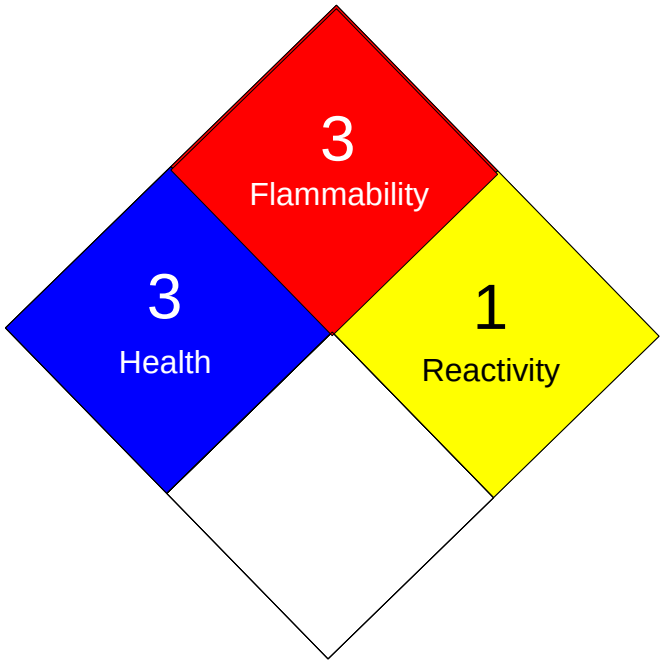
WVU SHARED RESEARCH FACILITIES

Sample Preparation Lab Chemical Hygiene Plan

B64 Engineering Science Building



Emergency Contact:

Marcela Redigolo, Ph.D.
Office: G75D Engineering Sciences Building
Cell Phone: (304) 680-3007
Office Phone: (304) 293-9973

CHEMICAL HYGIENE PLAN

Approval Sheet

for the

WVU-SRF Sample Preparation Lab

ESB B64

Approvals:

Applicant — M. Rodigolo — Date: 03/15/12

Engineering Safety Review — R. Watts — Date: 3/21/12

WVU EH&S — J. Hando — Date: 3/28/12

Engineering Review — K. Claudio — Date: 3/20/12

WVU Shared Research Facilities Director — L. Williams — Date: 3/23/12

SECTION 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: (Also in Table 1)

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

Non-Standard Symbols (also put in the White area)

Note: These hazard symbols are not part of the NFPA 704 standard, but are occastionally used in an unofficial manner. The use of non-standard symbols or text may be permitted or required by the authority having jurisdiction.

COR - corrosive

ACID – acids

ALK – alkalines

BIO – biological hazard

POI – poisonous

☢ – radioactive

CYL or **CRYO** – cryogenic (e. g. Liquid Nitrogen)

LN2 – Liquid Nitrogen

NFPA Rating Explanation Guide

RATING NUMBER	HEALTH HAZARD	FLAMMABILITY HAZARD	INSTABILITY HAZARD
4	Can be lethal	Will vaporize and readily burn at normal temperatures	May explode at normal temperatures and pressures
3	Can cause serious or permanent injury	Can be ignited under almost all ambient temperatures	May explode at high temperature or shock
2	Can cause temporary incapacitiation or residual injury	Must be heated or high ambient temperature to burn	Violent chemical change at high temperatures or pressures
1	Can cause significant irritation	Must be preheated before ignition can occur	Normally stable. High temperatures make unstable
0	No hazard	Will not burn	Stable

RATING SYMBOL	SPECIAL HAZARD
ALK	Alkaline
ACID	Acidic
COR	Corrosive
OX	Oxidizing
☢	Radioactive
₩	Reacts violently or explosively with water
₩ OX	Reacts violently or explosively with water and oxidizing

This chart for reference only - For complete specifications consult the NFPA 704 Standard

NFPA-Chart_1 www.ComplianceSigns.com

Table 1: NFPA Rating Explanation Guide

SECTION 1.1: 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

Marcela Redigolo, Electron Microscopy Manager
Cell Phone: **(304) 680-3007**
Office Phone: **(304) 293-9973**
Room: **G75D ESB**

or

Kolin Brown
Cell Phone: **(304)366-6551**
Office Phone: **(304)293-9683**
Room: **G75D ESB**

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:

Marcela Redigolo, Electron Microscopy Manager
Cell Phone: **(304) 680-3007**
Office Phone: **(304) 293-9973**
Room: **G75D ESB**

SECTION 1.2: EMERGENCY EVACUATION PROCEDURES

In case of Fire or Chemical Spill all users should evacuate the laboratory immediately!

- Use the shortest, unobstructed path to the exterior of the building. (see Figure 1)

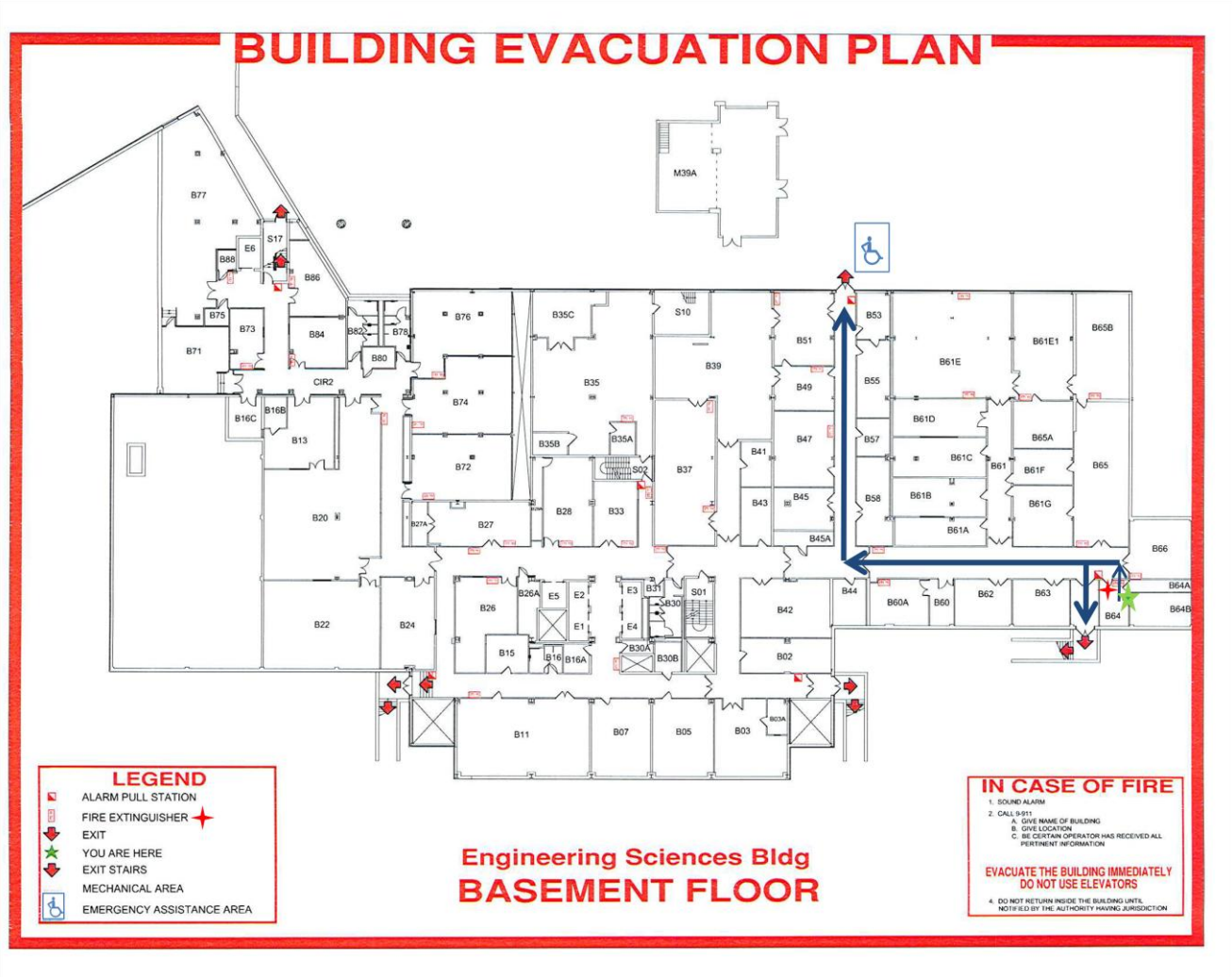


Figure 1: Sample Preparation Lab Evacuation Plan (room B64) in the basement of the Engineering Sciences Building. Closest exits marked with dark blue arrows

- Evacuate the building by pulling the fire alarm pull station when exiting the building. All basement exits have a fire alarm pull station.
- Call the emergency contacts.

SECTION 1.3: 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 an instrument. The user should then notify all other persons in the lab 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, and the user's contact number.

Listed below are the procedures to place the Sample Preparation Lab instruments into a safe default mode, or to shut down. Shutdown procedures may also be found on the cover of the equipments logbook or in the Standard Operating Procedure found in Appendix A. Figure 2 shows the power switches for each instrument in the lab.

To place in default mode:

Optical Microscope

- **Turn OFF the microscope by turning the power switch to ZERO. The power switch is located at the base of the microscope, right side.**

MultiPrep Polishing System:

- **Make sure the system is not polishing a sample. Slide the MultiPrep head to the side of the instrument.**
- **Turn OFF the power button in the front panel of the instrument.**
- **Turn OFF the power button in the back of the instrument.**

Saw:

- **Make sure the blade is not rotating.**
- **Turn OFF the power button in the back of the saw.**

To shutdown any of the instruments In the Sample Prep Lab (this emergency shutdown will turn OFF power to instruments):

- **In case of emergency shutdown, just remove the cable from the power outlet in the wall. This will immediately cut the power to the instrument.**

a)  *b)* 

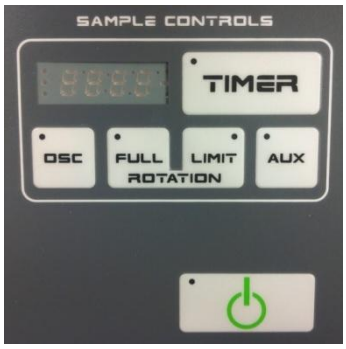
c) 

Figure 2: Photograph of the power buttons for each instrument: a) Optical Microscope (right side). b) Saw (back of the instrument). c) MultiPrep Polishing System (front panel).

SECTION 1.4: EMERGENCY RESPONSE EQUIPMENT

First Aid kit is located inside the lab, **B64**, attached to the wall by the entrance door.

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 (ESB).

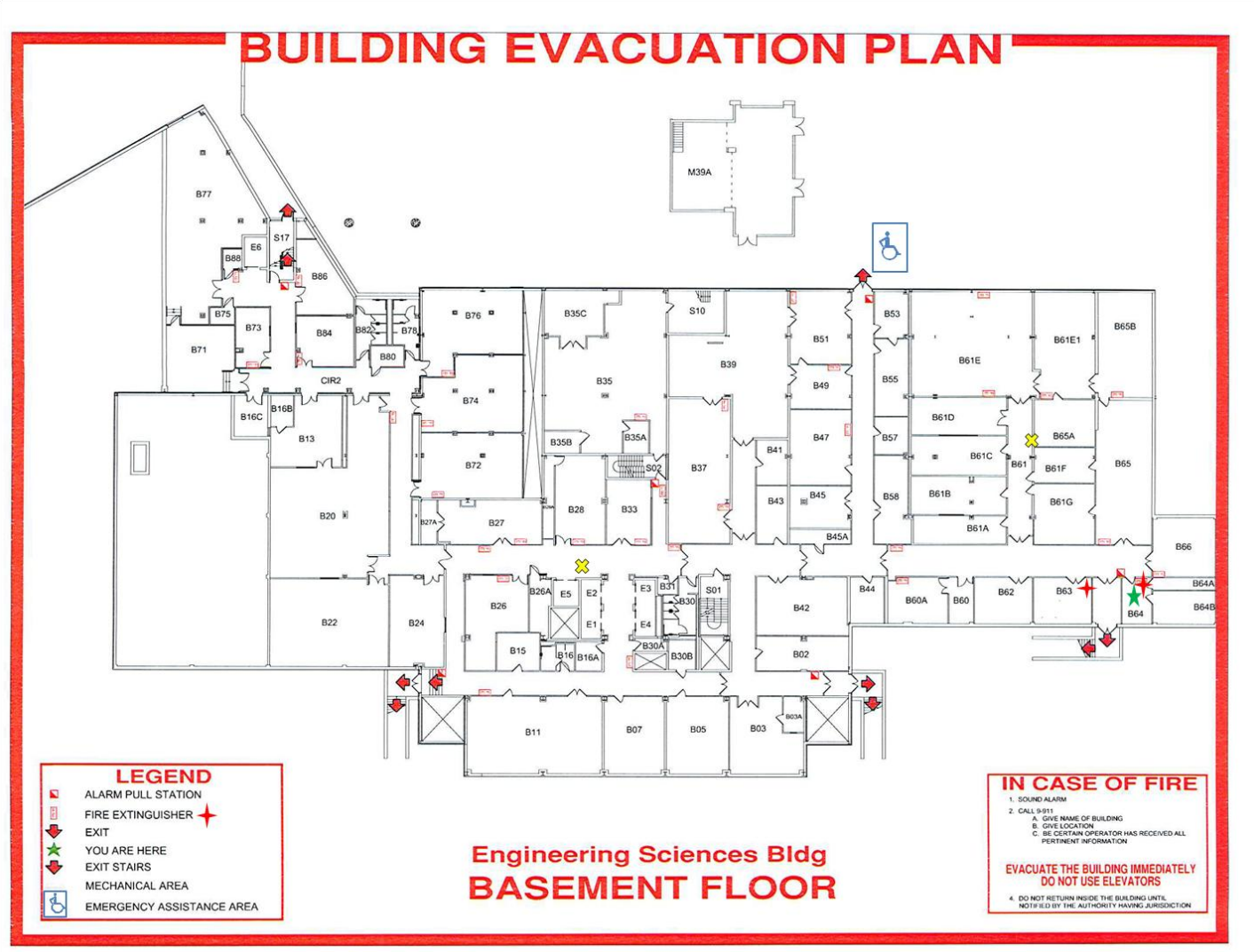


Figure3: Location of the safety showers (✖), eyewash stations (✖) and fire extinguisher (✦).

Safety shower is located in the ESB basement, inside the B61 area (in the hall after the glass doors). Another s**afety shower** but with **eyewash station** is located in the ESB basement, by the freight elevators. Figure3 indicates the location of these safety showers and eyewash station using ✖ symbol.

An additional **safety shower** and **eyewash station** is located in the corridor outside the cleanroom (G75) in the ground floor of the Engineering Sciences Building (ESB).

The **Chemical Hygiene Plan** and **MSDS**s are located inside the lab by the computer, room **B64 ESB**. The lab also has a fire extinguisher, type ABC, indicated in figure 3 by the cross ✦.

All basement exits count with a fire alarm pull station.

SECTION 2: LAB OVERVIEW AND DESCRIPTION

The Sample Preparation Laboratory is part of the Electron Microscopy Facility, which is one of the four WVU Shared Research Facilities. This lab is a support lab for sample preparation for electron microscopy analyses among others. Bulk, solid samples can be prepared in this lab for transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic force microscopy (AFM) and focused ion beam (FIB) analyses.

The MultiPrep Polishing System is currently the main instrument in the Sample Prep Lab, and provides the ability to prepare a wide range of materials for microscopic evaluation. Capabilities include parallel circuit delayering, cross-sectioning, serial / 3D preparation, wedge polishing, optical microscopy observation with image capture or video recording, and more.

As part of the WVU Shared Research Facilities, the Sample Prep Lab 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.

The Sample Prep Lab is located in room **B-64** that is the front area of a shared space. Room **B-64A** is a chase that contains water chillers for electron microscopes in rooms ESB B-63 (Transmission Electron Microscopy TEM Lab) and ESB B66 (Scanning Electron Microscopy SEM Lab). It is responsibility of the Electron Microscopy Facility the equipment in the chase that serves the TEM Lab only. Equipment that serves the SEM Lab are responsibility of the Chemical Engineering Department.

Room **B-64B** is Prof. Xueyan Song group's lab. Shared Research Facilities is not responsible for that lab. Although, since the lab has a cylinder of Liquid Nitrogen, all users of the Sample Prep Lab are instructed about Liquid Nitrogen and proper emergency procedures.

Instruments located in the Sample Preparation Lab are:

1. MultiPrep Polishing System
2. Techno 4 Slow Speed Saw
3. Metallurgical Optical Microscope
4. Support instruments: Hot Plate, computer with internet connection

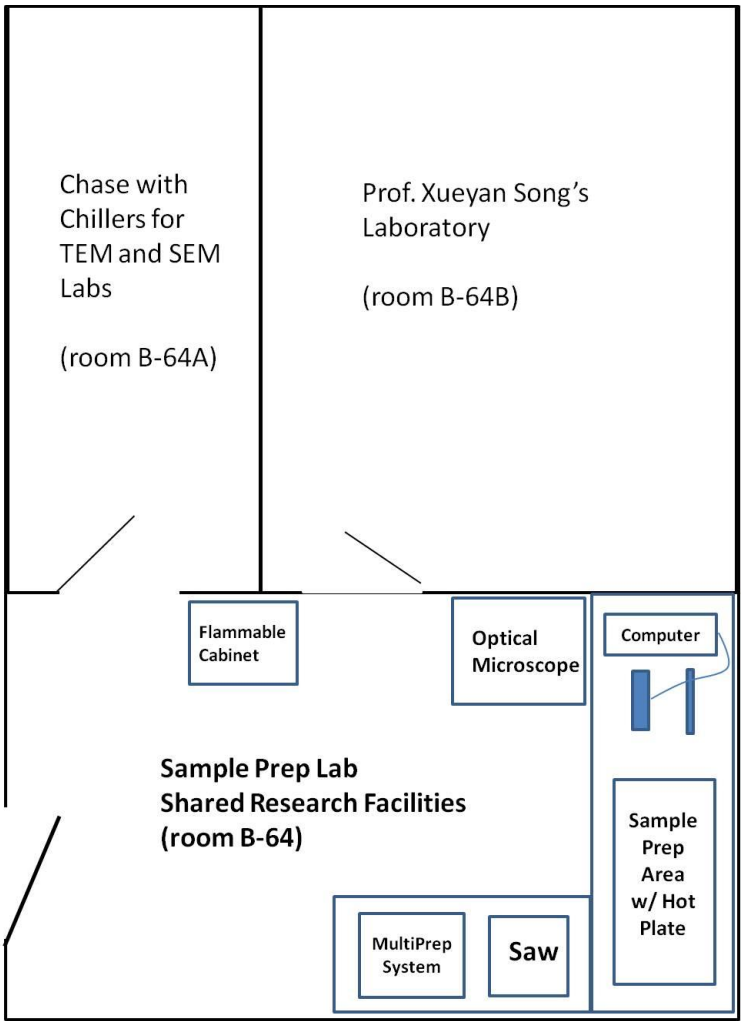


Figure4: Approximate Layout of the Sample Preparation lab and other labs in the same area.

SECTION 2.1: LABORATORY ACCESS

Access to the WVU Shared Research Facilities is controlled through the WVU ONITY Lock system. The door to the Sample Prep lab, B64 ESB, has one ONITY lock.

As part of the CEMR Electronic Lock policy, the Sample Prep lab lock, B64 ESB, has been identified as a restricted lock. Access to this lock is only given to lock shop personnel, campus security, emergency services, appropriate CEMR Administration, Shared Research Facilities staff, and Sample Prep Lab 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 to the Dean's office.

The following persons are the official operators of this lock:

- Kolin S. Brown
- Lisa Sharpe

In addition, the WVU Lock Shop and WVU Card Services also have capabilities to add students, staff and faculty to this lock. Authorized people for Prof. Xueyan Song group lab and personnel from the Chemical Engineering Department / SEM Lab are also added to the B64 door lock, so they can access the chase in B-64A or the lab in B-64B.

Sample Prep Lab users are only given access to the Sample Prep laboratory during normal working hours after they have completed all required safety trainings and have a signed user agreement on file with the SRF Electron Microscopy Facility Manager.

The normal working hours of the Sample Prep lab are 8 AM to 5 PM, Monday to Friday. After-hours are 5 PM to 8 AM, Monday to Friday, and full time during weekends and holidays.

SECTION 2.2: REQUIRED SAFETY TRAINING

All Sample Prep Lab users must complete the following three safety and equipment trainings to receive access to the facility during normal working hours.

- SRF General Lab Safety Training
- SRF Chemical Safety Training
- Instruments Training, depending on which instruments they will be working with in the lab.

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

SECTION 2.3: USER AGREEMENTS

All Sample Prep Lab users must have a user agreement on file with the WVU SRF Electron Microscopy Facility Manager. User agreements must be signed by the user, the user's advisor/supervisor 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 2.4: DRESS CODE

The following dress code is required for all users entering the Sample Prep Lab:

- No shorts. Legs must be fully covered
- No sandals or open toed shoes. Feet must be fully covered

Users operating the Saw must wear proper protection gear:

- High Impact glasses

Users operating the MultiPrep System must wear proper protection gear:

- Nitrile gloves

Users mounting samples and using our chemicals must wear proper protection gear:

- Splash googles
- Nitrile gloves

SECTION 2.5: AFTER HOUR ACCESS

After hour access to the Sample Prep Lab is given upon request by the WVU Shared Research Facilities Electron Microscopy Facility Manager. The manager will use her own discretion to grant access when a user has demonstrated that he or she can work alone safely and handle an emergency.

SECTION 2.6: TEMPORARY USER SUPERVISION

Temporary users in the Sample Prep lab must be accompanied by a trained 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 present in the Sample Prep Lab:

- Acetone
- IsoPropanol
- GreenLube lubricant
- Cutting fluid for saw
- Aluminum colloidal suspension for polishing
- Silica colloidal suspension for polishing
- Silver paint
- Micro-organic soap

A current chemical inventory may be found in Appendix B. This inventory is updated yearly.

SECTION 3.1: CHEMICAL STORAGE

Chemicals are stored in the flammable cabinet located in the lab and also inside the wood cabinets in the room, depending of the type of chemical: flammable or non-hazardous respectively.

The small flammables cabinet, represented in Figure 4, is used to store:

- Acetone
- IsoPropanol
- Silver paint

The maximum volume of these chemicals available for work in the lab is 500 ml each, except for the silver paint that has a maximum volume of 25ml. Due to the nature of the chemicals and their volumes, there is no need of a fume hood in the lab. In this lab, only sample preparation for microscopy is authorized. Any synthetic route of materials and other chemical processes should be developed by the user in their own research group and are not authorized in the Sample Preparation Lab.

Inside the wood cabinets, the following chemicals can be found:

- GreenLube lubricant
- Cutting fluid for saw
- Aluminum colloidal suspension for polishing
- Silica colloidal suspension for polishing
- Micro-organic soap

SECTION 3.2: AUTHORIZING CHEMICAL USAGE

The Sample Preparation Lab for the WVU SRF Electron Microscopy Facility only purchases chemicals that are general use. Often, research projects require the use of chemicals that are specific to a project. For example, a different colloidal suspension for the polishing of specific materials. Any user, who wishes to bring a new chemical into the Sample Prep Lab, 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 Electron Microscopy 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. The MSDS are added to the MSDS file kept in the lab, room B-64 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 Sample Prep Lab.

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

SECTION 3.3: 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 closest 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 the closest safety show by pulling down ring.
3. Flush contaminated area for a total of 15 minutes.
4. 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

SECTION 3.4: 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 staff. Personal protective equipment should be worn at all times.

If a chemical has been spilled in the lab:

A spill kit is kept in the lab by the door. 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 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 electron microscopy facility staff will contact EH&S for pickup.

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

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

Then Call,

Marcela Redigolo, Electron Microscopy Manager
Cell Phone: **(304) 680-3007**
Office Phone: **(304) 293-9973**
Room: **G75D ESB**

or

Kolin Brown
Cell Phone: **(304)366-6551**
Office Phone: **(304)293-9683**
Room: **G75D ESB**

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 3.5: CHEMICAL DISPOSAL

All chemicals inside the Sample Prep Lab must be captured in waste jars. The only exceptions to this policy are the detergents and micro-organic soap that can be disposed down the drain in the sink inside the lab, with copious amounts of water. Users should turn on the sink faucet in the lab and then slowly pour out the beakers.

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 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.

SECTION 3.5.1: HAZARDOUS WASTE DISPOSAL

Waste jars are inspected weekly by the SRF electron microscopy facility staff. When a waste jar is full, it is taken to room G55A1 ESB (cleanroom), which serves as the hazardous waste collection point for the electron microscopy facility labs. 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 3.5.2: CONTAMINATED MATERIAL HAZARDOUS WASTE DISPOSAL

Any Sample Prep Lab wipe, gloves or papers that has been contaminated with a chemical must be disposed of as hazardous waste. Used wipe/solid waste container with lid is kept in the lab. The contents of these containers are collected weekly by the SRF electron microscopy staff and taken to room G55A1 ESB for disposal following the procedures described in the cleanroom chemical hygiene plan.

SECTION 3.5.3: USED OIL/CUTTING FLUID DISPOSAL

All used oil/cutting fluid in the lab is captured and stored in an appropriately chosen waste jar which is properly labeled with the words USED CUTTING FLUID. It is taken to room G55A1 ESB, which serves as the hazardous waste collection point. 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: LABORATORY HAZARDS

Users should be aware of additional hazards when working in the Sample Prep lab. These are:

- Sharps and broken glass
- Burn hazard (hotplate)
- Mechanical hazard (Saw and MultiPrep System)
- Adjacent area hazard (Liquid Nitrogen present in Prof. Xueyan Song group's lab in B-64B)

SECTION 4.1: SHARPS AND BROKEN GLASS DISPOSAL

A broken glass disposal box is kept in the lab, room B-64 ESB. This box is for the disposing of broken glass. 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 work bench in the lab. This box is primarily for the disposal of razor blades, though any sharp may be disposed of here. SRF staff members inspect this box monthly. When full, the box is sealed and properly disposed.

SECTION 4.1: BURN HAZARD

The following instrument inside the Sample Prep lab presents burn hazard:

- Hot Plate

All Sample Prep lab users are given proper instruction on equipment operation before given authorization to use the tool. Users must follow all operational procedures.

WARNING: Any attempt to bypass any safety interlocks on this piece of equipment in the Sample Prep lab may result in severe burn.

SECTION 4.3: MECHANICAL HAZARD

Numerous physical hazards may be present in the laboratory. While not as exotic as chemical and biological hazards, physical hazards are responsible for the majority of workplace injuries. It is important to be aware of these hazards, preplan, use personal protective equipment and follow basic safety rules in order to prevent accidents involving physical hazards.

Many laboratory instruments, such as the saw and the MultiPrep polisher, have moving parts. Some of these devices are blades, rotary platens. Generally these machines have safeguards or interlocks to prevent machinery-related injuries; however, caution must always be exercised around moving parts. If working with such equipment, follow these safety guidelines:

- Avoid wearing loose fitting clothing or necklaces that could be drawn into a rotating assembly.
- Do not defeat interlocks on panels, circuits, handles, etc.
- Do not brake moving parts by hand; wait for motion to stop on its own.
- Be aware of assemblies that vibrate and could "walk" into other objects or fall off a counter.
- Safety glasses must always be worn around any power tool operation.
- Use caution with automatic or computer-controlled machines that could start unexpectedly.

Note: High impact safety glasses are located together with the saw, in the Sample Prep Lab, and must be worn all times while working with this instrument.

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SECTION 4.4: ADJACENT AREA HAZARD - LIQUID NITROGEN

Liquid nitrogen (LN2) is inert, colorless, odorless, non-corrosive, non-flammable, tasteless, extremely cold, and has no warning properties. Special care must be taken by personnel who handle or work in areas where liquid nitrogen is used. The hazards associated with LN2 include:

- Over-pressurization and explosion due to LN2 vaporizing to nitrogen gas (700x expansion ratio) in unvented containers.
- Severe burns caused by exposure to cold temperatures.
- Asphyxiation due to displacement of oxygen in the air in confined work areas.

Humans cannot reliably detect the presence of nitrogen. Liquid nitrogen has a 700x expansion ratio which may create physical hazards and injuries from the explosion of unvented containers. Extensive tissue damage or burns can result from exposure to LN2 or cold nitrogen vapors.

Asphyxiation may result from the displacement of oxygen in the air with nitrogen to levels where there is insufficient oxygen to support life. Inhalation of oxygen deficient air can cause dizziness, nausea, vomiting, loss of consciousness, and death.

The following personal protective equipment is required when handling or using LN2:

- **Water proof thermal insulated gloves** (e.g., cryo-gloves):- Hands must be protected with water proof thermal insulated gloves that can be quickly removed if LN2 is spilled on them. Insulated gloves are not intended for submersing hands into LN2.

- **Cryo-aprons**:- Body must be protected with pants and closed-toe shoes. Thermal insulated aprons should be available.

- **Safety goggles**:- Eyes are most sensitive to the extreme cold of LN2 and its vapors. Over-pressurization may result in the explosion of improperly vented equipment. Chemical splash goggles must be utilized when handling LN2.

- **Full face shield**:- Face must be protected against splashes and spills of liquid nitrogen by a face shield.

People handing liquid nitrogen are required to wear appropriate personal protective equipment (PPE) for their safety. If at any time a piece of PPE becomes damaged or torn, it should be replaced immediately.

Liquid Nitrogen is located only inside the room B64A. Users of the Sample Prep Lab are not authorized to enter Prof. Xueyan Song group's lab (B64A) without their authorization. If a spill or other accident happens inside that lab, room B64B, their personnel should inform the Sample Prep Lab users and personnel immediately so we can also take proper action. Prompt medical attention is mandatory in all cases of overexposure to nitrogen. Quick removal to uncontaminated area is most important.

Although Liquid Nitrogen is not physically present in our space (B64), during users training, all hazards related to liquid nitrogen are mentioned and explained.

SECTION 4.4.1: ACCIDENTAL EXPOSURE

In case there is any accidental exposure of a user to liquid nitrogen, the following procedures should be followed immediately.

For frostbite exposure:

7. Remove all contaminated clothing and gloves, and any clothing item that may restrict circulation to the frozen area.
8. Do not rub frozen parts, as tissue damage may result.
9. Place the affected area in a warm water bath that has a temperature not exceeding 105°F (40°C).
10. Never use dry heat!!

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 you were exposed to liquid nitrogen.

SECTION 4.4.2: LIQUID NITROGEN SPILL RESPONSE

Personal protective equipment should be worn at all times. If a significant quantity of liquid nitrogen has escaped, or been spilled, in the adjacent lab, the area affected will not contain adequate oxygen to support life. The area should be immediately evacuated. It is responsibility of the personnel in lab B64B to inform and evacuate everyone present also in the adjacent areas (B64 and B64A). Then, the following personnel should be contacted:

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

Then call,

Xueyan Song, Professor (responsible for lab B-64B)
Cell Phone: **(304) 237-4208**
Office Phone: **(304) 293-3269**

And

Marcela Redigolo, Electron Microscopy Facility Manager
(responsible for lab B-64 and B-64A)
Cell Phone: **(304) 680-3007**
Office Phone: **(304) 293-9973**

Or

Kolin Brown, Cleanroom Manager
Cell Phone: **(304) 366-6551**
Office Phone: **(304) 293-9683**
Room: **G75D ESB**

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**

If a person is showing symptoms of mild or severe asphyxia, they should be moved to an area with fresh air. If they are not conscious, security should be called immediately and resuscitation started by a qualified first aid officer or physician.

Cold burns from liquid nitrogen should be immediately and continually flushed with tepid or unheated tap water.

Professional medical advice should always be sought urgently for significant cold burns and asphyxia. Persons affected may need urgent medical treatment at a hospital.

APPENDIX A

STANDARD OPERATING PROCEDURE

MultiPrep Polishing System

Sample Preparation Lab – room B64 ESB

STANDARD OPERATING PROCEDURE

Metallurgical Optical Microscope

Sample Preparation Lab – room B64 ESB

STANDARD OPERATING PROCEDURE

Techno 4 Slow Speed Saw

Sample Preparation Lab – room B64 ESB

APPENDIX B

CHEMICAL INVENTORY AND MATERIAL SAFETY DATA SHEET (MSDS)

Sample Preparation Lab – room B64 ESB