

# Laboratory Safety



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# Laboratory Accidents



down p.261

cold comfort p.262

ice melts p.263

## Accidents in waiting

*Every researcher and institution should question their own attitudes to safety in the lab after the death of an undergraduate student in a Yale University workshop.*

**T**he shocking death of physics and astronomy undergraduate student Michele Dufault in a machine shop at Yale University in New Haven, Connecticut, last week should grab the attention of researchers and safety officers at universities across the United States, and the wider world. Rightly, the immediate focus is on whether the

university could have taken more precautions to prevent the a  
But whatever the verdict, Dufault's death — late at night and p  
while working alone — should remind every researcher to consi  
own attitude to safety, and whether it is crowded out by other p

Most scientists are well aware of poor safety practices in their  
ories — such as too many people working on their own, stud  
properly trained to use equipment, or a general reluctance to we  
glasses and lab coats. But, just as bottles of unidentified solvent  
stashed guiltily in the depths of a fume cupboard, so such probl  
often pushed to the back of the mind, and only properly con

The UCLA centre would be a good place to pool this knowledge  
make it widely available — and not just between health and safety  
ers, who already discuss experiences and data. There are useful exa  
of collaboration on safety issues elsewhere, such as an MIT peer-r  
process with the National University of Singapore, in which each

***“Poor safety practices are often pushed to the back of the mind and only confronted after an accident.”***

d safety programmes of the other. If  
than happy to make safety policies av  
Imperial College London and UCLA  
like their safety plans widely availabl  
nt requests for information from res  
in other countries.

To see safety precautions as a dr  
earch is an irresponsible and cou  
ductive attitude, but one that is h  
ange. At UCLA, for example, too

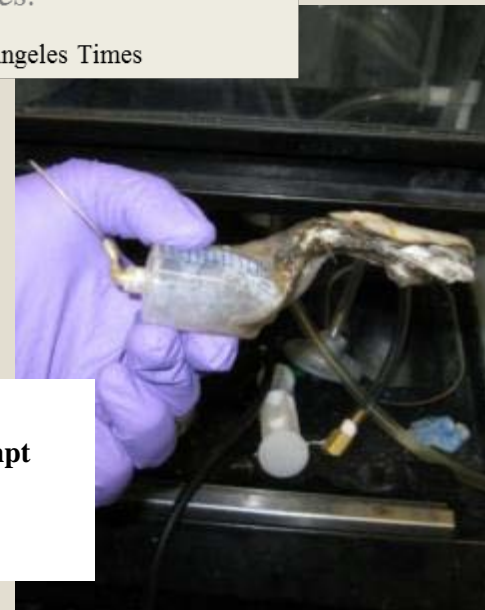
# Laboratory Accidents



## Felony charges filed against UC and a UCLA chemistry professor after fatal laboratory fire

*A research assistant was fatally burned when chemicals burst into flame. Her death three years ago has focused attention on safety issues.*

December 28, 2011 | By Kim Christensen, Los Angeles Times



**C&EN**  
CHEMICAL & ENGINEERING NEWS

### Learning From UCLA:

Details of the experiment that led to a researcher's death prompt evaluations of academic safety practices

August 3, 2009 | Volume 87, Number 31 | PP 29-31, 33-34

# Laboratory Accidents



## New Haven Register

**'A TRUE TRAGEDY': Yale student asphyxiated in lathe accident at chemistry lab, medical examiner rules**



**nature** International weekly journal of science

### **A death in the lab**

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

Richard Van Noorden

# Laboratory Accidents



**CSB** Case Study  
U.S. Chemical Safety and Hazard Investigation Board

**Texas Tech University  
Laboratory Explosion**  
NOV. 2015 (08-172)

**ISSUES**

- Laboratory safety management for physical hazards
- Hazard evaluation of experimental work in research laboratories
- Oversight of safety and organizational accountability
- Organizational accountability and oversight of safety

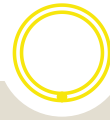
**LubbockOnline**  
Lubbock, TX - November 10, 2015



## Blast probe finds 20 safety violations

Texas Tech investigators have linked a Jan. 7 laboratory explosion that severely injured a doctoral candidate to 20 surrounding violations of the university's safety policy, according to documents released Monday.

# Laboratory Accidents



T · H · E  
OHIO  
STATE  
UNIVERSITY



PENN STATE  


# Laboratory Accidents



CNN U.S.

CHEMICAL REACTION

**University chemistry lab fire injures 2**

September 26, 2011 | By the CNN Wire Staff



# Laboratory Accidents



- What are the common failures?
  - Insufficient training
  - Insufficient hazard evaluation
  - Lack of appropriate PPE
  - Failure to follow safety policies



# Today's Program



- **Emergency Procedures and Reporting**
- **Responsibilities**
- **Hazard Identification and Risk Assessment**
- **Personal Protective Equipment**
- **Specific Hazard Information**

# Emergencies



- **Emergency irrigation equipment**

- **Eyewashes**

- Flush eye for a full 15 minutes
- Users should flow the eyewash weekly
- Facilities Management will check annually
- Do not block



- **Safety showers**

- Flush for a full 15 minutes
- Remove clothing under shower
- Facilities Management will check annually
- Do not block



# Emergencies



- **Seek medical attention:**
  - Eye contact with chemical
  - Significant chemical exposure
  - Chemical exposure that results in symptoms
    - Inhalation of any substance that causes coughing
    - Burning or severe irritation
  - Electric shock
  - Laser injury

# Emergencies



- **Chemical spills**
  - All spills should be cleaned up in a timely fashion
  - Small spills can be cleaned up by lab staff unless:
    - Toxic
    - Flammable

# Emergencies



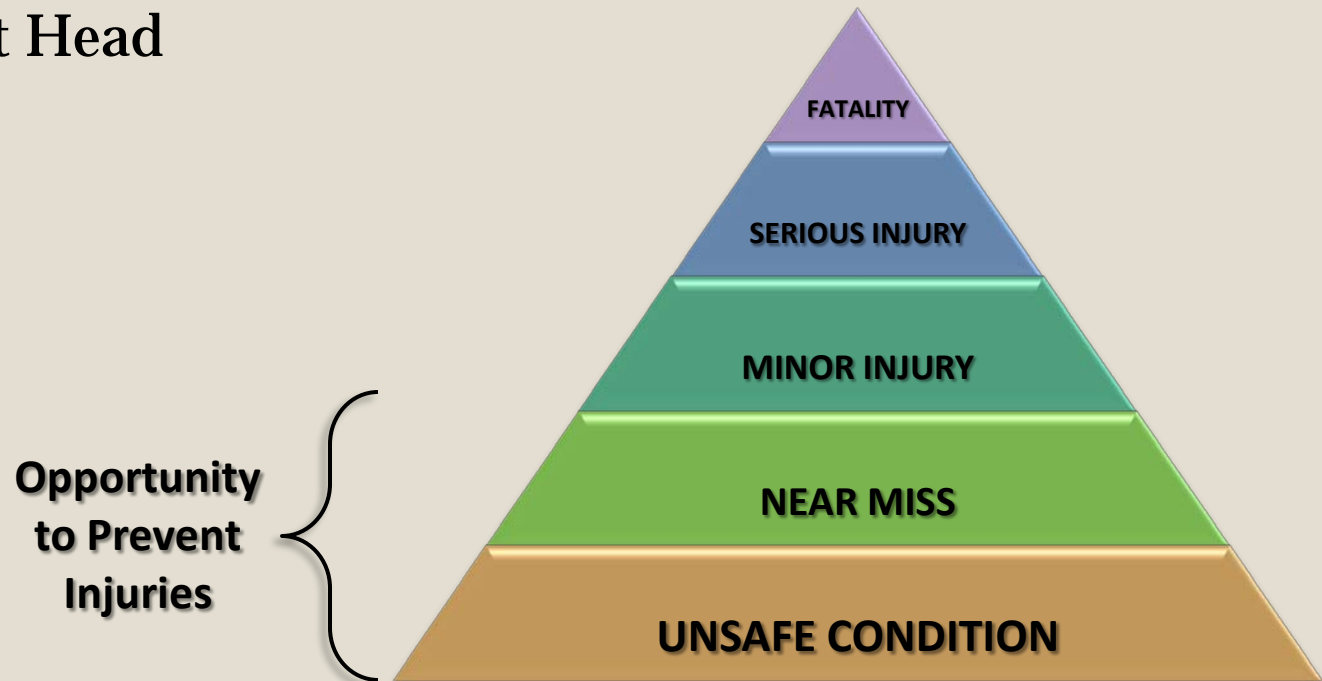
- **Building Evacuation or Closure**
  - Stabilize reactions in progress
  - Close fume hood sashes
  - Notify safety or emergency response personnel if any unusual hazards exist



# Reporting



- Report incidents, near misses and unsafe conditions
  - P.I.
  - Safety Officer
  - Department Head

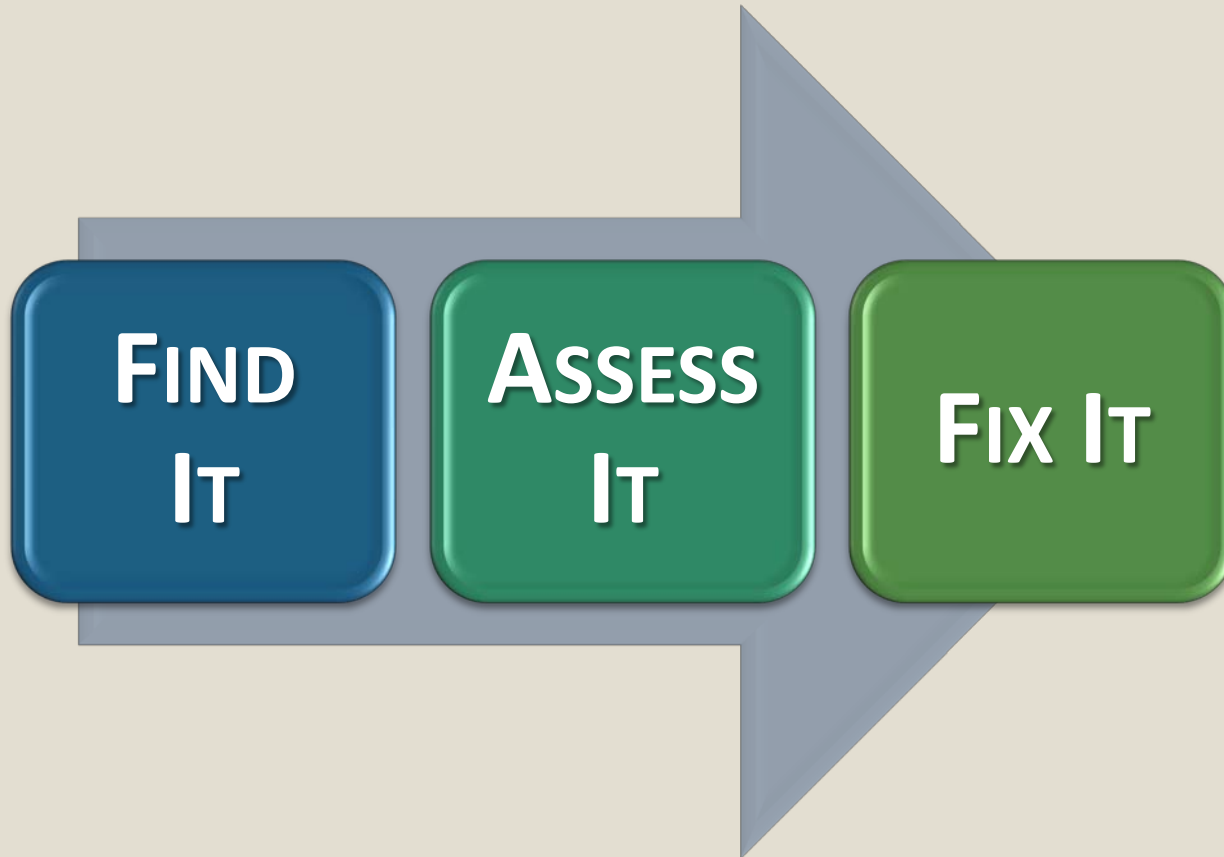


# Responsibilities



- Who is responsible for safety in the lab?
  - PI
  - You
- Support
  - Safety Committee
  - Safety Officer
  - Department

# Hazard Identification & Risk Assessment





# Hazard Identification & Risk Assessment



- A **hazard** can cause harm or adverse effects
- **Risk** is the chance or probability that a person will be harmed or experience an adverse effect if exposed to a hazard
- **Risk Assessment** is the process where you:
  - Identify the hazards
  - Analyze or evaluate the risk associated with that hazard
  - Determine appropriate ways to eliminate or control the hazard
- Perform hazard identification and risk assessment prior to new experimental procedures and new chemical usage

# Hazard Identification



- Identify **health hazards** associated with the chemicals
  - Irritant or sensitizer
  - Corrosive
  - Acute toxin
  - Carcinogen or potential carcinogen
  - Reproductive or developmental toxin
  - Other systemic toxin
- Identify routes of exposure
  - Inhalation
  - Skin/eye contact
  - Skin absorption
  - Injection
  - Ingestion

# Hazard Identification



- Identify **physical hazards** associated with the chemicals
  - Flammable
  - Explosive
  - Cryogen
  - Other physical hazard
  - Air or water reactive
  - Strong oxidizer
  - Compressed gas
- Identify **process hazards** associated with the experiment
  - Pressure
  - Heat
  - Other process hazards
  - Vacuum
  - Electricity

# Risk Assessment



- Identify circumstances of use, handling and storage
  - Quantity
  - Concentration
  - Frequency of use
  - Experiment location
  - Storage location
- Evaluate hazards posed by chemical changes over course of experiment
  - Pressure changes
  - Heat generation
  - Gas production
  - Other products of reaction
- Consider additional hazards posed by scaling up a reaction

# Risk Assessment



- Identify appropriate controls

- Administrative

- Training
- Procedures
- Signage
- Prior approval

- Engineering

- Local exhaust ventilation
- Gas cabinets
- Storage cabinets
- Shielding/isolation

- Personal Protective Equipment (PPE)

- Eye protection
- Face protection
- Gloves
- Clothing
- Respiratory protection

# Hazard Information Resources



- **Chemical container label**
  - Chemical name and CAS number
  - Supplier identification
  - Signal words
    - Warning
    - Danger
  - Hazard statements
  - Hazard symbols/pictograms
  - Numerical hazard rating system
    - Numbers from 0-4 indicate severity of hazard for health, flammability and reactivity
    - Higher the number, higher the hazard

# Hazard Information Resources



The image shows a Safety Data Sheet (SDS) label for N,N-Dimethylformamide, minimum 99%. The label is organized into sections labeled with letters K through M. Section K contains identification information: CAS 68-12-2; C<sub>3</sub>H<sub>7</sub>NO; FW 73.1; Fp 58 °C (136.4 °F); bp 153 - 155 °C; mp -61 °C; d 0.948. Section L contains hazard statements: "May cause harm to the unborn child. Harmful by inhalation and in contact with skin. Irritating to eyes. Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Teratogen. Combustible liquid. Readily absorbed through skin. Target organ(s): Liver, Kidneys." Section A contains the product name: "N,N-Dimethylformamide, minimum 99%". Section B contains the product code: "D158550-250ML". Section G contains the batch number: "Batch #: D10K0895". Section H contains the molecular weight: "Molecular Biology Tested". Section O contains the hazard pictogram: "Toxic" (skull and crossbones). Section M contains the manufacturer information: "SIGMA-ALDRICH".

Hazard Statement →

↑ Hazard Pictogram

# Hazard Information Resources



## Signal Word and Hazard Statement



## Numerical Rating System



Avantor Performance Materials, Inc. Phillipsburg, NJ 08865 USA PH (908-859-2151)




**Acetonitrile**

**WARNING!**  
**FLAMMABLE LIQUID AND VAPOR. Will be easily ignited by heat, spark or flames. Toxic in contact with skin. Harmful if swallowed. Harmful if inhaled. Harmful if absorbed through skin. Irritating to eyes, respiratory system and skin. Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. FIRST AID: Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Immediately flush skin with plenty of water. Get medical attention immediately. If gas/fume/vapor/dust/mist from the material is inhaled, remove the affected person immediately to fresh air. Get medical attention immediately. If SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do not induce vomiting without advice from poison control center. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Rinse mouth thoroughly. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.**

**SEE MATERIAL SAFETY DATA SHEET**

**acétionitrile**

**AVERTISSEMENT!**  
**LIQUIDE ET VAPEUR INFLAMMABLES. S'enflamme facilement au contact d'une source de chaleur, d'un étincelle ou d'une flamme. Toxique par contact cutané. Nocif en cas d'ingestion. Nocif par inhalation. Nocif en cas d'absorption par la peau. Irritant pour les yeux, les voies respiratoires et la peau. Ne pas respirer la brume ni vapeur. Ne pas laisser pénétrer dans les yeux, ni mettre en contact avec la peau ou les vêtements. Gardez le contenant fermé. Utiliser uniquement avec une ventilation appropriée. Lavez vigoureusement après manipulation. PREMIERS SECOURS: Rincer immédiatement les yeux à grande eau pendant au moins 15 minutes. Consulter immédiatement un médecin. Rincer immédiatement la peau à grande eau. Consulter immédiatement un médecin. Si les gaz/émanations/vapeurs/poussières/brumes du matériau sont inhalés, emmener immédiatement la victime à l'air frais. Consulter immédiatement un médecin. EN CAS D'INGESTION: Appeler immédiatement un CENTRE ANTIPOISON ou un médecin. Ne pas faire vomir sans avis préalable d'un centre antipoisson. Ne jamais faire avaler quelque chose à une victime inconsciente ou souffrant de convulsions. Ne pas pratiquer le bouche-à-bouche si la victime a ingéré la substance. Recourir à la respiration artificielle à l'aide d'un masque de poche muni d'une valve de retenue ou de tout autre appareil respiratoire et médical approprié. Rincer soigneusement la bouche. En cas de vomissement, garder la tête basse pour éviter une pénétration du contenu de l'estomac dans les poumons.**

**VOIR FICHE SIGNALÉTIQUE**

**1 L** **9017-02**

**Acetonitrile**

acetonitrile  
 For Use in Liquid Chromatography and Spectrophotometry

**'BAKER ANALYZED'® HPLC Ultra Gradient Solvent**

**CH<sub>3</sub>CN** **FW 41.05**

**LOT**

Ultraviolet Absorbance (1.00-cm cell vs. water):  
 400-254 nm . . . . . 0.005 max.  
 220 nm . . . . . 0.01 max.  
 200 nm . . . . . 0.05 max.  
 UV Cut-off, nm . . . . . 190 max.  
 Gradient Elution Test (a.u.):  
 254 nm . . . . . 0.0005 max.  
 210 nm . . . . . 0.002 max.  
 Density (g/mL) at 25°C . . . . . 0.775 - 0.780  
 Fluorescence (Trace impurities, in ppb, measured as Quinine Base):  
 at 450 nm Emission . . . . . 0.5 max.  
 at Emission Maximum for Impurities . . . . . 1.0 max.  
 Assay (CH<sub>3</sub>CN) (by GC, corrected for water) . . . . . 99.9 % min.  
 Appearance . . . . . Passes Test  
 Color (APHA) . . . . . 10 max.  
 Fluorescence detection (PAH) . . . . . 0.5 ppb max.  
 Residue after Evaporation . . . . . 1 ppm max.  
 Titrable Acid (µeq/g) . . . . . 0.8 max.  
 Titrable Base (µeq/g) . . . . . 0.6 max.  
 Water (by KF, coulometric) . . . . . 100 ppm max.  
 Carbonyl Compounds (as Acetone) . . . . . 25 ppm max.

For Laboratory, Research or Manufacturing Use  
 Filtered through a 0.2 micron filter.



**FLASH POINT: 2°C (36°F) (Closed Cup)**  
**DOT Name: ACETONITRILE UN1648**  
**CAS NO: 75-05-8**  
 J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.  
**MADE IN USA**  
**WARNING: This product contains chemical(s) known to the state of California to cause cancer.**

110024950 G24

FFFA



www.avantormaterials.com





# Hazard Information Resources



- Material Safety Data Sheets (MSDS) contain:
  - Manufacturer information
  - Chemical name, synonyms, CAS number
  - Ingredients, if applicable
  - Exposure limits
  - Detailed hazard information
    - Health
    - Physical
    - Environmental
  - Symptoms of overexposure and first aid information
  - Chemical and physical properties
  - Precautions for safe handling, use and disposal

# Hazard Information Resources



## IDENTIFICATION

: Nitric acid, 70%  
 : 438073  
 : Sigma-Aldrich  
 : Sigma-Aldrich  
 : 3050 Spruce Street  
 : SAINT LOUIS MO 63103  
 : USA  
 : +1 800-325-5832  
 : +1 800-325-5052  
 : (314) 776-6555

: Sigma-Aldrich Corporation  
 : Product Safety - Americas Region  
 : 1-800-521-8956

## DESCRIPTION

Corrosive, Oxidizer

Corrosive

Cardiovascular system.

Category 3)

Category 1A)

3 (Category 1)

Statements, including precautionary statements



Danger

May intensify fire; oxidiser.  
 Causes severe skin burns and eye damage.

HMIS Classification  
 Health hazard: 3  
 Chronic Health Hazard: \*  
 Flammability: 0  
 Physical hazards: 3

NFPA Rating  
 Health hazard: 3  
 Fire: 0  
 Reactivity Hazard: 2  
 Special hazard: OX

Health hazard: 3  
 Fire: 0  
 Reactivity Hazard: 0

Components	CAS-No.	Value	Control parameters	Basis
Nitric acid	7697-37-2	TWA	2 ppm	USA, ACGIH Threshold Limit Values (TLV)
Remarks	Eye & Upper Respiratory Tract irritation Dental erosion			

### Materials to avoid

Alkali metals, Organic materials, Acetic anhydride, Acetonitrile, Alcohols, Acrylonitrile, Ammonia, Crotonaldehyde, Halogenated hydrocarbon, Acids, Bases, Metals, hexalthium disulfide, Hydrogen peroxide, Ketones, metal acetylides, Water, Fluorine, Amines, Thiols, cadmium, Bromine, Copper, Hydrazine, Hydrazinium nitrate, Nitro compounds, Cyanides, Phosphorus trihydride (phosphine), Diphosphine, Halides, Organic halides, May set fire to wood or paper., Polyethers, Methyl vinyl ether

### Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - nitrogen oxides (NOx)  
Other decomposition products - no data available

### Potential health effects

**Inhalation** May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.

**Ingestion** May be harmful if swallowed.

**Skin** May be harmful if absorbed through skin. Causes skin burns.

**Eyes** Causes eye burns. Causes severe eye burns.

### Signs and Symptoms of Exposure

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., Inhalation may provoke the following symptoms., spasm, inflammation and edema of the bronchi, spasm, inflammation and edema of the larynx, pneumonitis, pulmonary edema, Symptoms and signs of poisoning are., burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Pulmonary edema. Effects may be delayed., Large doses may cause: conversion of hemoglobin to methemoglobin, producing cyanosis, marked fall in blood pressure, leading to collapse, coma, and possibly death.

# Hazard Information Resources



- **MSDS resources:**

- **Internet**

- Manufacturer/distributor website (Fisher Scientific, Sigma Aldrich, Alfa Aeser, J.T. Baker, Mallinckrodt, etc.)

- **Paper**

- Your laboratory

- **Vendor**

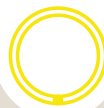
The screenshot displays the Fisher Scientific website's MSDS search interface. The header features the Fisher Scientific logo and navigation tabs for Scientific, Safety, Healthcare, and Science Solutions. Below the header, there is a search bar and a 'Search' button. The main content area is titled 'MSDS Search' and includes instructions on how to locate a Material Safety Data Sheet. A search bar is provided for user input, and a 'Search' button is located to its right. The footer contains links for Trademarks, Terms and Conditions, Legal Notice, Privacy Policy, and Thermo Fisher Scientific Inc., along with the copyright notice for 2011 Thermo Fisher Scientific Inc.

# Hazard Information Resources




- **Other sources of chemical hazard information:**
  - **Laboratory Chemical Safety Summaries (LCSS)**
    - [www.nap.edu](http://www.nap.edu)
  - **International Chemical Safety Cards**
    - [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

# Hazard Information Resources



## NITRIC ACID

p1/2

SYNONYMS	CAS#	Formula
Conc. nitric acid is 68 to 70% HNO <sub>3</sub> by wt White fuming nitric acid is 97.5% HNO <sub>3</sub> , 2% H <sub>2</sub> O, <0.5% NO <sub>2</sub> by wt Red fuming nitric acid contains 85% HNO <sub>3</sub> , <5% H <sub>2</sub> O, and 6 to 15% NO	7697-37-2	
PHYSICAL PROPERTIES		
Odor:	Suffocating fumes detectable at <5.0 ppm	Appearance: Colorless, yellowish, or reddish-brown fuming liquid
Water Solubility:	Miscible with water in all proportions	Vapor Density: >1 (air = 1.0)
Flash Point:	Not flammable	Vapor Pressure: White fuming nitric acid: 57 mmHg at 25 °C 70% nitric acid: 49 mmHg at 20 °C Concentrated: 122 °C White fuming: 83 °C/-42 °C
Autoignition:	Explodes above 60 °C	bp/mp:
TOXICITY		
EXPOSURE LIMITS		
LC <sub>50</sub> Inhal. (rat):	2,500 ppm (1 h)	TLV-TWA (ACGIH): 2 ppm (5.2 mg/m <sup>3</sup> ) STEL (ACGIH): 4 ppm (10 mg/m <sup>3</sup> ) PEL (OSHA): 2 ppm (5 mg/m <sup>3</sup> )

## HEALTH AND SYMPTOMS

General	Concentrated nitric acid and its vapors are highly corrosive to the eyes, skin, and mucous membranes. An oral dose of 10 mL can be fatal in humans. Tests in animals demonstrate no carcinogenicity or developmental toxicity for nitric acid. Tests for mutagenic activity or for reproductive hazards have not been performed.
Skin	Dilute solutions cause mild skin irritation and hardening of the epidermis. Contact with concentrated nitric acid stains the skin yellow and produces deep painful burns.
Eyes	Eye contact can cause severe burns and permanent damage.
Ingestion	Ingestion of nitric acid may result in burning and corrosion of the mouth, throat, and stomach.
Inhalation	High concentrations can lead to severe respiratory irritation and delayed effects, including pulmonary edema, which may be fatal.

## FIRST AID

Skin	Immediately flush with water and remove contaminated clothing. Wash clothing before reuse.
Eyes	Immediately flush with copious amounts of water for 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention.

The information in this LCSS has been compiled by a committee of the National Research Council from literature sources and MSDSs and is believed to be accurate as of February 2011. This summary is intended for use by trained laboratory personnel in conjunction with the NRC report *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. It is advisable to consult comprehensive references in addition to these summaries. This information should not be used as a guide to the nonlaboratory use of this chemical.

## NITRIC ACID

p2/2

**Ingestion** Seek medical attention immediately.  
**Inhalation** If the individual is overcome by fumes, move the person to fresh air and seek medical attention at once.

## FLAMMABILITY & EXPLOSIVITY

NFPA rating (flammability) = 0; LEL = NA; UEL = NA

Not a combustible substance, but a strong oxidizer. Contact with easily oxidizable materials including many organic substances may result in fires or explosions.

## REACTIVITY & INCOMPATIBILITY

Nitric acid is a powerful oxidizing agent and ignites on contact or reacts explosively with a variety of organic substances including acetic anhydride, acetone, acetonitrile, many alcohols, thiols, and amines, dichloromethane, DMSO, and certain aromatic compounds including benzene. Nitric acid corrodes steel and reacts violently with many bases, reducing agents, alkali metals, copper, phosphorus, and ammonia.

## STORAGE & HANDLING

Gloves: Butyl rubber

Splash goggles and rubber gloves should be worn when handling this acid, and containers of nitric acid should be stored in a well-ventilated location separated from organic substances and other combustible materials.

## CLEANUP & DISPOSAL

In the event of a spill, soak up nitric acid with a spill pillow or absorbent material, place in an appropriate container, and dispose of properly. Respiratory protection may be necessary in the event of a large spill or release in a confined area. Excess and waste material should be placed in an appropriate container, clearly labeled, and handled according to your organization's waste disposal guidelines.

## ADDITIONAL CONSIDERATIONS

None

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# Engineering Controls



- **Fume hoods**
  - Perform all work > 6" into hood
  - Elevate large objects above hood deck
  - Don't use hood for *excessive* storage
  - Follow instructions for sash position
  - Avoid rapid movements around hood

# Engineering Controls



- Fume hoods
  - Minimize storage



# Engineering Controls



- **Storage cabinets**
  - Flammable liquids storage cabinets
  - Corrosives storage cabinets
- **Proper segregation and storage**
  - Flammables
  - Acids
  - Bases
  - Oxidizers
  - Water reactives
  - Pyrophorics





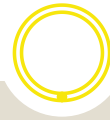
# Personal Protective Equipment



- Proper laboratory attire:
  - Lab coat
  - Safety glasses
  - Long pants
  - Closed toe shoes



# Personal Protective Equipment



- Eye and face protection

- Safety glasses
- Splash goggles
- Face shield

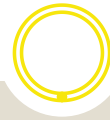


- Gloves

- Disposable nitrile
  - Accidental splash protection only
- Chemical resistant gloves
  - Chemical specific



# Personal Protective Equipment



- Respirators
  - Contact Safety Officer
    - Training
    - Fit-testing
    - Medical clearance
    - Voluntary use



# Specific Hazardous Chemicals



- Good Practice Requires Designated Areas for:
  - Acute Toxins
  - Carcinogens
  - Teratogens
  - Mutagens



# Specific Hazardous Chemicals



- Peroxide Formers:
  - Ethyl Ether
  - Isopropyl Ether\*
  - Dioxane
  - Acetal
  - Tetrahydrofuran\*
  - Tetrahydronaphthalene
- Date chemicals when open
- Dispose of within 12 months of opening
  - \*Dispose of within 3 months of opening



# Specific Hazardous Chemicals



- **Hydrofluoric Acid**

- **Corrosive**

- > 50% immediate pain and tissue destruction
- 20-50% symptoms delayed 1-8 hours
- < 20% symptoms delayed up to 24 hours

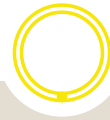
- **Systemic toxin**

- Penetrates deep into tissue prior to dissociating
- F<sup>-</sup> avidly binds to calcium and magnesium causing electrolyte imbalances (hypocalcemia and hypomagnesemia)

- **First aid kit with calcium gluconate gel**



# Cryogenic Liquids



- Hazards
  - Extreme cold
  - Asphyxiation
- Protective Equipment
  - Cryogenic gloves
  - Face shield



# Compressed Gases



- Compressed gas cylinders have mechanical and possibly chemical hazards
- Large potential energy from the compression of the gas turns gas cylinders into potential rockets





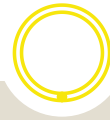
# Compressed Gases



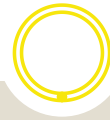
- Cylinders must always be properly secured
- Regulators and tubing must be compatible with gas and should never be interchanged
- Toxic gases must be in a ventilated gas cabinet
- Incompatible gases must be segregated



# Electrical Safety



# Electrical Safety



# Laboratory safety



- Laboratory Hygiene
- Sharps Safety
- Safety Equipment
- Fire Safety
- Chemical Safety
- Personal Safety

# Laboratory Hygiene



- **Scrub hands thoroughly when finished**
- **Avoid cross contamination**
  - Do not touch self, faucets, doorknobs, notebooks, pens etc. with gloves on.
  - Keep a pen or two in your drawer for lab use only
- **Clean and disinfect your workspace**

# Sharps Safety

- Sharps include
  - Razor and scalpel blades
  - Needles and pins
  - Microscope cover slips
  - Broken glass
- Place sharps in sharps boxes
- Broken Glass into glass box (ask for help)
- NO SHARPS or GLASS in the TRASH



# Equipment safety

Eye wash and Shower

Fire Blanket



Fire Extinguisher



Fume Hood



# Fire Safety



- Never leave flames unattended
- Do not use flammables near ignition sources
- Fire Extinguishers
  - Pull ring, aim at fire's base, squeeze handle, sweep back and forth (evacuate if  $>1 \text{ m}^3$ )
- Fire Blanket
- Fire alarm pulls



# Chemical safety



- Wear gloves and glasses where appropriate
- Follow instructor's directions
- Dispose of waste properly-**Do Not** pour down the drain

# Personal safety

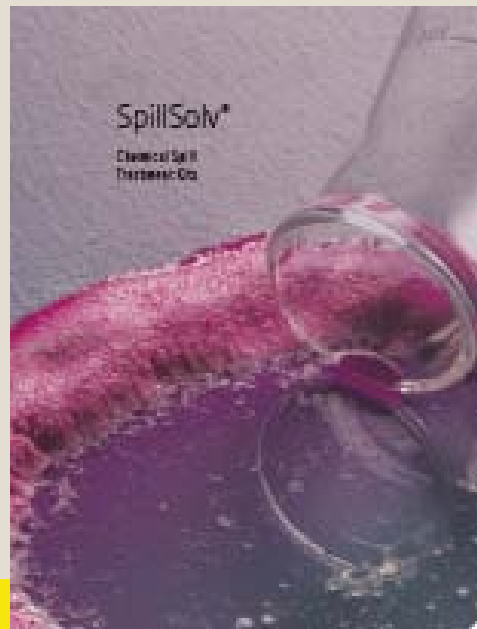


- Lab coat to be worn all the time
- Safety goggles must be worn all the time while working in the lab.
- Wear sensible clothing and
- Wear shoes.
- Appropriate gloves while handling chemicals
- Working of alone student is not allowed

# Safety Rules



- Keep tabletops clean. Return all equipment to its original location before leaving the lab. Clean all spills immediately.



# Safe Cleaning



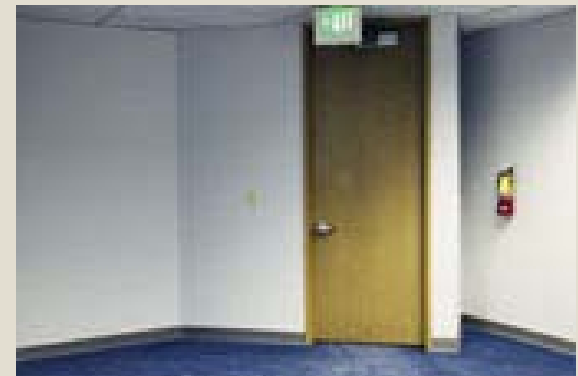
- Report all accidents, no matter how minor, to the PI, Safety Committee. If you break something made of glass, be sure to use dustpan and hand broom to sweep it up and dispose of it in the glass waste receptacle.



# Safe Exit



- In case of an emergency where we have to evacuate, proceed out through the nearest exit.
- Both the door should remain open all the time while working in the lab.



# Safety Rules



- Never put anything in your mouth while in the lab (including chemicals, solutions, food and drink).
- All food and drinks should be restricted to sitting area only.



# Laboratory Etiquette



- ✓ Clean your personal workspace after use
- ✓ Wipe down benches with disinfectant before and after use
- ✓ Ensure that no trash is left behind
- ✓ No trash in the sinks
- ✓ Push in chairs
- ✓ Place lab items back on carts and trays

# Chemical Informations



- Prepare the complete list of chemicals and paste it to respective places such as chemicals cupboard and refrigerators
- Segregate the chemicals according to their compatibility groups for storage
- It is important to know as much about a chemical as possible.
- The most dangerous substance is the one that has no label.



# Waste Disposals Practice



- All the waste should be isolate in the following categories
- Halogenated solvents
- Non-Halogenated solvents
- Heavy metals waste
- Silica waste

# Precautions/Announcements

- In absence of any students no house keeping person should be allowed to enter the lab.
- Keep check on First Aid Box utilities
- No vendors
- No visitors
- Always keep atleast 1 litre of dil  $\text{NaHCO}_3$  solution in stock.
- Contact details of all the person related to discipline of chemistry

# And finally



- Examination on laboratory safety and is compulsory to everyone

# Questions?

