

## Facility Safety Procedure

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# Procedure for Safely working in TRACES (EV215) & EV216

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## 1. Introduction

### 1.1. Purpose

The purpose of this document is to familiarize the user with the dangers and safety procedures involved when cryogenic liquid or solid (defined by the NIST as being below 93.15 K) used in an authorized and control manner in a laboratory environment. This document will also highlight the dangers involved when using the TRACES laboratory (EV215) and EV216 in the EV Building. This document will also detail the procedures, protocols, and expectations each user MUST meet when using TRACES.

### 1.2. Scope

The use of cryogenic substances is restricted to advanced staff and students who have been trained in the dangers, use and transportation (See Section 2).

### 1.3. Responsibility

All Users are expected to have training and follow UofT WHMIS and EH&S practices for laboratory safety and waste disposal. Furthermore, ALL users must complete the DPES' On Boarding & Training and have a signed PREP Form before entering TRACES (EV215) and EV216.

### 1.4. Accountability

User/Entry Personnel

### 1.5. Emergency Contacts

- Emergency Fire/Police/Ambulance:911
- UofT Police:416-978-2222

**Emergency Contact Numbers:** The only following individuals have keyed access to the room

- Lab Phone Number (EV215 only): 416-287-7643
- TRACES Lab Manager: Tony Adamo, Office: 416-287-7239

## 2. Referenced Documents/Courses

- 2.1. [Standard for Inert Cryogenic Liquid Usage in the Laboratory](#) (link)
- 2.2. [Control Program for Liquid Cryogenic Transfer Facilities](#) (link)
- 2.3. [Cryogenic Liquids – Hazards \(CCOHS.ca\)](#) (link)
- 2.4. [Safely work with Cryogenic Liquids \(CCOHS.ca\)](#) (link)
- 2.5. [EHS101 WHMIS and Lab Safety](#) (course)
- 2.6. <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-requirements-guidance-analytical-equipment-safety-code-32.html>
- 2.7. UofT's Compressed Gas Safety <https://ehs.utoronto.ca/wpcontent/uploads/2018/12/Compressed-gas-safety-standard-March-2018.pdf>




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T. Adamo

## Facility Safety Procedure

### 3. TRACES Hazards

#### 3.1. Flammable Chemicals

- A maximum of 500 L of combustible (class II and III) and flammable liquids (class I), of which no more than 250 L is flammable (class I), is stored in an approved flammable liquid storage cabinets. EV215 contains 3 flammable liquid storage cabinets. Furthermore, several instruments house bottles (~1L) of flammable solvents for immediate use.
- Additional Chemical Hazards:  Toxics  Poisons  Corrosives

#### 3.2. Cryogenics

- The Raman and FTIR-VCD may contain inert liquid nitrogen in the detector storage (10L max). In addition, the NMR contains more than 200L of liquid nitrogen and 100L of liquid helium. The room also contains several dewars filled with liquid nitrogen (>200L), and liquid argon (>200L).

#### 3.3. High Voltage

- High voltage transformer is located in EV215A. Furthermore, multiple high voltage/high amperage instruments are located in the room and in the utility rooms.

#### 3.4. Magnet Field

- The NMR generates an intense magnetic field that extends beyond the perimeter of the magnet. This affects pacemakers, phones, credit cards by either interrupting the signals or demagnetizing the cards.

#### 3.5. X-Rays

- X-Ray device(s) is operational when 'X-Ray ON' sign is lit. This room contains multiple devices that emit high energy X-Rays. X-Rays of this nature will destroy soft tissue, eyes, and organs.

#### 3.6. Compressed Gases

- A minimum of 7 inert compressed gas cylinders (Nitrogen, Argon, Helium, Air) are stored within the lab.

#### 3.7. Flammable Compressed Gases

- A minimum of one cylinder of EACH of the following flammable compressed gases utilized by various instruments is stored in the flammable gas cabinets: Acetylene, Methane, and Hydrogen(X2) and mixed gas of Methane.

#### 3.8. Oxidizing Compressed Gases

- Multiple cylinders of Oxygen, an oxidizing compressed gas are contained in the lab.

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T. Adamo

## Facility Safety Procedure



### 3.9. Radioactive Materials

- Multiple containers, bottles and sample tubes will contain liquids samples of radioactive Uranium and Thorium in the lab.



### 3.10. Corrosive Materials

- Multiple containers, bottles and sample tubes will contain varying concentrations of various corrosive acids and bases such as nitric, hydrochloric and sulphuric acids and aqueous ammonia and sodium hydroxide.



### 3.11. Hydrofluoric Acid

- Please see the University of Toronto Hydrogen Fluoride Protocol for further information.
- <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Hydrogen-Fluoride-Protocol.pdf>

## 4. EV216 Hazards



### 4.1. Flammable Chemicals

- A maximum of 100 L of combustible (class II and III) and flammable liquids (class I), of which no more than 50 L is flammable (class I), is stored in an approved flammable liquid storage cabinet. EV216 contains 2 flammable liquid storage cabinets. Furthermore, several instruments house bottles (~1L) of flammable solvents for immediate use.

- Additional Chemical Hazards:  Toxics  Poisons  Corrosives



### 4.2. Compressed Gases

- A minimum of 2 inert compressed gas cylinders (Nitrogen, Argon, Helium, Air) are stored within the lab.



### 4.3. Cryogenics

- The room may contain several dewars filled with liquid nitrogen (~4L) or Dry Ice (~2kg).



### 4.4. Oxidizing Compressed Gases

- Multiple cylinders of Oxygen, an oxidizing compressed gas are contained in the lab.



### 4.5. Radioactive Materials

- Multiple containers, bottles and sample tubes will contain liquids samples of radioactive Uranium and Thorium in the lab.

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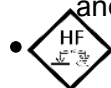
## Facility Safety Procedure

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### 4.6. Corrosive Materials

- Multiple containers, bottles and sample tubes will contain varying concentrations of various corrosive acids and bases such as nitric, hydrochloric and sulphuric acids and aqueous ammonia and sodium hydroxide.



### • Hydrofluoric Acid

- Please see the University of Toronto Hydrogen Fluoride Protocol for further information.
- <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Hydrogen-Fluoride-Protocol.pdf>

## 5. Instrument Use

- 5.1. The use of instrumentation is intended solely for the purpose of educational instruction and approved university research.
- 5.2. All new users must be trained by TRACES staff before commencing with the use of the any instrument.
- 5.3. Usage of the said equipment must be prearranged with TRACES staff and booked accordingly, for both individual student and class use.
- 5.4. Unauthorized users will have their accounts charged 24 hours of instrument time per episode.
- 5.5. Instrumentation is only available to undergraduate students under the present supervision of the TRACES staff or instructors. The times of use are to be within regular course hours or under the direct and present supervision of an instructor.
- 5.6. Personal or commercial use of TRACES Centre instrumentation OR other instrumentation available in EV216 is strictly forbidden without permission.

## 6. TRACES & EV216 Conduct

- 6.1. TRACES Centre strictly prohibits the use of the Centre or its equipment for any illegal or contraband purposes.
- 6.2. The replacement or exchange of various accessories (ATR, DRIFTS, GC Columns) is the sole prerogative of trained TRACES staff.
- 6.3. Under no circumstance should a user attempt to adjust or modify any aspect or accessory attached to the instrument.
- 6.4. All accessories and their respective computers are the sole property of TRACES and DPES. Under NO circumstance are they to be moved or changed from their present location.
- 6.5. Passwords and usernames are not to be shared or misused. Under no circumstances are untrained or non-user allowed to gain access or use the instrumentation in TRACES or EV216.

## 7. Fume hood and Lab Signup Sheet (EV216 ONLY)

- 7.1. EV216 Users are expected to follow the procedure below for keeping safe laboratory practices.
- 7.2. ALL fume hoods in use will display the following information outside the fume hood:
  - Fume hood Signup Sheet must be completed and legible.

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T. Adamo

## Facility Safety Procedure

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- These sheets are available from TRACES Staff. However, a properly labelled 8"x11" paper placed inside the fume hood holder will suffice. Label MUST include the following (Please see Appendix II);
  - 7.2...1. Name of the user(s)
    - 7.2...1.1. Email address or phone number
    - 7.2...1.2. Supervisor/PI
  - 7.2...2. Chemical reaction/experiment
  - 7.2...3. Date the chemical(s) preparation
  - 7.2...4. Dangers/Hazards/Concerns (heat, acids, corrosives)
- 7.3. ALL chemical bottles, beakers, flasks and vessels and waste containing chemicals MUST be labelled with the following;
  - Proper chemical names of all components (and percentages)
  - Percentages of each component
  - Date the chemical(s) preparation
- 7.4. After each lab session all chemicals, accessories and non-shared items (pipettes, filters) will be stored in labeled white bin(s) with the user(s) name attached.

### 8. Waste & Use of Chemicals

- 8.1. All Users are expected to have training and follow U of T WHMIS and EH&S practices for laboratory safety and waste disposal. The users are responsible for proper disposal of chemicals, materials used in the labs and related to their work/experiments.
- 8.2. All users must be aware of the dangers and safety concerns related to working with the instrumentation, accessories, chemicals, and equipment.
  - Prepare a properly labelled waste container (Please see Appendix III);
  - Please consult the TRACES website safety documentation (<https://www.utoronto.ca/~traceslab/>)
  - EHS website for safety details (<https://ehs.utoronto.ca/>)
- 8.3. Users must remove all chemicals and materials (i.e., vials, NMR tubes) that were accompanied into the lab.
  - A Waste Disposal Sign-up sheet is available in EV216. Each student is responsible for signing the form & arranging with Chemstores staff and a transportation time period.
  - Communal (ENTIRE EV216) waste is to be removed weekly from EV216 and must be documented using the Waste Disposal Sign-up sheet.
  - Green Contaminated waste bins, recycling bin, sharp containers are considered Communal waste.
- 8.4. Users are to clean all the accessories and surrounding area of any chemical/material contamination.
- 8.5. Waste must be placed in properly labeled containers.
  - Please inform TRACES staff if the condition of the area is not clear of contaminants.

### 9. Consequences of Failure to Follow Procedures

- 9.1. Failure to observe one or more of the preceding protocols will lead to suspension of privileges and/or permanent restriction from using the instruments or lab area.
- 9.2. All users/PI are responsible for the charges incurred. Any damage to the instrumentation or lab area due to malicious intent, failure to follow set procedures, negligence, or improper use or chemical

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## Facility Safety Procedure

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incompatibility shall result in the user replacing the damaged equipment and facing suspension of privileges and/or permanent restriction from the labs.

### APPENDIX I

#### **Emergency Entry Procedure:**

Never enter the room if the low-oxygen alarms are activated. In this case there is a real risk of suffocation. The immediate area should be evacuated.

Never enter the room if the X-Ray units have been compromised. 'X-ray ON' sign does not confirm or exclude the risk of X-ray exposure. The TRACES Lab Manager possesses an X-Ray survey meter to determine exposure levels. Until X-ray levels can be resolved, the area should be immediately evacuated.

#### **Fire:**

#### **IF POSSIBLE, POWER AND EMERGENCY POWER AND COMPRESSED AIR SHOULD BE CUT TO THE LABORATORY**

Do not use water, use a powder that cannot freeze or ideally an insert gas fire extinguisher. ABC extinguishers are not recommended.

Fire suppression system is setup with NOVEC 1230

- Novec 1230, NON-METALLIC fire extinguishers are recommended.
- Halotron I, NON-METALLIC fire extinguishers are recommended.

Large metal objects (metal breathing apparatus, fire extinguishers included) should NOT enter the room.

Small metal objects (metal tools, steel-toed boots included); keep a MINIMUM perimeter of 10 feet from the NMR magnet (far north east corner).

## Facility Safety Procedure

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### APPENDIX II

EV216 Fume hood Signup Sheet  
Please see below for a full page version

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## EV216 Fume hood Signup Sheet

USER Name(s): \_\_\_\_\_

USER EMAIL/Phone: \_\_\_\_\_

Supervisor/PI: \_\_\_\_\_

Experiment: \_\_\_\_\_

Date of Reaction/Experiment: \_\_\_\_\_

Hazards/Concerns: \_\_\_\_\_

## Facility Safety Procedure

### APPENDIX III

#### EV216 Waste Bottle Preparation

10. Remove or cross-out original label(s) (Figure 1).
11. Allow bottle to evaporate residual solvent.
12. Washout bottle with warm water.
13. Label once chemicals have been added to the waste bottle.
  - 13.1. NO chemical abbreviations/shortform-**FULL NAMES ONLY** (Figure 2).
  - 13.2. Fill waste container to  $\frac{3}{4}$  of the bottles' capacity-this is considered 'full'.
  - 13.3. PI/Supervisor's name will ALWAYS follow your own name.
14. Label each chemical with the approximate percentages **before** transporting the 'full' waste containers to ChmStores for disposal (Figure 3).
  - 14.1. Waste containers are considered 'full' once they reach 75% of their capacity.
15. Waste collection is every Thursday 1-4pm.
  - 15.1. **BY APPOINTMENT ONLY**
    - 15.1...1. Room Number: EV120
    - 15.1...2. Email: [chemstores@utsc.utoronto.ca](mailto:chemstores@utsc.utoronto.ca)
    - 15.1...3. Phone: (416)-287-7645
  - 15.2. Speak with ChmStores staff regarding transportation time and dates and safe movement of waste container through the EV Building.
16. FAILURE TO FOLLOW ONE OR MORE of the procedures will lead to loss of laboratory privileges.

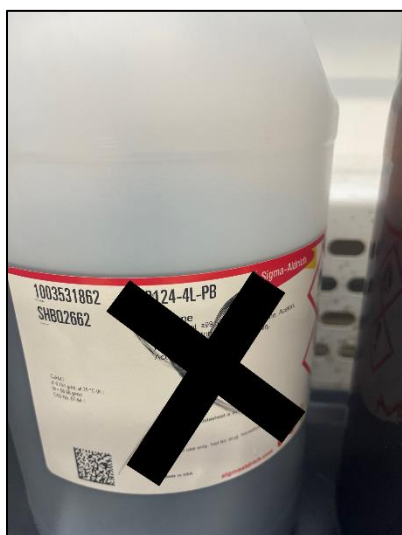


Figure 1

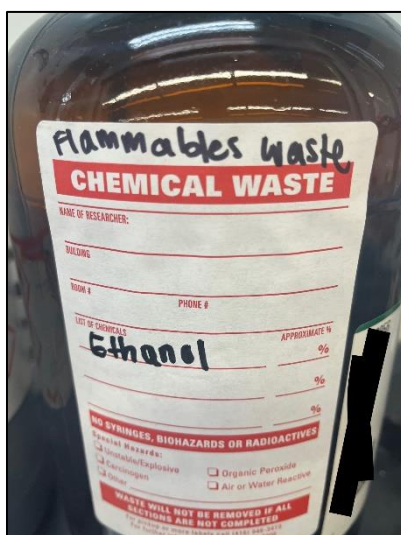


Figure 2

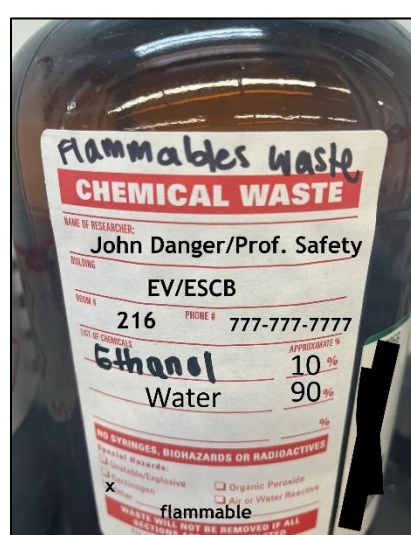


Figure 3

\*Contact the TRACES Manager for further details.

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