



The Need for Academic Institutional Laboratory Safety

Safety Training Program Workshop

hosted by the IUPAC Committee on Chemistry & Industry

Sao Paulo, Brazil

10th July 2017



Dr. Robert J. Audette, FCIC
Audette Consulting

Dr. Gerald F. Audette
Professor, Dept. of Chemistry, York University

Lab Safety - still a university lab issue

“Death in the Lab” Discover Magazine, June 2015

Death in the Lab | DiscoverMagazine.com

<http://discovermagazine.com/2015/june/20-death-in-the-lab>

FROM THE JUNE 2015 ISSUE

Death in the Lab

A UCLA laboratory fire took Sheri Sangji's life. Her boss and the university closed ranks. Will her family's crusade for justice make researchers any safer?

By Reryl Lief Brenderly | Thursday, April 30, 2015



Jonathan Bartlett

With the campus nearly deserted for winter break, this Monday in late 2008 should have been a quiet one at the University of California, Los Angeles. Around 1 p.m. Dec. 29, Sheharbano “Sheri” Sangji began an experiment in the fourth-floor chemistry lab where the 23-year-old worked as a research assistant to chemistry professor Patrick Harran.

Alone at the bench, wearing a synthetic-fiber sweatshirt, she put on goggles and gloves and began the procedure Harran had outlined to her that morning as part of work to develop a drug to treat obesity. It included transferring a liquid called tert-butyllithium from the bottle it came in to another bottle.

Tert-butyllithium is pyrophoric — it ignites on contact with air — so its manufacturer, Sigma-Aldrich, sent detailed instructions for safe handling with each bottle. Only “fully qualified and experienced laboratory workers” should work with it, the instructions say, according to an investigative report. They should receive training on the specific procedures needed to stay safe: goggles and gloves, but also a fire-resistant lab coat over natural-fiber clothing down to the underwear, and possibly a full-face respirator mask. If a syringe is used, it should be glass, at least twice as large as the quantity to be transferred and fitted with a needle a foot or two long. Sangji had learned to make a transfer from one of Harran's postdoctoral researchers, who would

- UCLA laboratory safety standards on trial
- “family pushed for accountability from researcher in charge & for better safety standards in academic labs”
- “UCLA spent \$4.5M on professor’s defence”
- <http://discovermagazine.com/2015/june/20-death-in-the-lab>

Academic Institutional Safety Training

Brief Overview of a Canadian University perspective

▀ York University Institutional safety training

- Undergraduate & graduate students
- Faculty

❖ York University Human Resources

Health, Safety & Employee Well-Being - Health & Safety Training

➤ Undergraduates & Graduate Students

- ✓ Once every 3 years (3 hours per course) for any laboratory work:
 - ✓ Minimum WHIMS II
 - ✓ Biosafety - to work in lab with biologicals
 - ✓ Compressed Gas Cylinder Safety - if appropriate
 - ✓ Laboratory specific training (on-going)
- ✓ Specialty training:
 - ✓ Radiation Safety if working with isotopes
 - ✓ X-Ray Safety if working in X-Ray diffraction - just access to area

❑ <http://hr.info.yorku.ca/health-safety-training/>

❖ Faculty Safety Officer

- ✓ “Solvents” training (chemical handling & volatile rooms):
 - ✓ To access the solvent storage (blowout) room
 - ✓ Located in common Science Stores area

❖ York University Dept. of Occupational Health & Safety

➤ Faculty (Principle Investigators)

- ✓ Same as students plus overview of:
 - ✓ Occupational Health & Safety Act
 - ✓ Biosafety: Full Training
 - ✓ Accident Investigation (online)
 - ✓ Reporting accidents
 - ✓ Workplace Violence
 - ✓ Harassment

- ✓ Typically by web-seminars

❖ This occurs by law every 3 years

❖ Principle Investigators safety training within their laboratories

- ✓ Varies by Principle Investigator
- ✓ It is laboratory specific
- ✓ Some PI's have guideline documents, some don't
- ✓ PI and senior lab designate do the training & monitoring as necessary

- ✓ OHS does a safety audit of all PI laboratories once a year

- ✓ Specialty training:
 - ✓ Usually instrument specific
 - ✓ X-Ray Safety training working in X-Ray crystallography
 - specific to instrument, need radiation badges

► Laboratory Safety is an ongoing challenge - the difficulty is buy-in

❖ In General -

- ✓ Everyone is fine at beginning
- ✓ Can become rather lax quickly there after
- ✓ Laboratory safety comes with experience in lab
- ✓ Students will take short cuts - leads to problems

- ✓ On-going safety needs to be trained & kept foremost in mind
- ✓ The “spirit” of the rules in addition to the letter of the law
- ✓ On-going - in order to work safely & prevent injury/infection - & BAD data

❖ Industry

- ✓ Why this matters - need it when they go to industry lab
- ✓ Not up to their safety standards

➡ Audette Laboratory equipment - other student's using it

Sonicator with lid open



- ✓ Student leaving soundproof enclosure open so they can hold samples being sonicated
- ✓ Students complaining about their hearing & concerns about infection/contamination
- ✓ Typically “non compliant” students go to other PI labs to use their sonicators

➡ Audette Laboratory equipment - other student's using it

Floor centrifuge



- ✓ Classic example of undergraduate student being lax with lab safety
- ✓ Container didn't have lids on properly - biological spill
- ✓ Undergraduate student did not clean up after the spill
- ✓ Caused a lot extra work to clean up the centrifuge due to biological contamination
- ✓ Thankfully only clean up and not damage to the instrument
- ✓ Requires ongoing vigilance & continuous training - undergraduate student turn over

Academic Institutional Safety Training NOT confined to a specific lab safety program

“Globe & Mail, April 2017

- PhD student notices in Dec 2016 “a lot of white powder” in corridors of UofT laboratory building
- Faculty & students working in area not informed of asbestos dust until at least 1 month later
- Major lack of communications & safety training by DOHS on asbestos exposure
- Health implications of known carcinogen
- Ontario Ministry of Labor ongoing investigation
- Results in major UofT DOHS protocols being changed

THE GLOBE AND MAIL • SATURDAY, APRIL 1, 2017

NEWS • A7

U of T faculty demand asbestos audit

Following concerns of communication failures and testing conduct, many are demanding an investigation into the matter

TAVIA GRANT

Faculty and students at Canada's largest university are increasingly frustrated they weren't more clearly informed about asbestos in dust in their building, and are worried over the long-term health implications of exposures to the known carcinogen. Those concerns have now sparked a demand that a task force examine the university's handling of the situation.

Test results on Feb. 1 showed asbestos present in dust in some labs at the University of Toronto's medical sciences building on the sixth and seventh floors.

Another positive result came from a dust sample on Feb. 24. Separate tests also showed asbestos-containing dust on the third floor on March 17. Five labs have been affected; two labs remain closed.

Many people who work in or near the affected areas were not clearly informed of the asbestos until at least a month after the first positive test result, interviews with more than a dozen faculty members, graduate students and a caretaker who all work on the affected floors show. This meant that for weeks, students, researchers, professors and cleaners say, they continued to work in labs, clear dust and clean off equipment without full knowledge there was an unfolding asbestos situation in or close to their work areas.

Concerns over a lack of communication and over how air testing was conducted have prompted the university's faculty association to ask for a task force to be established to investigate the situation.

“The administration has lost the confidence of faculty, staff and students in their ability to appropriately manage this situation,” said Professor Patricia Brubaker, right, seen speaking with Prof. Adria Giacca, centre right, fellow Dier Mahmood, centre left, and Prof. Paul Hamel, left, on Friday at the university. GAIL IT BODAN/THE GLOBE AND MAIL



one incident, but we need to think of the broader implications of this, and how careful we need to be in removing asbestos, and how challenging that is in buildings that are fully occupied.”

Ontario's Ministry of Labour says its investigation is ongoing. It hasn't issued any orders, but says two requirements for documentation from the university are still outstanding.

The university says all its air-sample tests have come back as negative for asbestos. A report by an outside firm on Friday said the building is “safe for general occupancy.”

“All required communication was done,” Scott Mabury, vice-president of university operations, said, adding that faculty members in the affected labs were notified and notes were immediately placed on doors. He adds that the university has been trying “to correct a lot of unfortunate misinformation.”

The university is changing practices – protocols across the university are being updated and it has expanded oversight, bringing in outside experts.

“I recognize and acknowledge their [students] concern. Our primary interest is their safety,” he said, acknowledging communication has been “a challenge.”

Some students say they have lost weeks and months of lab work and missed deadlines.

Farshad Azimi, a PhD student who works on the sixth floor in a lab adjacent to one of the shuttered rooms, says he first noticed “a lot of white powder” in the corridors in December. He assumed it was from construc-

renovation and asbestos abatement were under way in the building. In January, they also noticed unusual amounts of white dust. They describe dust as coating their lab equipment, papers, laptops, benches and the floor.

Test results Feb. 1 showed as-

“They should have informed me,” said the cleaner, who has lost sleep with worry.

Asbestos was commonly used in building materials, such as ceiling tiles, until the 1970s. This situation illustrates the challenges of dealing with asbestos in aging public buildings, and, if

Audette Laboratory ISO/IEC 17025 Quality Management System Laboratory Safety Manual TOC



Audette Laboratory

SECTION: QMS	APPROVED BY: DR. G. AUDETTE
LAB SAFETY MANUAL	SIGNATURE: <i>G. Audette</i>
SOP ID: LS-M01-TOC	DATE ISSUED: 13 AUGUST 2016

I. TABLE OF CONTENTS

SECTION	TITLE
0	LABORATORY SAFETY MANUAL
1	1. LABORATORY SAFETY MANUAL TABLE OF CONTENTS
2	2. ROUTINE LABORATORY SAFETY PRACTICES
3	3. SPECIFIC LABORATORY SAFETY REQUIREMENTS
4	4. CHEMICAL HYGIENE
5	5. CHEMICAL SPILL PROCESS
6	6. CLEANUP OF BIOLOGICAL FLUID SPILLS
7	7. CLEANING EQUIPMENT WORK AREAS
8	8. CHLORINE DISINFECTANTS
9	9. ELECTRICAL SAFETY
10	10. WASTE DISPOSAL
11	11. WORKPLACE HAZARDOUS INFORMATION SYSTEMS
12	12. CRYOGENICS
13	13. INCIDENT/INJURY REPORTING
14	14. HAZARD ASSESSMENT & CONTROL
15	15. WORKPLACE INSPECTION
16	16. INFECTION CONTROL

Document Control No.:	AL-QMS-L-001.DOC	LSM Rev. No.:	3.0
Computer File Name:	LSM 01 Table of Contents r3 0.docx	LSM Rev. Date:	13 August 2016

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007

Signoff on reading Laboratory Safety Manual



Audette Laboratory

SECTION: QMS	SOP ID: GF-F06-ACK LSM
FORM	DATE ISSUED: 13 AUGUST 2016

ACKNOWLEDGEMENT OF READING LAB SAFETY MANUAL

Once you have read, understood and agree to abide by the current revision of the following Lab Safety Manual documents, place an "X" in the far right column

Lab Staff Name: **NS – undergrad honors research project**

SOP Document Title	Document Control No.	Rev. No.	Read (X)
Laboratory Safety Manual Title Page	AL-QMS-L-000.DOC	4.0	X
1. Laboratory Safety Manual Table of Contents	AL-QMS-L-001.DOC	3.0	X
2. Routine Laboratory Safety Practices	AL-QMS-L-002.DOC	5.0	X
3. Specific Laboratory Safety Requirements	AL-QMS-L-003.DOC	4.0	X
4. Chemical Hygiene	AL-QMS-L-004.DOC	4.0	X
5. Chemical Spill Process	AL-QMS-L-005.DOC	3.0	X
6. Cleanup of Biological Fluid Spills	AL-QMS-L-006.DOC	4.0	X
7. Cleaning Equipment Work Areas	AL-QMS-L-007.DOC	4.0	X
8. Chlorine Disinfectants	AL-QMS-L-008.DOC	5.0	X
9. Electrical Safety	AL-QMS-L-009.DOC	4.0	X
10. Waste Disposal	AL-QMS-L-010.DOC	4.0	X
11. Workplace Hazardous Materials Information Systems	AL-QMS-L-011.DOC	5.0	X
12. Cryogenics	AL-QMS-L-012.DOC	4.0	X
13. Incident/Injury Reporting	AL-QMS-L-013.DOC	4.0	X
14. Hazard Assessment & Control	AL-QMS-L-014.DOC	4.0	X
15. Workplace Inspection	AL-QMS-L-015.DOC	4.0	X
16. Infection Control	AL-QMS-L-016.DOC	4.0	X

I have read, understood and agree to abide by all above QMS documents. I acknowledge this by filling in my York ID# in the space below and filling in the Date Completed.

YorkU ID#: **2122xxxxx**

Date Completed: **Sept. 21, 2016**

Once completed rename the file (File > Save as) by completing the current year/month/day.
(XX = your initials)

[XX_Acknowledgement Reading Lab Safety Manual 201y-mm-dd.docx](#)

Email this completed acknowledgement form to Dr. G. Audette for his records.

Document Control No.:	AL-QMS-F-006.DOC	Form Rev. No.:	5.0
Computer File Name:	Acknowledgement Reading Lab Safety Manual form r5_0.docx	Form Rev. Date:	13 August 2016

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007

Laboratory Safety Manual Examples

4 CHEMICAL HYGIENE	PAGE: 2 OF 7
SECTION: QMS	SOP ID: QM-LSM04-CH

- "Good Laboratory Practices" document (AL-QMS-A-002.DOC)
- "Laboratory Maintenance & Waste Disposal" document (AL-QMS-A-007.DOC)
- "Safety" document (AL-QMS-A-011.DOC)

PROCESS

Process	Chemical Type	Instructions
Storage	General	All chemicals should be stored in their original container with the manufacturer's label intact.
		All chemicals shall be labelled using WHMIS guidelines. If the manufacturer's label is missing or the chemical has been transferred to another container, a WHMIS Workplace label shall be applied to the container that identifies the chemical and its' main chemical constituents.
		All chemicals shall be stored in a container that is inert to the contents and sealed so it shall not spill during transport or handling.
		When in doubt as to how a chemical should be stored, refer to the MSDS sheet for the product.
Flammable & Combustible		Store in proper flammable storage cabinets, which are labeled appropriately. The total quantity of flammable or combustible liquids stored in an approved cabinet shall not exceed 500L.
		Maintain as small a supply as needed for the efficient, uninterrupted operation of your laboratory.
		Not more than 50L of flammable liquids and not more than 300L of flammable & combustible liquids shall be permitted in any open working laboratory areas. This includes open shelves, benchtops and fume hoods.
		Containers used for the storage of flammable or combustible liquids shall not exceed 5L in capacity except if they are approved safety storage cans up to 25L capacity.
		If flammable or combustible liquids shall be refrigerated, store them only in explosion proof refrigerators.
Corrosive Material		Containers of acids and highly caustic material shall be stored in the proper storage cabinets, near the floor, to minimize the danger of bottles falling from shelves.
		Rubber or plastic safety containers shall be used to transport bottles over 500mL in size.
		Use only the smallest size containers compatible with the current need.

Document Control No.:	AL-LSM-S-004.DOC	SOP Revision No.:	3.1
Computer File Name:	LSM 04 Chemical Hygiene r3_1.docx	SOP Revision Date:	13 March 2015

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007



Audette Laboratory

SECTION: QMS	APPROVED BY: DR. G. AUDETTE
LAB SAFETY MANUAL	SIGNATURE: <i>[Signature]</i>
SOP ID: QM-LSM05-CSP	DATE ISSUED: 13 MARCH 2015

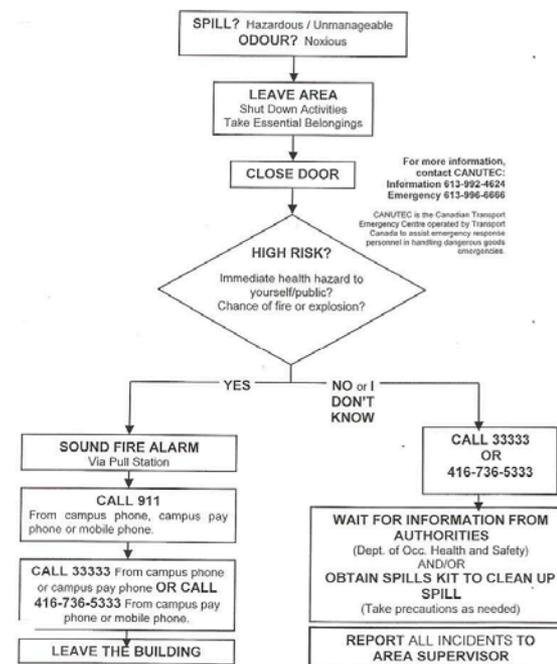
5 CHEMICAL SPILL PROCESS

SCOPE

This section of the **Laboratory Safety Manual** outlines the process for handling a chemical spill in the laboratory.

PROCESS

EMERGENCY SPILL AND/OR ODOUR PROCEDURE



Document Control No.:	AL-LSM-S-005.DOC	SOP Rev. No.:	2.1
Computer File Name:	LSM 05 Chemical Spill Process r2_1.docx	SOP Rev. Date:	13 March 2015

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007

Laboratory Safety Manual Examples

10 WASTE DISPOSAL	PAGE: 2 OF 3
SECTION: QMS	SOP ID: QM-LSM10-WD

PROCESS

Waste Classification	Contains	Type of Container	Notes
General Waste	<ul style="list-style-type: none"> Office waste. Items contaminated with non-hazardous biomedical waste. Kitchen or food waste. Maintenance and construction waste. 	Black waste bag in a solid container.	Items contaminated but not dripping with fluids should be put in the general waste.
Biomedical Waste	<p>Refer to the Faculty of Science (FSc) and DOHS current "Biohazardous Waste Disposal Protocol" document for specific details</p> <ul style="list-style-type: none"> Biomedical specimen waste Biomedical sharps <p>Note: <u>The Audette Laboratory waste is not biomedical.</u> This section is for educational purposes only.</p>	<ul style="list-style-type: none"> Yellow biohazard pail with tightly fitting lid. Any sharps contaminated with biomedical/biological waste shall be placed into a YELLOW sharps container labelled with a biohazard symbol Double barrier containment system consisting of a yellow plastic liner in a cardboard box (for non glass containers). An approved clinical sharps container. 	<p>Biohazardous Waste</p> <p>Includes human fluid or blood products, items saturated or dripping with blood, needles, laboratory glass that is broken or can easily be broken, biological or discarded materials known to be contaminated with highly communicable infectious diseases.</p>
Hazardous Waste	<ul style="list-style-type: none"> Sharps <p>Note: Most of the Audette Laboratory waste is microbiological (treatable at YorkU) with the exceptions of sharps.</p>	<ul style="list-style-type: none"> After use, needles, disposable syringes and other sharps shall be placed in a stericycle sharps container (RED). 	
Hazardous Waste	Refer to the Faculty of Science (FSc) and DOHS current " Hazardous Waste Disposal Protocol " document for specific details		

Document Control No.:	AL-LSM-S-010.DOC	SOP Rev. No.:	3.1
Computer File Name:	LSM 10 Waste Disposal r3_1.docx	SOP Rev. Date:	13 March 2015

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007

14 HAZARD ASSESSMENT & CONTROL	PAGE: 2 OF 3
SECTION: QMS	SOP ID: QM-LSM14-HAC

- "Laboratory Maintenance & Waste Disposal" document (AL-QMS-A-007.DOC)
- "Safety" document (AL-QMS-A-011.DOC)

PROCESS

Step	Detail	Information		
1 Hazard Recognition	1.1.) Ask the question: Does this condition or circumstance create the possibility of potential harm to the worker?	Energy hazards can be electrical, chemical, mechanical, gravitational, biological or kinetic. Ergonomic hazards can be the worker, the task, the tool, the environment or the organization (shift conditions, work loads).		
2 Hazard Assessment	Hazards are assessed by three components: severity, probability and worker exposure. To evaluate the risk posed by a hazard, values are assigned to the three components. The values are added together to indicate the hazard risk. This enables the hazards to be prioritized in order of the risk to the worker. In the formal hazard assessment the person doing the evaluation shall rate the hazards and prioritize them in the order they should be looked at for control or elimination.	Component Severity	Definition	Value
			<ul style="list-style-type: none"> No loss or damage First Aid Lost time injury Fatal 	<p>1</p> <p>2</p> <p>3</p> <p>4</p>
		Probability	<ul style="list-style-type: none"> Practically impossible Possible (has happened) Probable (>50/50) Likely to happen 	<p>1</p> <p>2</p> <p>3</p> <p>4</p>
		Worker Exposure	<ul style="list-style-type: none"> Rarely (<1/month) Occasionally (>1/month) Frequently (>1/week) Often (>1/day) 	<p>1</p> <p>2</p> <p>3</p> <p>4</p>
3 Hazard Control	<p>3.1) Engineering controls:</p> <ul style="list-style-type: none"> Installation or modification of equipment. <p>3.2) Administrative controls:</p> <ul style="list-style-type: none"> Training of workers in safe work practices. Task scheduling or rotation to reduce exposure to hazard. Substituting a hazardous product with one that is less hazardous. <p>3.3) Personal Protective Equipment: (As outlined in routine safety practices).</p> <ul style="list-style-type: none"> The use of correct protective gloves when handling body fluids or chemicals. The use of protective eyewear when there is danger of splashes and the wearing of protective footwear that covers the whole foot. The use of protective clothing such as gowns or lab coats when working in laboratory areas. <p>The use of protective masks and respirators when handling chemicals.</p>			

Document Control No.:	AL-LSM-S-014.DOC	SOP Rev. No.:	3.1
Computer File Name:	LSM 14 Hazard Assessment & Control r3_1.docx	SOP Rev. Date:	13 March 2015

CONTROLLED DOCUMENT: Do not reproduce without prior written authorization.
Audette Laboratory at York University. Copyright ©2007

Academic Institutional Safety Training

In summary

❖ General Discussion -

- ✓ All YorkU students get training and everyone is fine at beginning
- ✓ The challenge is laziness (buy-in) and people becoming rather lax there after
- ✓ Laboratory safety comes with experience in lab - it's a mind set!
- ✓ People will take short cuts - which can lead to problems

- ✓ With our ISO/IEC 17025 QMS Laboratory Safety Manual approach, on-going safety is trained & kept foremost in mind
- ✓ The “spirit” of the rules in addition to the letter of the law
- ✓ Mistakes can happen, but occur less often
- ✓ On-going - in order to work safely & prevent injury/infection - & prevent BAD data

❖ Industry

- ✓ Why this matters – students need it when they go to an industry lab
- ✓ Our students have a better understanding and training in laboratory safety so they can more easily become up to speed to the specific industries safety standards

The Need for Academic Institutional Laboratory Safety



Questions? Discussion

Safety Training Program Workshop

hosted by the IUPAC Committee on Chemistry & Industry



Sao Paulo, Brazil

10th July 2017



Dr. Robert J. Audette, FCIC
Audette Consulting

Dr. Gerald F. Audette
Professor, Dept. of Chemistry, York University