Standard Operating Procedures for Working with Dangerously Reactive Chemicals

REVISION NUMBER: **01;** EFFECTIVE DATE: **Jan 01, 2007;** REVISION DATE: **Jan 01, 2012**

PRINCIPLE AUTHOR: **BRYAN GRIMMELT**
UPEI HEALTH AND SAFETY ADVISOR: **DENISE BUSTARD**

1 INTRODUCTION:

This document describes the safety requirements that laboratory workers and supervisors must follow when dangerously reactive chemicals are used in UPEI laboratories. Its purpose is to minimize risks to the health of UPEI laboratory workers.

2 SCOPE:

This Standard Operating Procedure (SOP) is under the control of the UPEI Health and Safety Advisor and may be downloaded from the UPEI Health and Safety Website.

This SOP is appropriate for the handling of dangerously reactive chemicals used in UPEI laboratories.

These chemicals in use at UPEI include derivatizing agents such as trifluoracetic anhydride, acetic anhydride and N-Methyl-N-[tert-butyldimethyl-silyl] trifluoroacetamide] and other chemicals designed to be reactive. Their extreme chemical reactivity is essential to their usefulness, but it also underlies severe risks in their handling.

This document is meant to help educate laboratory workers working in UPEI laboratories about safety measures required for working with dangerously reactive chemicals.

A laboratory worker with a chemical background should be able to read and understand this SOP in about 1 hour.

Laboratory Supervisors may use this SOP as a part of Site Specific training by following *SOP2.103Site Specific Training Using UPEI Safety SOPs* available through the UPEI Safety Website.

This SOP is meant to compliment, but not to replace, other classes of SOPs which are required in Laboratories (such as those related to organic chemistry) and which must also contain relevant safety information and/or references.

3 SAFETY RISKS:

Dangerously Reactive compounds:

1)May be unstable, reacting dangerously to jarring, compression, heat or light
2)May burn, explode or produce dangerous gases when mixed with incompatible materials
3)May react with water to liberate poisonous gases.
4)May also be toxic, corrosive, oxidizing or flammable
5)May cause Central Nervous System depression from inhalation of vapors.
6)May cause Liver damage.

4 DEFINITIONS

Chemical Reaction is a process that results in the alteration of chemical substances. The substances initially involved in a chemical reaction are called reactants. Chemical reactions are characterized by a chemical change that yields one or more products which are different chemicals from the reactants.

Derivatization is a technique used in chemistry which transforms a chemical compound into a product with a different chemical structure.
The resulting new chemical may possess desirable properties which can be used for quantification or used for further research.

Explosive material has the following characteristics: 1) It is energetically unstable. The reaction produces a sudden expansion of the material accompanied by the production of heat and large changes in pressure (and often a flash or loud noise)

Laboratory workers:Refers to all permanent and temporary UPEI employees, students, faculty and visitors who make use of UPEI laboratory space.

5 RESPONSIBILITIES:

Laboratory Supervisors are required to provide laboratory workers with written standard operating procedures for all hazardous processes using dangerously reactive chemicals.

Laboratory Supervisors are responsible to ensure that all laboratory workers who work with dangerously reactive chemicals have been educated in relevant safety issues.

Laboratory Supervisors are to document and maintain a list of laboratory workers who have had safety training for working with dangerously reactive chemicals, and for checking that only appropriately trained individuals are allowed to work with these chemicals in the areas under their supervision.

Laboratory Supervisors should follow SOP2.102 for documenting safety training records.

Laboratory Supervisors shall ensure that adequately ventilated areas are available for operations utilizing dangerously reactive chemicals.

Laboratory Supervisors are required to provide workers with any necessary personal protective equipment.

All laboratory workers who work with dangerously reactive chemicals must be satisfied that they have received sufficient education in safety techniques including: use of personal protective equipment; knowledge of potential hazards; use of spill kits; and appropriate emergency procedures, before working with dangerously reactive chemicals.

Before performing any procedure using dangerously reactive chemicals an laboratory worker must read and be satisfied that they understand the SOP associated with that procedure.

All laboratory workers are required to use due diligence in working with dangerously reactive chemicals.

Additional responsibilities for supervisors and workers are defined in the UPEI Laboratory Safety Manual Chapter 2

6.0 REQUIRED SUPPLIES:

FUME-HOODS. Fume-hoods shall be used when working with dangerously reactive chemicals. Fume-hood doors can be lowered for additional protection.

PROTECTIVE GLOVES. Protective gloves shall be worn whenever dangerously reactive chemicals are handled. Nitrile gloves are recommended to prevent incidental contact. Heavier Nitrile gloves are necessary for cleaning up.

GLASSES. Laboratory workers must be provided with splash-proof chemical goggles or face shields when handling dangerously reactive chemicals.

FACE SHIELDS. Face shields may be necessary when there is the potential for splashes.

SPILL MATERIALS. Adsorbent materials such as spill control pillows, and chemical resistant gloves (Nitrile are provided). Consult MSDS for appropriate spill materials.

PROTECTIVE CLOTHING. A lab coat, is required when handling dangerously reactive chemicals.

7.0 GENERAL PROCEDURES:

A) Read the MSDS sheets prior to the initial use of the chemical.
B) Store away from flammable solvents.
C) Work must be performed under a fume-hood.
D) Analysts must be fully alert and focused when working with these chemicals.

E) Plastics should **NOT** be used with most of these compounds. Use syringes for adding small volumes.
F) Use extreme caution if initiating chemical reactions in closed containers.
G) The analyst must wear a lab-coat, gloves and eye protection when working with these compounds.
H) Ensure that adequate absorbent material is closely available before initiating work
I) Ensure that an eyewash station is located nearby.
J) Ensure the openings of reaction vessels are directed away from analysts.
K) Extreme diligence must be used when the reactions are initiated.
L) All laboratory workers working with dangerously reactive chemicals should be trained in using respirators and possess their own personal respirator for use in minimizing exposure and for cleaning up spills outside of a fume-hood.
M) Any unattended containers must be labeled according to WHMIS workplace labeling requirements.
N) Select and when possible, modify, procedures to use compounds with lower hazards.
O) Scale methods down to use lower quantities of dangerously reactive chemicals.

8.0 STORAGE

Store in tightly closed containers in a cool dry, well ventilated area away from incompatible substances. Keep away from heat, sparks and sources and ignition.

9.0 TRAINING:

All laboratory workers are required to have up to date WHMIS and a site specific safety orientation.
All laboratory workers must be made aware of and have easy access to the UPEI Health and Safety Policy and the UPEI Laboratory Safety Manual
The supervisor shall supply this procedure to laboratory workers, verify that they understand it through either an oral or a written Quiz (SOP2.103), and document this process, before the laboratory workers are authorized to work with dangerously reactive chemicals in UPEI laboratories.

10.0 SPILL PROCEDURES:

Refer to the product Material Safety Data Sheet, before using the chemical to understand and be prepared for proper spill clean-up procedures.

11.0 FIRST AID PROCEDURES:

GENERAL INFORMATION FOR FIRST AID:

The individual MSDS sheets must be read and understood and the analysts must be prepared for first aid before working with these compounds.

Many of these compounds are strong corrosives. Some of these compounds are highly reactive with water. If skin irritation or dermatitis develops, the affected individual should be examined at a Medical Facility.

In the event of ingestion have call the **poison control center 1-800-565-8161**.
DO NOT give anything by mouth unless instructed to do so by the poison control center, or by a physician.
If victim is unconscious, remove to fresh air and Dial 0384 for emergency assistance.

12.0 WASTE DISPOSAL PROCEDURES:

Place wastes into clearly labeled, appropriate containers for Hazardous waste disposal.

13.0 REFERENCES:

1. HALE, J. R. Inherent Safety and Pollution Prevention Strategies for the Analytical Laboratory. Managing the Modern Laboratory Vol. 6, No. 4, 2004
2. SHEMATEK, G; WOOD, W. Laboratory Safety Canadian Society of Laboratory Technologists Guidelines 4th ed. 1996
3. Individual MSDS sheets
4. FURR, KEITH A., CRC HANDBOOK OF LABORATORY SAFETY, 5th Edition, CRC Press, Boca Raton 2000

14.0 ADDITIONAL INFORMATION:

15.0 COMMENTS AND SUGGESTIONS

16.0 **QUESTIONS ON REACTIVE CHEMICALS**: These questions should be used by Supervisors for assessing laboratory workers safety skills by following SOP2.102 = *Site Specific Training Using UPEI Safety SOPs.*

1. What quantities of dangerously reactive chemicals are normally ordered?

2. What would you do first if you are directed to work with a highly reactive chemical that you have never worked with before?

3. What makes a chemical dangerously reactive

4. Where would you work with dangerously reactive chemicals?

5. Where are the eyewash stations in your Area?

6. How should one dispose of dangerously reactive chemicals

7. What is the phone number for the poison control center?

8. What PPE should you wear when working with dangerously reactive chemicals?

9. What would you do if there was inadequate ventilation in an area where you were told to work with dangerously reactive chemicals