

**STANDARD OPERATING PROCEDURE (SOP)
FOR
EMERGENCY REPOSSES FOR JOHN O' BRIEN
NANOFABRICATION FACILITY (BASEMENT) & HPM
(1ST FLOOR)**



USC University of
Southern California

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Table of Contents

1	OUTLINE OF FACILITY	1
2	LAB DESIGN	2
3	EMERGENCY RESPONSE	3
4	BUILDING ALARMS	4
5	CLEANROOM RESPONSE MATRIX	5
	Appendix 1	6
	- MAP OF HPM (FIRST FLOOR)	
	- MAP OF CLEANROOM (BASEMENT)	
	- TGM VIEW PANEL (1 ST FLOOR)	
	- TGM VIEW PANEL (BASEMENT)	
	- EMERGENCY EGRESS MAP FOR THE CLEANROOM	
	- EMERGENCY PHONE FOR THE CLEANROOM	
	- Designated Safe Area – Emergency Assembly point (EAP)	
	Appendix 2	13
	- Gas Inventory in HPM (First Floor) & Cleanroom (Basement)	
	- Gas Matrix	
	Appendix 3	15
	- Toxic Gas Lab Alarm Response Protocols	
	Appendix 4	18
	- EH&S SOP for Toxic Gases	
	Appendix 5	24
	- EH&S 24/7 On-Call Notification Flow Chart	
	APPENDIX 6	25
	- DPS Toxic Gas Alarms Procedures	

1 OUTLINE OF FACILITY

John O' Brien Cleanroom and HPM is located in Basement and 1st floor of MCB. HPM is located in the first floor

- 1] Hazardous Production Material (HPM) (rooms 112B, 112C): hazardous gases include 2% Silane, Silicon Tetrachloride, Ammonia, Boron Trichloride, Chlorine. Gases from HPM are delivered to the cleanroom located in the basement through gas pipes. The VMBs and other non-toxic gases are stored in the basement (Ar, He, Fluorocarbons).
- 2] Chemical/Liquid Room: Chemicals are stored in Corrosive Liquid Room (112A) and Flammable Liquid Room (112D)
- 3] Equipment rooms: Contain physical hazards related to electrical equipment, Emergency generators, UPS, Acid Neutralization and RO water filters.
- 4] Offices and other minimal-hazard areas.

Appendix 1 provides a map of the MCB Basement and HPM.

Laboratory Information

Room	Gases of Concern	Contact	Office	Email
112B (Flammable)	Ammonia, Methane, Silicon Tetrachloride, 2% Hydrogen in Nitrogen, 4% H2 in N2	Shiva Bhaskaran Donghai Zhu Jivin Seward	213-821-2374 213-740-1065 213-821-9849	sb86922@usc.edu donghaiz@usc.edu jseward@usc.edu
112C (Corrosive)	Boron Trichloride, Chlorine, 2% Silane, Nitrous Oxide, Oxygen, 20% O2 in N2	Shiva Bhaskaran Donghai Zhu Jivin Seward	213-821-2374 213-740-1065 213-821-9849	sb86922@usc.edu donghaiz@usc.edu jseward@usc.edu
LL103N (Inert and Fluro Carbon)	Sulphur Hexa Fluoride, CF4, Helium, C4F8, CHF3, Ar	Shiva Bhaskaran Donghai Zhu	213-821-2374 213-740-1065	sb86922@usc.edu donghaiz@usc.edu

Room	Chemicals/Liquids	Contact	Office	Email
112A (Corrosive, Solvent)	Acetone, Isopropyl Alcohol, Methyl Alcohol, R-methyl-pyrrolidone, Anisole, Xylenes, Methyl isobutyl Ketone	Shiva Donghai Jivin	213-821-2374 213-740-1065 213-821-9849	sb86922@usc.edu donghaiz@usc.edu jseward@usc.edu
112C (Flammable, Acid)	Acetic Acid, Hydrochloric Acid, Hydrofluoric Acid, Phosphoric Acid, Nitric Acid, Sulfuric Acid, Buffered Oxide Etch, Ammonium Hydroxide, Sodium Hydroxide, MF-319 Developer, Hydrogen Peroxide	Shiva Bhaskaran Donghai Zhu Jivin Seward	213-821-2374 213-740-1065 213-821-9849	sb86922@usc.edu donghaiz@usc.edu jseward@usc.edu
112C (Flammable)	Carboy pump out station – Solvent waste collection	Shiva Donghai Jivin	213-821-2374 213-740-1065 213-821-9849	sb86922@usc.edu donghaiz@usc.edu jseward@usc.edu

The labs were designed to ensure the safety of lab and building personnel when toxic gases are utilized. The Toxic Gas Monitoring System (TGMS) is the primary control center and coordinator of infrastructure in the labs. The TGMS has been programmed to detect certain conditions (including but not limited to gas releases, loss of exhaust, and loss of power) and determine the appropriate response (shut down, alert, warning, etc.).

The gases used are kept in a closed system (meaning they never flow into an open space but are kept in piping or cylinders throughout their path). Four sections make up the closed loop for the gas flow:

- 1] Gas Cabinets: The gas cylinders are stored in gas cabinets. The gas cabinet controls are located on top of each cabinet. The gas cabinets are exhausted to the scrubbers. In case of emergency, the TGMS will issue a command to the cabinets to shut off the flow of gas.
- 2] Valve Manifold Boxes (VMBs): The gases are then piped from the gas cabinets into VMBs which are used to direct and control the flow of gas. Each VMB is monitored by a gas detector and will be shut down by the TGMS in an emergency.
- 3] User Equipment Piping: From the VMBs, the gases are supplied to the equipment in the cleanroom. The user equipment is hooked up to these pipes. Each equipment that is supplied with gas is also monitored by a gas detector.
- 4] Exhaust Piping: The exhaust from the equipment and vacuum pump have dedicated exhaust pipe. The exhaust pipe leads to the scrubbing system, which removes nearly all of the toxic gases from the exhaust air and exhausts through the system on the roof of MCB.

Toxic Gas Monitoring System

The Honeywell Toxic Gas Monitoring System (TGMS) is centered on a computer situated in room MCB 110. This computer receives input from all the sensors detailed below, and outputs to:

- Visible and audible building alarms.
- Annunciator panels in room next to MCB Loading Dock (114B).
- The Department of Public Safety (DPS) 24 hour monitored annunciator system.
- Selected Viterbi/Dornsife and EH&S staff via automatically-sent emails.

Hazardous Gas Sensors

Honeywell "Midas" gas detectors of four types are used, namely *Hydrogen (Hydrogen, Methane) hydride (silane)*, *Amine(ammonia)*, and *Halogen (Chlorine) Mineral Acid (Boron Trichloride, Silicon Tetrachloride)*. Detectors of the appropriate type(s) are situated as follows:

- On the exhaust outlet of each cylinder cabinet.
- On the exhaust outlet of each valve/manifold cabinet.
- On the exhaust outlet of the hazardous gas scrubber system which services the vacuum pumps.
- On back of the tool (gas connections)- hanging next to the tool as ambient sensor

3 EMERGENCY RESPONSE	
Gas Leak, Toxic spills	<ul style="list-style-type: none"> • Pull the Blue Pull station • Evacuate the building and meet at Emergency Assembly point
Emergency Eyewash	<ul style="list-style-type: none"> • The eyewash is located in the Base and Acid wetbenches. • If any chemicals get into your eye, wash your eye for 15 minutes and seek medical attention immediately. • Report incident to DPS & EH&S • Seek medical attention immediately • Escort the user to the Medical Facility
Safety Shower	<ul style="list-style-type: none"> • Any chemical exposure to any part of your body should be handled immediately by using the safety shower • Any chemical exposure to any part of your body should be handled immediately by using the safety shower • When spills like this occur, get help from other users and ask them to use the emergency phones to contact the DPS and also report the incident to EH&S. • Seek medical attention immediately.
Life-Threatening Emergency	<ul style="list-style-type: none"> • Press the Panic Button (If you are wearing one) • Go to the Emergency phone and speak loudly about your situation • Call 911 immediately
Building and Facility Equipment Emergency	<ul style="list-style-type: none"> • Call Cleanroom Staff Immediately • After Hours call DPS/FMS • Which equipment? How to respond?
Power outage	<ul style="list-style-type: none"> • Emergency lights should be on in 5-10 sec • Stop the process and evacuate the building safely (use the staircase)
Chemical Spill	<ul style="list-style-type: none"> • Small spill – follow the procedure as described in the training (use proper protective equipment) • Large Spill – if you are not comfortable in containing the spill, then call the Cleanroom staff. After hours call EH&S • Please review Chemical SOP and EH&S for spills https://ehs.usc.edu/hazmat/spill-cleanup/
Odor in the lab	<ul style="list-style-type: none"> • Leave the area immediately and warn other users in the cleanroom • Notify Staff • After hours call EH&S
Earthquake	<ul style="list-style-type: none"> • Take cover and wait for the shaking to stop. • Stop the process, Press Emergency Button the tool that you are using. • Dispose or contain the chemical safely or secure it in secondary containment • Use the staircase to evacuate the building and meet at Emergency Assembly Point

For any Non-Life-Threatening injury, please follow instructions at,
<https://ehs.usc.edu/occhealth/non-life-threatening-workplace-injury-or-illness/>

4 BUILDING ALARMS

If the siren or strobe light is activated, users should evacuate the facility immediately (see the exits signs on the layout). After you reach the designated safe area, you can remove your gowns and throw them out.

Fire Alarm:

Fire alarm system is a fire protection system that is composed of

- Alarm initiating units which are smoke detectors, heat sensors
- Alarm notification system – that produce loud noise such as sirens, strobe/horns
- Fire Control units which are sprinkler, fire extinguisher

The fire alarm system can be triggered automatically when smoke detectors or sensors detect certain level of heat or smoke which will cause the strobe to flash and very loud pulsing sound.

In the event of Fire Alarm activation, users should evacuate the facility immediately (see the exits signs on the layout). After you reach the designated safe area, you can remove your gowns and throw them out.

Fire Alarm strobes located in the throughout the basement (including cleanroom) and in the Michelson Convergent Bioscience (MCB) and adjacent Ray Irani building. The strobe is a rectangular, clear light mounted on a bright red frame.

Toxic Gas Alarm:

Toxic gas alarm is located in the cleanroom and throughout the basement. The strobe blue color and rectangular shaped. There are two levels of alarm

Level1 – Low Alarm, this is due to gas leak from the enclosed area like gas pod, equipment and Valve Manifold Box (VMBs). All cleanroom users have to be evacuated and reach the designated safe area.

Level2- High Alarm, this is due to toxic gas leak might not be enclosed area. This will activate the white strobes as well as blue strobes, which all the building occupant has to be evacuated and reach the designated safe area

TGMS do monitor heat sensor, exhaust flow, air conditioner, to ensure safety of occupants in the lab and the building.

Oxygen depletion alarm:

Oxygen depletion alarm located in the enclosed area where nitrogen is used, especially when Liquid Nitrogen is used to fill the dewar and also Nitrogen gas is used to fill the Ultra-pure tank in RO/DI water room (LL193). O2 depletion sensor is located throughout the basement where N2 is used.

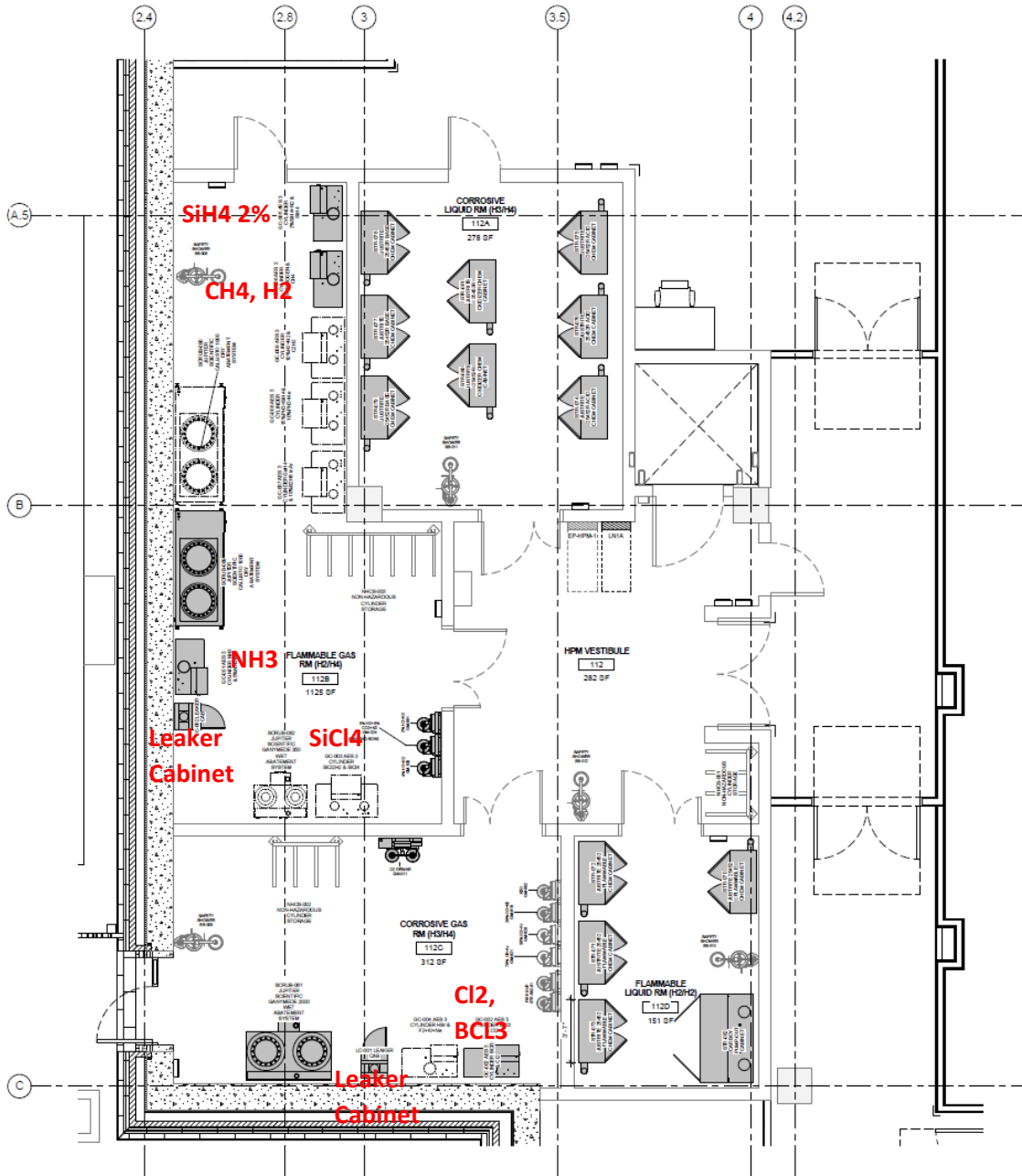
This O2 depletion alarm is tied up to TGM system, any alarm the all the basement occupant is evacuated.

5 CLEANROOM RESPONSE MATRIX

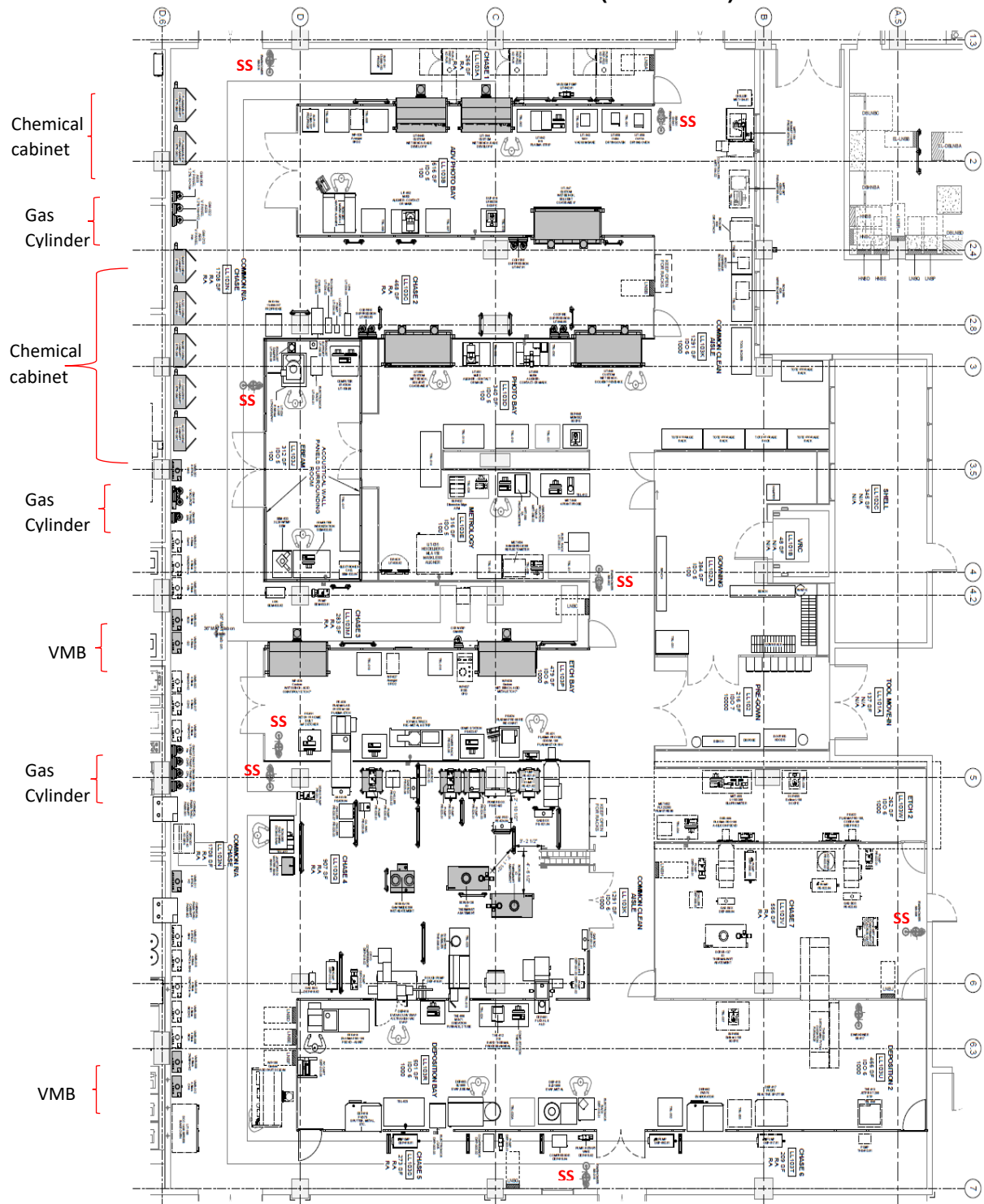
	MCB Building Occupant	Cleanroom & HPM Users
Toxic Gas Low Alarm	No	Evacuate
Toxic Gas High Alarm	Evacuate	Evacuate
Building Fire Alarm Activation	Evacuate	Evacuate
UV/IR Fire Detector (Wet Benches, VMBs, Gas Cabinet at HPM))	Evacuate	Evacuate
Early Warning Smoke Detection (Alert, Action)	No	No *
Early Warning Smoke Detection (Fire1, Fire2)	Evacuate	Evacuate
Fire/Smoke Detected HPM and Basement	Evacuate	Evacuate
Haz Mat Manual Station (Blue)	No	Evacuate
Oxygen Alarm (Low Level)	No	Evacuate (Local area, Room)
Oxygen Alarm (High Level)	No	Evacuate
Loss of Exhaust	No	Evacuate
Solvent Bench Suppression System (Wet Bench)	Evacuate	Evacuate
Seismic Event		Turn off the equipment, secure the Chemicals (see Sec 3. Emergency Response)

*Early Warning Smoke Detection – If you see any smoke, fumes or vapors on the wetbenches on the equipment/tools, please alert users in the cleanroom to evacuate immediately.

**APPENDIX 1
MAP OF HPM (FIRST FLOOR)**

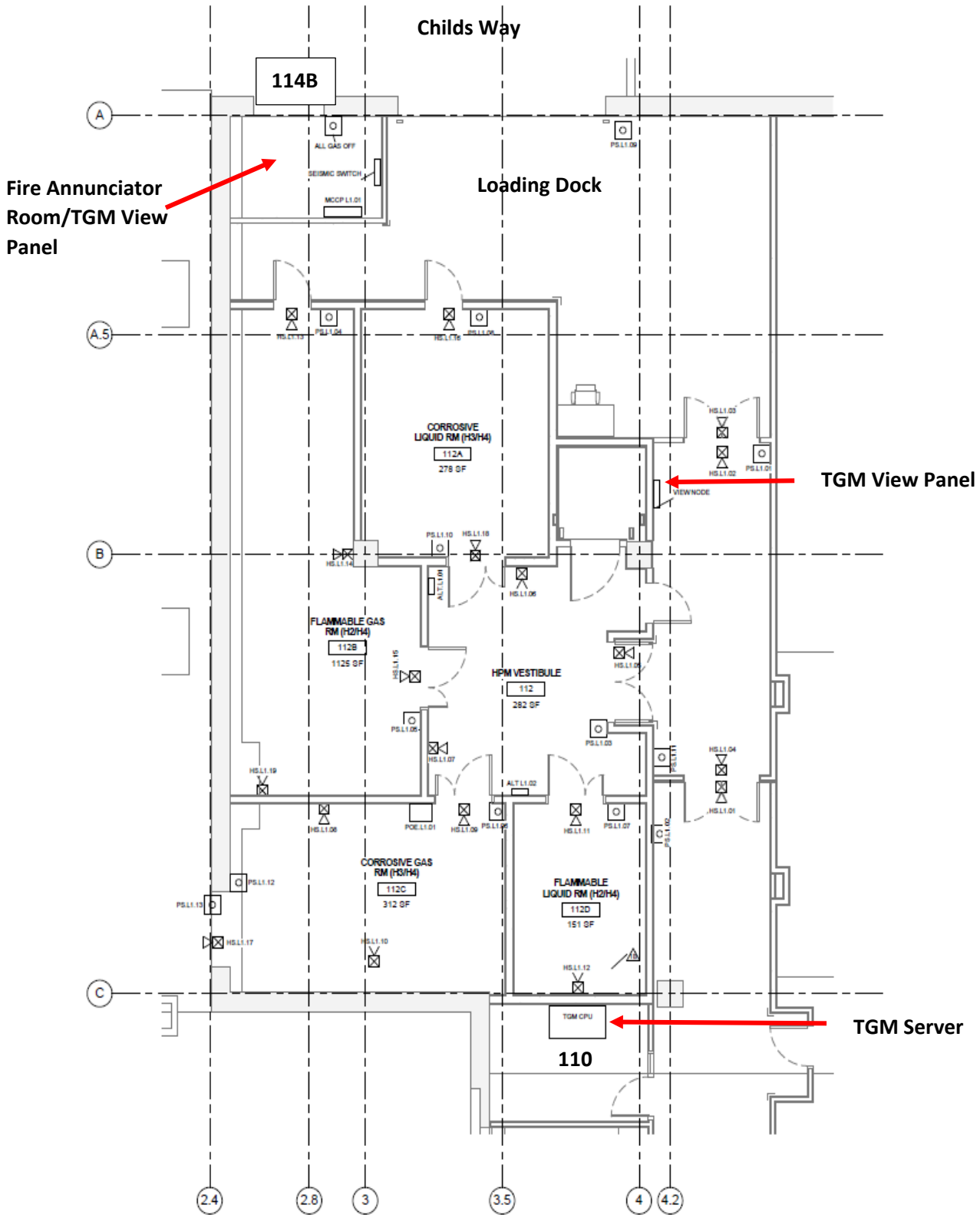


MAP OF CLEANROOM (BASEMENT)

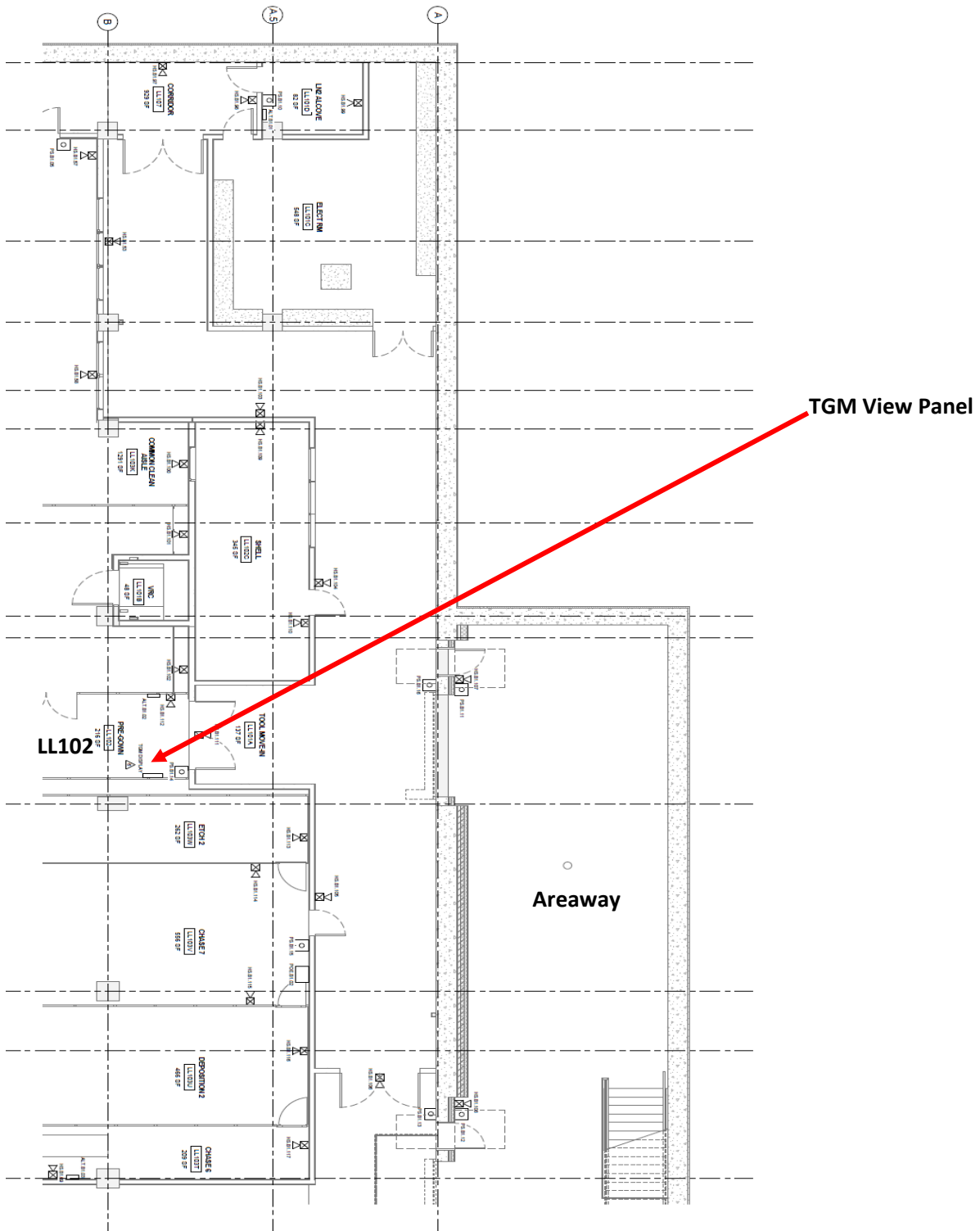


SS – Safety Shower

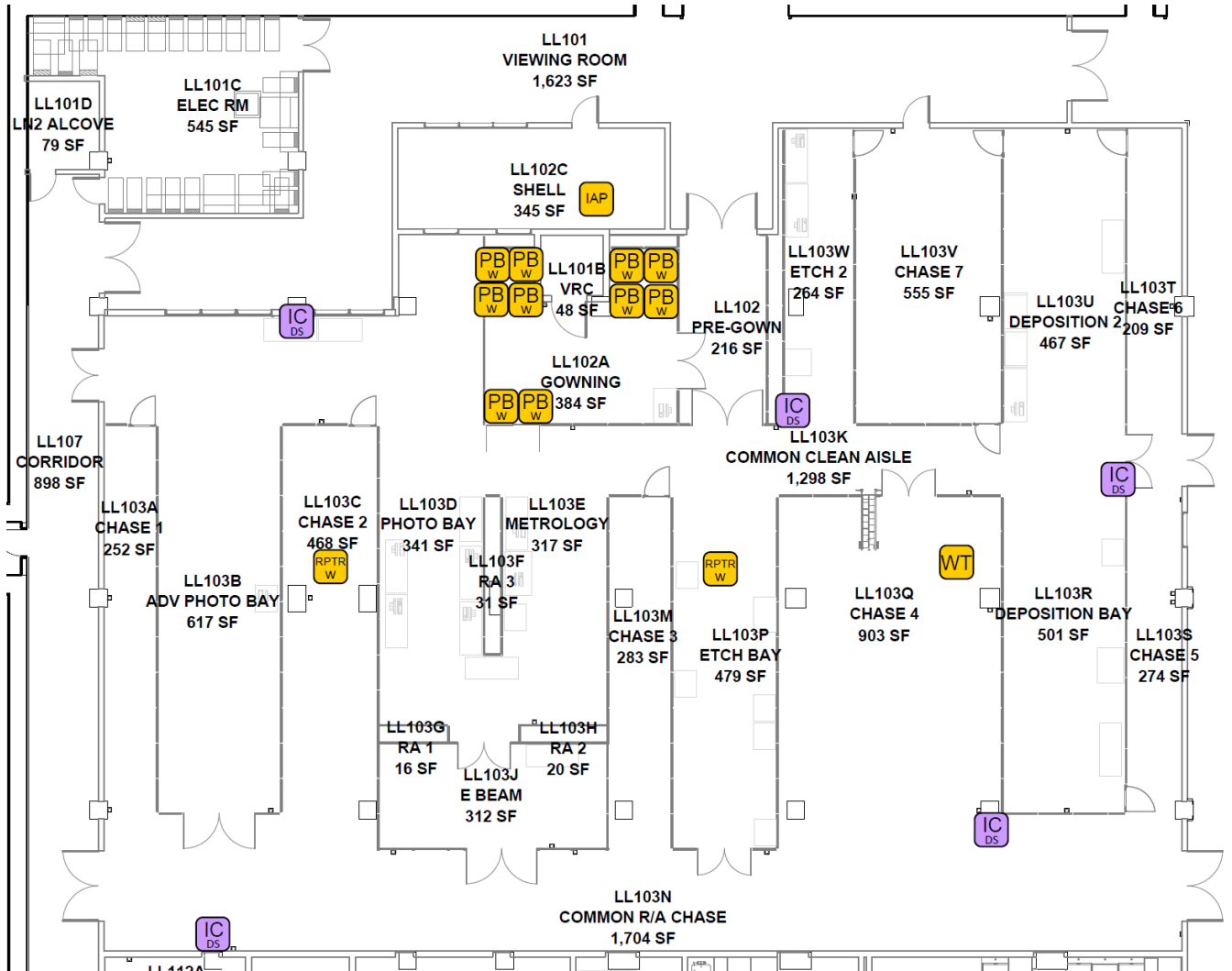
TGM View Panel (1st Floor)



TGM View Panel (Basement)



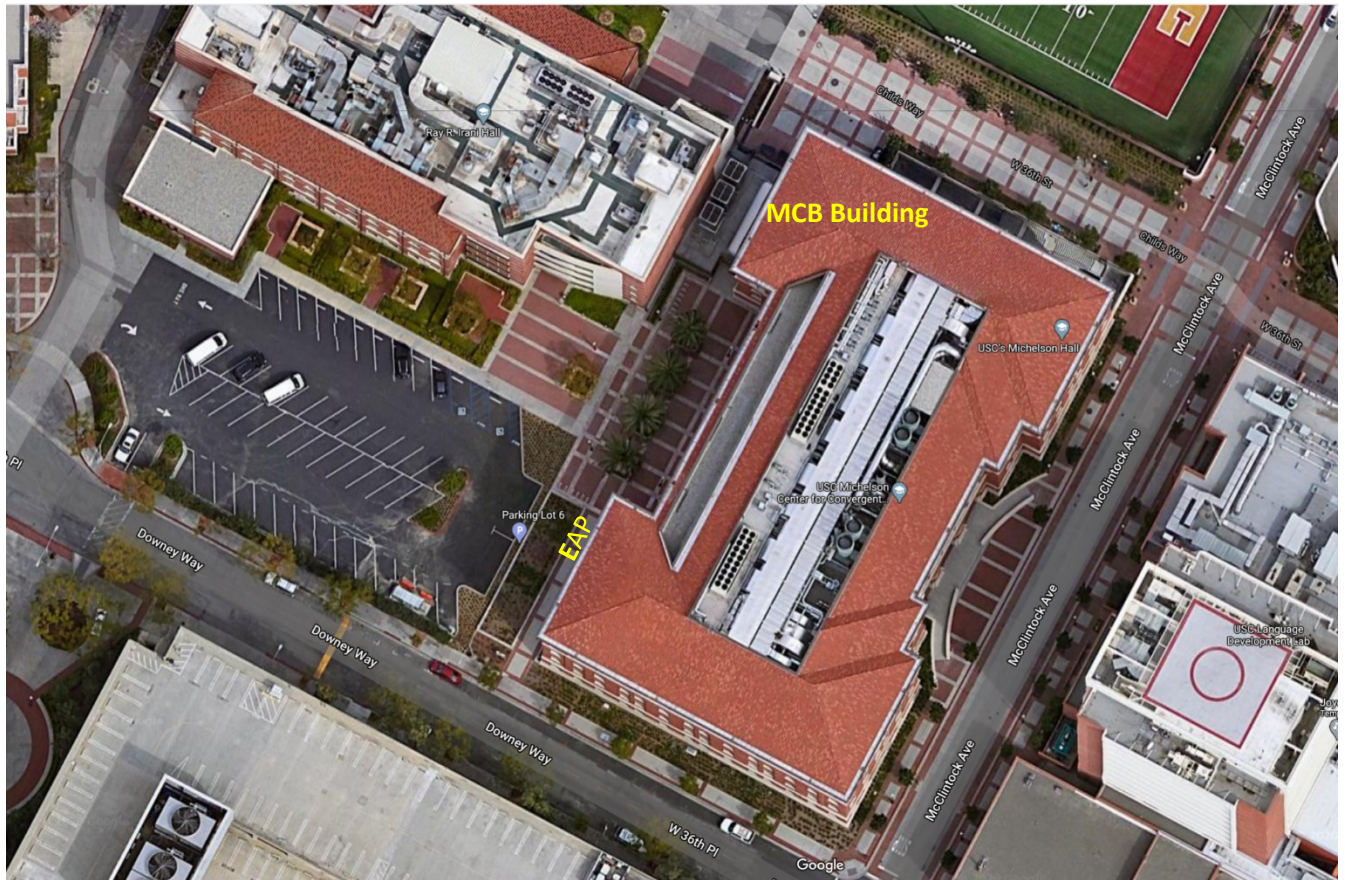
Emergency Phone for the Cleanroom



IC_{DS} – Emergency Phone

PB_w – Panic Button

Designated Safe Area – Emergency Assembly point (EAP)



Appendix 2

Gas Inventory in HPM (First Floor) & Cleanroom (Basement)

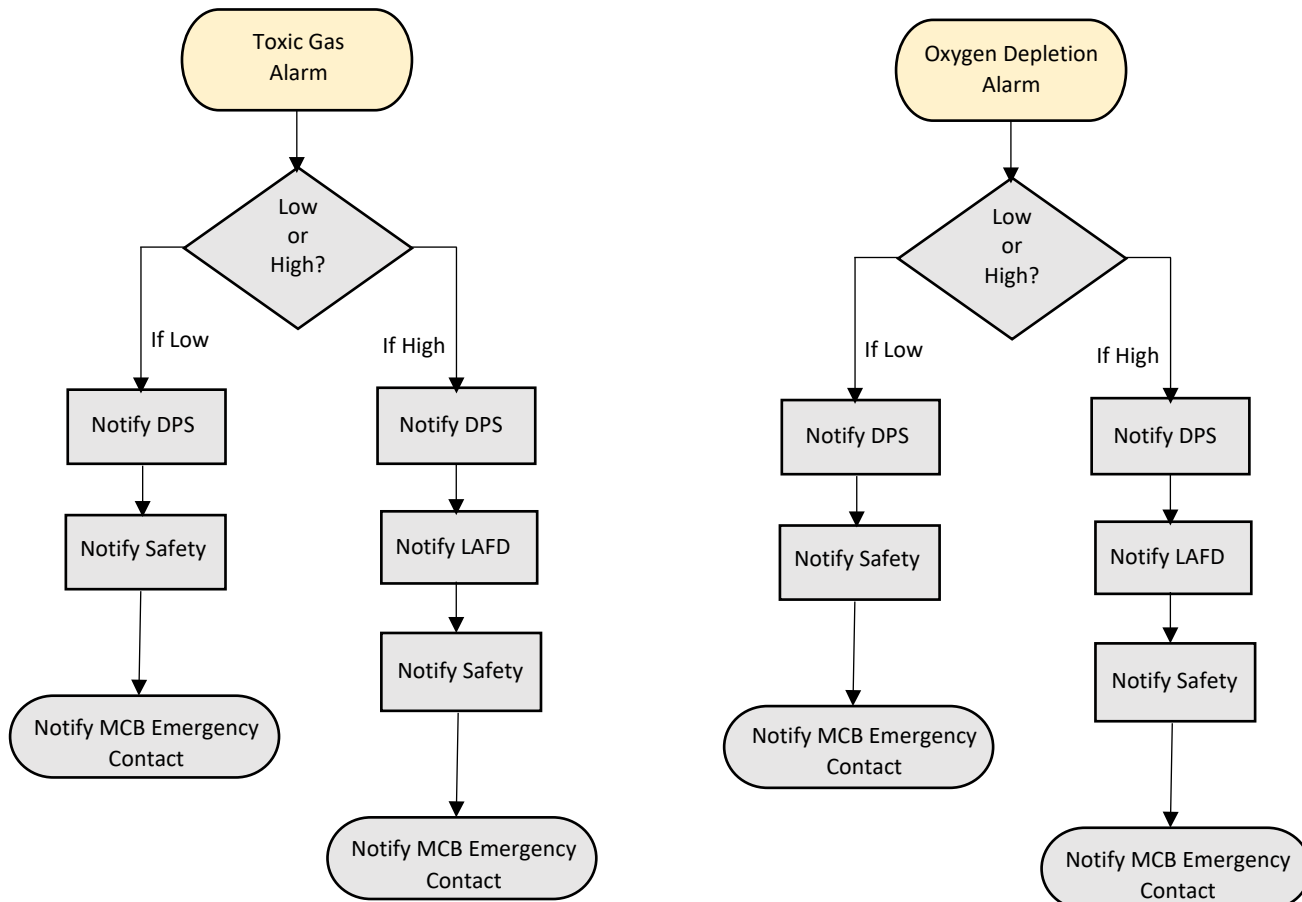
Inventory ID	Name	Purity	Purity	Quantity in Stock	SIZE	HPM 112B	HPM 112C	Cleanroom Common Chase LL103N	Spare
H2	Hydrogen	SEMI	99.9999%	1	284cft	1			
N2	Nitrogen	Research	99.9999%	2	304	7	1		
O2	Oxygen	Research	99.999%	2	337		2		
Ar	Argon	Research	99.9999%	2	335			2	
He	Helium	Research	99.9999%	2	335			1	
CF4	TETRAFLUOROMETHANE, CARBON TETRAFLUORIDE (HALOCARBON-14)	SEMI	99.999000%	1	70lbs			1	
C4F8	OCTAFLUOROCYCLOBUTANE (HALOCARBON-C318)	SEMI	99.999000%	1	110lbs			1	
SF6	SULFUR HEXAFLUORIDE	SEMI	99.999000%	1	150A			1	
CHF3	TRIFLUOROMETHANE, FLUOROFORM (HALOCARBON-23)	SEMI		1	200			1	
Cl2	CHLORINE	VLSI		1			1		
BCL3	BORON TRICHLORIDE	SEMI		1	110lbs		1		
CH4	Methane	Research	99.999000%	1	300				
NH3	Ammonia	SEMI	99.999940%	1	50lbs	1			
N2O	NITROUS OXIDE	ELEC	99.999600%	1	200		1		
SiCl4	Silicon Tetrachloride	SEMI	99.980000%	1	120lbs		1		
2% H2 balance N2	Hydrogen 2% in Nitrogen	HP		1	200	1	1		
20% O2 in N2	Oxygen 20% in Nitrogen	HP		1	200		1		
SiH4/N2	SILANE-2%/NITROGEN	HP		1	200	1			
CO2					300		1		
5%H2,5%CO2/N2	5%H2,5%CO2/N2	HP			300				
4%H2,N2	4%H2,N2	HP			300				

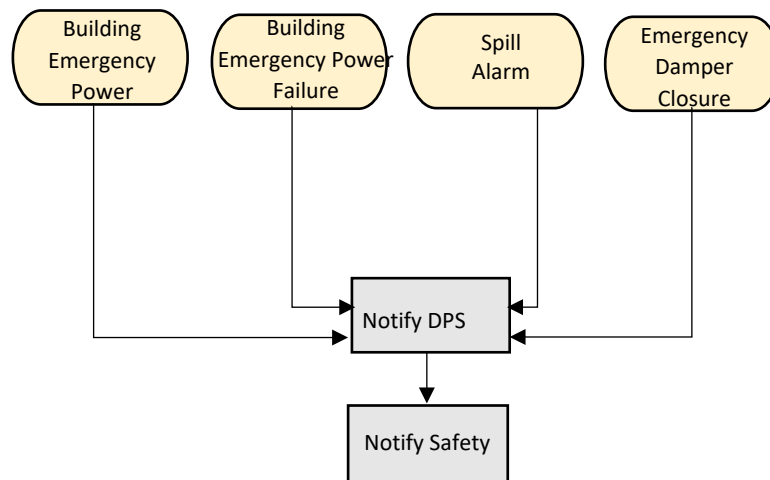
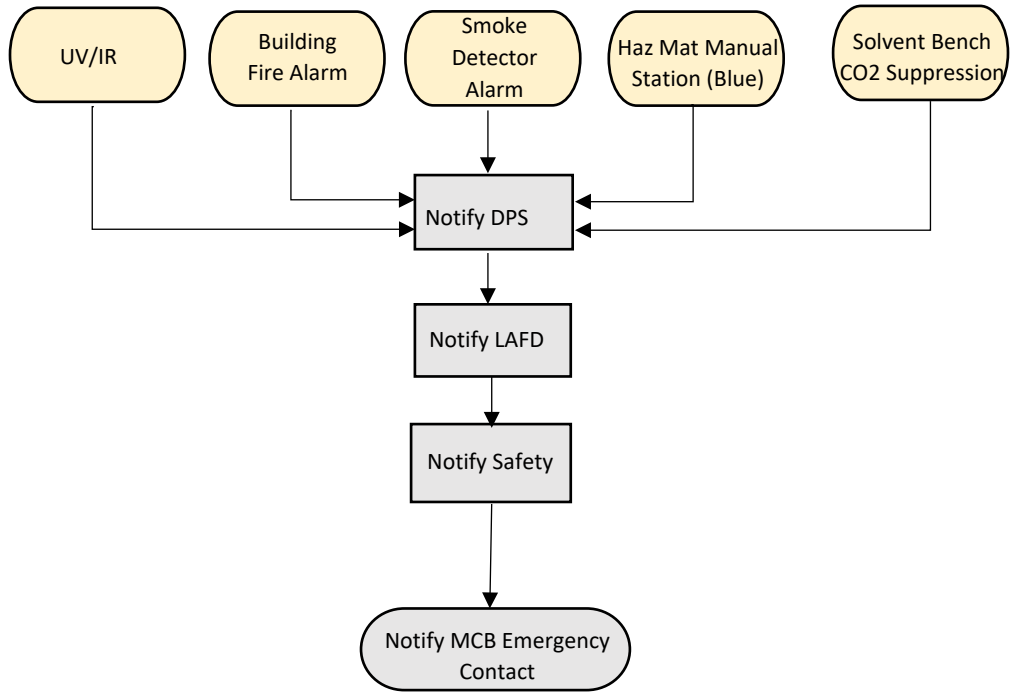
GAS MATRIX

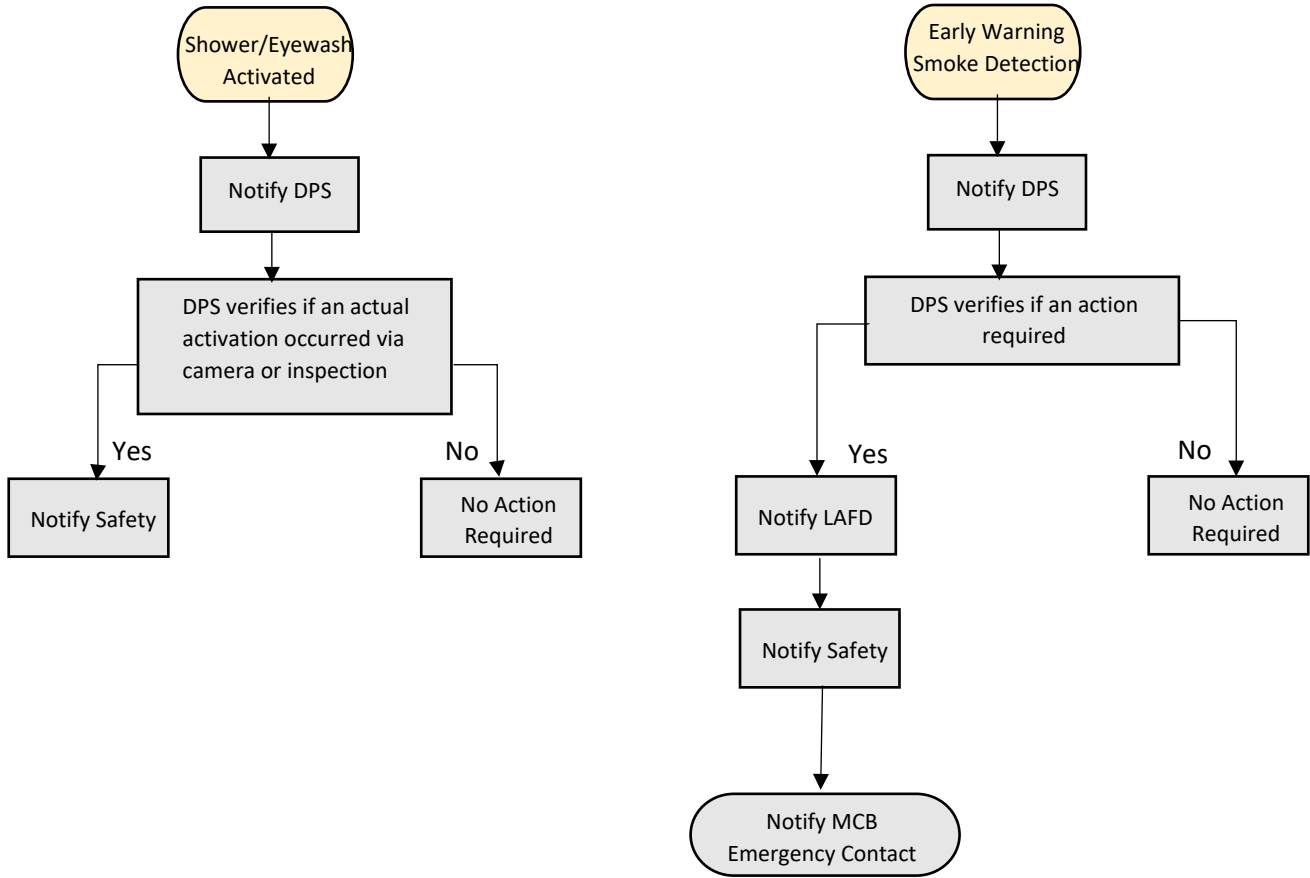
Area#	Gas Cab ID	Gas Type	Scrubber ID	Scrubber Location	VMB ID	VMB Location	Tool ID	Tool Name	Tool Location	Tool Scrubber ID	Tool Scrubber Location
112B	GC-001	NH3	SCRUB-089	112B	VMB-001	LL103N	DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-99	LL103Q
112C	GC-002	BCl3	SCRUB-081	112C	VMB-003	LL103N	PE-021.04	PLASMA ETCH III-V	LL103P	SCRUB-136	LL103Q
112C	GC-002	Cl2	SCRUB-081	112C	VMB-004	LL103N	PE-021.04	PLASMA ETCH III-V	LL103P	SCRUB-136	LL103Q
112B	GC-003	SiCl4	SCRUB-082	112B	VMB-006	LL103N	PE-021.04	PLASMA ETCH III-V	LL103P	SCRUB-136	LL103Q
112B	GC-005	2%SiH4 in N2			VMB-009	LL103N	DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-99	LL103Q
112B	GC-006	CH4			VMB-012	LL103N	PE-021.04	PLASMA ETCH III-V	LL103P	SCRUB-136	LL103Q
112B	GC-006	H2			VMB-001	LL103N	PE-021.04	PLASMA ETCH III-V	LL103P	SCRUB-136	LL103Q
112BC	LC-001	Leaker Cabinet	SCRUB-081	112C							
112B	LC-002	Leaker Cabinet	SCRUB-089	112B							
112B		2%H2 in N2					THE-012	RTP	LL103R		
112C	GM-002	N2O					DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-99	LL103Q
LL103N	GM-003	SF6					PE-024.04	RIE-OX/NIT,GAS POD	LL103Q	SCRUB-129	LL103Q
							PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
							PE-021.04	PLASMA ETCH III-V, GAS POD	LL103Q	SCRUB-136	LL103Q
LL103N	GM-008	CF4					LIT-042	PLASMA STRIP	LL103B		
							DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-99	LL103Q
							PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
LL103N	GM-009	C4F8					PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
112C	GM-011	Oxygen					DEP-018	UHP, EVAP	LL103R		
							THE-006	OXIDATION FURNACE	LL103R		
							PE-024.04	RIE-OX/NIT,GAS POD	LL103Q	SCRUB-129	LL103Q
							LIT-042	PLASMA STRIP	LL103B		
							DEP-016	SPUTTER METAL	LL103R		
							PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
							PE-021.04	PLASMA ETCH III-V, GAS POD	LL103Q	SCRUB-136	LL103Q
LL103N	GM-012	He					DEP-010	PECVD, OX/NIT	LL103R	SCRUB-99	LL103Q
							PE-020	PLASMA ETCH, BACK OF MAIN TOOL	LL103Q	SCRUB-129	LL103Q
							PE-021.04	PLASMA ETCH III-V, BACK OF MAIN TOOL	LL103Q	SCRUB-136	LL103Q
							DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-136	LL103Q
LL103N	GM-015	CHF3					PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
							PE-024.04	RIE-OX/NIT,GAS POD	LL103Q	SCRUB-129	LL103Q
LL103N	GM-016	Argon					DEP-018	UHP, EVAP	LL103R		
							DEP-016	SPUTTER METAL	LL103R		
							LIT-042	PLASMA STRIP	LL103B		
							DEP-003	EVAP, THERMAL EBEAM	LL103R		
							PE-020.04	PLASMA ETCH, GAS POD	LL103Q	SCRUB-129	LL103Q
							PE-021.04	PLASMA ETCH III-V, GAS POD	LL103Q	SCRUB-136	LL103Q
							PE-024.04	RIE-OX/NIT,GAS POD	LL103Q	SCRUB-129	LL103Q
							DEP-010.02	PECVD-OX/NIT, GAS BOX	LL103Q	SCRUB-136	LL103Q
112C	GM-019	20%O2 + N2					DEP-003	EVAP, THERMAL EBEAM	LL103R		

Appendix 3

Toxic Gas Lab Alarm Response Protocols







Appendix 4: EH&S SOP for Toxic Gases

Purpose

The following Standard Operating Procedure (SOP) has been developed to provide guidance outlined in 29 CFR 1910.120(q) and minimize the severity of damage to human health, environment and property in the event of an unexpected **toxic gas** release or in the event of and environmental alarm activation at MCB.

The response SOP should be used as a roadmap to confine and limit the release if such actions can be taken without risk of injury or contamination. USC EHS has documented policies and procedures in place which, as far as possible, cover both smaller and more significant events.

Scope

The Emergency Response SOP pertains to any hazardous material incidents in MCB. This shall also include any confirmed fire, suspected contamination and serious injuries and/or death as a direct result of a hazardous material incident.

This Standard Operating Procedure addresses response procedures for the release of toxic gases. Besides being a gas emergency, they are also a chemical emergency with its unique properties (gases can be flammable, toxic and corrosive).

Personnel who might be required to deal with such events should receive adequate information, instruction and training on assessing the extent of any spill/accidental release, the clean-up measures to be taken, and the PPE which should be worn, as well as guidance on the safe disposal of any waste collected during the clean-up.

Emergency responders, regardless of their discipline and organizational affiliation, should be trained to perform their expected tasks. This SOP pertains to all response personnel in USC office of Environmental Health and Safety organization.

Definitions

These definitions are pertinent to this SOP

Emergency – An emergency is any actual or potential release of a hazardous material that CANNOT be stopped by closing the product’s cylinder or container valve.

Compressed gas - Compressed gas is any material that, when enclosed in a container, has an absolute pressure of more than 40 psi at 70 F, or an absolute pressure exceeding 104 psi

at 130 F, or both. Compressed gases may be pressurized, liquefied or in a cryogenic state. High pressure gases are generally above 1000 psig

Toxic Gas- A compressed gas that has a LC50 in air of less than or equal to 5,000 parts per million (ppm) but greater than 200 ppm, for a one-hour exposure. National regulations may have additional classification

Gas Cabinet - Safe handling, storage and delivery of hazardous gases.

IC- Incident Commander - The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident scene. This term is equivalent to the on-scene incident commander.

Hot Zone - Also referred to as the exclusion zone in some jurisdictions. The hot zone is usually set up in the immediate area surrounding the spilled material or incident scene. Access to the hot zone should be controlled for accountability purposes as well as contamination control purposes.

Warm Zone -Also referred to as the contamination reduction zone, the warm zone is usually established around the hot zone to provide a buffer between the hot and cold zones. Decontamination often takes place in the warm zone.

Control Zones - The areas at a hazardous materials incident that are designated based upon safety and the degree of hazard. Many terms are used to describe the zones involved in a hazardous materials incident. For the purposes of this document, these zones are defined as the hot, warm and cold zones.

Decontamination (Contamination Reduction) - The physical and/or chemical process of reducing and preventing the spread of contamination at a hazardous materials incident.

PPE - Personal Protective Equipment includes both respiratory and physical protection. One cannot assign a level of protection to clothing or respiratory devices separately. These levels were accepted and defined by response organizations such as U. S. Coast Guard, NIOSH, and U.S. EPA.

Monitoring Equipment - Instruments or devices used to identify and quantify contaminants.

UEL - Upper Explosive Limits - The highest concentration of a material in air that produces an explosion or fire or that ignites when it contacts an ignition source.

LEL - Lower Explosive Limit - Refers to the lowest concentration of gas or vapor (% by volume in air) that burns or explodes if an ignition source is present at ambient temperatures.

Hazardous Material - A substance capable of creating harm to people, the environment and property

Procedures

Arriving first responder will establish command and begin size-up. Survey the visible activity, signs and symptoms. The First arriving Staff member **MUST** consciously avoid committing themselves to a dangerous situation, Always isolation of hazard, denial of entry, etc. Request DPS to secure a perimeter and wait for arrival of hazardous materials team. Always route other responding staff away from visible hazardous. The techniques used for approaching incident, up wind, uphill and upstream etc.

- Establish control zones (hot, warm, and cold) around the incident. Restrict access to the facility.
- Establish initial response priorities (i.e., protect the public and responders, protect property, protect the environment).
- Determine the required Personal Protective Equipment (PPE) for the chemical, and verify that all responders have appropriate PPE.
- Determine additional resource needs and request resources as needed.
- Establish accountability for workers and response personnel.
- Make necessary notifications
- Notify appropriate agency (agencies) of chemical release.
- Conduct a safety briefing for all responders, and implement responder safety measures.
- Develop a public safety strategy, including in-place sheltering and notification to the public.
- Advise the school to get all students inside, shut doors and windows, turn off ventilation systems, and remain indoors until advised otherwise
- Notify local emergency management personnel and make a determination about whether the Emergency Operations Center (EOC) should be opened.

Incident Objectives / Action Plan

Develop and list incident objectives using the ICS Form 202 and name assignments for each team member. All personnel shall be briefed on communication methods, emergency evacuation, event status, product hazards, personal protective equipment required, and overall objectives and on their specific job functions.

- Safety for all first responders
- Evacuation of endangered area, if necessary
- Stabilization of hazardous materials and /or
- Disposal or removal of hazardous materials

First arriving EHS responders will immediate head to the fire annunciator panel room located at the east end of MCB 1st floor adjacent to Loading dock. Responder will be able to identify location of alarm, gas cabinet or tool which is experiencing trouble alarm. Depending on the type of alarm EHS responders will exercise one of two options.

Uncontrolled release or fire the first responder will activate the blue HAZMAT EMERGENCY stop pull station. Then review panel to confirm toxic gas distribution or release has been stopped.

Following the emergency activation, two EHS HazMat Teams will be dispatched to the basement, one team to the 2nd, 3rd and 4th floor. Each team will conduct air monitoring to ensure a hazardous free atmosphere.

If release cannot be stopped or plugged gas will be allowed to vent inside gas cabinet and evacuated into dry scrubber.

Incident Monitoring

Incident scene monitoring must be conducted during initial and subsequent entries. Consideration needs to be given to the selection of appropriate leak detection equipment for use by the Emergency Response Team. This equipment must be portable and be suitable to detect gas leaks that could be hazardous to personnel at the incident site.

The type of gas detection equipment used by the HM team will depend on the material and extent of the release / leakage and the properties of the gases contained in the cylinder.

EH&S HazMat Teams in order to ensure that hazardous atmospheres do not exist or are abated and toxic gas release is contained. No one other than HazMat Response Team should enter the following HIGH HAZARD floor until they have been released for general occupancy.

Typical detection equipment:

- leak detection fluid
- dragger CMS chip measurement system
- portable gas detectors
- % Oxygen meter (asphyxiation risk)
- flammable gas detector
- hydride detector
- Other specific gas detectors

Safe Refuge

All responders should be briefed on designated refuge locations. These include upwind locations. Refuge may be required for severe weather, unexpected conditions, an emergency evacuation routes.

Personal Protective Equipment (PPE)

Hazardous Materials Supervisor shall ensure that the Emergency Response Team have been provided with and trained in the use of Personal Protective Equipment that is to be used in dealing with emergency incidents.

Safety Officer shall ensure that the PPE items selected are appropriate for the gases that will be

Handled and that they are maintained in good condition. Depending on the type of emergency and the possible product hazards, the following items should also be provided to the Emergency Response.

a) Inert, non-toxic oxidant gases and cryogenic liquids

- Safety glasses
- O2 meter
- Nomex coveralls/ Turnouts
- Leather type gloves
- Protective footwear

b) Flammable gases

- SCBA
- Nomex coveralls or Turnouts
- Heat resistant gloves
- Protective footwear

c) Toxic, non-corrosive gases

- Nomex coveralls
- Chemical-resistant gloves (outer)
- (inner Chemical-resistant gloves)
- Breathing apparatus (SCBA)
- Chemical-resistant boots with a steel toe and shank.

d) Toxic / corrosive gases

- Level B suits
- Chemical-resistant boots with a steel toe and shank.
- Breathing apparatus (SCBA)
- Chemical-resistant gloves (outer)
- Chemical-resistant gloves (inner)
- pH paper

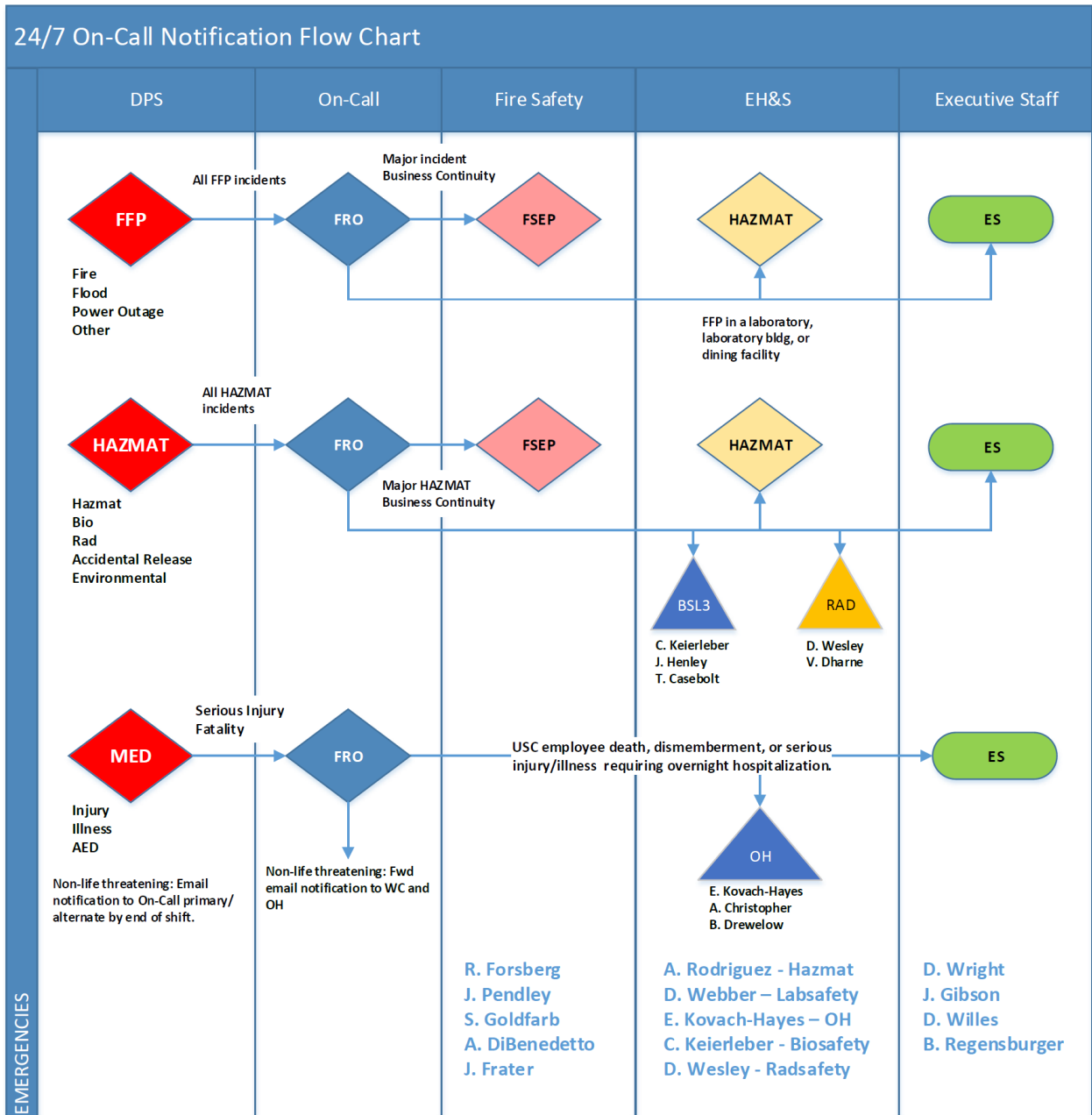
Equipment Failure Procedure

If any equipment on the incident scene fails to operate properly, the Incident Commander and the Safety Officer shall be notified and shall then determine the effect this failure has on continuing operations. If the failure affects the safety of personnel or prevents completion of the Entry Objectives, all personnel shall leave the hot zone until the situation is evaluated and appropriate actions are taken.

Terminating the Incident

This final step has four components: (1) Incident Debriefing to be conducted immediately after the emergency has passed, before responders leave the scene; (2) Post-Incident Analysis which provides a formal review of the event; (3) Incident Critique which evaluates the strengths and weaknesses of the overall response; and (4) Reporting and Documentation.

APPENDIX 5: EH&S 24/7 ON-CALL NOTIFICATION FLOW CHART



NOTES

- Fire Safety/Emergency Planning/Business Continuity is notified on major incidents (FFP) to assess potential business continuity issues at affected units. FS/EP/BC will assist affected units in marshaling their business continuity plans.
- First Responder notifies FSEP on major hazmat release if it has the potential to impact university business continuity.
- DPS to notify On-Call Primary/Alternate by phone on life-threatening injuries/fatalities. DPS will provide: Location of incident; Injury or fatality; Name; Status (Employee/Student Worker/Student/Visitor); Employee/Student ID; Contact information for injured party; Hospitalization; Released from hospital.
- Cal-OSHA (Los Angeles office: **213-576-7451** or fax 213-576-7461) must be notified of a death, dismemberment, or serious injury/illness (e.g. burn; laceration w/significant bleeding or requiring stitches; fracture; concussion) requiring overnight hospitalization.
- DPS will send non-life threatening injury e-mail notifications to On-Call Primary/Alternate by end of shift.

APPENDIX 6

DPS Toxic Gas Alarms Procedures

HPM (1ST FLOOR) AND (MCB) BASEMENT LAB- TOXIC GAS ALARMS PROCEDURES

The following procedure shall be used by the Public Safety Communications Operator (PSCO) upon receipt of a call reporting a Hazardous Material Spill in the HPM and Basement lab.

1. The PSCO shall gather the following information to initiate an emergency response:
 - a. Obtain the exact location of the alarm;
 - b. The type of activation, toxic gas, oxygen depletion, flame, fire alarm, ego manual, eye wash, loss of air;
 - c. The amount of toxic gas (low or high) the amount of oxygen depletion (low or high);
 - d. Anyone exposed; number of people exposed;
 - e. Any injury as a result of exposure;
 - f. Type of injury sustained;
 - g. Location of the injured person(s);
 - h. Reporting Person contact information;
 - i. Enter complete details of the call and subsequent actions into the radio log via the CAD/ARMS.
2. Immediately dispatch officers to location of incident, including all critical information on the initial broadcast for officer safety;
3. Confirm with the Alarm Monitoring Center that the MCB floor CCTV cameras are being monitored and that all pertinent lab activity is being communicated over the radio;
4. Notify the Watch Commander of the incident;
5. Follow the MCB Toxic Gas Labs Alarm Response flowchart for the appropriate emergency and notification response;
6. Notify LAFD Communications to request LAFD Rescue Ambulance response immediately for injuries or illness;
7. Notify LAFD immediately for the following activations; Fire Alarm, High Toxic Gas, High Oxygen Depletion, Flame Infrared and Emergency Gas Off Manual;
8. Notify MCB contact person for any additional details regarding the lab, refer to flowchart for contact person;
9. Notify USC FMS of any facilities related issues.
10. The PSCO shall log into the Career and Protective Services (Administrative Operations) website (srm.usc.edu) and search the **DPS Door Sign** application to retrieve chemical reaction and contact person information to be relayed to responding DPS officers and other emergency response personnel.

11. The PSCO shall make every effort to obtain the name of the hazardous material, as well as check the **Material Safety Data Sheet Database (MSDSs)** on the Administrative Operations Environmental Health & Safety website (*adminopsnet.usc.edu*) to gather additional information that will assist emergency personnel with their response to the hazardous material incident.
12. TrojansAlert notifications will be at the discretion of the Watch Commander or Communications Center manager.
13. Follow the procedures dictated in General Order 2-90 Unusual Occurrences Procedures.

Follow the procedures dictated in General Order 2-91 Incident Command System.

Contributors	Revised Date
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