EHS ENVIRONMENTAL HEALTH AND SAFETY

Lab Chatter

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UNE UNIVERSITY OF NEW ENGLAND

Contents:

Asphyxiation Hazard of Cryogens and Liquid Nitrogen

By Peter Nagle

Cryogenic liquids, also known as cryogens, are gases at normal temperatures and pressures. However, at extremely low temperatures they are liquids with boiling points that are below -238°F. Cryogens become liquefied at different temperatures and pressures; however they all have two things in common, they are extremely cold and a small amount of liquid can expand to a very large volume of air.

There are several hazards associated with cryogens. They include fire, pressure, embrittlement of materials, asphyxiation, and skin burns on contact with the liquid. In this article we'll focus on the asphyxiation hazard, especially with liquid nitrogen.
Cryogenic liquids will vent (boil off) from the containers as part of normal operation. Their storage containers are designed to allow this in order to prevent the build-up of excessive pressure. For example a 160 liter tank of liquid nitrogen will vent the equivalent of 2 liters of liquid a day. The normal ventilation of cryogens is not considered hazardous since it vents in small amounts at a time. The problem arises when there is excessive venting or a spill.

Ambient air contains 78% nitrogen, 21% oxygen and trace gases making up the remainder 1%. If a sufficient amount of liquid nitrogen is vaporized and escapes, it can reduce the oxygen levels to below 19.5%, the OSHA definition of an oxygen deficient atmosphere. In confined spaces or poorly ventilated areas such as elevators, storage areas and small rooms, the risk becomes much greater. Escaping gas will expand rapidly and displace oxygen presenting an asphyxiation hazard to any personnel in the area. The gas will create a visible fog when escaping because the vapors are still cold enough to condense the moisture in the air, but this is deceiving. The nitrogen gas may warm up enough to evaporate the moisture as it expands thus the fog clouds should not be used to define the vapor clouds. The vapor cloud may extend far beyond the visible fog. Therefore, during a release it is important not to define the release area strictly by the fog area. Nitrogen gas is odorless, colorless and tasteless at room temperature, so eventually the vapor would not be detectable.

Asphyxiants like liquid nitrogen do not give ample warning. A person may not feel "light headed" and may pass out without warning. Below are the effects depleted oxygen can have on someone.

% Oxygen	Effects
16-20%	Minimal
10-15%	Decreased mental effectiveness, visual acuity, and loss of muscular coordination
6-10%	Loss of consciousness may occur
<6%	Death will result

To prevent injury, take the following precautions.

- Make sure the area is well ventilated before using cryogens
- If large quantities of cryogenic vapors are released, the entire area should be evacuated immediately
- Do not store in a confined space

Refer to the UNE Chemical Hygiene Plan (page 36) for further details and precautions taken for other hazards associated with cryogens. The UNE CHP can be found on the EHS portion of the UNE website.

Safety Spotlight

Our February 2015 Safety Spotlight is on the

UNE Chemical Sharing Program

You can find more information on this topic by contacting EHS (contact information on last page).

The **UNE Chemical Sharing Program** is a great way to reduce hazardous waste, reduce costs for your department, and have a positive environmental impact on campus. We would like to use this month's Safety Spotlight to highlight how the program works and why it is important to UNE.

HOW IT WORKS:

1) If you find that you have chemicals in your department that have not been used, (whether they are open or not) you can submit the name of the chemical, the quantity of the chemical and the manufacturer's name to EHS.
2) Once received by EHS, we will publish a list of the chemicals in the following month's EHS Lab Chatter in the UNE Chemical Sharing Program section at the end of the newsletter.
3) At that time you may email EHS and ask to take possession of some or all of the chemicals available.
4) If they are still available, we will notify you that you may take ownership of the chemicals. To take ownership of the chemicals, EHS will :
    a. coordinate pickup of the chemicals from the department discarding them and
    b. complete a "Chemical Transfer Form" (the three copies go to: person discarding chemicals, person receiving chemicals and one stays on file with EHS).
    c. change the information in the Vertere Chemical Inventory Management System from the previous user to the new user.
    d. EHS will then deliver the chemicals to the new user

BENEFITS OF THE UNE CHEMICAL SHARING PROGRAM:

- Reduces costs for hazardous waste disposal
- Reduces the environmental impact of disposal of unused material as hazardous waste
- Reduces the amount of chemicals purchased by a department, saving the department money
- Enhances communications and relationships between different departments on both campuses

Real Example of cost savings:

3 chemicals were recently relocated from the College of Pharmacy to the Chemistry Department:
-Between $30-$50 saved in hazardous waste disposal fees
-Estimated $100 to $300 in savings for the Chemistry Department in new chemical purchases

If you have any commonly used lab chemicals you are thinking of disposing, please contact EHS so they can be listed in the next issues of EHS Lab Chatter as available for the UNE Chemical Sharing Program.

The Dangers of Corrosives **By Jessica Tyre**

A corrosive is a chemical that has a pH less than 2 or greater than 12.5 and causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. Corrosive liquids (e.g. mineral acids, alkali solutions and some oxidizers) represent a significant hazard because skin or eye contact can readily occur from splashes and their effect on human tissue takes place very rapidly. Bromine, sodium hydroxide, sulfuric acid and hydrogen peroxide are examples of highly corrosive liquids. The eyes are particularly vulnerable so it is essential that approved eye and face protection be worn in all laboratories where corrosive chemicals are handled. Gloves and other chemically resistant protective clothing should be worn to protect against skin contact. To avoid a flash steam explosion due to the large amount of heat involved, always add acids or bases to water (and not the reverse). Acids and bases should be segregated for storage, and liquid corrosives should be stored below eye level. Incidental spill control materials should be readily available. Specialized spill kits for acids and bases are available through most chemical and laboratory safety supply catalogs.

Corrosive gases and vapors are hazardous to all parts of the body; certain organs (e.g. the eyes and the respiratory tract) are particularly sensitive. The magnitude of the effect is related to the solubility of the material in the body fluids. Highly soluble gases (e.g. ammonia and hydrogen chloride) cause severe nose and throat irritation, while substances of lower solubility (e.g. nitrogen dioxide, phosgene, and sulfur dioxide) can penetrate deep into the lungs. Warning properties such as odor or eye, nose or respiratory tract irritation may be inadequate with some substances. Therefore, they should not be relied upon as a warning of overexposure. Perform manipulations of materials that pose an inhalation hazard in a chemical fume hood to control exposure and wear appropriate respiratory protection. Protect all exposed skin surfaces from contact with corrosive or irritating gases and vapors. Regulators and valves should be closed when the cylinder is not in use and flushed with dry air or nitrogen after use. When corrosive gases are to be discharged into a liquid, a trap, check valve, or vacuum break device should be employed to prevent dangerous reverse flow.

Corrosive solids, such as sodium hydroxide and phenol, can cause burns to the skin and eyes. Dust from corrosive solids can be inhaled and cause irritation or burns to the respiratory tract. Many corrosive solids, such as potassium hydroxide and sodium hydroxide, can produce considerable heat when dissolved in water. Wear gloves and eye protection when handling corrosive solids. When mixing with water, always slowly add the corrosive solid to water, stirring continuously. Cooling may be necessary. If there is a possibility of generating a significant amount of dust, conduct work in a fume hood.

Remember, when using corrosives:

- ✓ Always investigate the additional hazards such as flammability and reactivity before using.
- ✓ Purchase only the amount needed; small quantities are recommended for easier handling and storage.
- ✓ Secondary containment should be used when moving chemicals within the building.
- ✓ Store separately from incompatible materials.
- ✓ Wear appropriate protective equipment as described in SDS for the substance you are using.
- ✓ Always add chemicals slowly and always add concentrated acid to water.
- ✓ Keep ignition sources away from inorganic acid spills (that may produce flammable hydrogen gas on contact with metals), and from glacial acetic acid, which as an organic acid is a combustible material.

(Sources: UNE Safety Manual, Princeton Lab Safety Manual, Hampshire College Lab Safety Manual)

First Aid Kits by Peter Nagle

One item EHS has been looking for during lab inspections is the possession of a first aid kit in each lab. OSHA regulations state that "adequate first aid supplies shall be readily available". The rule applies to treatment of minor injuries that may occur in the workplace and does not provide any exemptions to the rule regardless of workplace size or work performed. OSHA does not legally set a minimum amount or type of supplies needed in the kits. The only requirement is that the supplies must correspond to the hazards which can be reasonably expected to occur in the workplace. In essence, the type and amount of supplies are left to the discretion of the employer. At UNE the EHS Department provides the initial first aid kit to each lab and the lab is then responsible for re-stocking their kits as they become depleted. Inspections of the kit should take place at least once a year or after usage, whichever is less.

The supplies in the EHS provided kits are listed below:

- Triangular bandage (1)
- Nitrile gloves (2 pair)
- Bandages (16)
- Fingertip bandages (8)
- Knuckle bandages (8)
- Alcohol wipes (10)
- Antiseptic wipes (10)
- Triple antibiotic (10)
- Face shield for CPR rescue breathing (1)
- First aid and CPR guide (1)

Laboratories are welcome to provide additional supplies if needed. If you feel the supply list above is inadequate, please contact EHS (contact information on last page).

Biosafety Levels by Jessica Tyre

When working with biological agents there are different hazard levels that dictate how a laboratory should be setup and what precautions must be taken to protect people, animals, and the environment at an institution. This is a brief description of those levels defined by the Centers for Disease Control. **At UNE you must contact EHS BEFORE beginning work with ANY BSL- 2 or BSL-3 materials.** For more information on precautions to be taken for each level, please visit: **http://www.cdc.gov/biosafety/publications/bmbl5/index.htm**

Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building. Work is typically conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment. Laboratory personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.

Biosafety Level 2 builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that: 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2) access to the laboratory is restricted when work is being conducted; and 3) all procedures in which infectious aerosols or splashes may be created are conducted in biosafety cabinets or other physical containment equipment.

Biosafety Level 3 is applicable to clinical, diagnostic, teaching, research, or production facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure. Laboratory personnel must receive specific training in handling pathogenic and potentially lethal agents, and must be supervised by scientists competent in handling infectious agents and associated procedures. All procedures involving the manipulation of infectious materials must be conducted within BSCs or other physical containment devices. A BSL-3 laboratory has special engineering and design features.
(Source: www.cdc.gov)

Laboratory Sharps Disposal

By Ron Souza

Definition:
"Sharps waste" means any device having acute rigid corners, edges, or protuberances capable of cutting or piercing including, but not limited to, all of the following: hypodermic needles, syringes, razor blades and scalpel blades. Glass items contaminated with biohazards, such as pipettes, microscope slides and capillary tubes are also considered a "sharps waste."

Under no circumstances should "sharps waste" be disposed of in the normal trash. Sharps must be disposed of in approved sharps containers.

Sharps Contaminated with Hazardous Chemical Waste

1. Place in a rigid, puncture-resistant container which, when sealed, is leak proof.
2. Deface any biohazard symbols, if present.
3. Label the container with a hazardous waste label and include the chemical constituents. (Available through EHS)
4. Request waste collection by contacting the EHS department. Please note on the request that the material is not biologically contaminated.

Sharps Contaminated with Radioactive Materials

1. Place in a rigid, puncture-resistant container which, when sealed, is leak proof.
2. Deface any biohazard symbols, if present.
3. Label the container with a radioactive waste label and include the radioactive isotope.
4. Request waste collection by contacting the EHS department. Please note on the request that the material is not biologically contaminated.

Sharps Contaminated with Medical or Biohazardous Waste

1. Place in an approved biohazardous sharps container that is red, rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty.
2. Autoclave your sharps container for a minimum of 30 minutes at 121°C and 15psi.
3. Label the sharps container with the word "autoclaved".
4. Request waste collection by the EHS department. Please note on the request that the material has been autoclaved.

Or

1. Place in an approved biohazardous sharps container that is red, rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty.
2. Request waste collection by the EHS department.

Unused or Non-Contaminated Hypodermic Needles

1. Place in an approved biohazardous sharps container that is rigid, puncture-resistant and which, when sealed, is leak proof and cannot be opened without great difficulty.
2. Deface any biohazard symbols, if present.
3. Request a sharps (non-contaminated) waste collection by the EHS department. Please note on the request that the material is not biologically contaminated.

Never leave used sharps on bench-tops or carts!
Always store these items in appropriate, safe locations!

www.une.edu/campus/ehs

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UNE Chemical Sharing Listing

The UNE Chemical Sharing Program is a great way to reduce hazardous waste, reduce costs for your department, and have a positive environmental impact on campus. If you have any commonly used lab chemicals you are thinking of disposing of, please contact EHS so they can be listed in the next issues of EHS Lab Chatter as available for the UNE Chemical Sharing Program.

Chemicals currently available through the College of Pharmacy:

Chemical name	Volume (approximate)	Manufacturer
1,4- dichlorobenzene	2.5 kg	Alfa Aesar
dimethyl sulfoxide	1 L	Sigma
ethoxy diglycol	500ml	Letco Medical
copper (II) sulfate	50g	Aldrich
sodium carbonate	500g	Fisher
nystatin	4 tubes of 30g	Taro
zinc oxide	500g	Fisher
zinc sulfate monohydrate	1kg	Acros
betamethasone valerate	3 tubes of 45g	Actavis
sodium metabisulfite	500g	Letco Medical
charcoal	500g	Fisher
calcium chloride	2 containers of 500g	Sigma-Aldrich
calcium gluconate, anhydrous	500g	Sigma-Aldrich
kaolin	4 containers of 500g	Fisher

Please email jtyre@une.edu if you are interested in any of the above chemicals.

EHS will handle the transfer from one department to the other.

Thank you!!