实验室安全教育

Fellow students hold a vigil for Yale undergraduate Michele Dufault.

HIGHER EDUCATION

A death in the lab

Fatality adds further momentum to calls for a shake-up in academic safety culture.

BY RICHARD VAN NOORDEN

In the early hours of 13 April, undergraduate students working at Yale University's Sterling Chemistry Laboratory made a shocking discovery. There in the lab's machine shop was the dead body of 22-year-old undergraduate student Michele Dufault, her hair tangled in a lathe. She had apparently died of asphyxiation in an accident described by Richard Levin, president of Yale in New Haven, ever-present tension between research freedom and safe working conditions in academia. And it underscores the slow pace of change since another high-profile laboratory fatality led to similar soul-searching less than three years ago.

In late 2008, 23-year-old research assistant Sheharbano Sangji sustained horrific burns in a lab fire at the University of California, Los Angeles (UCLA), and died of her injuries 18 days later. Sangji's death — in very differ-

ing up chunks of nickel hydrazine perchlorate — using a hundred times the recommended amount — when it detonated.

Unusually, the US Chemical Safety Board (CSB) — a body that usually investigates large industrial accidents such as refinery explosions — stepped in. For the first time ever, it said it would review academic laboratory safety. At an August 2010 meeting of the American Chemical Society in Boston, Massachusetts, CSB chairman Rafael Moure-Eraso said that the board had gathered media reports of around 120 university chemistry laboratory accidents since 2001, and concluded that "safety practices at US universities leave a lot to be desired".

Chemistry labs have been a particular focus of concern because the most dangerous procedures in other sciences tend to have more detailed safety protocols, says Peter Reinhardt, head of environmental health and safety at Yale University. "Using radioactive materials or biological materials is much more stringently regulated," he told *Nature* (speaking before Dufault's accident). "The big gap is hazardous chemicals in laboratories."

Rick Danheiser, an organic chemist at the Massachusetts Institute of Technology in Cambridge who chairs the chemistry department's health and safety committee, agrees that some labs' safety standards are too lax. But "there are chemistry departments with very strong safety programmes, and there's a whole range of

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http://www.chem.purdue.edu/chemsafety/Chem/Chemicals.htm

PURDUE UNIVERSITY Department of Chemistry

Chemical Safety

Gases	Liquids	Carcinogens
N_2, other Cryogens	HF *(aqueous or anhydrous)*	
Pregnancy	Allergies	
Report These Materials		

Purdue Chemical Hygiene Plan	ToxNet
Chemical Waste Disposal at Purdue	**MSDS**'s Required In Labs?
--> quick link to waste pickup web submit	Mercury Information
Request approval to purchase cyanide compound	NAP: Prudent Practices.... Handling and Disposal

Chemical Hazards References

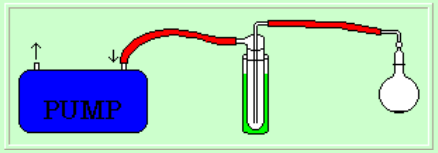
Liquid Nitrogen Safety

See rules from Oak Ridge rules OMRL NOAO

calculate how much LN2 is necessary to displace all your air.

1. General precautions for all use of LN2 (liquid nitrogen)

- At all times, HAVE A PLAN of what you will do if....
  - a pressurized Dewar spontaneously vents?
  - you freeze your watchband or wedding band to your finger?
  - the funnel (which you should not be using) freezes and spews nitrogen upward into your face?
  - 160 L of LN2 for whatever reason falls onto its side? (It happens. It's scary and unpleasant and could easily be quite disastrous.)
- Liquid nitrogen can cause terrible "burns." (Death of living tissue caused by the extreme cold.) Hand protection and goggles (not safety glasses) are to be worn when dispensing and handling liquid nitrogen. When handling large quantities, a full length apron will minimize the chance of a spill going into your shoes, where it might destroy some cubic centimeters of flesh before you can get your shoes and socks off. Persons using a tipper to dispense LN2 must wear a full face shield over goggles, cryo-gloves, full length cuffless trousers which completely cover the tops of the shoes (or a full length apron), and shoes which will not permit liquefied gas to enter them in case of a spill, and which are also quickly removable in case they do (allow liquid to enter).
- Do not use a funnel.
- Do not store container(s) of LN2 in a cold room or any other location where a person could physically enter an anoxic atmosphere. (Cold rooms have no air changes and a person entering a room with elevated nitrogen in the air can quickly pass out and then die within several minutes of entering.
- Liquid nitrogen will condense oxygen from the air. This is most alarmingly demonstrated if a person leaves his/her vacuum pump's coldfinger in a Dewar of liquid nitrogen overnight. In the morning the coldfinger will contain **LIQUID OXYGEN** up to the level of the nitrogen in the Dewar.



- Guard against pressure build-up by using a pressure relief vessel or a venting lid.
- Remove metal jewelry/watches on hand and wrists.
- Glass Dewars must be taped solidly around the outside. The plastic mesh with which some small thermoses are sold protects the Dewar itself to some extent, but does not protect very well against injury from glass shards resulting from implosion.
- Asphyxiation -- nitrogen is not poisonous; the air is already about 78% nitrogen (oxygen makes up about 21%, and trace gases the remaining 1%). However, if sufficient liquid nitrogen is vaporized so as to reduce the oxygen percentage to below 19.5%, you are at risk of oxygen deprivation. Rapid venting can cause near-total displacement of normal air, leading to a local concentration of about 100% nitrogen. Simple asphyxiants such as nitrogen **do not have good warning properties!** (You might not feel "light-headed," you

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GUIDELINES:
HANDLING AND DISPOSAL OF CHEMICALS

Purdue University Chemical Management Committee

Liquid Nitrogen Safety

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1.Liquid nitrogen can cause terrible "burns." (Death of living tissue caused by the extreme cold.)

2. Hand protection and goggles (not safety glasses) are to be worn when dispensing and handling liquid nitrogen. When handling large quantities, a full length apron（围裙） will minimize the chance of a spill going into your shoes, where it might destroy some cubic centimeters of flesh before you can get your shoes and socks off.

3. Persons using a tipper to dispense LN2 must wear a full face shield over goggles, cryo-gloves, full length cuffless trousers which completely cover the tops of the shoes (or a full length apron), and shoes which will not permit liqufied gas to enter them in case of a spill, and which are also quickly removable in case they do (allow liquid to enter).

4. Do not use a funnel

5. Do not store container(s) of LN2 in a cold room or any other location where a person could physically enter an anoxic atmosphere. (Cold rooms have no air changes and a person entering a room with elevated nitrogen in the air can quickly pass out and then die within several minutes of entering)

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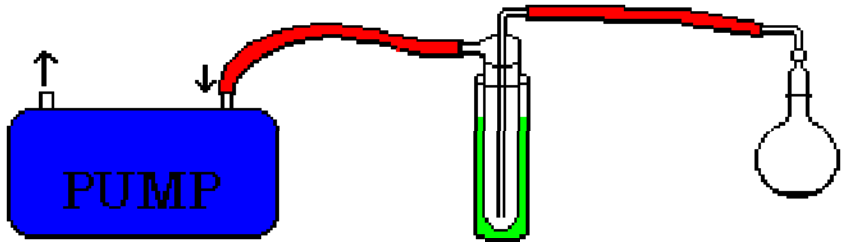

7.Remove metal jewelry/watches on hand and wrists (if not, you may freeze your watchband or wedding band to your finger)

8. Do not carry liquid nitrogen in a passenger elevator

9. Glass Dewars must be taped solidly around the outside. The plastic mesh with which some small thermoses are sold protects the Dewar itself to some extent, but does not protect very well against injury from glass shards resulting from implosion

10. Asphyxiation(窒息) -- nitrogen is not poisonous; the air is already about 78% nitrogen (oxygen makes up about 21%, and trace gases the remaining 1%). However, if sufficient liquid nitrogen is vaporized so as to reduce the oxygen percentage to below 19.5%, you are at risk of oxygen deprivation. Rapid venting can cause near-total displacement of normal air, leading to a local concentration of about 100% nitrogen. Simple asphyxiants such as nitrogen **do not have good warning properties!** (You might not feel "light-headed," you may simply pass out without any warning whatsoever. And then die without regaining consciousness.)

What's wrong with this picture?

If the photo is gone, well, that's a fair indication that it was removed from the Moravian College website where I found it (while looking up the density of LN2). It is/was clear advertisement of the fact that students were not required in this case to wear the commonly accepted PPE for working with liquid nitrogen