Standard Operating Procedures for Hazardous Chemicals

- **Title of Procedure:** Flame AA Operation with Air/Acetylene Flame
- **Date:** March 29, 2011
- **Date of Last Review:** 3/30/2012
- **Principal Investigator:** B. D. Freeman
- **Lab Location:** EME 1.704
- **Lab Personnel who have reviewed SOP/Date:**
  - G Geise 3/29/2012
  - K Stevens 3/30/2012

Risk Assessment

Hazardous Chemicals:

Acetylene, dissolved; acetylene; acetylen, ethane, ethyne, narcylene

Potential Hazard(s):

Acetylene Gas Cylinder:

EMERGENCY OVERVIEW

DANGER! Flammable gas under pressure.
Can form explosive mixtures with air.
Fusible plugs in top, bottom, or valve melt at 208-224°F (98-107°C).
Do not discharge at pressures above 15 psig (103 kPa).
May cause dizziness and drowsiness.
Self-contained breathing apparatus may be required by rescue workers.
At normal temperature and pressure, commercial acetylene is a colorless gas with a distinctive garlic-like odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard
Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Asphyxiant. Effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, nausea, vomiting, and unconsciousness. The vapor from a liquid release may also cause incoordination, abdominal pain. Effects may be delayed. Lack of oxygen can kill.

Skin Contact. No harm expected from vapor. Liquid may cause frostbite.

Swallowing. An unlikely route of exposure, but frostbite of the lips and mouth may result from contact with the liquid. If swallowed, the liquid may cause nausea.

Eye Contact. Vapors containing acetone may irritate the eyes. Liquid may irritate and cause frostbite.

Effects of Repeated (Chronic) Overexposure. No harm expected.

Other Effects of Overexposure. Asphyxiant. Lack of oxygen can kill.

Medical Conditions Aggravated by Overexposure. The toxicology and the physical and chemical properties of this product suggest that overexposure is unlikely to aggravate existing medical conditions.

CARCINOGENICITY: This product is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None expected.

Varian AA 240 (Flame AA):

The Flame AA system is designed to burn a fuel in the presence of an oxidant. While the Flame AA system is equipped with various safety features as specified by the manufacturer, it is ultimately the user's responsibility to ensure that all components are in good condition and used according all applicable safety regulations.

Use of the Flame AA involves expansion of a highly flammable gas (acetylene), filtration of that gas, and ultimately controlled combustion of acetylene in the presence of air. All EHS guidelines regarding pressurized gas cylinders and tubing/other pressurized equipment should be followed.

This standard operating procedure only applies to the use of acetylene in the Flame AA equipment. User's must consult the appropriate safety training and standard operating procedure training and documentation required for any additional chemicals that are to be analyzed using the flame AA system; see the manufacturer's documentation for limitations.

Routes of Exposure:

Inhalation as a result of acetylene leaking from the cylinder and/or supply tubing or improper operation of the combustion chamber
Unlikely exposure to liquid acetylene
The combustion chamber contains a hot flame while the Flame AA is in operation

Quantity/Concentration Hazards:

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2009)
Acetylene	N.E.*	Simple asphyxiant

*N.E.–Not Established.

NOTE: Acetone, used as a solvent, has a TLV-TWA of 500 ppm for acetone and a TLV-STEL of 750 ppm (ACGIH, 2009). OSHA PEL, 1000 ppm (2400 mg/m^3).

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = Not available.

Substitution of Less Hazardous Chemicals:

None

Control Measures

Personal Protective Equipment (PPE):

Skin Protection. Wear work gloves when handling cylinders.

Eye/Face Protection. Wear goggles with filter lenses selected as per ANSI Z49.1. Provide protective screens and goggles, if necessary, to protect others. Select as per OSHA 29 CFR 1910.33.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus. Adequate ventilation must keep worker exposure below applicable exposure limits for fumes, gases, and other by products.

Other Protective Equipment. As needed, wear hand, head, and body protection, which help to prevent injury from radiation and sparks. See ANSI Z49.1. At a minimum, this includes welder's gloves and protective goggles, and may include arm protectors, aprons, hats, and shoulder protection, as well as substantial clothing. Regardless of protective equipment, never touch live electrical parts.

Engineering Controls:

Local Exhaust. Use a local exhaust system, if necessary, to prevent oxygen deficiency and to keep hazardous fumes and gases in the worker's breathing zone below all applicable exposure limits.

Mechanical (General). General exhaust ventilation may be acceptable if it can maintain an adequate supply of air and keep hazardous fumes and gases in the worker's breathing zone below all applicable exposure limits.

Special. None

Other. None

Work Practice Controls:

All users must be trained prior to using the instrument.

The instrument must be centered underneath the ventilation duct, and the ventilation system must be operating per EHS and Varian specifications.

The instrument should not be used at times when no other people are present in the building.

Monitoring:

The system must be monitored by the user at all times when the flame is active and the Flame AA system is in use.

Cleanup Procedures:

After use, the flame must be extinguished, and the main cylinder valve on the acetylene cylinder should be closed. Additionally, all chemical/reagent samples and standards should be handled according to the required EHS safety and standard operating procedures for the specific chemicals that are present.

Storage Procedures:

The acetylene cylinder should be stored with the main cylinder valve securely in the 'closed' position. If the cylinder will not be used for an extended period of time, it should be stored in the gas storage shed as required by EHS and site-specific protocols. The cylinder should also be chained or strapped against the wall.

Transportation Procedures:

Follow all EHS and site-specific documentation and safety practices regarding transportation of gas cylinders. If unsure about appropriate transportation procedures, seek training before proceeding.

When transporting a gas cylinder, use a cart with a chain.

DOT/IMO SHIPPING NAME:	Acetylene, dissolved.		
HAZARD CLASS: 2.1	**PACKING GROUP/Zone:** None	**IDENTIFICATION NUMBER:** UN1001	**PRODUCT RQ:** None
SHIPPING LABEL(s):	FLAMMABLE GAS		
PLACARD (when required):	FLAMMABLE GAS		

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Acetylene is not listed as a marine pollutant by DOT.

Waste Disposal Procedures:

Return cylinder to manufacturer when the cylinder pressure reaches 100 psi to prevent the dissolved acetone in the cylinder from vaporizing during use.

Emergency Procedures:

Spills or Releases:

If acetylene gas is released, close the valve on the acetylene cylinder only if it is safe to do so. Evacuate the building by pulling a fire alarm upon exiting the laboratory. Provide information about the nature of the emergency to appropriate personnel after evacuating the building.

Fire:

FLAMMABLE PROPERTIES: Extremely flammable gas. Forms explosive mixtures with air and oxidizing agents.

In the event of an uncontrolled fire (i.e. a flame outside of the Flame AA combustion chamber and/or an abnormal flame inside the Flame AA combustion chamber), close the acetylene cylinder valve only if it is safe to perform this task. If the fire persists, evacuate the building by pulling a fire alarm after evacuating the laboratory. DO NOT ATTEMPT TO EXTINGUISH THE FIRE as discussed below.

SUITABLE EXTINGUISHING MEDIA: See the following paragraphs. See CGA Pamphlet SB-4, Handling Acetylene Cylinders in Fire Situations.

PRODUCTS OF COMBUSTION: Carbon monoxide, carbon dioxide

PROTECTION OF FIREFIGHTERS: DANGER! Flammable gas under pressure. Evacuate all personnel from danger area. Immediately cool cylinders with water spray from maximum distance, taking care not to extinguish flames. If flames are accidentally extinguished, explosive re-ignition may occur. Use self-contained breathing apparatus. Remove ignition sources if without risk. Stop flow of gas if without risk while continuing cooling water spray. Remove all cylinders from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. Acetylene cylinders are provided with pressure relief devices designed to vent contents when exposed to elevated temperature. No part of a cylinder should be subjected to a temperature higher than 125°F (52°C). If venting or leaking acetylene catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an approved explosion meter.

Protective Equipment and Precautions for Firefighters. Firefighters should wear selfcontained breathing apparatus and full fire-fighting turnout gear.

Emergency Shut Offs:

Emegency shut offs should only be used if it is safe to do so.
The Flame AA system is shut down by pressing the red shutoff switch on the lower left front face of the instrument. Additionally, the acetylene cylinder valve, the acetylene regulator valve, the air regulator, and air shutoff valve can also be used to disrupt flow of acetylene and air to the instrument.

Signs and Symptoms of Exposure:

Acute Dose Effects: No known effects from acetylene gas.

Effects of a Single (Acute) Overexposure

Inhalation. Asphyxiant. Effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, nausea, vomiting, and unconsciousness. The vapor from a liquid release may also cause incoordination, abdominal pain. Effects may be delayed. Lack of oxygen can kill.
Skin Contact. No harm expected from vapor. Liquid may cause frostbite.
Swallowing. An unlikely route of exposure, but frostbite of the lips and mouth may result from contact with the liquid. If swallowed, the liquid may cause nausea.
Eye Contact. Vapors containing acetone may irritate the eyes. Liquid may irritate and cause frostbite.

Effects of Repeated (Chronic) Overexposure. No harm expected.

Other Effects of Overexposure. Asphyxiant. Lack of oxygen can kill.

Medical Conditions Aggravated by Overexposure. The toxicology and the physical and chemical properties of this product suggest that overexposure is unlikely to aggravate existing medical conditions.

Exposures:

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove contaminated clothing while showering with warm water. Call a physician.

SWALLOWING: If liquid is swallowed, immediately give two glasses of water and induce vomiting if victim is conscious. Call a physician.

EYE CONTACT: In case of splash contamination, immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are thoroughly flushed. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: Aspirated acetone may cause severe lung damage. If a large quantity of material has been swallowed, stomach contents should be evacuated quickly in a manner that avoids aspiration. Otherwise, there is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

Occupational Health Requirements:

Not Applicable

Material Safety Data Sheets (MSDS):

An MSDS sheet for acetylene is available in the laboratory.

Training Requirements:

All users must be trained prior to using the instrument. Additionally, all required site-specific and EHS training must be completed prior to using the Flame AA. All users should be familiar with the Varian AA 240 operating handbook and all other related equipment documentation provided by the manufacturer. All required training regarding chemicals for use with the Flame AA that are not covered by this standard operating procedure must be completed prior to using the Flame AA.

The user operating guide provided in the Flame AA instrument log should be used as a reference and not a replacement for appropriate instrument training.

Review of Procedure:

This standard operating procedure should be reviewed prior to using the Flame AA.

Protocol:

Pre-Use Checklist:

Inspect the instrument for obvious cosmetic and/or structural damage that may indicate that the instrument is damaged and not safe for use.

Inspect all of the gas hoses to ensure that they are in good and safe operating condition.
Do not use the instrument if a gas hose appears to be compromised.

Inspect all of the gas tubing, connections, and filtering equipment.
Ensure that all connections are secure and that filters are properly secured in place.

Inspect the air compressor while looking for any signs of damage.

Ensure that the compressor is turned on and that the tank pressure is greater than 70 psi. Additionally, ensure that the compressed air regulator is set such that the air pressure is in the range of 50-55 psi.

Inspect the acetylene regulator for any signs of damage.

Open the acetylene cylinder valve and verify that the cylinder pressure is greater than 100 psi and verify that the discharge pressure is below 15 psi.

Inspect the combustion chamber.
The burner head should be properly installed and secured.
The burner head should be free from debris, ash, or other foreign material.
Ensure that the combustion chamber is in good condition.
Ensure that the combustion chamber door is secure and closed.

Inspect the ventilation system.
Ensure the instrument chimney is below the ventilation duct.
Ensure the ventilation system is operating per EHS and Varian specifications.

Review safety documentation and instrument use information.

Preparing the Instrument for Use Checklist:

Configure the software according to training and manufacturer requirements.
Do not set the gas flow rates outside of the values recommended by the software.

Prepare and load samples and standards while following all applicable EHS, site-specific, and standard operating procedure documentation and safety requirements.

Using the Instrument Checklist:

Ignite the flame by pressing and holding the ignite switch until the flame ignites.
Ensure that the flame is burning normally (sound, appearance, etc.).

Use the software to control the Flame AA throughout use.

The user must monitor the instrument at all times while the flame is burning in the combustion chamber.

Shutting Down the Instrument Checklist:

Extinguish the flame by pressing the red shutoff button on the lower left face of the instrument. Confirm that the flame extinguishes.

Close the acetylene cylinder valve, and store the cylinder if required while following all applicable safety procedures.

Turn off the air compressor.

Dispose of samples and standards as per the required procedures for the specific chemicals.

Ensure that the logbook has been filled out.

Survey the instrument prior to leaving the laboratory to ensure that all appropriate safety and cleanup steps have been performed.