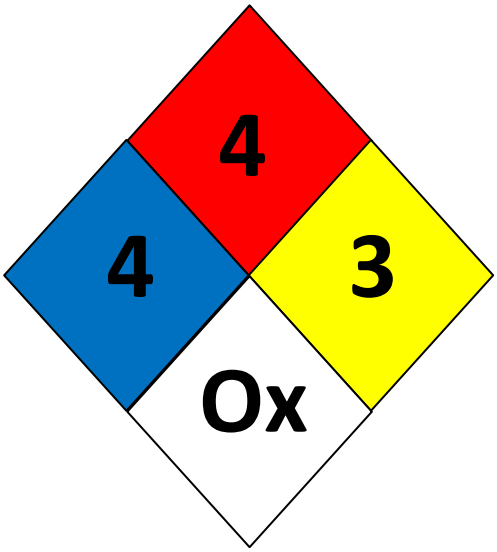
WVU Shared Research Facilities

# Cleanroom Chemical Hygiene Plan

G75B Engineering Science Building




Emergency Contact:

Kolin S. Brown, Ph.D.
Office: G75D Engineering Sciences Building
Cell Phone: (304)366-6551

Kolin S. Brown
12/5/2011

## SECTION 1.1: NFPA CHEMICAL HAZARD LABEL

**NFPA Rating -** The National Fire Protection Association (NFPA) has developed a standard system (ANSI/NFPA 704) for indicating the health, flammability, and reactivity hazards of chemicals. In addition, a special precaution symbol may be used where necessary.

This system of identifying hazards associated with various materials was developed primarily for fire protection and emergency personnel but can be useful to anyone who needs to handle potentially hazardous material. As stated in NFPA 704, "This standard provides a simple system of readily recognizable and easily understood markings, which will give at a glance a general idea of the inherent hazards of any material and the order of severity of these hazards as they relate to fire prevention, exposure, and control."

**General Rating Summary:**

**Health (Blue)**

0- Hazard no greater than ordinary material
1- May cause irritation; minimal residual injury
2- Intense or prolonged exposure may cause incapacitation: residual injury may occur if not treated
3- Exposure could cause serious injury even if treated
4- Exposure may cause death

**Flammability (Red)**

0- Will not burn
1- Must be preheated for ignition, flashpoint above 93°C (200°F)
2- Must be moderately heated for ignition flashpoint above 83°C (100°F)
3- Ignition may occur under most ambient conditions, flashpoint below 83°C (100°F)
4- Extremely flammable and will readily disperse through air under standard conditions, flashpoint below 83°C (100°F)

**Instability (Yellow)**

0- Stable
1- May become unstable at elevated temperatures and pressure, may be mildly water reactive
2- Unstable; may undergo violent decomposition, but will not detonate. May form explosive mixtures with water
3- Detonates with strong ignition source
4- Readily detonates

**Special Symbols (White)**

**OX**- oxidizer
~~**W**~~- Water reactive, use no water

## SECTION 1.2: EMERGENCY CONTACTS

In case of FIRE, INJURY, or EMERGENCY ASSISTANCE, contact in the following order:

**9-911 from any campus phone**
or
**Campus Security**
Phone: **(304)293-3136 (293-COPS)**

Then Call,

**Kolin Brown,** Cleanroom Manager
Cell Phone: **(304)366-6551**
Office Phone: **(304)293-9683**
Room: **G75D ESB**
or
**Harley Hart,** Cleanroom Technician
Cell Phone: **(412)443-1514**
or
**Marcela Redigolo**
Cell Phone: **(214)766-2904**

If no one responds to any numbers above, then contact:

**Kenny Claudio**
Cell Phone: **(304) 216-4858**
Office Phone: **(304) 293-4091**
Room**: 373A MRB**

**Royce Watts,**
Cell Phone: **(304) 288-6762**
Office Phone: **(304) 293-4124**
Room: **377A MRB**

For non-emergency assistance please contact:

**Kolin Brown,** Cleanroom Manager
Cell Phone: **(304)366-6551**
Office Phone: **(304)293-9683**
Room: **G75D ESB**
or
**Harley Hart,** Cleanroom Technician
Cell Phone: **(412)443-1514**

For non-emergency assistance relating to the SEM please contact:

**Marcela Redigolo**
Cell Phone: **(214)766-2904**

## SECTION 1.3: EMERGENCY EVACUATION PROCEDURES

**Cleanroom Evacuation Plan**

**In case of Fire or Chemical Spill all users should evacuate the entire Cleanroom immediately!**

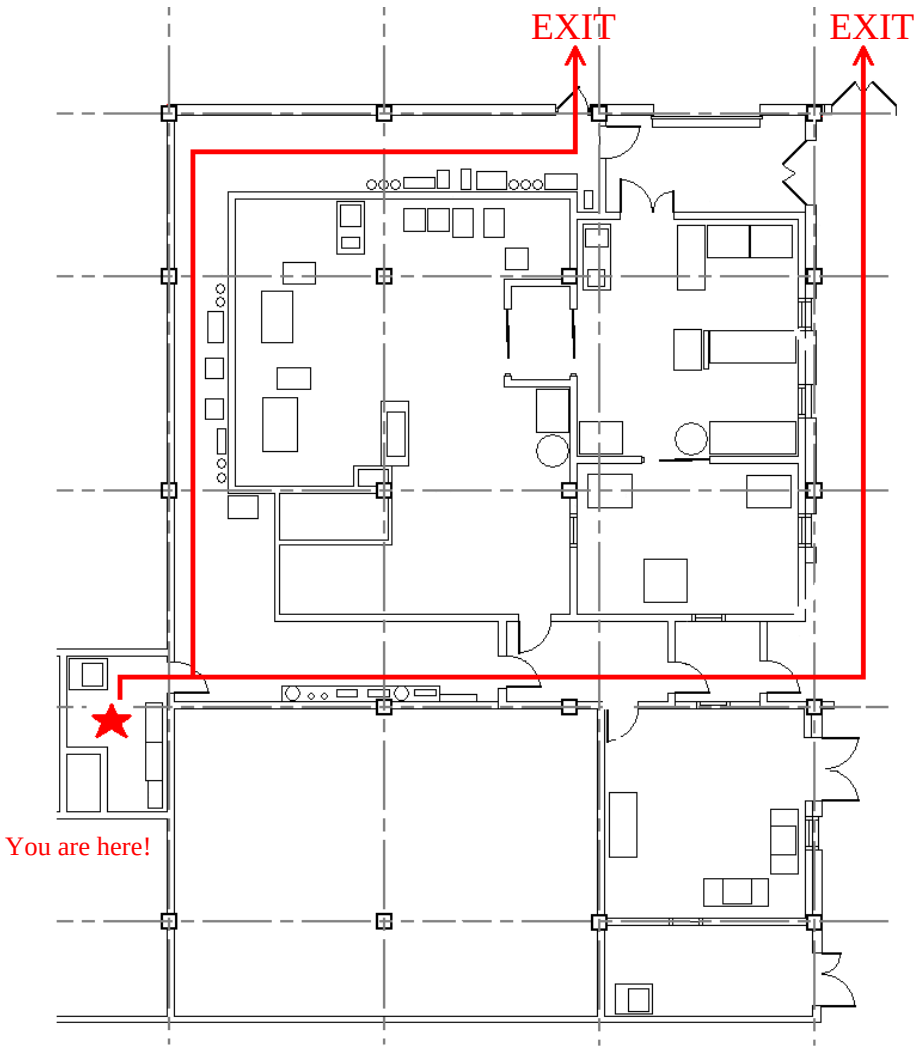
- Do not stop to ungown.
- Use the shortest, unobstructed path to the exterior of the building.
- Stationary leaves of the automated doors will swing open for emergency egress when pushed or pulled.
- Only if it is safe to do so, users should turn off or unplug hotplates before evacuating.
- Only if it is safe to do so, users should turn off or unplug the ultrasonic bath before evacuating.

**Warning:** Due to the high number of air exchanges in the cleanroom to maintain positive pressure and room cleanliness, fire will travel quickly throughout the cleanroom. An individual in the cleanroom may find their emergency egress quickly blocked if they hesitate to fight the fire or ungown.

**Warning:** Due to the high number of air exchanges in the cleanroom to maintain positive pressure and room cleanliness, chemical vapors and gasses will travel quickly through the cleanroom. It is safer to evacuate all persons from the room than to try to clean up any chemical spills.

# Cleanroom Evacuation Plan

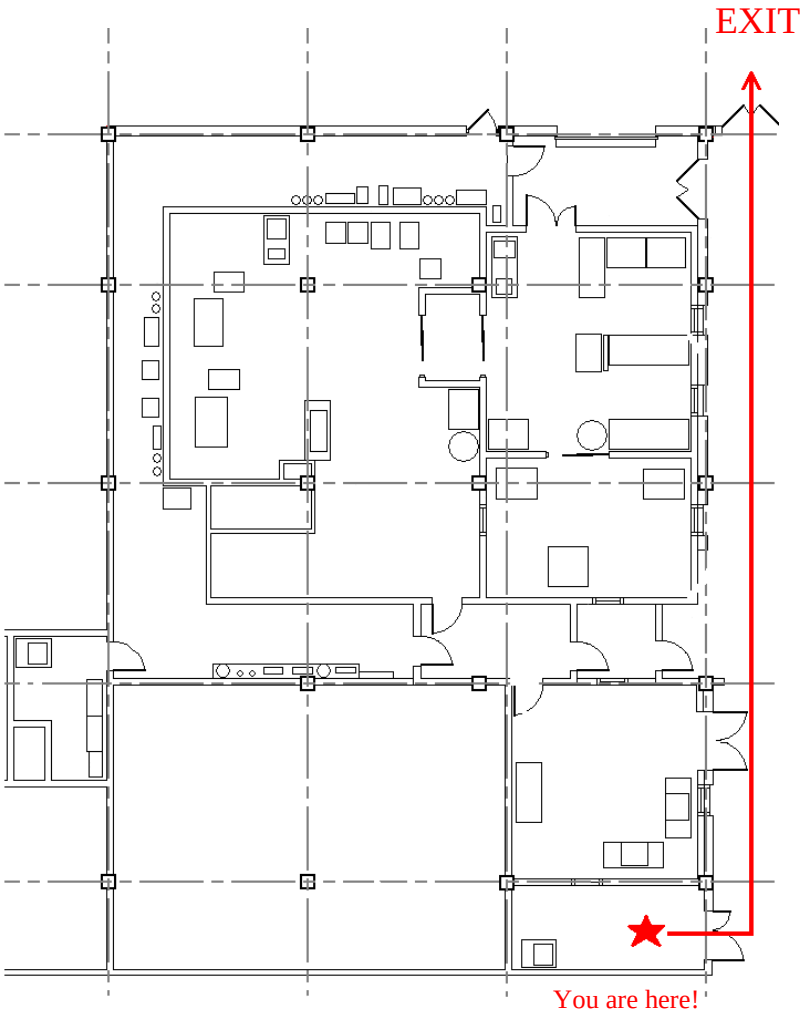
G55A1 Engineering Sciences Building
Chemical Storage Area



# Cleanroom Evacuation Plan

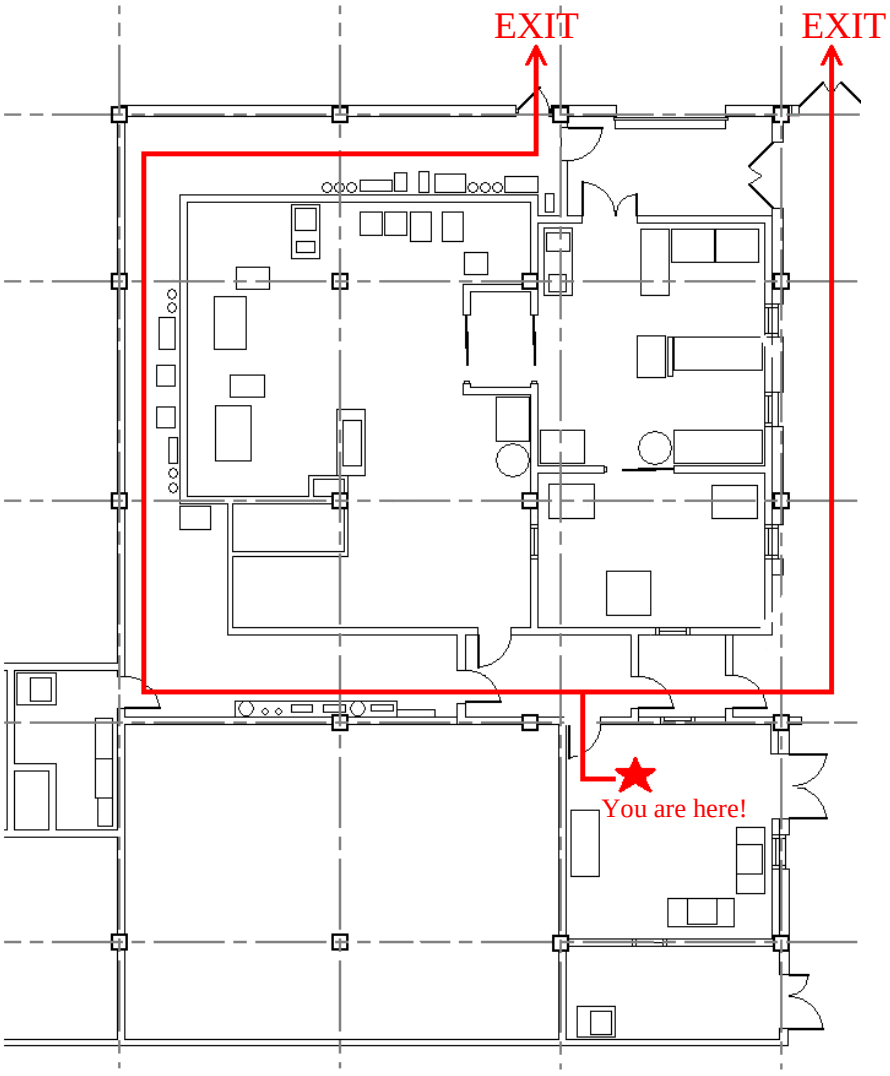
G71 Engineering Sciences Building

Service Chase



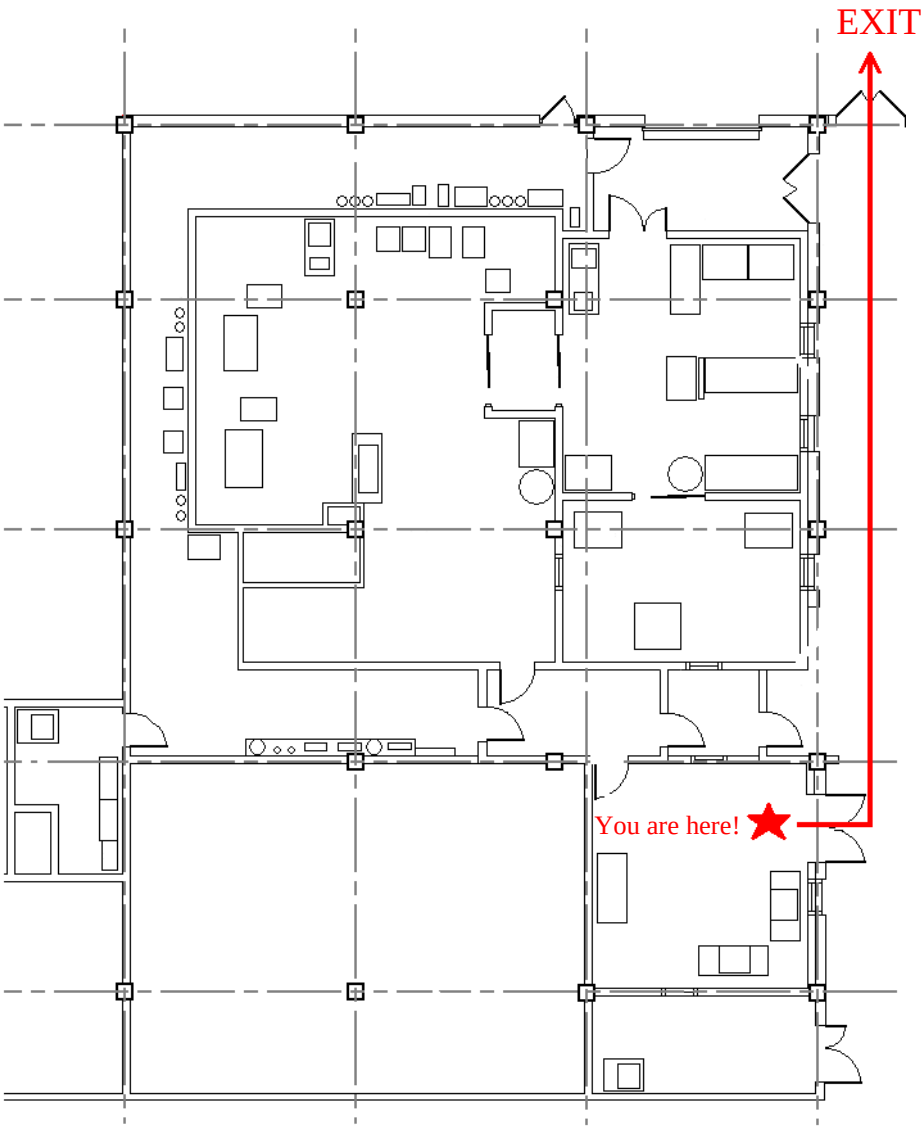
# Cleanroom Evacuation Plan

G73 Engineering Sciences Building
SEM and Packaging Room



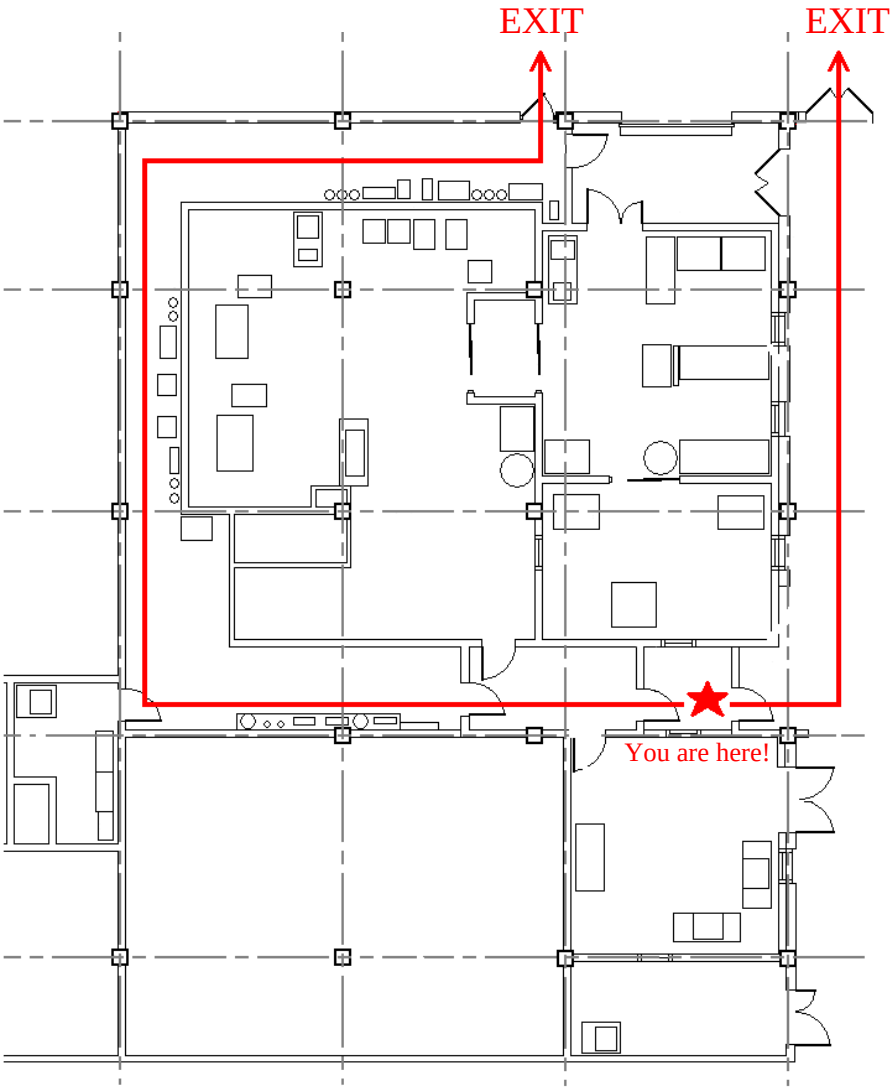
# Cleanroom Evacuation Plan

G73 Engineering Sciences Building
SEM and Packaging Room



# Cleanroom Evacuation Plan

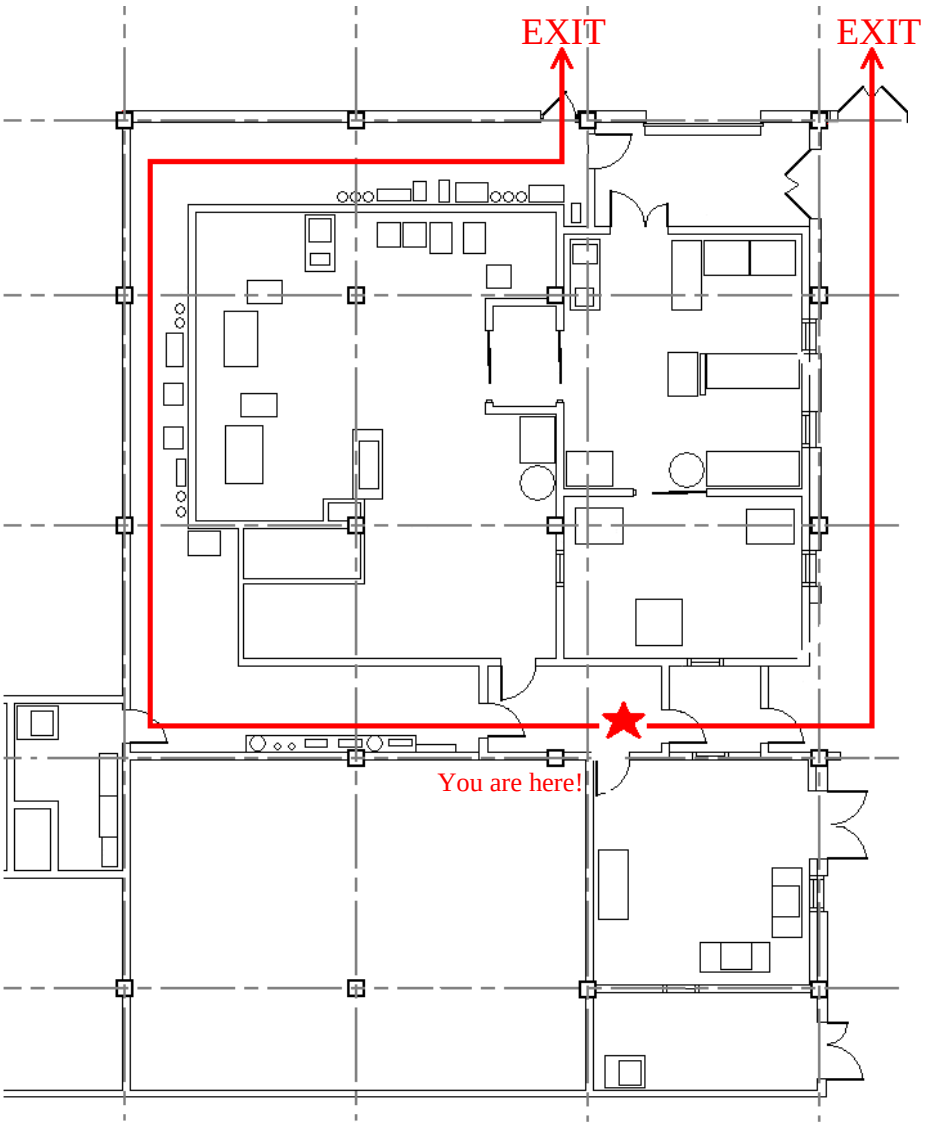
G75A Engineering Sciences Building
Cleanroom Entry



# Cleanroom Evacuation Plan

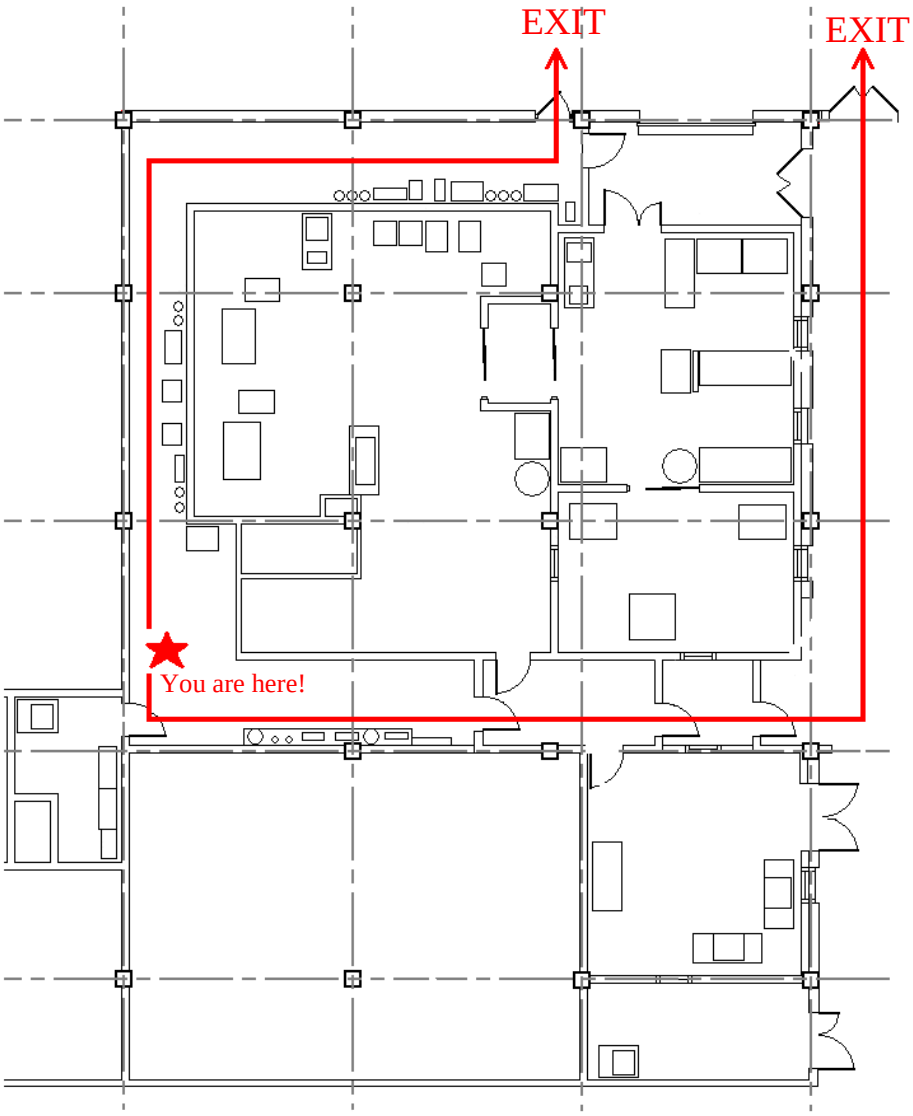
G75B Engineering Sciences Building

Gowning Room



# Cleanroom Evacuation Plan

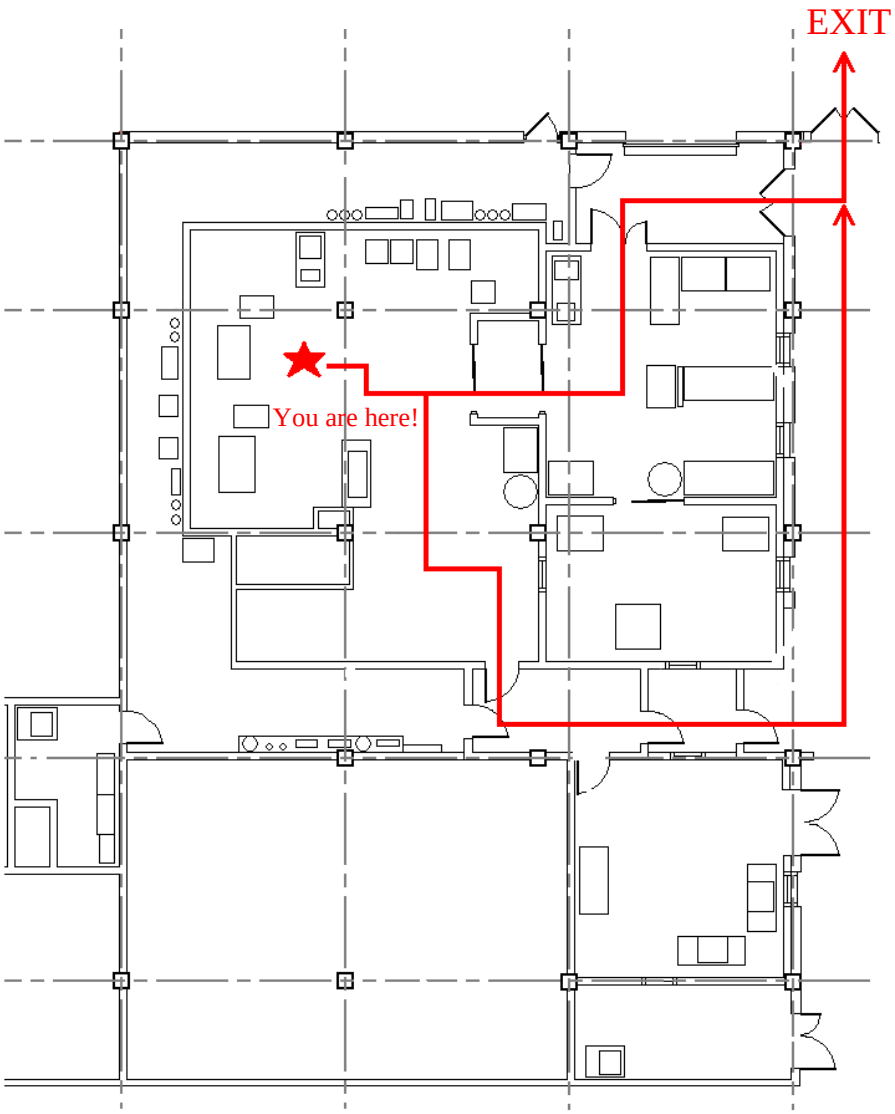
G75B1 Engineering Sciences Building
Service Chase Area



# Cleanroom Evacuation Plan

G75B2 Engineering Sciences Building

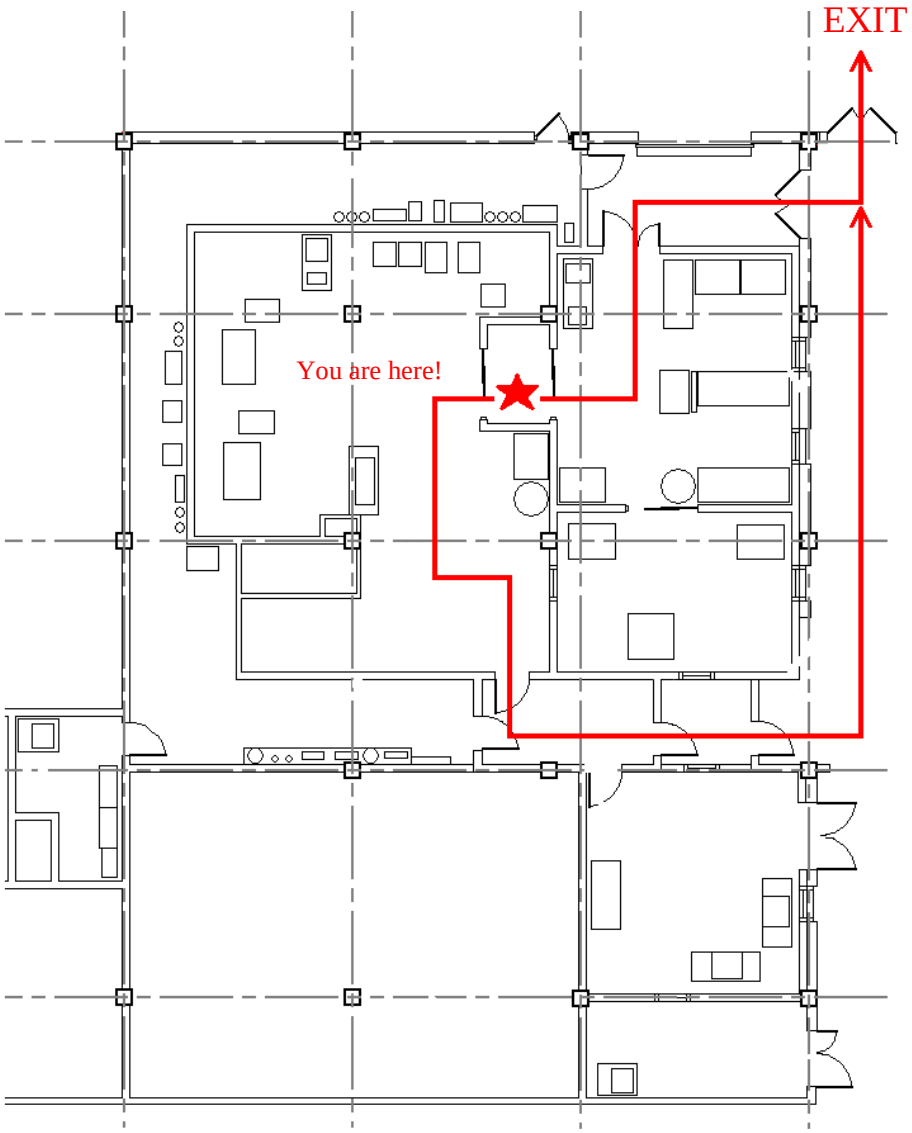
Dry Processing Room



# Cleanroom Evacuation Plan

G75B3 Engineering Sciences Building

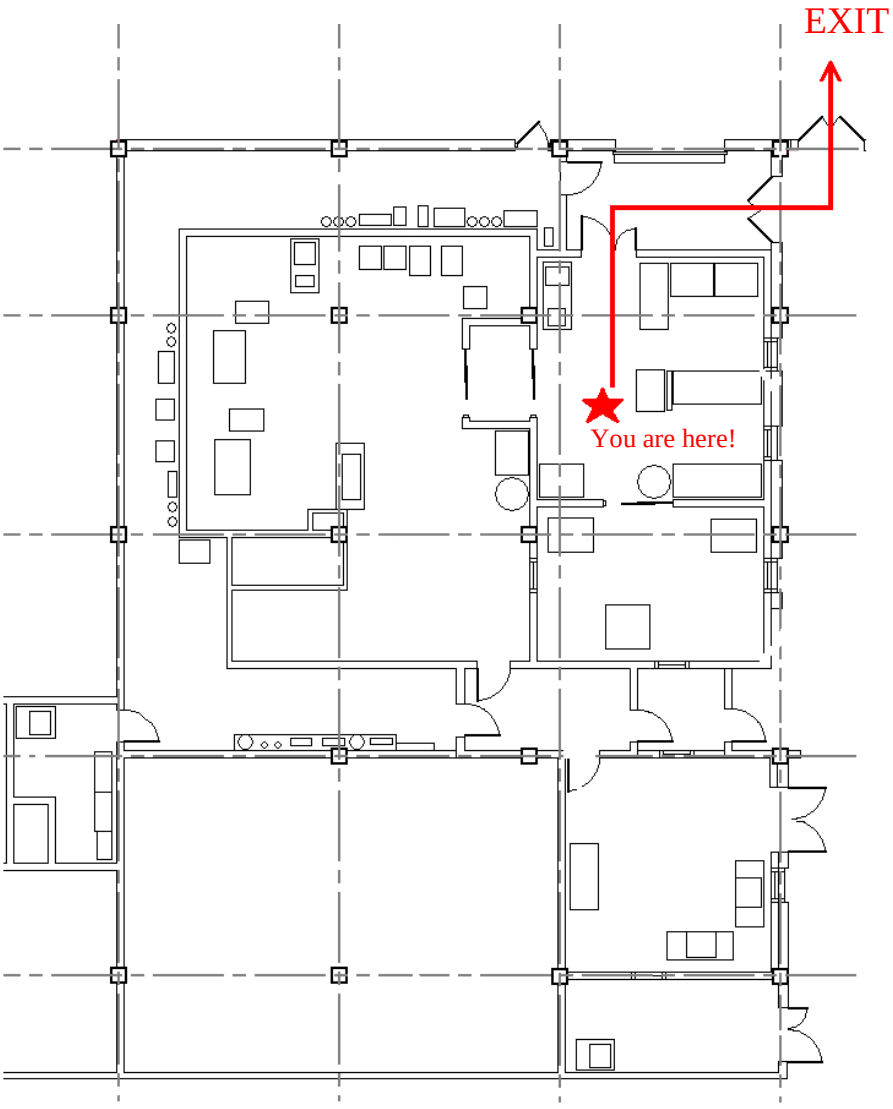
Light Lock



# Cleanroom Evacuation Plan

G75C1 Engineering Sciences Building

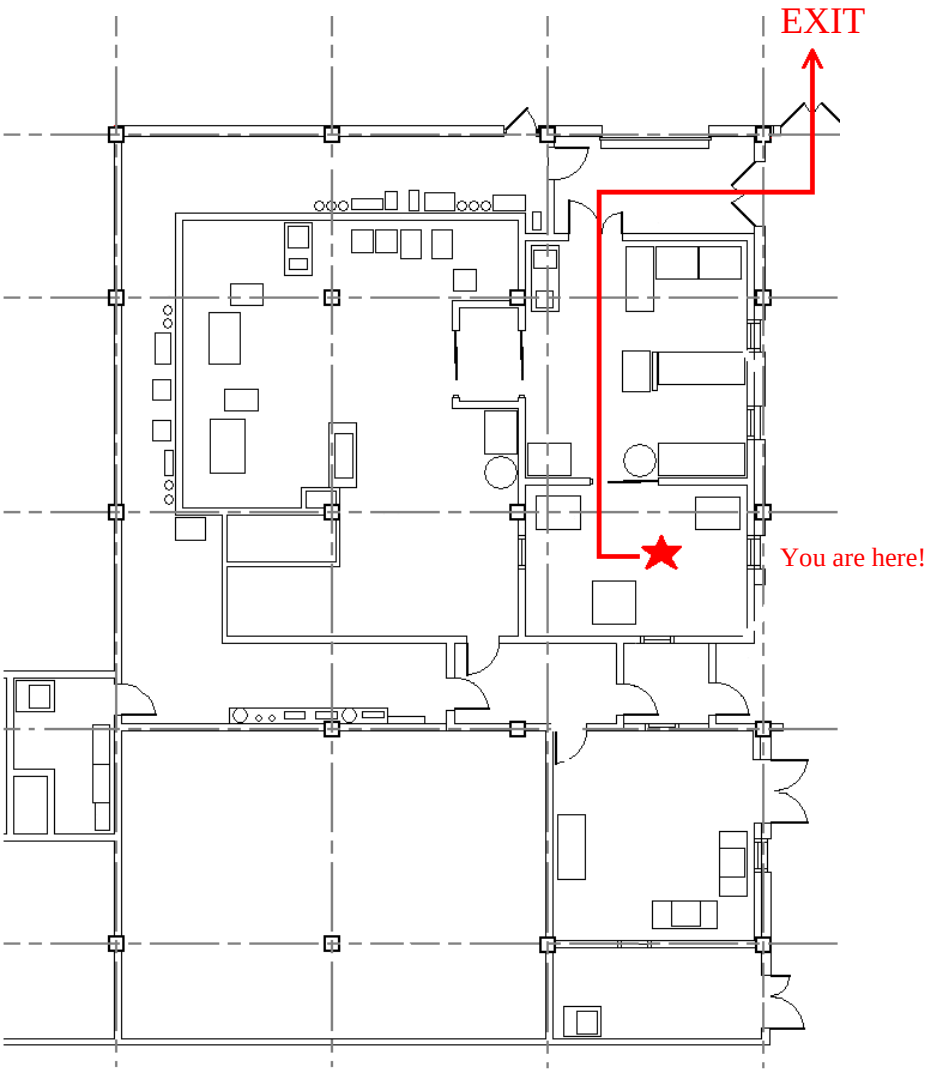
Wet Processing Room



# Cleanroom Evacuation Plan

G75C2 Engineering Sciences Building

Photolithography Room



## SECTION 1.4: SHUTDOWN PROCEDURES

If a dangerous situation is evident (smoke, fire, sparks, etc.), ONLY if it is safe to do so, should a user attempt to shut down a system. The user should then notify all other persons within the clean room to evacuate immediately. After evacuation, a user should contact proper emergency personnel from a safe place.

If no one is available and a machine is not acting as expected then the user should attempt to put the machine in its default mode; do not leave the machine running in an abnormal state! If the machine cannot be placed in its default mode, the user should stay by the tool and contact one of the WVU Shared Facilities staff members. If it becomes necessary to leave the tool then the user should leave a large, legible note on the machine stating that the tool is down.

Listed below are the procedures to place each tool into a safe default mode, or to shut down each tool. Detailed shutdown procedures may be found on the cover of each tool logbook or in the Standard Operating Procedures found in Appendix A.

**Alpha Step:**

To shut down: **Unplug the instrument**
To place in default mode: **Turn OFF the power switch located on the front of the instrument**

**$CO_2$ Dryer:**

To shut down: **Turn OFF the power switch located on the back of the instrument**
To place in default mode: **Press OFF on the chamber power supply**

**E-Beam Evaporator:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front side of the tool or on the electrical panel**
To place in default mode:

- **Press STOP on deposition controller**
- **Turn the EMISSION CURRENT to zero and turn OFF the E-beam and HIGH VOLTAGE by pressing the associated icons on chamber control screen**
- **Turn the power controller key to “OFF” position**

**ICP Reactive Ion Etcher:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the left-side of the tool**
To place in default mode:

- **Press ABORT on the process screen**
- **Go to main screen and choose STANDBY MODE to backfill gas lines**
- **Go into chase and turn OFF all process gas bottles**

**Mask Aligner:**

To shut down: **Unplug the instrument**
To place in default mode:

- **Turn OFF the system power**
- **Turn OFF the lamp power**

**Oxygen Plasma Asher:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front of the tool**
To place in default mode:

- **Shut OFF the plasma asher by pressing the red emergency button on the front panel.**
- **Shut OFF the oxygen tank valve outside the cleanroom**
- **Shutting off the nitrogen before shutdown will disable the pneumatic valves and may leave things stuck open. There is no harm in leaving this on.**

**PECVD:**

To shut down**: Press the EMO (EMERGENCY OFF) button on the top of the tool**
To place in default mode: **Abort the process by pressing <STOP> on the software window**

**Programmable Furnace:**

To shut down: **Unplug the instrument**
To place in default mode: **Turn OFF the power, switch located on control panel**

**Rapid Thermal Annealer:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front of the tool**
To place in default mode:

- **Click the "Stop process" button in the software to stop the heating**
- **Press the red OFF button (under the green ON button) on the front panel of RTA to shut off the furnace**
- **Shut down the computer**

**Reactive Ion Etcher:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front of the tool**
To place in default mode: **Abort the process by pressing <STOP> on the software window**

**Scanning Electron Microscope:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front of the SEM console**
To place in default mode:

- **Shut OFF the electron beam (OFF button under "Observation" on top of the PC_SEM program window).**
- **If the PC_SEM program freezes, open the front door of the SEM enclosure chamber and press the GUN button in front of the specimen exchange chamber to shut off the electron beam.**
- **Exit the PC_SEM program**

**Spinner:**

To shut down: **Unplug the tool or unplug the spinner hood**
To place in default mode: **No action required**

**Sputtering Station:**

To shut down: **Press the EMO (EMERGENCY OFF) button on the front of the control rack**
To place in default mode:

- **Turn OFF the power supply**
- **Turn OFF gases on front panel of control rack**

**UV Flood Exposure:**

To shut down: **Unplug the instrument**
To place in default mode: **Turn OFF the lamp power**

**Wire Bonder:**

To shut down: **Unplug the tool**
To place in default mode: **Turn OFF the hot plate**

## SECTION 1.5: EMERGENCY RESPONSE EQUIPMENT

**First Aid kits** are located in the gowning room, **G75B ESB**, and in the SEM service chase room, **G71 ESB**.

**Calcium Gluconate Gel** (HF Antidote) is kept in the first aid kit in **G75B ESB**.

The nearest **AED** (Emergency Defibrillator) is located in the **MRB Atrium**. A second AED can be found on the 1st floor lobby of the Engineering Sciences Building.

Two **safety showers and eyewash stations** are located inside the cleanroom: one is located in the dry processing room, **G75B2 ESB**, next to the solvent hood and one is located in the wet processing room, **G75C1 ESB**, next to the acid hood. An additional safety shower and eyewash station is located in the corridor outside the cleanroom.

The **Chemical Hygiene Plan** and **MSDS** are located in the gowning room, **G75B ESB**.

## SECTION 2: LAB OVERVIEW

The WVU Shared Research Facilities Cleanroom, is a specialized laboratory environment for fabricating electrical and photonic devices. This suite of labs consists of 2,100 square feet of clean space and accompanying support spaces. The clean spaces include class 100, class 1,000 and two class 10,000 rooms. The facility is capable of photo- and e-beam lithography, wet chemical processing, metallization and deposition, reactive ion etching, and thermal processing.

As part of the WVU Shared Research Facilities, the Cleanroom provides student and postdoctoral researchers with the opportunity to learn how to use cutting-edge materials science and engineering equipment. The facility is open to all researchers, including researchers at government laboratories and industries.

## SECTION 2.1: FACILITY DESCRIPTION

The WVU SRF Cleanroom facility is a suite of four rooms and additional support spaces. A map of the entire facility is shown in Figure 1. The four laboratory rooms are:

- Photolithography Room (G75C2 ESB)
- Wet Processing Room (G75C1 ESB)
- Dry Processing Room (G75B2 ESB)
- SEM and Packing Room (G73 ESB)

A light lock (G75B3) connects the Dry Processing Room to the Wet Processing room. This area is used to store PPE and store student lab ware.

## SECTION 2.1.1: PHOTOLITHOGRAPHY ROOM

G75C2 Engineering Sciences Building is a Class 100 room that serves as the Photolithography Room. The purpose of this room is to create polymer process masks on substrates using standard photolithography techniques.

This room houses a spinner hood, mask aligner and flood exposure system.

The spinner hood is a chemical wet bench where users can apply resist polymers to their substrates.

- Two spinners and two hotplates are installed on the spinner hood deck.
- Resist polymers, HMDS and waste jars are stored in the cabinet under the hood.
- A waste container for contaminated wipes is kept on the hood deck.
- A waste jar for contaminated pipettes is stored in the cabinet under the hood.
- A sharps disposal container is kept at the hood for disposal of razor blades.
- Supplies are stored at the hood for point of use.

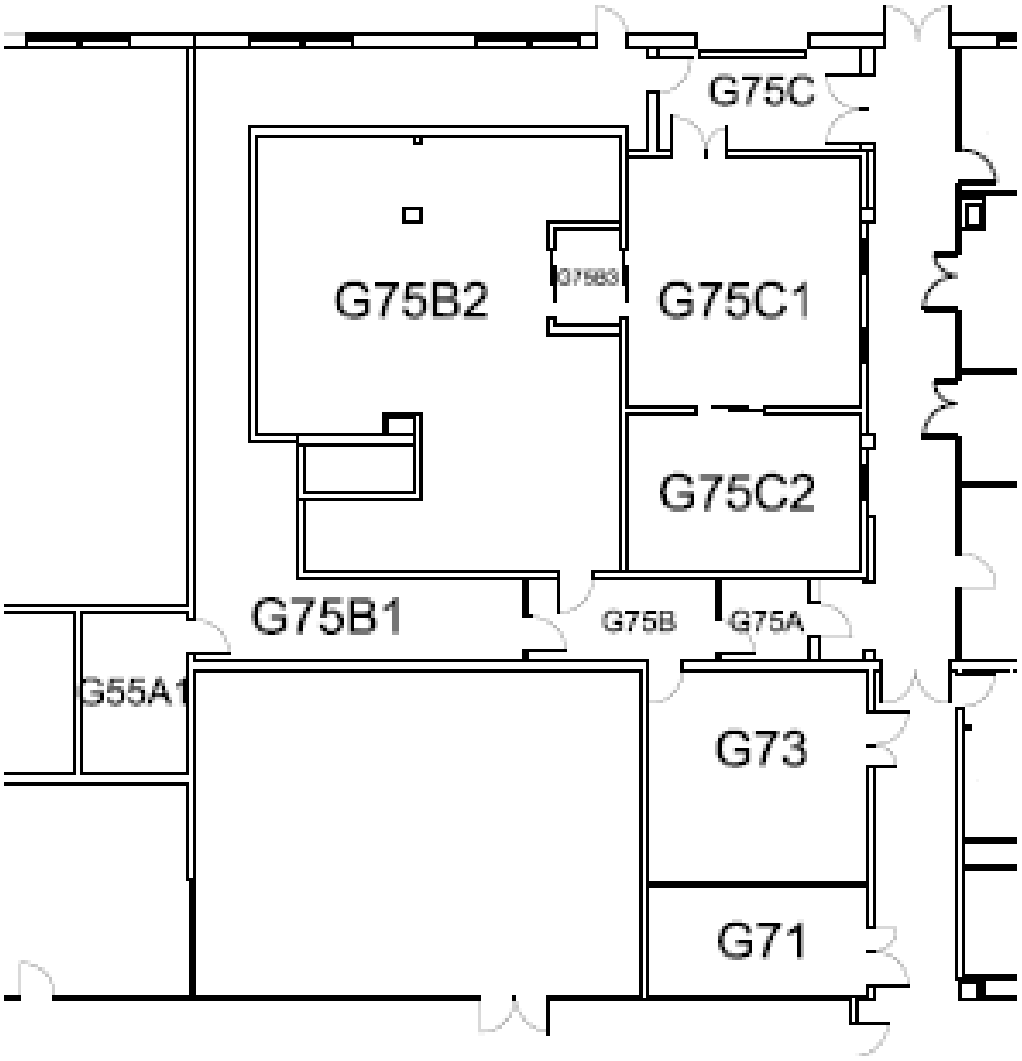



**FIGURE 1: Map of Cleanroom Suite**

Equipment:

Suss Microtech MA6 Mask Aligner

- For patterning photoresist
- Front side or back side alignment
- 320 nm UV exposure source
- Contact, vacuum contact or proximity modes
- Sample size between 10x10 mm die to 4inch-diameter wafer
- Masks with 2 to 4 inch diameter pattern area

Laurel Technologies 400 Spinners

- For solvent cleaning and spin development or spin application of resist polymers
- Located in 4 foot spinner hood with hotplates available
- Substrates from 10 mm to 6 inches
- Maximum speed of 8,000 rpm

OAI UV Flood Exposure

- For image reversal photolithography or SU-8 feature patterning
- 365 nm, 10 mW /cm2 UV exposure source
- 5 inch diameter exposure area

## SECTION 2.1.2: WET PROCESSING ROOM

G75C1 Engineering Sciences Building is a Class 1,000 room that serves as the Wet Processing Room. The purpose of this room is for chemical processing, sample cleaning, sample preparation, sample inspection and thermal processing.

This room houses 5 chemical hoods, a microscope, a stylus profiler, a CO2 dryer, an oxygen plasma asher and a programmable furnace.

The acid hood is an 8’ chemical wet bench where users can work with acids.

- Acids, Etchants and waste jars are stored in the cabinet under the hood.
- A waste container for contaminated wipes is kept on the hood deck.
- Supplies and specialty lab ware are stored at the hood for point of use.
- A hotplate is stored on top of the bench.

The solvent hood is an 8’ chemical wet bench where users can work with solvents.

- A waste container for contaminated wipes is kept on the hood deck.
- Waste containers for Acetone and Alcohol are stored on the hood deck.
- Rinse bottles of Acetone, Methanol and Isopropanol are stored on the hood deck for ease of use.
- Solvents, strippers and waste jars are stored in the cabinet under the hood.
- Supplies are stored at the hood for point of use.
- A hotplate, ultrasonic bath, and vacuum desiccator are stored on top of the bench.

The developer hood is a 4’ chemical wet bench where users can develop samples that have been patterned using UV light or an electron beam.

- A waste container for contaminated wipes is kept on the hood deck.
- Developers and waste jars are stored in the cabinet under the hood.
- Supplies are stored at the hood for point of use.
- A small box furnace for dehydrating samples is located on top of the bench.

The left, spare hood is a 4’ chemical wet bench where users can work long term chemical processes or to isolate process contamination.

- A waste container for contaminated wipes is kept on the hood deck.
- Supplies are stored at the hood for point of use.
- A hotplate is stored on top of the bench.

The right, spare hood is a 4’ chemical wet bench where users can work long term chemical processes or to isolate process contamination.

- A waste container for contaminated wipes is kept on the hood deck.
- Bases and waste jars are stored in the cabinet under the hood.
- Supplies are stored at the hood for point of use.

Equipment:

March PX-250 Oxygen Plasma Asher

- Oxygen plasma for cleaning substrates
- 8” x 8” shelf can accommodate a variety of substrate sizes
- 300W maximum RF power

Thermolyne 6000 Programmable Furnace

- Maximum temperature of 1200°C
- 12.75” W x 6.75” H x 10” D chamber
- Ramp rate of 100°C per minute
- Nitrogen purge

Tousimis $CO_2$ Dryer

- For MEMS release
- For drying biological samples

Alpha Step 200 Stylus Profiler

- For non-destructive measuring of height
- ±160 µm height range
- 10 µm horizontal scan range
- Measures hard or soft films (i.e. polymers)

Olympus BH-2 Optical Microscope

- 5x, 10x, 20x, 50x, 100 x objectives with 10x eyepiece
- Bright field/dark field with polarizers and Nomarski prisms
- Reflective and transmissive
- Canon PowerShot digital camera for image capture

## SECTION 2.1.3: DRY PROCESSING ROOM

G75B2 Engineering Sciences Building is a Class 10,000 room that serves as the Dry Processing Room. The purpose of this room is to house equipment for deposition, plasma etching and thermal processing.

This room houses a solvent hood, an e-beam evaporator, a sputter station, a rapid thermal annealer, a reactive ion etcher, a PECVD and furnaces.

The solvent hood is an r' chemical wet bench for cleaning machine parts and components.

- A waste container for contaminated wipes is kept on the hood deck.
- Rinse bottles of Acetone, Methanol and Isopropanol are stored on the hood deck for ease of use.
- Supplies are stored at the hood for point of use.

Equipment:

Temescal BJD 2000 E-Beam Evaporator

- Thin-film deposition of metals and oxides (magnetic or non-magnetic)
- 6 pocket, single-beam source
- In-situ crystal deposition monitor
- Standard planetary holds a maximum of 13 substrates up to 3 inches in diameter
- Variable-angle planetary holds one 3" wafer and can be used for glancing-angle deposition
- Oxygen ion source
- Substrate heater

CVC 610 Sputtering Station

- Thin film deposition of metals
- 8-inch aluminum target
- 2-inch interchangeable targets (maximum surface coverage of 3 inch area)
- Standard targets: Platinum, Gold, Copper, Titanium, Aluminum, and Tantalum
- Holds up to 6 substrates each up to 6" diameter
- Argon source gas
- Capable of nitrogen-assisted argon deposition for reactive sputtering
- Argon-ion cleaning source
- Backside substrate heater

Annealsys AS-Micro Rapid Thermal Annealer (RTA)

- For rapidly heating and cooling samples
- Maximum temperature of 12500C
- Variable ramp rate of 0.1 to 3000C per a second

- Nitrogen or Argon environment
- Sample sizes up to 2 inches in diameter

Oxford 80+ Reactive Ion Etcher (RIE)

- Directional plasma etching of silcon, oxides and polymers
- 9 inch cathode table can handle a wide variety of substrate sizes
- 250W RIE power supply and 250 W ICP power supply
- Ar, SF6, CF4 , and O2 etch gases
- Quartz cathode coverplate
- Currently not operational

Oxford 80+ Plasma Enhanced Chemical Vapor Deposition (PECVD)

- Deposition of silicon oxide or silicon nitride
- 9-inch cathode table can handle a wide variety of substrate sizes

Lindberg Blue M Tube Furnace

- Quartz tube
- Maximum Temperature 1200°C
- For 3 inch diameter wafers

Low Pressure Chemical Vapor Deposition Furnace

- Not fully installed or operational

## SECTION 2.1.4: SEM AND PACKAGING ROOM

G73 Engineering Sciences Building is a Class 10,000 room that serves as the Inspection and Processing Room. The purpose of this room is to house equipment for plasma etching, device packaging, e-beam lithography and sample inspection

This room houses a reactive ion etcher, a SEM, a wire bonder and additional packaging tools.

Equipment:

TRION Minilock III Reactive Ion Etcher with Inductively Coupled Plasma (RIE/ICP)

- Directional plasma etching of semiconductors, insulators, metals and polymers
- Maximum substrate size of 3” wafer
- 600 W RIE power supply and 1000 W ICP power supply
- Cl2, BCl3, CF4, O2 and Ar etch gases

JEOL 2100 Scanning Electron Microscope (SEM)

- For microstructure observation of materials at high resolution and material crystal structure determination
- For electron beam lithography

- Micro-chemical analysis of the materials with Energy Dispersive X-ray (EDX) Spectrometer
- NPGS patterning software
- Accelerating Voltage between 80 and 200 kV
- Magnification of 50 to 1,500,000 x

West Bond Gold Wire Bonder

- For making gold wire connections between device and package
- Ball-wedge bonding, deep-access ball-wedge bonding, and wedge-wedge bonding
- Packages of any shape up to 2 inches square

West Bond Die Bonder

- For epoxy mounting 10x10 mm die into package
- Packages of any shape up to 2 inches square

Thermolyne Blue M Mini Furnace

- Quartz Tube
- Maximum 1100°C
- For samples less than ½-inch diameter

## SECTION 2.1.5: SUPPORT SPACES

**G55A1: Chemical Storage Room**

This space houses:

- Nitrogen generation system for entire cleanroom
- Bulk chemical storage
- Tool chest

This space also serves as a waste collection site for the cleanroom.

**G71 ESB: Equipment Service Chase**

This space houses:

- Central vacuum system for the entire cleanroom
- Water Chillers and Nitrogen Gas supply for the JEOL SEM
- Water Chillers, pumping system, and gas supply for the Trion ICP

In addition this room houses a fire panel and network switches for the College of Engineering and Mineral Resources (CEMR).

**G75A ESB: Entry**

This space serves as an entrance to the cleanroom.

**G75B ESB: Gowning Room**

This space serves as the location where users can dress in proper cleanroom garments before entering the cleanroom suite. This room is also used as a wipe down location for any items or equipment entering the cleanroom areas.

**G75B1 ESB: Equipment Service Chase**

This space houses:

- The DI Water generation system for the entire cleanroom
- Water Chiller, pumping systems, air compressor, and gas supply for the Temescal E-Beam Evaporator
- Pumping system and gas supply for the CVC Sputtering Station
- Gas supply for the Anealsys Rapid Thermal Annealer
- Water Chiller, pumping system, and gas supply for the Oxford RIE
- Water Chiller, pumping system, and gas supply for the Oxford PECVD
- Pumping system and gas supply for the March $O_2$ Plasma Asher

This space also serves as storage for cleanroom consumables and spare parts.

**G75C: Loading Area**
This space serves as a gas cylinder storage area for full or empty tanks that are not in use. It is also a receiving area for large equipment.

**Cleanroom Compressor Building (Not on Map)**
A separate building houses the cleanroom compressor and air dryer unit that generates the compressed air for the entire cleanroom. This building is located adjacent to Parking Area 41.

**Cleanroom HVAC Penthouse (Not on Map)**
The cleanroom HVAC unit and power transformers are housed in a penthouse above the cleanroom on the ESB low roof.

**Cleanroom Chiller Penthouse (Not on Map)**
The cleanroom chiller is housed in a penthouse on the ESB low roof.

## SECTION 2.2: LABORATORY ACCESS

Access to the WVU Shared Research Facilities is controlled through the WVU ONITY Lock system. The three cleanroom locks are located on the doors to G71 ESB, G75B ESB and G75B1.

As part of the CEMR Electronic Lock policy, the cleanroom locks, G71 ESB, G75B ESB and G75B1 ESB have been identified as restricted locks. Access to these locks is only given to lock shop personnel, campus security, emergency services, appropriate CEMR Administration, Shared

Research Facilities staff, and cleanroom users. A version of the CEMR Electronic Lock policy may be found on the website http://www.its.cemr.wvu.edu/cardlocks/index.php or a full, written version may be obtained upon request at the Dean's office.

The following persons are the official operators of these locks:

Kolin S. Brown
Lisa Sharpe
Harley Hart
Royce Watts.

In addition the WVU Lock Shop and WVU Card Services also have capabilities to give students, staff and faculty access in these locks.

Cleanroom users are only given access to the Cleanroom during normal working hours after they have completed all required safety trainings and have a signed user agreement on file with the SRF Cleanroom Manager.

The normal working hours of the Cleanroom are 8AM-5PM, Monday–Friday and the after-hours are 5PM-8AM, Monday-Friday; weekends and holidays are all hours.

## SECTION 2.2.1: REQUIRED SAFETY TRAINING

All Cleanroom users must complete the following three safety trainings to receive access to the facility during normal working hours.

- SRF General Lab Safety Training
- SRF Chemical Safety Training
- Cleanroom Protocols and Safety Training

Copies of the safety presentation slides are located on the Shared Research Facilities website: http://sharedresearchfacilities.wvu.edu/safety/srfSafetyMain.html

## SECTION 2.2.2: USER AGREEMENTS

All cleanroom users must have a user agreement on file with the WVU SRF Cleanroom Manager. User agreements must be signed by the user, the user's advisor and the user's department chair, when appropriate.

Copies of the User Agreements are located on the Shared Research Facilities website: http://sharedresearchfacilities.wvu.edu/forms/srfForms.html

## SECTION 2.2.3: DRESS CODE AND GOWNING REQUIREMENTS

The following dress code is required for all users entering the cleanroom:

1. No contact lenses
2. No shorts, legs must be fully covered
3. No sandals or open toed shoes, feet must be fully covered
4. No makeup or perfume

Users entering the cleanroom must wear the following cleanroom attire:

- A cleanroom suit that is free of rips and tears
- A bonnet
- Nitrile gloves
- Boot covers
- A beard guard is required if a male user has facial hair or if he did not shave that morning.
- A face mask or beard guard is required for any user working in the class 100 area.

## SECTION 2.2.4: AFTER HOUR ACCESS

After hour access to the cleanroom is given upon request by the WVU Shared Research Facilities Cleanroom Manager. The manager will use his own discretion to grant access when a user has demonstrated he or she can work alone safely and handle an emergency.

## SECTION 2.2.5: TEMPORARY USER SUPERVISION

Temporary users in the cleanroom must be accompanied by a trained cleanroom user or staff member at all times. Temporary users may include summer research participants, visitors or class participants.

## SECTION 3: CHEMICAL SAFETY

The following chemicals are always stocked in the cleanroom:

- Acetone
- AZ 300 MIF Developer
- AZ 300 T Stripper
- AZ 400 K Developer
- Buffered Oxide Etchant 10:1
- Hexamethyldisilazane (HMDS)
- Hydrochloric Acid
- Hydrofluoric Acid
- Isopropanol
- Methanol
- Nitric Acid
- Phosphoric Acid
- Sulfuric Acid
- Summa Clean SCM-15

In addition several types of photoresists and e-beam resists may be kept. Each of these resists may also have associated developers and strippers. The following list represents the types of resists that are typically kept inside the cleanroom; however, the exact formulations will change periodically based on current projects:

- AZ Photoresists
- Polymethyl Methacrylate (PMMA)
- SU-8 Resists

These lists represent the standard process chemicals used inside the cleanroom. A current chemical inventory may be found in Appendix B. This inventory is updated each semester.. The cleanroom is a multiuser facility that supports a wide variety of research projects. The amounts and types of chemicals stored inside the cleanroom will vary in time.

In addition to process chemicals, hydrocarbon based oils, fluorinated polymer based oils and ethylene glycol are stored and used by cleanroom equipment.

## SECTION 3.1: CHEMICAL STORAGE

Chemicals are stored in the chemical storage room G55A1 and at point of use in the hoods in the cleanroom.

When a chemical order arrives, an approval chemical label that is dated and signed by a SRF staff member is applied to each chemical container. The chemical is then stored in the appropriated cabinet in G55A1. On the occasion when a base, such as hydrogen peroxide or ammonia hydroxide is received, it is labeled and then directly taken to point of use storage inside the cleanroom.

The approved chemical labels are color coded to quickly identify proper chemical storage locations. The following color code is used:

- Green for acids and etchants
- Yellow for solvents and resist strippers
- Pink for polymers and resists
- White for resist developers
- Orange for bases

G55A1 ESB serves as a bulk chemical storage area for the cleanroom. It contains four chemical cabinets as shown in Figure2.

The large flammables cabinet, labeled cabinet 1 Figure 2, is used to store:

- Acetone
- Methanol
- Isopropanol
- AZ 300 MIF Developer
- AZ 300 T Stripper
- AZ 400 K Developer
- HMDS
- Photoresists and E-Beam resists
- Resist Ancillary chemicals like strippers and developers
- Any other solvent

Cabinet 2, the large, corrosives cabinet is used to store:

- Buffered Oxide Etchant 10:1
- Hydrochloric Acid
- Hydrofluoric Acid
- Sulfuric Acid
- Phosphoric Acid
- Summa Clean SC-15M
- Any etchants
- Any other acid that is not Nitric Acid

Cabinet 3, the small, corrosives cabinet is used to store **Nitric Acid** only.

Cabinet 4, the small, flammables cabinet is used to store non process oils, both hydrocarbon and fluorinated polymer based, and ethylene glycol.

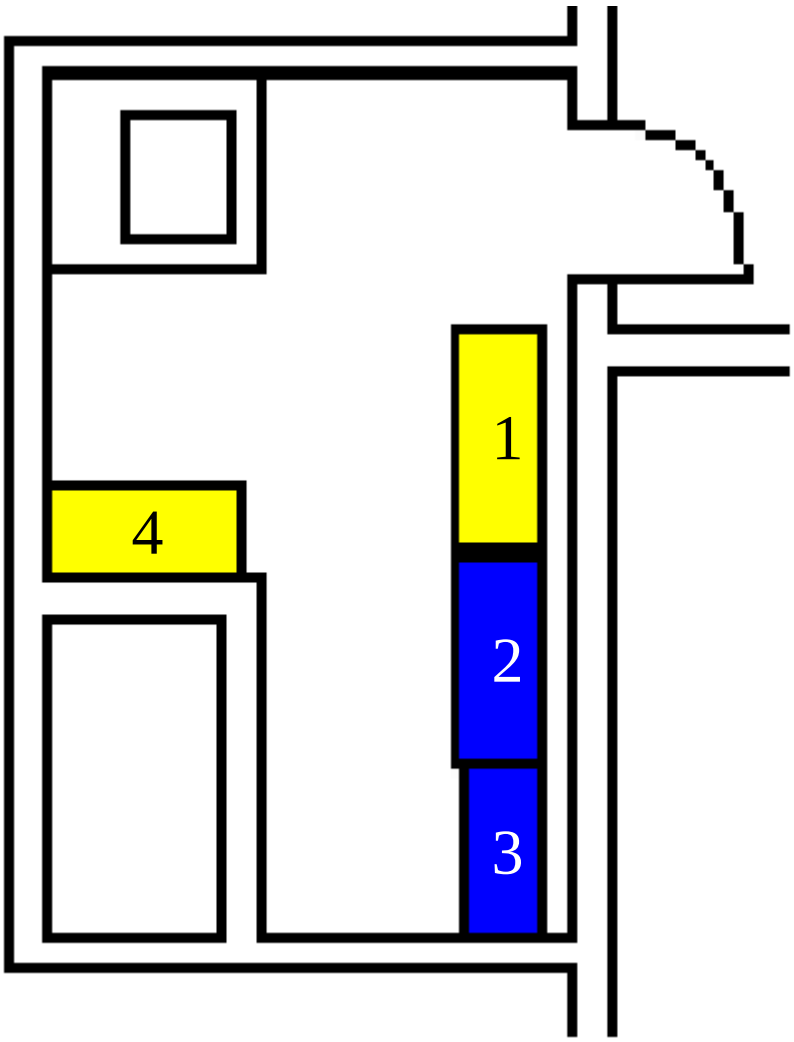



**FIGURE 2: G55A1 ESB Chemical Storage Room**

In addition, some ethylene glycol containers may be stored on the floor near the small flammables cabinet.

When a chemical is removed from G55A1 it must be wiped down in the gowning area before entering the cleanroom. Once the chemical has entered the cleanroom, it is stored under one of 5 chemical hoods. The location of these hoods is shown in Figure 3. Chemicals and chemical waste jars are store at the point of use.

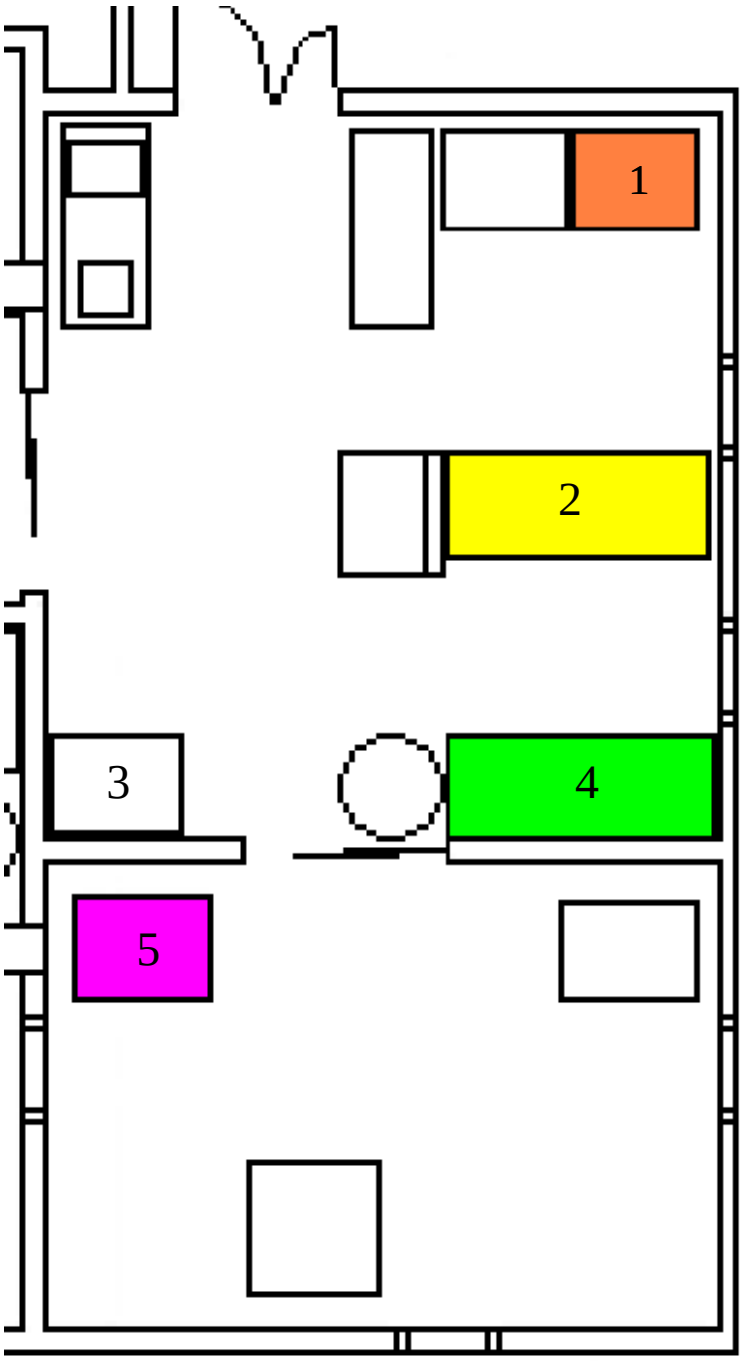



**FIGURE 3: Chemical Hoods and Point of use storage in cleanroom.**

The color displayed for each hood in Figure 3, indicates the approved label color that should be applied to chemicals stored in each hood.

Hood 1 (Orange) - The spare, right hand hood storage space is used to store bases or base waste jars.

Hood 2 (Yellow) - The solvent hood storage space is used to store Acetone, Methanol, Isopropanol, AZ 300 T stripper, any other solvents or resist strippers, and corresponding waste jars. Two waste jars, one for acetone and one for alcohol, are stored on the hood deck for user convenience. These two waste jars must be covered when not being used.

Hood 3 (White) – The developer hood storage space is used to store AZ 300 MIF developer, AZ 400 K developer, any other developers, and corresponding waste jars.

Hood 4 (Green) – The acid hood storage space is used to store all acids, etchants, Summa Clean and corresponding waste jars. The nitric acid stored under the acid hood must be isolated from all other acids by storing it in a secondary containment bucket.

Hood 5 (Pink) – The spinner hood storage space is used to store all HMDS, all resists and polymers, and the waste pipette jar.

## SECTION 3.2: AUTHORIZING CHEMICAL USAGE

The WVU Shared Research Facilities Cleanroom only purchases chemicals that are general use. Often, research projects require the use of chemicals that are specific to a project. Any cleanroom user, who wishes to bring a new chemical into the cleanroom, must first obtain permission before bringing a new chemical into the lab. The user must submit a signed material tracking form and a material safety data sheet(s) (MSDS) for each chemical container to the Cleanroom manager for approval. A copy of this form can be found on the shared research facilities website (http://sharedresearchfacilities.wvu.edu/forms/srfForms.html). This form identifies the chemical, proper storage and proper disposal methods. Material tracking forms are kept in a binder in the SRF Cleanroom manager's office. The MSDS are added to the MSDS file kept in G75B ESB.

All containers must be brought to a SRF staff member to receive an approved chemical label, which is signed and dated by the SRF staff member. The chemical container must be appropriate for the chemical and it must be labeled appropriately with the full chemical name to receive an approved chemical label. Only containers with approved chemical labels may be taken into the cleanroom.

A chemical must be approved before being brought or stored into the cleanroom, even if the chemical is only going to be used one time.

## SECTION 3.3: CHEMICAL HANDLING

All wet chemical processing or any work with open chemical vessels must be performed in a chemical hood. The cleanroom has seven chemical hoods, and each is designated for a specific type of process. All chemical hoods in the cleanroom are class 2 wet benches and do not have

a sash. Users should be working with all chemicals at arm's length in the back half of the hood for their protection.

**WARNING:** Users should use designated hoods for specific chemical processing. Using acids in the solvent hood or solvents in the acid hood may result in an explosion.

Users working in the cleanroom must be properly gowned wearing a cleanroom suit and nitrile gloves. Cleanroom suits are splash resistant and nitrile gloves are resistant to some chemicals. However, users are required to wear more personal protective equipment (PPE) when working at specific chemical hoods or for specific processes.

When working in a chemical hood:

- Always add acids to water, never add water to acids.
- Never mix solvents and acids.
- Use extreme caution if mixing acids and bases. Very few processes require a mix of the two.
- Check for appropriate chemical ratios. Improperly mixed chemicals may create dangerous reactions or dangerous fumes.
- Use the appropriate PPE and type of gloves for chemical usage
- Keep the work area inside the hood clean and free from obstructions.
- Always work in appropriate hood and use appropriate vessels.
- Never heat solvents in closed beakers.
- Do not store items in the hood.
- Do not leave unlabeled chemicals unattended in a hood.
- Always properly label beakers.

Figure 4 is a map of the chemical hood stations in the cleanroom.

**Spare, Left Hood (1)** - The spare hood is used for chemical processes that may take a long time or that may need to be isolated from other chemicals.

Users working at this hood are required to wear the appropriate level of PPE determined for their process.

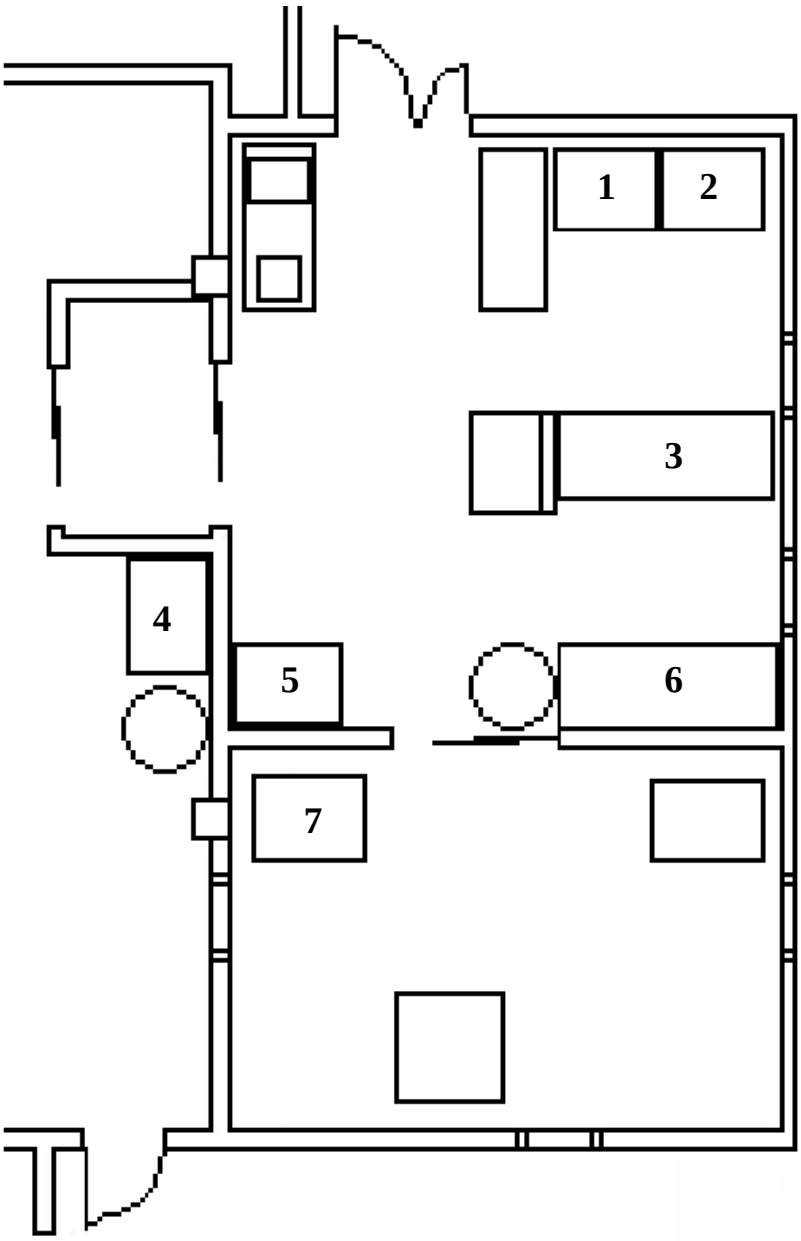



**Figure 4: Chemical hood stations in WVU SRF Cleanroom.**

**Spare, Right Hood (2) -** This spare hood is primarily used for wet processes that require base chemicals.

Users working at this hood are required to wear the following PPE:

- Orange protective gloves
- Splash protective goggles and face shield
- Acid apron when heating or mixing chemicals

**Solvent Hood (3)** - This hood is for working with solvents and strippers. Typical processes may be degreasing substrates and stripping resists.

Users working at this hood are required to wear the following PPE:

- Nitrile gloves
- Orange protective gloves when working with any chemical ending in "ene"

Splash resistant goggles and face shields when heating chemicals on a hotplate

**Solvent Hood (4)** – This hood is located in the dry processing room, and is for working with solvents. It is used for cleaning machine parts and substrate holders. This hood is placed here to separate the dirty maintenance processes from the fabrication processes to eliminate contamination.

Users working at this hood are required to wear the following PPE:

- Nitrile gloves

**Developer Hood (5)** - This hood is for working with photoresist and e-beam resist developers.

Users working at this hood are required to wear the following PPE:

- Nitrile gloves

**Acid Hood (6)** – This hood is for working with acids and etchants. Typical processes may include etching dielectrics, metals or semiconductors; as well as substrate cleaning.

Users working at this hood are required to wear the following PPE:

- Orange protective gloves
- Splash protective goggles and face shield
- Acid apron when handling HF, preparing piranha bath, or heating chemicals

**Spinner Hood (7)** – This hood is for applying with photoresists, e-beam resists and other polymers.

Users working at this hood are required to wear the following PPE:

- Nitrile gloves

## SECTION 3.4: ACCIDENTAL CHEMICAL EXPOSURE

Users are required to wear appropriate personal protective equipment (PPE) for their safety, if at any piece of PPE becomes damaged or torn it should be replaced immediately. If a user has been exposed to a chemical, the following procedures should be followed immediately.

For eye exposure:

1. Remove all contaminated clothing and gloves.
2. Initiate water flow at eyewash station by either pressing on the pedal or the hand lever.
3. Hold eyes open with fingers and lower face into eyewash bowl, so that water is rinsing the eyes.
4. Keep eyes open and rotate.
5. Flush eyes for a total of 15 minutes.
6. Seek emergency medical attention.

For exposure to any part of the body:

**WARNING:** Do not wipe off the chemical; you will only increase area of contact! Increasing area of contact will increase absorption through the skin and may result in faster or more severe reaction or poisoning.

1. Remove all contaminated clothing and gloves.
2. Initiate water flow at safety show by pulling down ring.
3. Flush contaminated area for a total of 15 minutes.
4. Seek emergency medical attention

For exposure to Hydrofluoric Acid (HF):

**WARNING:** 2% dermal exposure to HF may be fatal!

Hydrofluoric acid is indistinguishable from water. Because HF does not attack the skin, users will not feel immediate discomfort when exposed. HF is absorbed through the skin and attacks underlying tissue. It may take up to 48 hours to feel pain.

If exposed to HF:

1. Remove all contaminated clothing and gloves.
2. Initiate water flow at safety show by pulling down ring.
3. Flush contaminated area for a total of 15 minutes.
4. Liberally apply calcium gluconate gel to affected area.
5. Seek emergency medical attention.

## In case of MEDCIAL EMERGENCY contact:

**9-911 from any campus phone**
or
**Campus Security**
Phone: **(304)293-3136 (293-COPS)**

If going to the hospital for medical assistance, make sure you:

- Take a copy of the MSDS with you
- Inform medical personnel if you have been working with or have been exposed to HF

## SECTION 3.5: CHEMICAL SPILL RESPONSE

If at any time a user is unsure of how to clean up a spill or is uncomfortable in trying to clean up the spill they should immediately evacuate the area and seek assistance. Users should attempt to only contain the spill and then seek assistance from the SRF cleanroom staff. Personal protective equipment should be worn at all times.

**If a chemical has been spilled in the service chase areas:**

A spill kit is kept in the chemical storage room, G55A1 ESB. Users should only attempt to contain the spill if it is less than one gallon.

To contain the spill:

1. Open the spill kit by pressing the red lever with the thumb and rotating the lid counter clockwise.
2. Put on the green gloves inside the spill kit.
3. Remove a pink absorbent pad and place over the spill area. Use as many pads as necessary to contain the spill.
4. Seek SRF Cleanroom staff assistance.
5. With staff assistance, place all pads in the garbage bag.
6. Remove any remaining contents from the spill kit and place the garbage bag inside the pail.
7. Close the spill kit lid.
8. Fill out the USED Spill Kit label and attach to outside of the kit.
9. The cleanroom staff will contact EH&S for pickup.

**If a chemical has been spilled inside the cleanroom:**

A spill kit is stored on top of the acid hood in the wet processing room, G75C1 ESB. Users should only attempt to contain the spill if it is less than twelve inches in diameter.

To contain the spill:

1. Open the spill kit and put on the orange gloves.
2. Remove a tan absorbent pad and place over the spill area. Use as many pads as necessary to contain the spill.
3. Seek SRF Cleanroom staff assistance.

4. Absorbent pads must be left in place for at least 30 minutes to fully neutralize the chemical.
5. With staff assistance, place all pads in the garbage bag.
6. The Cleanroom staff will properly label waste and contact EH&S for pickup.

**NOTE:** Small spills of resist or polymers, which are less than two inches in diameter, may be wiped up with an acetone dampened cleanroom wiper. The wiper may then be disposed of in an appropriate waste container.

## In case of an ACUTELY HAZARDOUS SPILL contact in the following order:

**Environmental Health & Safety**
Phone: **(304) 293-3792**

Then Call,

**Kolin Brown,** Cleanroom Manager
Cell Phone: **(304) 366-6551**
Office Phone: **(304) 293-9683**
Room: **G75D ESB**
or
**Harley Hart,** Cleanroom Technician
Cell Phone: **(412) 443-1514**
or
**Marcela Redigolo**
Cell Phone: **(214) 766-2904**

If no one responds to any numbers above, then contact:

**Kenny Claudio**
Cell Phone: **(304) 216-4858**
Office Phone: **(304) 293-4091**
Room**: 373A MRB**

**Royce Watts,**
Cell Phone: **(304) 288-6762**
Office Phone: **(304) 293-4124**
Room: **377A MRB**

## SECTION 3.6: CHEMICAL DISPOSAL

All chemicals inside the cleanroom must be captured in waste jars. The only exceptions to this policy are the AZ developers and acids or acid mixtures that have not been used to etch metals.

**To dispose of AZ 300 MIF or AZ 400K:**
AZ 300 MIF developers and AZ 400K developers may be dumped down the drain with copious amounts of water. Users should turn on the sink faucet in the developer hood and then slowly pour out the beakers.

**To dispose of acids and acid mixtures that have not been used to etch metals:**
The cleanroom sinks are attached to an acid neutralization tank. Therefore acids that have not been contaminated with heavy metals may be aspirated. If an acid has been used to etch any metal, then it should be captured in a waste jar.

To aspirate an acid:

1. Make sure the aspirator is firmly attached to the faucet
2. Turn the faucet on full flow
3. Use the aspirator tube to draw up the acid (Aspirate at the surface)
4. Be careful when removing aspirator to avoid backflow
5. Fill beaker with water and aspirate again
6. Turn off aspirator

**To dispose of all other chemicals or chemical mixtures:**
Used chemicals must be captured in chemical waste jars. All chemical waste is captured and stored in an appropriately chosen waste jar which is properly labeled with the word WASTE. The jar label should clearly list all contents of the waste jar. Ideally, the waste jar should be an empty original container of the same chemical being disposed of. Each chemical or mixture should have its own waste jar. The only waste jar that should be used for multiple chemicals is the alcohol waste jar; this jar may be used to dispose of methanol, isopropanol, and ethanol.

Waste jars should be closed when not in use.

**WARNING:** Do not pour a hot liquid into a waste jar! Allow the hot chemical or chemical mixture to cool before adding it to a waste jar. Sealing a hot liquid in a waste jar may cause the jar to explode.

**WARNING:** Do not seal a waste jar if it the material is high reactive! If the waste jar heats up, or if it fumes, keep the jar open in the chemical hood deck and contact a SRF staff member immediately for assistance. Sealing a chemical reaction in a waste jar may cause the jar to explode.

## SECTION 3.6.1: HAZARDOUS WASTE DISPOSAL

Waste jars are inspected weekly by the SRF Cleanroom staff. When a waste jar is full, it is taken to room G55A1 ESB, which serves as the hazardous waste collection point for the cleanroom. When a waste jar is taken into G55A1, its label is modified to show the words HAZARDOUS WASTE. The label is dated and signed by the staff member. A hazardous chemical disposal form is filled out and submitted to EH&S for pickup. A copy of the hazardous chemical disposal form can be found on the WVU EH&S website, http://ehs.wvu.edu/forms.

## SECTION 3.6.2: CONTAMINATED MATERIAL HAZARDOUS WASTE DISPOSAL

A waste jar labeled "WASTE Photoresist Contaminated Pipettes" for used pipettes is kept in the exhausted storage cabinet under the spinner hood. This jar is inspected monthly by the SRF Cleanroom staff. When a waste jar is full, it is taken to room G55A1 ESB, which serves as the hazardous waste collection point for the cleanroom. The label is modified to show the words HAZARDOUS WASTE, then dated and signed by the staff member. A hazardous chemical disposal form is filled out and submitted to EH&S for pickup. A copy of the hazardous chemical disposal form can be found on the WVU EH&S website, http://ehs.wvu.edu/forms

Any cleanroom wipe that has been contaminated with a chemical must be disposed of as hazardous waste. Used wipe waste containers with lids are kept at all hoods, the sputter station, E-Beam evaporator and SEM preparation area. The contents of these containers are collected daily by the SRF Cleanroom staff and taken to room G55A1 and placed in the sealed drum for used wipe collection. The SRF staff member dates the tracking form on the drum lid when the first wipes are added. When the drum is full a hazardous chemical disposal form is filled out and submitted to EH&S for pickup. The EH&S staff person will sign and initial the tracking form when the drum is emptied.

## SECTION 3.6.3: USED OIL DISPOSAL

All used oil is captured and stored in an appropriately chosen waste jar which is properly labeled with the words USED OIL. It is taken to room G55A1 ESB, which serves as the hazardous waste collection point for the cleanroom. The label is dated and signed by the staff member. A hazardous chemical disposal form is filled out and submitted to EH&S for pickup. A copy of the hazardous chemical disposal form can be found on the WVU EH&S website, http://ehs.wvu.edu/forms.

## SECTION 4: GAS SAFETY

The following gasses are typically used by equipment inside the cleanroom:

- Ammonia
- Boron Trichloride
- Carbon Dioxide
- Chlorine
- Nitrogen
- Nitrous Oxide
- 20% Oxygen, balance Tetrafluoromethane
- 5% Silane, balance Nitrogen
- Tetrafluoromethane
- Ultra High Purity (UHP) Argon
- UHP Helium
- UHP Oxygen
- UHP Nitrogen

For a full list of gasses with specific information on each gas and location, please see the current chemical inventory in Appendix B. All unused, full gas cylinders and empty gas cylinders are stored in the loading area G75C ESB.

All unused cylinders are stored securely to the wall with valve caps on. All cylinders in use are mounted securely against a wall, secure structure or inside a gas cabinet. All cylinders are transported using a cylinder hand truck. Eye protection or face shield is to be worn when changing cylinders.

When operating equipment, users should only open or close the cylinder stem valves and outlet valves. Users should not have to make adjustments with the regulators. Adjustments to regulators should be done by SRF Cleanroom staff. Cleanroom users are to follow all equipment operational procedures outlined in the Standard Operating Procedures located in Appendix B, in the equipment manual and during equipment trainings, when working with compressed gasses.

**WARNING:** Users should never bypass equipment interlocks. Bypassing a safety interlock may expose the user to toxic or flammable gasses.

## SECTION 4.1: TOXIC GASSES

The following gasses used in the cleanroom are toxic or present a health hazard if exposed:

- Ammonia
- Boron Trichloride
- Chlorine
- Nitrous Oxide

Users must follow all follow all equipment operational procedures outlined in the Standard Operating Procedures located in Appendix B, in the equipment manual and during equipment trainings, when working on the PECVD or ICP. Bypassing any safety interlock on these machines may expose the users to the gasses.

Users should not attempt to change these gas bottles or disconnect any gas line connected to these cylinders. A SRF staff member should be contacted if the cylinder needs changed. Staff members will follow the procedures outlined in the equipment Standard Operating Procedures in Appendix B when changing the gas cylinders.

## SECTION 4.2: FLAMMABLE GASSES

5% Silane gas will spontaneously ignite when exposed to air. While it will not explode, the gas will produce flames.

Users must follow all equipment operational procedures outlined in the Standard Operating Procedures located in Appendix B, in the equipment manual and during equipment trainings, when working on the PECVD. Bypassing any safety interlock on this machine may expose the users to this gas or cause a flash fire.

Users should not attempt to change the silane or disconnect any gas line connected to the silane. A SRF staff member should be contacted if the cylinder needs changed. Staff members will follow the procedures outlined in the equipment Standard Operating Procedures in Appendix B when changing the silane cylinder.

## SECTION 5: LABORATORY HAZARDS

Users should be aware of additional hazards when working in the cleanroom, these are:

- Sharps and broken glass
- High voltages
- UV lamp hazards

## SECTION 5.1: SHARPS AND BROKEN GLASS DISPOSAL

A broken glass disposal box is kept in the gowning room, G75B ESB. This box is for the disposing of broken glass or substrates. SRF staff members inspect this box monthly. When full, the box is sealed and disposed with the laboratory trash.

A small sharps disposal box is kept on top of the spinner hood in the photolithography room, G75C2 ESB. This box is primarily for the disposal of razor blades, though any sharp may be disposed of here. This box is for the disposing of broken glass or substrates. SRF staff members inspect this box monthly. When full, the box is sealed and disposed with the laboratory trash.

## SECTION 5.2: HIGH VOLTAGE HAZARDS

The following instruments inside the cleanroom use High voltages:

- E-Beam Evaporator
- Flood Exposure System
- Mask Aligner
- Oxygen Plasma Asher
- Plasma Enhanced Chemical Vapor Deposition System (PECVD)
- Programmable Furnace
- Rapid Thermal Annealer
- Reactive Ion Etcher with Inductively Coupled Plasma Unit (ICP)
- Scanning Electron Microscope (SEM)
- Sputtering Station

All cleanroom users are given proper instruction on equipment operation before given authorization to use these tools. Users must follow all operational procedures outlined in the Standard Operating Procedures located in Appendix B.

**WARNING:** Any attempt to bypass any safety interlocks on any piece of equipment in the cleanroom may result in severe shock or electrocution.

## SECTION 5.3: UV ARC LAMP HAZARDS

The MA6 Mask Aligner and the Flood Exposure System utilize mercury-xenon arc lamps. Improper use of these two pieces of equipment may create a UV Light hazard or a mercury exposure hazard.

**UV Light Hazard:**
The arc lamps are a source of UV light for photolithography processes. Users must follow all equipment operational procedures outlined in the Standard Operating Procedures located in Appendix B when operating the Mask Aligner or Flood Exposure System. Users should not bypass any safety interlocks on the system.

These lamps produce intense UV light. UV protective glasses are required when operating the Mask Aligner or Flood Exposure System. Prolonged, direct UV exposure may burn skin or cause temporary or permanent blindness. Objects should not be moved in or out of the beam path when the shutters are open. Users should not place hands or tools directly under the beam when the shutters are open. The flood exposure system should not be moved or operated on its side.

**Mercury exposure hazard:**
When operating the Mask aligner or Flood Exposure system, do not attempt to increase the lamp voltage to increase optical output intensity. The mercury arc lamp output intensity will decrease over the lifetime of the lamp. If the optical output intensity is too low, then the lamp needs to be changed. Please see a SRF Cleanroom staff member for assistance. The procedures outlined in the equipment manuals must be followed when changing the arc lamps.

**WARNING:** Over driving an arc lamp with higher voltage may cause the lamp to crack or explode, releasing mercury vapor.

When an arc lamp breaks the sound of shattering glass can be heard. If this occurs while operating one of these systems:

1. Immediately turn off the lamp power supply. **Do not attempt to open the lamp housing!**
2. Evacuate the cleanroom of all persons immediately.
3. Contact a SRF staff member.
4. Let the arc lamp housing to cool for 30 minutes before re-entering the cleanroom. This will allow any mercury vapor to condense inside the lamp housing.
5. Clean up the mercury with a mercury spill kit located next to the Flood Exposure System.
6. The cleanroom staff member will properly dispose of the spill kit and broken arc lamp, by properly sealing them in a labeled container and contacting EH&S for hazardous waste disposal.

To use the mercury spill kit:

1. Put on the protective gloves found inside the kit.
2. Wet the mercury neutralizing sponge with water.
3. Carefully rub all mercury contaminated surfaces with the sponge, ensuring the neutralizing surface is face down.
4. Once the sponge has absorbed all the mercury, dispose of it in the plastic bag and seal.
5. The cleanroom staff member will properly dispose of the used spill kit by properly sealing and labeling it, and contacting EH&S for hazardous waste disposal.