Electron Microprobe/SEM Facility
Rooms 155-157 Morrill IVS
Safety and Chemical Hygiene Plan

Prepared: (10/15/2018)
Last Reviewed: (10/15/2018)
Current Lab Group Members and Emergency Contact Information

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Cell Phone</th>
<th>Home Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Jercinovic</td>
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</tbody>
</table>

Other Emergency Contacts:

UMPD (Medical Emergency, Fire, and Police) (413)-545-3111 or 911*

*Specify UMass Amherst and Building Name When Calling 911

Environmental, Health, and Safety (Lab Incidents and Spills) (413)-545-2682

Lab Building(s): Morrill IVS

Lab Building(s) Street Address: 627 N. Pleasant St.

Lab Room(s) In Each Building: 155-157

Responsibilities Within The Lab and Department

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Frequency</th>
<th>Responsible Person</th>
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</thead>
<tbody>
<tr>
<td>Inspections</td>
<td>weekly</td>
<td>Michael Jercinovic</td>
</tr>
<tr>
<td>Building Coordinator</td>
<td>Ongoing</td>
<td>NA</td>
</tr>
<tr>
<td>Department Lab Safety Coordinator</td>
<td>Ongoing</td>
<td>Jeff Salacup/Mark Leckie</td>
</tr>
<tr>
<td>Department Chair</td>
<td>Ongoing</td>
<td>Julie Brigham-Grette</td>
</tr>
</tbody>
</table>
Specialized Hazards and Hazard Communication Within The Lab

Liquid Nitrogen

Cryogenic liquids are materials with boiling points of less than -73°C (-100°F) at 14.7 psia. Liquid nitrogen in this lab suite is at -196°C and 22psi in the pressurized 240 liter dewar, and small amounts are kept in 10 liter and 3 liter unpressurized, vacuum insulated dewars for easy handling. The two pressure regulation/safety valves on the pressurized dewar should never be closed or altered in any way.

No liquid nitrogen should be dispensed without instruction. Do not open the liquid valve without permission, training and proper protective equipment.

All cryogenic liquids are gases at normal temperatures and pressures. These gases must be cooled below room temperature before an increase in pressure can liquefy them. Different cryogens become liquids under different conditions of temperature and pressure, but all have two properties in common: they are extremely cold, and small amounts of liquid can expand into very large volumes of gas. Example: liquid nitrogen expands in a 700:1 ratio.

Each cryogenic liquid has its own specific properties, but most cryogenic liquids can be placed into one of three groups:

Non-flammable cryogens (e.g., liquid nitrogen) can cause tissue damage from extreme cold because of contact with either liquid or boil-off gases. Cryogenic liquids also produce tissue damage similar to that associated with thermal burns and cause severe deep-freezing with extensive destruction of tissue. In the event of exposure to a cryogenic liquid, flush the affected areas with large volumes of tepid water (41-46°C [105-115°F]) to reduce freezing. Cover the affected area with a sterile protective dressing or with clean sheets if the area is large, and protect the area from further injury. Seek medical attention.

In poorly-ventilated areas, inhalation of gas due to boil off or spills can result in asphyxiation. Another hazard is explosion from liquid oxygen condensation in vacuum traps from ice plug formation or lack of functioning vent valves in storage Dewars. Because 1 volume of liquid nitrogen at atmospheric pressure vaporizes to 694 volumes of nitrogen gas at 20°C, the warming of such a cryogenic liquid in a sealed container produces enormous pressure, which can rupture the vessel.

Cryogenic liquids should be stored and handled in well-ventilated areas to prevent excessive build-up of gas. Cryogenic liquids should never be used in a closed environmental chamber. Liquid nitrogen can displace oxygen in a poorly ventilated space. The cold vapor is heavier than air and will concentrate at lower levels of the room. Oxygen levels should be monitored during dispensing operations. A general ventilation system for a laboratory that gives 6 to 12 room air changes per hour is normally adequate.

The extremely cold temperatures of cryogenic liquids can rapidly freeze human tissue and overpressurization of storage containers can result in an explosion of the vessel. The following must be worn when dispensing or handling cryogenics liquids: • Full-face shield over safety goggles, both compliant to ANSI Z87.1 to protect eyes. Eyes are most sensitive to extreme cold of cryogenic liquids and their vapors. • Loose fitting cryogenic gloves to protect hands. Gloves should be loose fitting so that quick
removal is possible if liquid should splash into them. Even with gloves, contact with cold liquids should be for a very brief time. Do not submerge your gloved hands into the cryogenic liquid. • Protective clothing should consist of cryogenic aprons, pants, and shoes (not made of canvas) to protect against skin contact in the event of a splash or spill, depending on the hazard.

Gas cylinders

Each instrument has associated nitrogen and P10 (Argon, 10% methane) gas cylinders for venting vacuum components (N2) and supplying counter tube gas (P10). These are high pressure cylinders with regulators to deliver gas at relatively low pressure. **Regulators should not be removed or adjusted except by the laboratory director. Cylinders should not be removed or replaced except under the supervision of the laboratory director.**

Procedures for Proper Handling of Gas Cylinders:

- Cylinders must be clearly marked with their contents.
- Regulators must be compatible with gas cylinders. Do not use adapters.
- Cylinders must be secured to a wall or bench. A gas cylinder cart or stand is also acceptable. • Cylinders must be stored in a cool, dry, well-ventilated area away from ignition sources, electrical supply sources, and heat.
- A safety cap or regulator must always be attached to the cylinder.
- Transport capped cylinders on an approved cylinder cart. • Be familiar with the special hazards associated with compressed gases or cryogenic liquefied gases in use. (See EH&S Cryogenic Liquids Policy [http://www.ehs.umass.edu/cryogenic-liquids-guidelines](http://www.ehs.umass.edu/cryogenic-liquids-guidelines))
- Store full cylinders away from empty cylinders.
- Store oxidizers away from flammable gases.
- Do not store cylinders with acids and/or bases.
- Keep flammable gases away from doorways.
- Work with acutely toxic hazardous gases with special procedures and in approved gas storage cabinets.
- Regulators for compressed gas cylinders should be inspected yearly.
- Auto-shut off valves must be installed on compressed gas cylinders containing hazardous or flammable gases.
Specific Policies For the Lab

- Analytical work may be conducted alone or in small groups.
- Instrument can only be used after proper training and authorization by the laboratory director.
- Instrument maintenance should be conducted by qualified personnel only ( Cameca service engineers or the laboratory director), particularly in regard to high voltage components.

Specific SOPs and Protocols for the Lab

All operating procedures are established through training of individual users. Assisted instrument use is available if authorized by the laboratory director, and performed by qualified users. All trained laboratory personnel are required to be familiar with all safety procedures, and have read the laboratory specific safety and chemical hygiene plan.

Hazardous Materials Storage and Segregation

Only temporary storage of waste vacuum pump oil is permitted in the lab suites. This waste oil must be placed in a properly labeled container, which itself is placed in a hazardous waste bin until picked up by EH&S.

Emergency Equipment and Information

Emergency power trips are located at inside each room (155 and 157) by the doors to the hallway. Automatic smoke/fire sensors are located in the labs.

Emergency Procedures

(Include procedures for Fire (see below), small spills that may be cleaned up by lab personnel, special exposure procedures, etc.)

In the event a fire:

- Alert people around you to evacuate and close the door as you leave the space to contain the fire
- Proceed to the nearest exit into the hallway and pull the fire alarm by the outside entrance to the building (courtyard entrance to the north).
- A fire extinguisher is available in the hallway across from room 154.
  - You may extinguish the fire if ALL of the following are true:
    - You have been trained to properly use a fire extinguisher
    - The fire alarm has been activated
    - The fire is small enough to be extinguished easily and you are comfortable doing so
If ANY of the above statements are not true, or if the situation becomes unsafe, evacuate.

If an instrument fire is detected, press the emergency trip near the door to the hallway as you exit. This will kill all power to both laboratory rooms. See below for location of electrical power trips (shunt trips).

- Evacuate the building
  - Do not use the elevator
  - Assemble in your predefined assembly location – The Morrill N/S courtyard.
  - Do not leave until a head count has been taken
  - The building may only be reentered once the fire alarm has been silenced and emergency responders have said it is safe to do so

In the event of a flood

If water is entering through the ceiling or doorways, exit immediately, and press the emergency electrical trip near the door as you exit. This will kill power to both rooms. See below for location of electrical power trips (shunt trips).