment Protocol

1) Don the appropriate Personal Protective Equipment (PPE) before cleaning up any chemical/biological spill. Wear disposable laboratory coat, goggles or face shield, hand gloves, rubber boots and face mask, where appropriate. Note chemical resistivity of hand glove material (neoprene gloves provided) and appropriateness of face mask to protect against respiratory hazard. Respirator shall not be used unless the user has been fit tested. Refer to MSDS for spilled chemical when in doubt.

2) If the spill generates flammable vapor, take precautions to avoid spark generation such as switching on/off or unplugging of any electrical equipment nearby.

3) If appliances with hot surfaces such as hot plates and heating mantle are near to the spill, turn off the main electricity supply to the benches.

4) Transfer any leaking and damaged containers to oversized containment bucket for eventual disposal by licensed toxic industrial waste collector.

5) Contain spill using adsorbent booms. Soak up spill using adsorbent pads. Use tongs when performing the process.

6) Place all contaminated adsorbent materials in enclosed containers for eventual disposal by licensed toxic industrial waste collector. Clearly label all filled containers accordingly.

7) Upon completion of the decontamination operation, clean up the affected area (using chemical disinfectant for biological spill) and thoroughly wash yourself clean of all chemical traces. Place the contaminated PPE in a plastic bag for disposal by licensed toxic industrial waste collector.

8) If the scale of the spill is beyond your control, close the lab door, lab the spill area with warning signs and evacuate the lab immediately. Activate the fire alarm and describe the spill situation to security, fire warden, fire safety manager as well as SCDF ground commander at the Assembly Area upon their arrival.

9) For spill of common acids, cover the contaminated areas with large excess of solid acid spill neutralizer. (Do this carefully as the process may be exothermic!) Transfer the mixture carefully in small portions into a large container of excess water. Retain the container of water for disposal by licensed toxic waste collector.

10) For spill of common bases, cover the contaminated areas with large excess of solid base spill neutralizer. (Do this carefully as the process may be exothermic!) Transfer the mixture carefully in small portions into a large container of excess

water. Retain the container of water for disposal by licensed toxic waste collector.

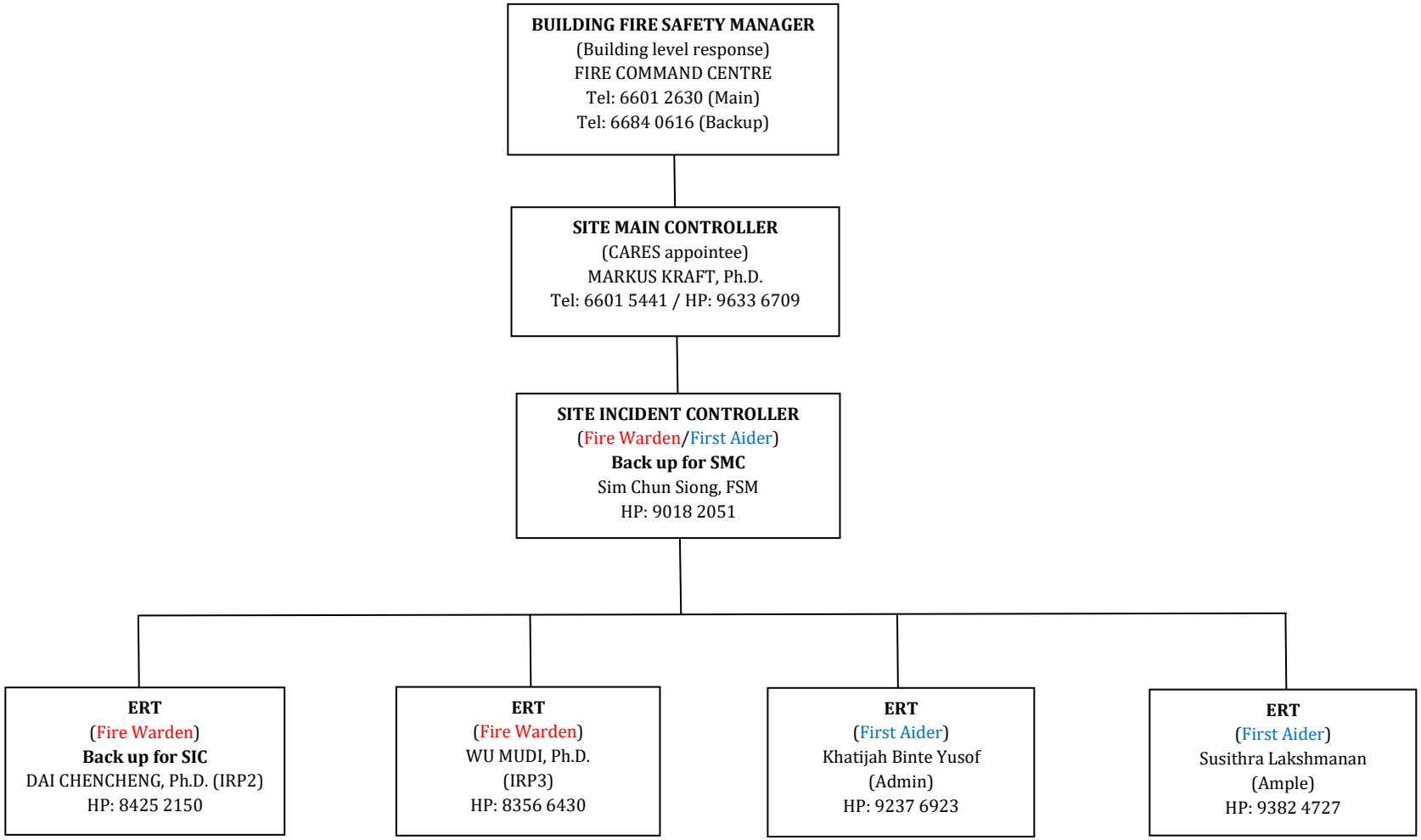
CHEMICAL SPILL KIT CONTENTS:

- 1 roll 3M Folded Chemical Sorbent
- 1 pc of DU PONT Disposable Tyvek Coverall
- 1 pc of AOSAFETY Safety Chemical Goggle
- 1 set of 3M Half Mask Respiratory w/Cartridges
- 1 pair of ANSELL Chemical Gloves
- 1 pair of WAYNE Chemical Resistant PVC Boots
- 1 Disposable Bag & Cable Ties
- 1 Plastic Container with Handle

BIOLOGIAL SPILL KIT CONTENTS:

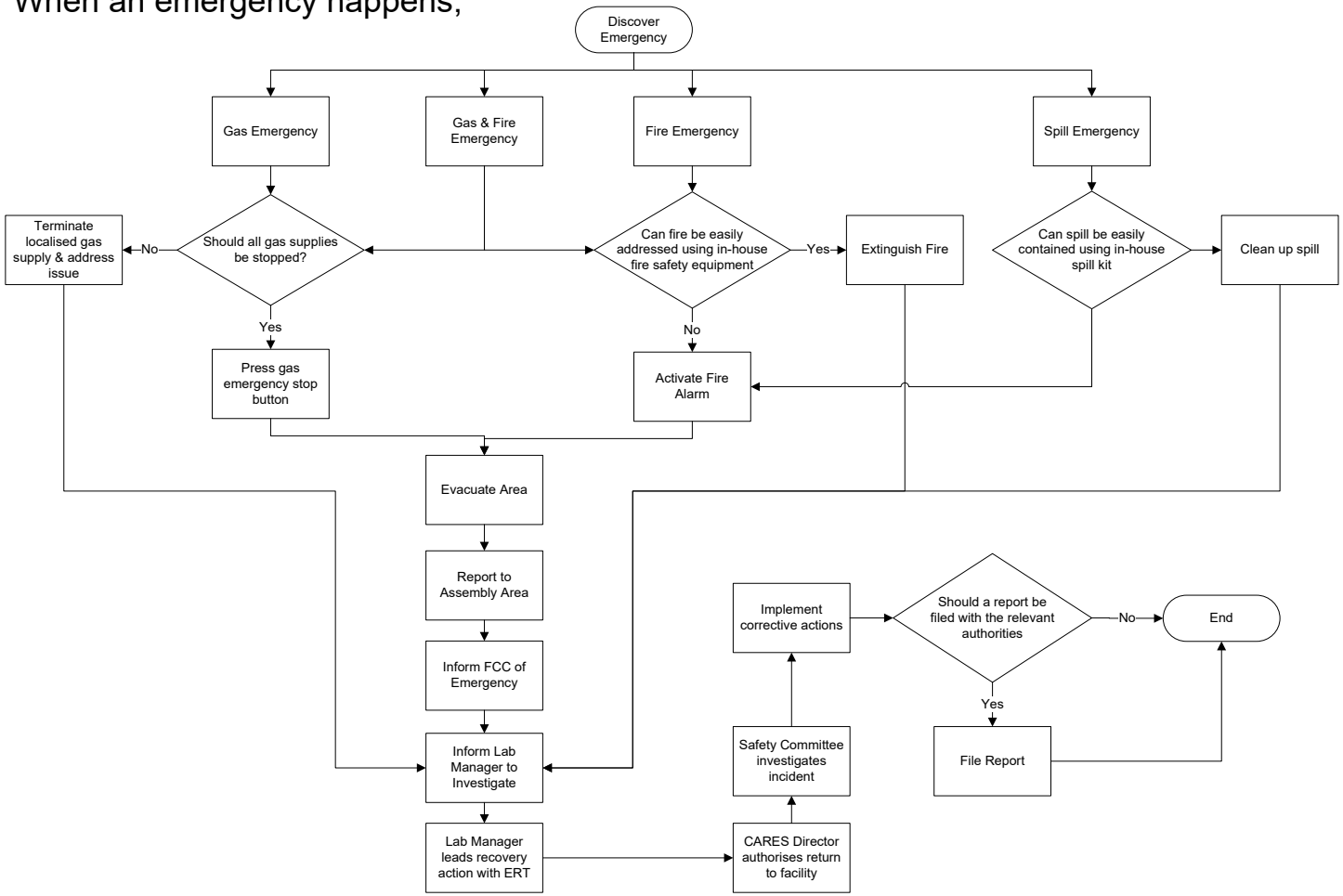
- The contents of the chemical spill kit shall be used during a biological spill emergency too. In addition, one of the following appropriate disinfectant will be used.
- Bleach (final 10% sodium hypochlorite) / 70% (v/v) ethanol

ANNEX I – CERT STRUCTURE
(1 SMC, 1 SIC and at least 4 ERT members)



ANNEX J – EMERGENCY RESPONSE FLOWCHART

When an emergency happens,



When one hears an alarm,