Compressed Gases
STANDARD OPERATING PROCEDURE

Type of SOP: ☒ Process ☐ Hazardous Chemical ☐ Hazard Class

1. HAZARD OVERVIEW

This document describes the safety requirements that laboratory workers and supervisors must follow when compressed gas cylinders are used in laboratory. Its purpose is not to have any accident or risk. Especially carbon monoxide is very toxic by inhalation and may cause harm to unborn child. Prolonged exposure can cause serious damage to health. Hydrogen, carbon monoxide and hydrocarbons are extremely flammable.

2. HAZARDOUS CHEMICALS

A variety of compressed gases are used for UHV camber works, Gas Chromatograph or FT-IR spectrometer. Please refer their MSDS always before using them.

1. Argon
2. Air
3. Carbon monoxide (Extremely Flammable, Toxic)
4. Hydrogen (Extremely Flammable)
5. Nitrogen
6. Oxygen
7. Helium
8. Ethane (Extremely Flammable)
9. Ethylene (Extremely Flammable)
10. Propane (Extremely Flammable)
11. Propylene (Extremely Flammable)
12. Butane (Extremely Flammable)
13. 1-Butene (Extremely Flammable)
14. *cis*-2-Butene (Extremely Flammable)
15. *trans*-2-Butene (Extremely Flammable)

3. PERSONAL PROTECTIVE EQUIPMENT (PPE)

a. Eye Protection

ANSI compliant safety glasses with side shields should be worn. Chemical splash goggles should be worn when working with larger quantities. If chemical has a skin hazard or is a caustic liquid, a face shield should be worn when splashing onto the face is a possibility.

b. Skin and Body Protection

Wear chemical resistant lab coat, long pants, and closed-toe shoes. These laboratory coats must be appropriately sized for the individual and be buttoned to their full length. Laboratory coat sleeves must be of a sufficient length to prevent skin exposure while wearing gloves.

A chemical resistant apron should be used when transferring or using large quantities and splashing is a possibility.

Flame-resistant lab coat will be required, if working with pyrophoric chemicals.

c. Hand Protection

At a minimum, wear a nitrile chemical-resistant glove. Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with the chemical and usage.

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf or http://www.showabestglove.com/site/default.aspx

Additional PPE may be required if procedures or processes present additional risk. It is the responsibility of the PI to ensure that any additional PPE requirements are identified and communicated to research staff. Contact EH&S for consultation.

4. ENGINEERING/VENTILATION CONTROLS

All chemicals should be ventilated to an annually certified laboratory chemical fume hood with the sash at the certified position or lower or the ventilation system of the ceiling. The hood flow alarm should be checked to be operating correctly prior to using the hood. Carbon monoxide in a lecture bottle should be used only with a gas manifold, which has been connected to a mechanical pump in a good condition, and a carbon monoxide detector in the room. Its lecture bottle should be secured not to be fall down.

5. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Handling

Always use a proper dolly to carry gas cylinders in building. Avoid inhalation of vapor or mist. Ensure adequate ventilation. Remove all source of ignition; no smoking or electrostatic charge. Beware of vapor accumulating to form explosive concentration. Vapor can accumulate in low areas. Do use right-sized tools and wear heavy protective gloves when connecting a regulator to gas cylinders. Do not breathe any leaked gas. Work in confined spaces. Prevent further leakage or spillage if safe to do so.

Storage

Gas cylinders for UHV works are stored upright and secured in outside hall cabinets if available. Oxygen cylinder has to be separated from hydrogen or combustible materials.

Metal rack is used to restrain the cylinders, and must be bolted to the floor and wall. The cylinders must be restrained by two chains or straps; chains at 1/3 from the bottom and 1/3 from top of the cylinders. Gas cylinders (H_2, N_2 and Air) for GC systems are stored in room inside to monitor and control the valves immediately. Small gas lecture bottles (hydrocarbons) are usually placed close to the system. Cylinders that are not in use, or empty cylinders should be closed and capped.

Argon: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid strong oxidizing agents.
Air: Keep cylinder closed and away from heat, sparks, and open flame.
Carbon monoxide: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flame, sparks and sodium/sodium oxide, potassium and strong oxidizing agents.
Hydrogen: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
Nitrogen: Keep cylinder tightly closed and away from heat, sparks, and open flame.
Oxygen: Keep cylinder tightly closed and away from heat, sparks, and open flame. Avoid phosphorus, organic materials and powdered metals.
Helium: Keep cylinder tightly closed in a cool dry and well-ventilated place.
Ethane: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
Ethylene: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
Propane: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
Propylene: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
Butane: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
1-Butene: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
***cis*-2-Butene**: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.
***trans*-2-Butene**: Keep cylinder tightly closed in a dry and well-ventilated place. Avoid heat, flames, sparks, and oxidizing agents.

Use small quantities whenever possible. Monitor your inventory closely to assure that you have tight control over your material.

6. SPILL AND INCIDENT PROCEDURES

Gas Leak - Dial 911 and EH&S 951-827-5528

In case of Controllable Leaks

1) If the regulator has leak, do not attempt to tighten it while the cylinder is under pressure. It may cause a bigger leaking. Close the main cylinder valve and move the cylinder into a safe location. The residual gas trapped in the regulator should be pumped out to the building ventilation system.
2) If a cylinder has leak, only an acceptable solution shall be used to test a leak. Close the main cylinder valve and move the cylinder into a safe location. Residual gas in the cylinder should be removed by a mechanical pump. Commercial cylinder should be safely vented prior to be returned to the supplier.

In case of Uncontrollable Leaks

Evacuate the room immediately. Call 911 from a campus phone or 951-827-5222 for EH&S from cell phone.

In case of Fire,

1) Alert personnel in the immediate vicinity
2) Confine the fire,

    a) Keep yourself between the emergency and an exit while attempting to confine the emergency to avoid being trapped.

    b) If you have been trained to put out small fires or use an extinguisher, fight the fire if you are confident that you will be able to put it out.
    c) If emergency is inside a hood, close the sash, if possible.
    d) Close lab doors, if possible, to prevent spread of smoke or vapors into adjoining rooms and corridors.
    e) For flammable liquid spills, shut off ignition sources, if possible. Avoid unplugging equipment due to possible electrical arc between receptacle and plug. Turning off breaker will work.
3) Evacuate the emergency area. If in doubt, evacuate the building. To evacuate a building, pull the nearest fire alarm pull station on your way out.
4) Summon aid. For emergencies that require response from the fire department, police department, or paramedics, dial 9-911 from a campus phone.
5) For other emergencies or incidents, call EH&S at 827-5528, or campus police 827-5222 after hours.

Medical Emergency - Dial 911 and EH&S 951-827-5528

Refer to “Injuries and Medical Treatment” Flipchart posted in the laboratory.

7. DECONTAMINATION

Ensure the ventilation is working well, and release gases slowly into vacuum pump, which is connected to the building ventilation system. Also monitor carbon monoxide release with carbon monoxide detector.

8. WASTE DISPOSAL

All waste must be disposed through the EH&S Hazardous Waste Program. Staff dealing with hazardous waste disposal should have completed UCR Hazardous Waste Management training - http://ehs.ucr.edu/training/online/hwm/indexlms.html

General hazardous waste disposal guidelines:

- Do not attempt to dispose of residual waste or unused quantities in cylinder. Return in the shipping container properly labeled, with caps secured and valve protection cap in place. Gas cylinders obtained from the department stockroom have to be returned to refill prior to taking another filled one. Gas cylinders supplied from campus storehouse has to be returned immediately after use or once empty because of demurrage fee. For other empty cylinders, please contact their supplier to return or to refill.
- Affix an on-online hazardous waste tag using the Online Tag Program (OTP - https://otp.ucop.edu/) on all waste containers as soon as the first drop of waste is added to the container.
- Store hazardous waste in closed containers, in secondary containment, and in a designated location. Do not let product enter drains. Discharge into the environment must be avoided.
- Double-bag dry waste using transparent bags.
- Waste must be under the control of the person generating and disposing of it.
- Dispose of routinely generated chemical waste within 90 days.
- Request a waste pick-up on-line: http://ehs.ucr.edu/services/waste.html

9. PRIOR APPROVAL/REVIEW REQUIRED

All work with compressed gases must be pre-approved by the Principal Investigator prior to use and all training must be well documented. In addition, the following shall be completed:

- Documented specific training and specific training on the techniques and processes to be used.
- Read and understand the relevant Safety Data Sheet.
- Demonstrate competence to perform work.

A review of this SOP and re-approval is required when there are any changes to procedures, personnel, equipment, or when an incident or near miss occurs.

10. DESIGNATED AREA

Gas cylinders for UHV works are stored in outside hall cabinets if available. Gas cylinders for GC systems are stored in room inside to monitor and control the valves immediately.

11. SAFETY DATA SHEETS

Online SDS can be found at http://www.ehs.ucr.edu/services/msds.html.

12. DETAILED PROTOCOL

All lab workers who will be using compressed gases must review this SOP and sign the associated training sheet. Lab workers must have specific training on the proper handling of compressed gases and understand the hazards.

Lab workers using compressed gases must demonstrate competence to the Principal Investigator or designee by being able to 1) identify the hazards and list any particularly hazardous handling techniques (use of a schlenck line, rotary evaporation, canula transfer, extremes of pressure or temperature, etc.), 2) list the foreseeable emergency situations, 3) describe the proper response to the emergency situations, and 4) know the control measures to minimize the risks.

The research laboratory requires variation in reaction conditions to develop and optimize new chemical or biological transformations. The researcher must seek literature precedent for reaction conditions that have reasonable similarities to new chemistry that is planned with compressed gases described in this SOP. The researcher must also consult the PI or designated, experienced research coworker for approval to proceed with chemical or biological transformations that have little literature or local research group precedent. PI approval must also be obtained for significant scale-up (PI defines scale) of new chemistry or biological transformations.

When working in the lab, a laboratory worker must:

1) not work alone;
2) be cognizant of all of the SDS and safety information presented in this document;
3) follow all related SOPs in the laboratory SOP bank (PPE, syringe techniques, waste disposal, etc. as appropriately modified by any specific information in the SDS information presented in this document);
4) use compressed gases below 1 bar in any given reaction (higher pressure REQUIRE the approval of PI or designee), and
5) discuss ALL issues or concerns regarding these compressed gases with the PI prior to its use.

If there is an unusual or unexpected occurrence when using compressed gases, the occurrence must be documented and discussed with the Principal Investigator or Lab Supervisor and others who might be using compressed gases. Unusual or unexpected

occurrences might include a fire, explosion, sudden rise or drop in temperature, increased rate of gas evolution, color change, phase change, or separation into layers.

Replace empty gas cylinder

1) In case of carbon monoxide, ensure carbon monoxide detector is on
2) Borrow a proper dolly from department stockroom.
3) Close the main cylinder valve.
4) Slowly release pressure from regulator into hood to vent.
5) Close the regulator valves.
6) Disconnect the regulator from an empty cylinder.
7) Screw cylinder cap.
8) Deliver the empty cylinder to the stockroom or store temporally in one of hall cabinets.
9) Bring a new gas cylinder to the rack.
10) Safely secure the cylinder using chain clamp.
11) Unscrew cylinder cap.
12) Ensure the main valve is closed.
13) Unscrew the main valve cap.
14) Connect the regulator to the cylinder.
15) Fully open the regulator valves.
16) Get vacuum in the gas manifold and the regulator.
17) Closed the diaphragm valve.
18) Quickly open and close the main cylinder valve to see if the diaphragm valve is working well.
19) If the good sealing is obtained, go ahead. Otherwise, pump the gas in the line and replace the regulator.
20) Set a delivery pressure as needed.
21) Carefully release pressure from regulator.
22) Fully open the main cylinder valve if needed.

SOP Reviewed and Approved by:

Francisco Zaera
Print name


Signature

Approval Date: 02/01/2013

Cryogenic Materials
STANDARD OPERATING PROCEDURE

Type of SOP: ☒ Process ☐ Hazardous Chemical ☐ Hazard Class

1. HAZARD OVERVIEW

This document describes the safety requirements that laboratory workers and supervisors must follow when pump oils are used in laboratory. Its purpose is not to have any accident or risk. Liquid nitrogen is cryogenic material that exists at a very low temperature below −150°C, and is used as coolants for various instruments and experiments.

2. HAZARDOUS CHEMICAL(S) OR CLASS OF HAZARDOUS CHEMICAL(S)

Nitrogen is not toxic, but simple asphyxiates. Cryogenic fluids are materials with extremely low boiling points (i.e., less than –150°F). At these temperatures, tissue burns may be sustained after contact with the fluids, surfaces cooled by the fluids, or by evolving gases. The hazard is comparable to that of handling boiling water. One special property of cryogenic liquids is that they undergo substantial volume expansion when converted to a gas phase, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited.

1. Liquid Nitrogen

3. PERSONAL PROTECTIVE EQUIPMENT (PPE)

a. Eye Protection

ANSI compliant safety glasses with side shields should be worn. Chemical splash goggles should be worn when working with larger quantities. A face shield should be worn when splashing onto the face is a possibility.

b. Skin and Body Protection

Wear chemical resistant lab coat, long pants, and closed-toe shoes. These laboratory coats must be appropriately sized for the individual and be buttoned to their full length. Laboratory coat sleeves must be of a sufficient length to prevent skin exposure while wearing gloves.

c. Hand Protection

Wear the blue waterproof Cryo-gloves (Tempshield) in room 135 or 137.

Additional PPE may be required if procedures or processes present additional risk. It is the responsibility of the PI to ensure that any additional PPE requirements are identified and communicated to research staff. Contact EH&S for consultation.

4. ENGINEERING/VENTILATION CONTROLS

Use liquid nitrogen only in well-ventilated areas. Even though nitrogen isn't toxic, but there is a danger of asphyxiation from unconsciousness, which occurs in a room if too much oxygen is displaced by nitrogen gas. Nitrogen expands its volume by a factor of ~700 when evaporated.

5. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Store and transport liquid nitrogen only in Dewars or cryogenic liquid cylinders designed for cryogen. Cryogenic liquid Dewars have to be stored in well-ventilated areas with the pressure relief valve in the opened position.

Use small quantities whenever possible. Monitor your inventory closely to assure that you have tight control over your material.

6. SPILL AND INCIDENT PROCEDURES

Chemical Spill - Dial 911 and EH&S 951-827-5528

In the event of a large spill,

1) Alert others immediately in the vicinity to evacuate.
2) Close the doors of the lab if opened.
3) Restrict access to the work area.
4) Do not attempt cleanup if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations.
5) Call 911 from a campus phone or 951-827-5222 for EH&S from cell phone.

Medical Emergency - Dial 911 and EH&S 951-827-5528

Refer to "Injuries and Medical Treatment" Flipchart posted in the laboratory.

7. DECONTAMINATION

Wear proper PPE, decontaminate equipment and bench tops using soap and water. Dispose of all used contaminated disposables as hazardous waste following the Waste Disposal Section.

8. WASTE DISPOSAL

Return container and unused product to supplier. Do not attempt to dispose of unused product.

9. PRIOR APPROVAL/REVIEW REQUIRED

All work with cryogenic materials must be pre-approved by the Principal Investigator prior to use and all training must be well documented. In addition, the following shall be completed:

- Documented specific training and specific training on the techniques and processes to be used.
- Read and understand the relevant Safety Data Sheet.
- Demonstrate competence to perform work.

A review of this SOP and re-approval is required when there are any changes to procedures, personnel, equipment, or when an incident or near miss occurs.

10. DESIGNATED AREA

Work should be completed in a well-ventilated place or laboratory.

11. SAFETY DATA SHEETS

Online SDS can be found at http://www.ehs.ucr.edu/services/msds.html.

12. DETAILED PROTOCOL

All lab workers who will be using cryogenic materials must review this SOP and sign the associated training sheet. Lab workers must have specific training on the proper handling of cryogenic materials and understand the hazards.

Lab workers using cryogenic materials must demonstrate competence to the Principal Investigator or designee by being able to 1) identify the hazards and list any particularly hazardous handling techniques (use of a schlenck line, rotary evaporation, canula transfer, extremes of pressure or temperature, etc.), 2) list the foreseeable emergency situations, 3) describe the proper response to the emergency situations, and 4) know the control measures to minimize the risks.

When working in the lab, a laboratory worker must:

1) not work alone;
2) be cognizant of all of the SDS and safety information presented in this document;
3) follow all related SOPs in the laboratory SOP bank (PPE, syringe techniques, waste disposal, etc. as appropriately modified by any specific information in the SDS information presented in this document);
4) employ <1 L of cryogenic materials in any given reaction (larger quantities REQUIRE the approval of PI or designee), and
5) discuss ALL issues or concerns regarding cryogenic materials with the PI prior to its use.

Transporting Liquid Nitrogen from Cylinder to Dewars

1. Cylinder for cryogenic liquids must not be closed completely. Even though liquid nitrogen is stored in vacuum-jacketed vessels (dewars), there is always some heat leak into the dewar such that there is boil-off of the liquid at all times. Pressure will build up if no exit is available to the gas, and then the container would ultimately explode. A pressure relief valve is attached to the cylinder to keep the internal

pressure very low. Make sure you are aware of the presence of a protective pressure relief valve on any cylinder that you handle.

2. If there is a crack in the metal between the liquid and the vacuum space of a cylinder, a rapid pressure build-up in this relatively confined space will occur since it would no longer be insulated by vacuum. For this reason, all metal dewars must be constructed such that a pressure relief valve or rupture disk connected to the vacuum space will relieve excess pressure prior to sufficient build-up to cause explosion. For the same reason, all glass dewars must be wrapped with tape or netting to prevent flying glass in the event of an explosion.
3. Do not leave openings to cold dewars wide open to the atmosphere for any longer than is absolutely necessary for the manipulations required for transferring liquids. The temperature of liquid nitrogen at atmospheric pressure is -196°C. Air (and its contents) will condense into the dewar and can cause blockages that are potentially dangerous and that will almost certainly interfere with some aspect of the liquid transfer or with the operation of the instrument in the long run. The freezing point of liquid oxygen is -183°C, above that of liquid nitrogen. Having liquid oxygen in liquid nitrogen is an explosion hazard!
4. The very cold temperatures of cryogenic fluids necessitate complete avoidance of contact with the skin. Frostbite, i.e. “burns” from extreme cold, will occur very quickly upon contact, especially if clothing, shoes, etc., hold the liquid tightly to the skin. Take care about spills and use appropriate hand protection while transferring these liquids. Use thermally insulated gloves; thin gloves will not help. Take care to avoid contact with the portions of the transfer line that have been inserted into the dewars during the transfer as they will be cold enough to cause cold “burns” for quite a while after removal from the dewars.
5. Liquid helium transfer lines are vacuum jacketed and should not be very cold to touch during the initial cool down of the transfer line. If a transfer line appears to be too cold, it is time to re-pump the vacuum space. The heat of vaporization of liquid helium is very small, i.e., ~10% of that of liquid nitrogen. Thus, helium is never seen as a liquid during transfer operations. A “plume” or “flame” is the indicator that liquid helium is coming through the transfer line during the cool down and is ready to be inserted.

If there is an unusual or unexpected occurrence when using liquid nitrogen, the occurrence must be documented and discussed with the Principal Investigator or Lab Supervisor and others who might be using cryogenic materials. Unusual or unexpected occurrences might include a fire, explosion, sudden rise or drop in temperature, increased rate of gas evolution, color change, phase change, or separation into layers.

SOP Reviewed and Approved by:

Francisco Zaera
Print name

Signature

Approval Date: 02/01/2013

Pump Oil
STANDARD OPERATING PROCEDURE

Type of SOP: ☒ Process ☐ Hazardous Chemical ☐ Hazard Class

1. HAZARD OVERVIEW

This document describes the safety requirements that laboratory workers and supervisors must follow when pump oils are used in laboratory. Its purpose is not to have any accident or risk, besides pump maintenance by changing pump oil regularly. Pump oils is NF or USP grade white menial oil, but is not expected to present any unusual hazards in proper use.

2. HAZARDOUS CHEMICAL(S) OR CLASS OF HAZARDOUS CHEMICAL(S)

Mechanical pump oil (TKO 19 Ultra from Kurt J. Lesker company)

THIS PRODUCT IS AN NF OR USP GRADE WHITE MINERAL OIL. IT IS NOT EXPECTED TO PRESENT ANY UNUSUAL HAZARDS, IN PROPER USE.

3. PERSONAL PROTECTIVE EQUIPMENT (PPE)

a. Eye Protection
ANSI compliant safety glasses with side shields should be worn.

b. Skin and Body Protection
Wear chemical resistant lab coat, long pants, and closed-toe shoes. These laboratory coats must be appropriately sized for the individual and be buttoned to their full length. Laboratory coat sleeves must be of a sufficient length to prevent skin exposure while wearing gloves.

c. Hand Protection
At a minimum, wear a nitrile chemical-resistant glove.

4. ENGINEERING/VENTILATION CONTROLS

Pump oil has to be filled or replaced into a pump in a well-ventilated place.

5. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Wash thoroughly after handling. Do not ingest or inhale nor get in eyes, skin or clothing. Remove contaminated clothing and wash before reuse.

Store pump oil in a tightly closed, labeled container and in a cool, dry well-ventilated area. Segregate from incompatible materials. Secondary containers must be labeled clearly. Follow any substance-specific storage guidance provided in Safety Data Sheet documentation.

Use small quantities whenever possible. Monitor your inventory closely to assure that you have tight control over your material.

6. SPILL AND INCIDENT PROCEDURES

Chemical Spill - Dial 911 and EH&S 951-827-5528

Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

- *Small* – If you have training, use appropriate personal protective equipment and clean-up materials for chemical spilled. Double bag spill waste in clear plastic bags, label, and arrange for chemical waste pick-up.
- *Large*– Dial 911 and EH&S at 951-827-5528 for assistance. Notify others in area of spill. Turn off ignition sources in area. Evacuate area and post doors to spill area. Remain on the scene, but at a safe distance, to receive and direct safety personnel when they arrive.

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. Notify supervisor and EH&S at 951-827-5528 immediately.

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. Notify supervisor and EH&S at 951-827-5528 immediately.

Medical Emergency - Dial 911 and EH&S 951-827-5528

Refer to “Injuries and Medical Treatment” Flipchart posted in the laboratory.

7. DECONTAMINATION

Wear proper PPE, decontaminate equipment and bench tops using soap and water. Dispose of all used contaminated disposables as hazardous waste following the Waste Disposal Section.

8. WASTE DISPOSAL

All waste must be disposed through the EH&S Hazardous Waste Program. Staff dealing with hazardous waste disposal should have completed UCR Hazardous Waste Management training - http://ehs.ucr.edu/training/online/hwm/indexlms.html

General hazardous waste disposal guidelines:

- Affix an on-online hazardous waste tag using the Online Tag Program (OTP - https://otp.ucop.edu/) on all waste containers as soon as the first drop of waste is added to the container.
- Store hazardous waste in closed containers, in secondary containment, and in a designated location. Do not let product enter drains. Discharge into the environment must be avoided.
- Double-bag dry waste using transparent bags.
- Waste must be under the control of the person generating and disposing of it.
- Dispose of routinely generated chemical waste within 90 days.
- Request a waste pick-up on-line: http://ehs.ucr.edu/services/waste.html

9. PRIOR APPROVAL/REVIEW REQUIRED

All work with pump oil must be pre-approved by the Principal Investigator prior to use and all training must be well documented. In addition, the following shall be completed:

- Documented specific training and specific training on the techniques and processes to be used.
- Read and understand the relevant Safety Data Sheet.
- Demonstrate competence to perform work.

A review of this SOP and re-approval is required when there are any changes to procedures, personnel, equipment, or when an incident or near miss occurs.

10. DESIGNATED AREA

Work should be completed in a well-ventilated place.

11. SAFETY DATA SHEETS

Online SDS can be found at http://www.ehs.ucr.edu/services/msds.html.

12. DETAILED PROTOCOL

All lab workers who will change pump oil must review this SOP and sign the associated training sheet. Lab workers must have specific training on the proper handling of pump oil and understand the hazards.

Lab workers using pump oil must demonstrate competence to the Principal Investigator or designee by being able to 1) identify the hazards and list any particularly hazardous handling techniques (use of a schlenck line, rotary evaporation, canula transfer, extremes of pressure or temperature, etc.), 2) list the foreseeable emergency situations, 3) describe the proper response to the emergency situations, and 4) know the control measures to minimize the risks.

Mechanical Pump Oil Change

Equipments required:

1. Tools for the cap to refill fresh oil and the plug to drain oil waste.
2. Oil drain basket
3. Oil waste container with proper chemical waste label
3. Pump rack designed for oil change
4. Folded paper tower or compatible absorbent.
5. Protective gloves
6. Mask
7. Plastic bag for collecting oil-wet paper towel and gloves.

Procedure:

1. Vent the gas manifold or close the valve to the pump.
2. Turn off the vacuum pump and disconnect the power plug from the outlet
3. Wait until the pump has cooled down fully. Allow at least 1 hr for cooling inside.
4. Isolate the pump completely from the main system (UHV chamber or gas manifold). Do not try to change pump oil near by the main system, because the workspace is limited and it may cause an accident such a falling due to slippery floor.
5. Open the top cap with a tool and clean the tube inside and the mist-filter with paper towel.
6. Close the top cap back by hand. If the top cap is opened, the oil waste comes suddenly and faster when opening the drain plug.
7. Put the pump on the rack for oil change securely.
8. Place the oil-waste drain basket
9. Open the drain plug slowly.
10. Open the top cap again while checking the drain speed.
11. Lift up the other side of pump if needed to remove the inside oil completely.
12. Rinse the pump with fresh clean oil several times if the color of oil is too dark.
13. Clean the drain plug and put it back to close.
14. Run the pump for several seconds if needed to clean more. And then repeat from the step 9.
15. Fill the pump with fresh clean oil up to ¾ of full scale of indicator or a proper level as suggested in manual.
16. Close the top cap tightly.
17. Put the pump down from the rack and clean the outer surface if contaminated.
18. Return the pump to the original position.
19. Make connections to both gas manifold (or system) and ventilation.
20. Plug in the power outlet.
21. Switch ON to see if how much oil level is changed.
22. Add more oil if needed.
23. Pour the drained oil waste in basket into the oil-waste container gently.

24. Clean the drain basket, the pump rack and floor (workspace) with paper towels completely.
25. Wipe the protective gloves also with paper towel.
26. Dispose the wiped gloves into a garbage can.
27. Collect all of oil-wet paper towels in a plastic bag and secure with a tie.
28. Put the plastic bag into a grey plastic can in one of hall cabinets.
29. Wash your hand with soap and remove all contaminated clothing immediately.

If there is an unusual or unexpected occurrence when using pump oil, the occurrence must be documented and discussed with the Principal Investigator or Lab Supervisor and others who might be using pump oil. Unusual or unexpected occurrences might include a fire, explosion, sudden rise or drop in temperature, increased rate of gas evolution, color change, phase change, or separation into layers.

SOP Reviewed and Approved by:

Francisco Zaera
Print name


Signature

Approval Date: 02/01/2013