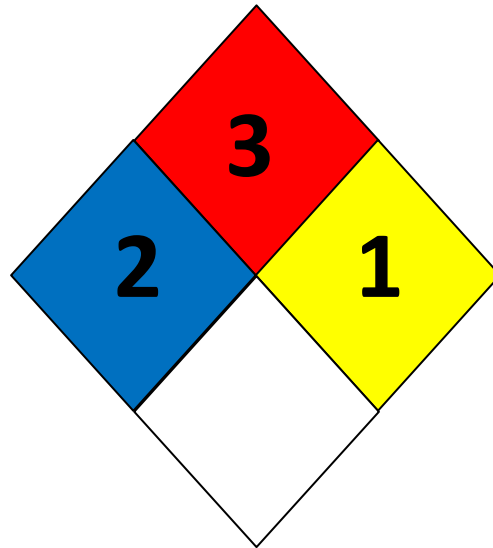


WVU Share Research Facilities

XPS Lab

Chemical Hygiene Plan

B 62 Engineering Sciences Building



Emergency Contact:

Weiqiang Ding, Ph.D.

Office: G75D Engineering Sciences Building

Cell Phone: (304) 685-1938

W. Ding

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SECTION ONE: EMERGENCY PROCEDURES

1.1 Emergency Contact List

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

9-911 from any campus phone
or **Campus Security** Phone: (304) 293-2677 (293-COPS)

Then Call

Weiqiang Ding, MFCF Manager
Cell Phone: (304) 685-1938 Room: G75D ESB/409 White Hall

or

Harley Hart, MFCF Technician
Cell Phone: (412) 443-1514 Room: G75D ESB/409 White Hall

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

Kenny Claudio, Coordinator of Facilities, Benjamin M. Statler College of Engineering and Mineral Resources
Cell Phone: (304) 216-4858
Office Phone: (304) 293-4091
Room: 373A MRB

Royce Watts, Associate Dean for Administration, Benjamin M. Statler College of Engineering and Mineral Resources
Cell Phone: (304) 288-6762
Office Phone: (304) 293-4124
Room: 377A MRB

For non-emergency assistance please contact:

Weiqiang Ding, MFCF Manager
Cell Phone: (304) 685-1938 Room: G75D ESB/409 White Hall

or

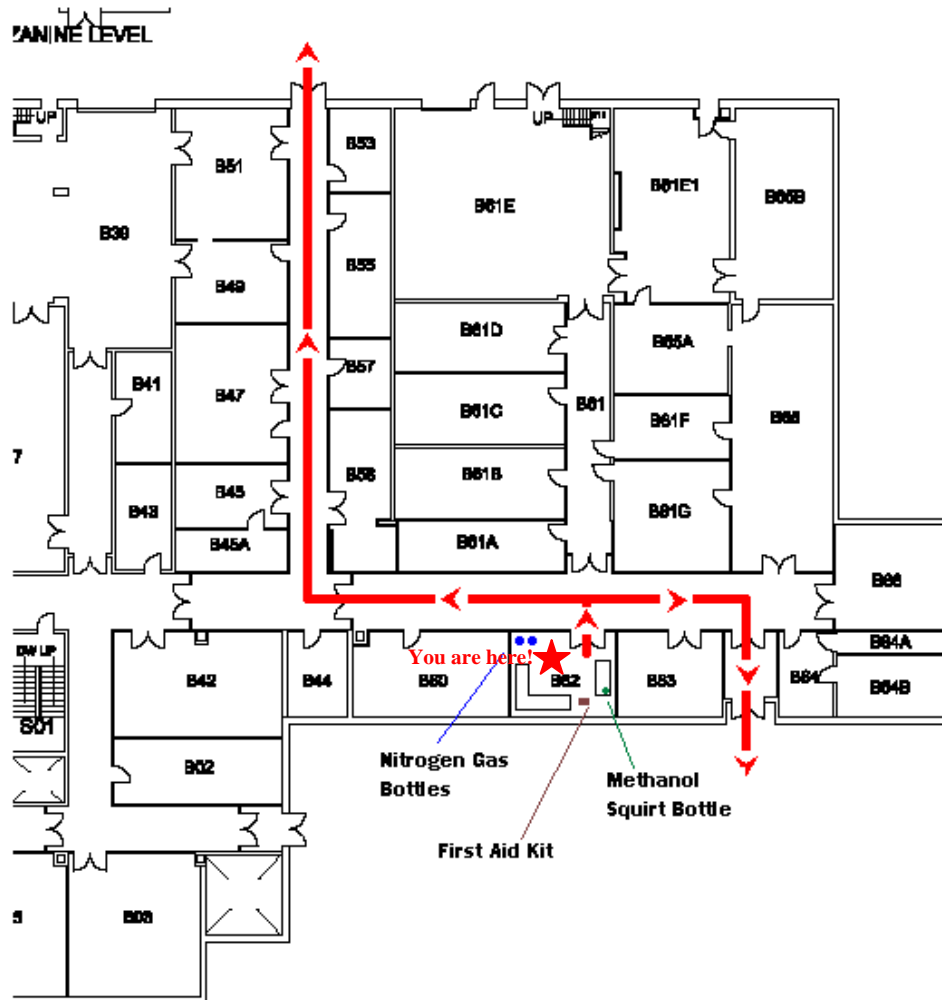
Harley Hart, MFCF Technician
Cell Phone: (412) 443-1514 Room: G75D ESB/409 White Hall

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1.2 Evacuation map

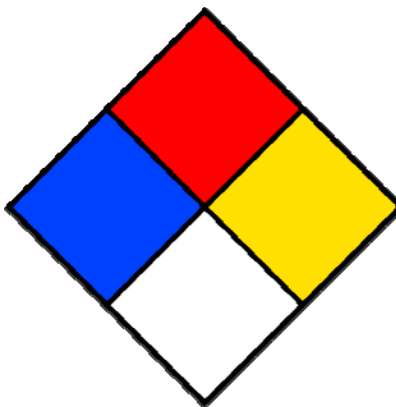
On the small scale floor plan of the ESB B-62 laboratory, the exact chemical storage areas are indicated and identified by color. **Fire escape routes are indicated in RED.**

1. Nitrogen cylinder storage	2. Methanol
3. First Aid Kit	4. Fire Escape Routes



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1.3 Safety Diamond



NFPA Rating Explanation Guide					
RATING NUMBER	HEALTH HAZARD	FLAMMABILITY HAZARD	INSTABILITY HAZARD	RATING SYMBOL	SPECIAL HAZARD
4	Can be lethal	Will vaporize and readily burn at normal temperatures	May explode at normal temperatures and pressures	ALK	Alkaline
3	Can cause serious or permanent injury	Can be ignited under almost all ambient temperatures	May explode at high temperature or shock	ACID	Acidic
2	Can cause temporary incapacitation or residual injury	Must be heated or high ambient temperature to burn	Violent chemical change at high temperatures or pressures	COR	Corrosive
1	Can cause significant irritation	Must be preheated before ignition can occur	Normally stable. High temperatures make unstable	OX	Oxidizing
0	No hazard	Will not burn	Stable	 W OX	Radioactive Reacts violently or explosively with water 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

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

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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)

4	Danger	May be fatal on short exposure. Specialized protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard

Flammability (Red)

4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Flammable liquid flash point below 100° F
2	Caution	Combustible liquid flash point of 100° to 200° F
1		Combustible if heated
0		Not combustible

Reactivity/Instability (Yellow)

4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

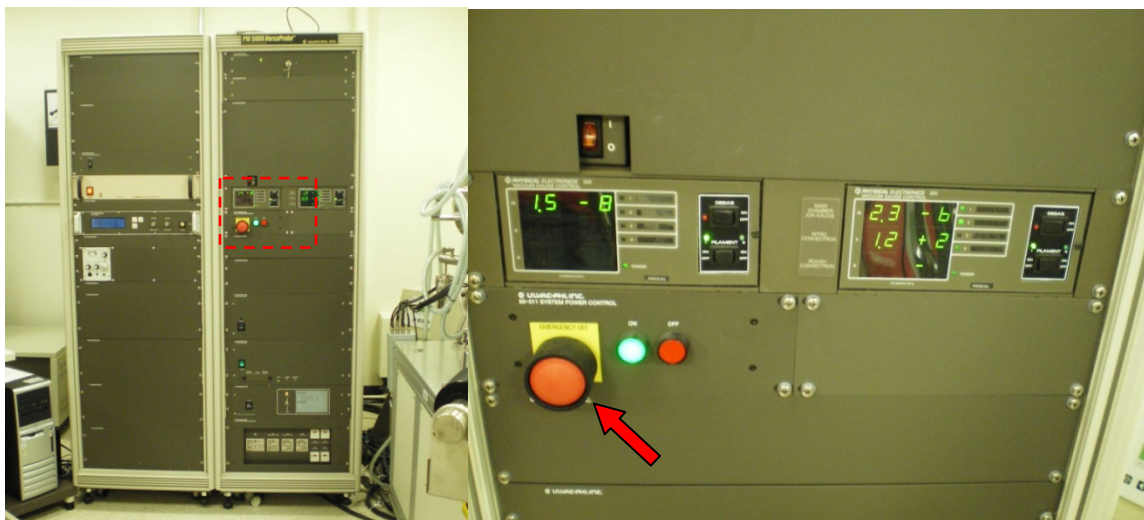
Special Symbols (White)

2	Contact	Mild irritant
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1.4 Emergency Shutdown Procedure

In case of emergency, shut down the XPS instrument by pushing the red emergency shutdown button in the middle of the right side control rack. Shut down the computer.



SECTION TWO: LAB OVERVIEW

2.1 Description of Lab

- **Purpose of the Lab**
The purpose of the ESB B-62 lab is for performing material surface analysis with X-ray photoelectron spectroscopy.
- **Lab Users**
This lab will be used by the trained users and the staff of the Materials Fabrication and Characterization Facility.

2.2 Facility Description

- **List of Equipments and Descriptions**

Physical Electronics VersaProbe 5000 XPS Microprobe

Purpose of the equipment: Micro-area element composition and chemical state determination at material surface (1-15 nm); Analysis of insulating samples with dual beam charge neutralization method; Depth profile analysis of structures and interfaces.

Sample Type: powder, solid

Sample Size: up to 50 mm in diameter

Energy Range:

0 - 1486.6 eV Binding Energy (with Al K α source)

0 - 1253.6 eV Binding Energy (with Mg K α source)

Resolution:

Minimum X-ray Beam Size: ~ 10 μ m

Minimum Energy Resolution: 0.025 eV

Modes of Operation:

XPS (Scanning micro-probe Al X-ray source; Conventional Al and Mg X-ray source) Ultraviolet Photoelectron Spectroscopy (UPS)

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2.3 Assumptions

○ **Lab Access**

Lab access is controlled through the WVU ONITY Lock system at the door.

As part of the CEMR Electronic Lock policy, the ESB-B62 lock has 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 XPS 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 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 add students, staff and faculty to these locks.

○ **Restrictions of Access**

General User: Monday – Friday 8:00 am – 5:00 pm

Experienced User: unlimited

SRF Staff: unlimited

Service Engineer: unlimited

Temporary Users: temporary users must be accompanied by a trained user or a staff member at all the time. Temporary users may include summer research participants, visitors or class participants.

XPS users reserve the time on the instrument via online reservation system (FOM). <http://fom.wvu.edu/fom>

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○ **User Agreements**

Users must sign a user agreement each year in order to gain access to the facility.

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

○ **Training Requirements**

- Users must take general lab safety training, chemical safety training before working in the lab.
- Copies of the safety presentation slides are located on the Shared Research Facilities website:
<http://sharedresearchfacilities.wvu.edu/safety/srfSafetyMain.html>
- Users will take XPS technique/operation training and then be observed using the tool before granted day-time access to the lab.
- Experienced users will receive additional training and be evaluated before granted unlimited access to the lab.

○ **Responsibilities**

The Materials Fabrication and Characterization Facility staff members are responsible for the daily operation and maintenance of the instrument. The building custodians serve the area for trash removal.

○ **Dress Code**

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

1. No shorts, legs must be fully covered
2. No sandals or open toed shoes, feet must be fully covered

○ **Description of Ordering Policies and Procedures for Hazardous Chemicals Used in the Lab**

- All hazardous chemical orders require prior facility staff's approval before the chemical can be brought into the lab.
- Use of the chemicals is restricted to users approved by the facility staff.
- User cannot store chemicals in the lab.

○ **References Available for this Laboratory**

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- Material Safety Data Sheets for chemicals that are used in the ESB B-62 lab are in the Chemical Hygiene Plan, Appendix B.
- All equipment manuals for the XPS instrument are stored on the computer in PDF format.
- The SOP for the XPS instrument is located in the instrument log book on the computer cart, on the computer in PDF format, and in the Chemical Hygiene Plan Appendix C.
- Emergency shutdown procedures are located in the Chemical Hygiene Plan and the SOP.
- Instrument usage log book is located on the computer cart of the B-62 lab and must be filled out for each experiment.

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SECTION THREE: CHEMICAL SAFETY

3.1 Chemicals and Storage

○ List of All Chemicals

Methanol (500 ml)

ULVAC SMR-100 pump oil (4 L)

Ultrapure compressed nitrogen gas (3 cylinders)

Polyethylene glycol (250g)

Poly(1,4-phenylene sulfide) (100g)

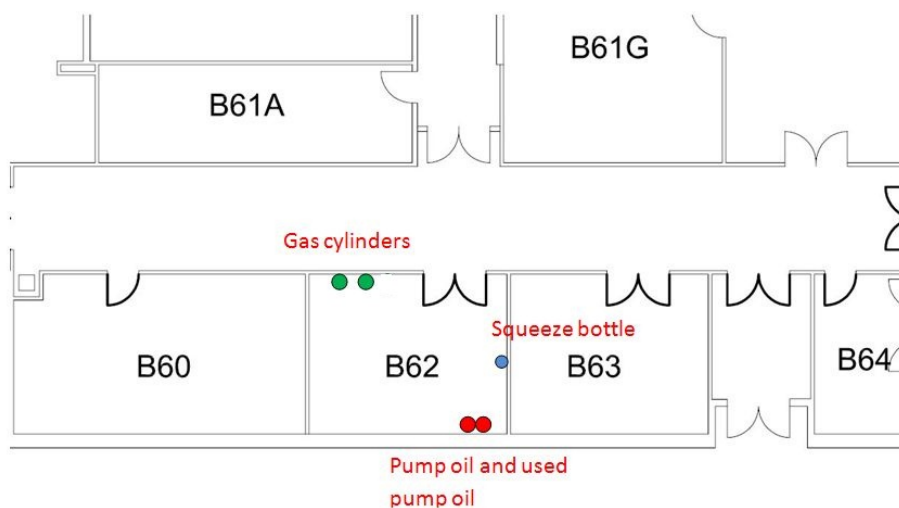
Poly(dimethylsiloxane) (25g)

Poly(4-chlorostyrene) (1g)

Polyacrylamide (50g)

○ Chemical Storage Locations

- There is no methanol stored in the lab other than in the 500 ml squeeze bottle.
- Pump oil (4L) in the manufacture container is stored in the cabinet under the sink.
- Five bottles of polymer powders are stored in the cabinet under the sink.
- Two high pressure gas cylinders are tied to the wall brackets in the lab.



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3.2 Assumptions

○ **Hood Use**

- 1) Wear safety glasses or a face shield when using chemicals.
- 2) Clean nitrile gloves are to be worn at all time when introducing or extracting samples.
- 3) The sash on the hood should be down when not in use.
- 4) Methanol squirt bottle is to remain in hood at all times. Contact MFCF staff member if the bottle is empty.
- 5) When you finish your experiments, wipe down the sample holder with methanol and place the holder in the plastic container in the hood.
- 6) Samples are not to be stored in the hood at any time. Please remember that many individuals use this equipment.
- 7) Any sample in hood not being used must be labeled with Name/Date/Sample composition.

○ **List of Personal Protection Equipment available to all personnel in this lab**

Items	Location
Safety Goggles	Hood of B62 Lab
Nitrile Gloves	Hood of B62 Lab

○ **Good General Lab Practice**

- If it is dirty, clean it up
- Put all items away immediately after use
- Keep toolbox organized
- Absolutely NO food or drink in the lab

○ **Gas Handling**

- There are two tanks of high pressure ultrapure nitrogen in B-62 that supplies clean nitrogen gas at 3 psi for venting the system and the pump down station. The main valve of the nitrogen tank should be closed when not in use.

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- When changing the gas tank, first close the tank valve and the valve after the regulator. Then, remove the regulator from the empty tank and attach it to the new tank. After that, turn on the valve after the regulator.
 - Gas cylinder caps are stored on the floor next to the cylinders.
 - Check the regulator reading before and after venting. The 2nd stage pressure should be 3 psi during venting. If the tank pressure is low, notify a MFCF staff.
 - Cylinders must be properly tied to wall brackets or fastened on a gas cart.
 - Cylinder caps should be in place on unused cylinders and should not be removed until properly fastened. An unused cylinder is defined as one not used on a daily basis.
 - Regulator valves must be attached to all **IN USE** cylinders.
- **Water Usage**
- The heat exchanger water reservoir of the XPS instrument should only be filled with DI water.
 - The DI water can be found in the chase area of the ESB G75 cleanroom.

3.3 Chemical Disposal Procedures

- Methanol is used to clean up specimen holder after the experiments. Wipes are used to clean up the methanol residual. The contaminated wipes must be disposed as hazardous waste. Used wipe waste container with lid is kept in the sample preparation hood to collect contaminated wipes. The content of the waste container is checked weekly by the SRF MFCF staff and taken to room G55A1 ESB (90 day waste collection site in SRF cleanroom) 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.
- All used pump oil is captured and stored in an appropriately chosen waste jar that is properly labeled with the words “Used Oil”. It is taken to room G55A1 ESB, the hazardous waste collection point of the cleanroom. The label is dated and signed by the SRF staff. A hazardous chemical disposal form is filled out and

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submitted to EH&S for pick up. A copy of the hazardous chemical disposal form can be found on the WVU EH&S website, <http://ehs.wvu.edu/forms>

SECTION FOUR: OTHER SAFETY ISSUES AND PROCEDURES

4.1 Definition of Hazard

Users should be aware of additional hazards when working in ESB B-62, these are:

- Sharps and broken glass
- High voltages

4.2 Assumptions

User should not try to open the control racks of the XPS instrument.

4.3 Safety Procedures

○ **Sharps and Broken Glass Disposal**

A broken glass disposal box is kept in the room beside the sample preparation hood. 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.

○ **High Voltage Hazards**

The XPS and UHV equipment utilizes high electrical voltage. Unintentional grounding of an electron beam can produce high spikes of current. Users are permitted to operate the equipment, but not to service. User must follow all operation procedures outlined in the Standard Operation Procedures located in Appendix B. All equipment issues must be brought to a MFCF staff attention. The tool must be disconnected from the power supply before being serviced.

4.4 Lab-specific Emergency Procedures

- Instrument shut down procedures are to be performed only by the MFCF staff and experienced users who are qualified to do so by the MFCF staff.
- In case of compressed gas emergency, exit the building and notify safety personnel immediately.
- In case of fire, evaluate the building and call **9-911**.

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- In case of unplanned power outage, the instrument will shutdown automatically. See power loss SOP and contact a MFCF staff immediately.
- In case of unplanned water outage, the instrument will shutdown automatically.
- If the emergency button is pressured, refer to the Power Loss SOP and contact a MFCF staff immediately.
- For other lab equipments:
 - Shut off all surge protectors to the computer.
 - Shut power off to all in-use equipments.

4.5 Additional Items

- **Visitors are not permitted in lab unless being authorized by the MFCF staff.**
- Replace wipes and gloves when their supplies are running low.
- Clean nitrile gloves are to be worn at all times when mounting, introducing, extracting and removing samples.
- If you use up any item (*e.g.*, carbon tab, steel puck, gloves, wipes, *etc*), notify MFCF staff.

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**APPENDIX A:
CURRENT CHEMICAL AND GAS INVENTORY**

○ **Chemicals:**

Methanol (500 ml)

ULVAC SMR-100 pump oil (4 L)

Polyethylene glycol (250g)

Poly(1,4-phenylene sulfide) (100g)

Poly(dimethylsiloxane) (25g)

Poly(4-chlorostyrene) (1g)

Polyacrylamide (50g)

Cleaning Duster (6 bottles)

Micro-90 concentrated cleaning solution (???)

○ **Gas:**

Ultrapure Compressed Nitrogen Gas, size 300 high pressure cylinder (2)

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**APPENDIX B:
MATERIALS SAFETY DATA SHEET (MSDS)**

- Methanol
- ULVAC SMR-100 pump oil
- Polyethylene glycol
- Poly(1,4-phenylene sulfide)
- Poly(dimethylsiloxane)
- Poly(4-chlorostyrene)
- Polyacrylamide
- Ultrahigh purity high pressure nitrogen gas
- Cleaning duster

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APPENDIX C:
EQUIPMENT STANDARD OPERATION PROCEDURE

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APPENDIX D:

BENJIMIN M. STATLER
COLLEGE OF ENGINEERING AND MINERAL RESOURCES (CEMR)

CHEMICAL HYGIENE PLAN