

INITIAL LAB SAFETY

Connie Heird, CHO, BSO
Environmental Health & Safety
University of Rhode Island

WHY ATTEND SAFETY TRAINING?

- The OSHA Laboratory Standard, 29 CFR 1910.1450, identifies best management practices for laboratory operations.
- URI has adopted the Laboratory Standard per URI's "Policy on Environmental Health & Safety". Labs must comply with this policy.

<https://web.uri.edu/policies/files/EHS-Policy-20201023-APPROVED.pdf>

- It comes into play when the EPA conducts a multi-media inspection. Failure to comply with our own policies can lead to violations and possible fines.
- Everyone who works in a lab has to understand this and recognize that the Laboratory Standard will apply to most research labs in the US. You will be expected to know this and follow these best management practices.

Prudent Practices in the Laboratory

- The Laboratory Standard is published in book form as *Prudent Practices in the Laboratory*
- A free download is available from the National Academies Press

<https://www.nap.edu/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical>

OVERVIEW

- **Federal Regulations: OSHA**
- **The Chemical Hygiene Plan**
- **Global Harmonization System**
- **Reading a Safety Data Sheet**
- **Chemical Safety and Risk Management**
- **Lab Safety**
- **Show and Tell**

FEDERAL REGULATIONS - OSHA

PROTECTING HUMAN HEALTH

Occupational Safety and Health Administration (OSHA – 1983)

- **Hazard Communication Standard (HCS)**

Mandates Annual training, Safety Data Sheets + proper labeling of all chemical containers and lab doors

aka: Right-to-Know Standard (RTK Standard)

URI CHEMICAL HYGIENE PLAN

OSHA Laboratory Standard

Prudent Practices in the Laboratory

- Requires every lab to have a Chemical Hygiene Plan (CHP)
- At URI we have a master institutional CHP
- Labs are required to implement the sections that apply to the research they do. For in lab training purposes, these sections should be included in the lab's CHP.
- E.g. If the lab uses Liquid Nitrogen, the Cryogenic Safety section applies.

<https://web.uri.edu/ehs/files/ChemicalHygienePlan.pdf>

URI CHEMICAL HYGIENE PLAN (CHP)

The University's CHP identifies the hazards of specific materials and processes, as well as specific institutional policies that must be followed:

e.g. *Always wear safety glasses in the lab*

Prevent an eye exposure when popping the lid on a centrifuge tube

INSTITUTIONAL POLICIES

NO CHEMICALS DISPOSED TO THE SINK

In rooms where chemicals are used*:

- **No eating or drinking**
- **No cups, food or beverage containers**
- **No application of make-up, lip balm or lotions**
- **No handling of contact lenses**
- **No shorts, sandals, flip flops or open-toed shoes**

***Based on the Routes of Exposure (i.e. how you can be exposed)**

ROUTES OF EXPOSURE

HOW CAN CHEMICALS ENTER YOUR BODY?

- **Inhalation:** Absorption via respiratory tract
- **Dermal Contact:** Absorption via skin
- **Injection:** Introducing the material directly into the body or bloodstream
- **Ingestion:** Absorption via digestive tract (eating with contaminated hands or in contaminated areas)

EXPOSURE CONTROLS

In the lab the primary routes of exposure are through inhalation and dermal contact.

Use Safe Work Practices to mitigate risk of exposure:

- Use Chemical Fume Hoods (an Engineering Control) to prevent inhalation exposures
- Wear chemical protective clothing (PPE) to prevent dermal contact
- Practice good hygiene habits such as regular hand washing; use tongs to pick up sharp objects to prevent cuts and exposure through injection.

SAFETY DATA SHEETS

CHEMICAL SAFETY BEGINS HERE

Mandated by the OSHA Hazard Communication Standard

Aka: Right-to-know Standard

- **In addition to mandating Annual Training and SDSs, the Standard also requires proper labeling: containers, samples/specimens, lab entrances**
- **GHS versions of SDSs must be available in the lab**
Info on hazard class, safe handling and storage, PPE
- **Read BEFORE using chemicals!!**

SAFETY DATA SHEETS GLOBAL HARMONIZATION SYSTEM (GHS)

**International System of Classification and Labeling of Chemicals
(collaboration between OSHA and the United Nations)**

- **OSHA adopted effective May 25, 2012**
 - * Some labs are still using old format – need to update ASAP!**
 - Hazards are not be properly identified.**
- **Standardized to improve quality and consistency of information on SDS (no longer MSDS)**
- **Physical hazard or health hazard now identified on first page**

MAIN DIFFERENCE BETWEEN MSDS AND SDS?

- MSDS hazard rating: **based on NFPA fire code**
1 is least hazardous and 4 is most hazardous
- NEW SDS system: **based on GHS rating and is the opposite**
1 is most hazardous and 4 is least hazardous
- Physical or Health Hazard now on first page so you know you are working with a hazardous chemical
Don't confuse this with the EPA Hazard Class in Section 14
- **Always use a current SDS so you understand the hazards; they are not properly identified on earlier MSDS's**

SAFETY DATA SHEETS

WHAT IS A HAZARDOUS CHEMICAL?

A hazardous chemical that is classified on an SDS as a

- **Physical Hazard**
- **Health Hazard**

New GHS classifications

- **Simple Asphyxiant**
- **Combustible Dust**
- **Pyrophoric Gas**
- **Hazard Not Otherwise Classified (HNOC)**



FLAG:

If the SDS indicates a chemical has a

- Physical Hazard or
- Health Hazard

You have a hazardous chemical
and must dispose the waste and
spill clean-up material as

hazardous waste



PHYSICAL HAZARDS

- Flammable (Liquid, Gas, Aerosol, Solid)
- Gas Under Pressure
- Oxidizer (Liquid, Solid or Gas)
- Corrosive to Metal
- Other Bad Stuff
 - Explosive
 - Self-Reactive
 - Pyrophoric (Liquid or Solid)
 - Self-heating
 - Organic Peroxide
 - Emits Flammable Gas With Water



Physical Hazard

Gas under pressure



- Carbon monoxide is toxic

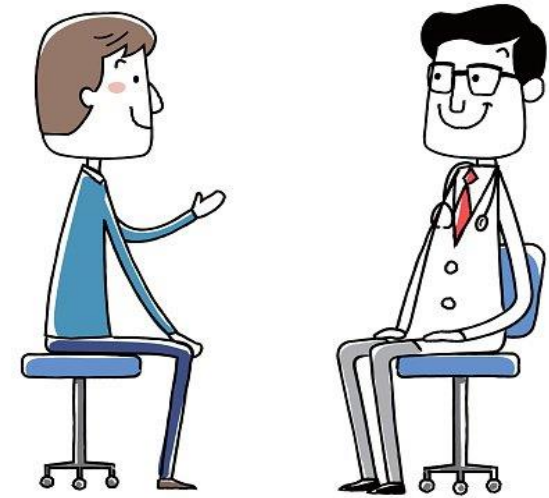


- Gas under pressure



HEALTH HAZARDS

- Skin Corrosion/Irritation
- Serious Eye Damage/Eye Irritation
- Respiratory or Skin Sensitization
- Other
 - Acute Toxicity (any exposure route)
 - Carcinogenicity
 - Germ Cell Mutagenicity
 - Reproductive Toxicity (single or repeated exposure)
 - Specific Target Organ Toxicity
 - Aspiration Hazard (chemical pneumonia)



GHS PICTOGRAMS

- **Pictograms are OSHA symbols that are used on containers and Safety Data Sheets**
- **Each denotes a specific type of hazard**
- **If you work in a lab, you need to become familiar with the meaning of these symbols. Lab chemical containers are often too small for proper written identification of hazards.**

GHS PICTOGRAMS

Health Hazard

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity



Flame

- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides



Exclamation Mark

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effect
- Respiratory Tract Irritant



Gas Cylinder

- Gases Under Pressure



Corrosion

- Eye or skin Damage
- Corrosive to Metals
- Burns



Exploding Bomb

- Explosives
- Self-Reactives
- Organic Peroxides



Flame Over Circle

- Oxidizers



Environment

(Non-Mandatory)

- Aquatic Toxicity



Skull and Crossbones

- Acute Toxicity (fatal or toxic)



A Note on Pictograms

- Placards and other signage that includes a pictogram may not always be color coded.
- You have to be able to recognize the Oxidizer symbol as a flame over the letter O. At a quick glance, it can easily be mistaken for the Flammable pictogram and the Oxidizer hazard missed completely. The words “Flammable” and “Oxidizer” are not usually included.



GHS PICTOGRAMS

! The Exclamation Mark !

It's tempting to overlook this category because IRRITANT and SKIN SENSITIZER don't sound like they are much of a threat to your health and well being. But let's take a quick dive and see why you need to pay attention to chemicals with this warning.

- **Irritant (skin and eye):** Skin irritation is the production of reversible damage to the skin following the application of a test substance for up to 4 hours.
- **Skin Sensitizer:** Skin sensitizer is a chemical that will lead to an allergic response following skin contact. In contrast to skin irritation, skin sensitization is an immunological response to previous exposure to a substance which results in an inflammatory skin reaction. **If you've had this reaction once, you may need to carry an Epi Pen.**
- **Acute Toxicity:** refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.
- **Respiratory Tract Irritant:** Any substance which can cause inflammation or other adverse reactions in the respiratory system (lungs, nose, mouth, larynx and trachea).
- **Narcotic Effects:** Breathing and heart rate slow down, loss of coordination and disorientation, loss of consciousness and/or impaired vision, nausea and vomiting, airways may swell leading to breathing and heart problems

A FEW WORDS ABOUT SAFETY DATA SHEETS

- Originally written for industry but adapted for lab use.
- Chemicals behave differently when in industrial quantities and are generally more hazardous than in lab quantities.
- Even if working with lesser quantities, it is always best to err on the side of caution and adopt more restrictive protections (Engineering Controls, Administrative Controls/Safe Work Practices and PPE)
- Don't be surprised to find inconsistencies between SDS or even between federal agencies within a single SDS!

Case in point: On the included Chloroform SDS, IARC (International Agency for Research on Cancer at the World Health Organization) lists Chloroform as a Probable Carcinogen. The National Toxicology Program (NTP at NIH) and OSHA both say “No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen.”

- Remember: Much is still unknown about chemicals in common use. Always err on the side of caution.

SAFETY DATA SHEETS

They contain a LOT of information so how do you know what's important?

It's all important, but some is more important if you are working in a lab:

- **Section 2:** Hazards identification
- **Section 4:** First aid measures
- **Section 6:** Accidental release measures
- **Section 7:** Handling and storage for incompatibilities
- **Section 8:** Exposure controls/personal protection
- **Section 9:** for pH, flammability, flash point, vapor pressure
- **Section 10:** Stability and reactivity
- **Section 11:** Toxicological information
- **Section 14:** Transportation

SAFETY DATA SHEET

Chloroform

SECTION 1: Identification

1.1 Product identifiers

Product name: Chloroform

Product Number: 288306

Brand: Sigma-Aldrich

CAS-No.: 67-66-3

1.2 Relevant identified uses of the substance or mixture and uses advised against Identified uses:

Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich Inc.

3050 SPRUCE ST

ST. LOUIS MO 63103

UNITED STATES

Telephone: +1 314 771-5765

Fax: +1 800 325-5052

1.4 Emergency telephone

Emergency Phone #: 800-424-9300 CHEMTREC (USA)

+1-703- 527-3887 CHEMTREC

(International) 24 Hours/day;

7 Days/week

SAFETY DATA SHEET

Chloroform

SECTION 2: Hazards Identification

2.1 Classification of the substance or mixture

GHS-US classification in accordance with 29 CFR 1910 (OSHA Hazard Communication Standard)

- Acute toxicity, Oral (Category 4), H302
- Acute toxicity, Inhalation (Category 3), H331
- **Skin irritation (Category 2), H315**
- **Eye irritation (Category 2A), H319**
- **Carcinogenicity (Category 2), H351**
- **Reproductive toxicity (Category 2), H361**

GHS-US classification

- Specific target organ toxicity - single exposure (Category 3)
- Central nervous system, H336
- **Specific target organ toxicity - repeated exposure (Category 1)**
- Liver, Kidney, H372
- Short-term (acute) aquatic hazard (Category 3), H402
- Long-term (chronic) aquatic hazard (Category 3), H412

SAFETY DATA SHEET

Chloroform

2.2 GHS Label elements, including precautionary statements



- Signal word **Danger**

Hazard statement(s)

- H302 Harmful if swallowed.
- H315 Causes skin irritation.
- H319 Causes serious eye irritation.
- H331 Toxic if inhaled.
- H336 May cause drowsiness or dizziness.
- H351 Suspected of causing cancer.
- H361 Suspected of damaging fertility or the unborn child.
- H372 Causes damage to organs (Liver, Kidney) through prolonged or repeated exposure.
- H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
- P264 Wash skin thoroughly after handling.
- P270 Do not eat, drink or smoke when using this product.
- P271 Use only outdoors or in a well-ventilated area.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
- P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
- P302 + P352 IF ON SKIN: Wash with plenty of soap and water.

SAFETY DATA SHEET

Chloroform

2.2 Precautionary statement(s) continued

- P304 + P340 + P311 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor.
- P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P308 + P313 IF exposed or concerned: Get medical advice/ attention.
- P332 + P313 If skin irritation occurs: Get medical advice/ attention.
- P337 + P313 If eye irritation persists: Get medical advice/ attention.
- P362 Take off contaminated clothing and wash before reuse.
- P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
- P405 Store locked up.
- P501 Dispose of contents/ container to an approved waste disposal plant.

■ **2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none**

NOTE: Do not launder at home

SAFETY DATA SHEET

Chloroform

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : Trichloromethane, Methylidyne trichloride

Formula : CHCl₃

Component	Classification	Concentration
Chloroform	Acute Tox. 4; Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; Repr. 2; STOT SE 3; STOT RE 1; Aquatic Acute 3; H302, H331, H315, H319, H351, H361, H336, H372, H402 Concentration limits: 20 %: STOT SE 3, H336	<= 100 %
Ethanol	Flam. Liq. 2; Eye Irrit. 2A; H225, H319 Concentration limits: >= 50 %: Eye Irrit. 2A, H319	>= 1 - < 5 %

SAFETY DATA SHEET

Chloroform

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Consult a physician. Show this material safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

- The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

- No data available

SAFETY DATA SHEET

Chloroform

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Hydrogen chloride gas

Not combustible.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

SAFETY DATA SHEET

Chloroform

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and **dispose of as hazardous waste**. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

SAFETY DATA SHEET

Chloroform

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): 6.1D: Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SAFETY DATA SHEET

Chloroform

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS Number	Value	Control Parameters	Basis
Chloroform	67-66-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
				Remarks: Confirmed animal carcinogen with unknown relevance to humans
		ST	2 ppm 9.78 mg/m3	USA. NIOSH Recommended Exposure Limits
				Potential Occupational Carcinogen
		C	50 ppm 240 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		PEL	2 ppm 9.78 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
				TWA – Time Weighted Average PEL – Permissible Exposure Level ACGIH - American Conference of Governmental Industrial Hygienists

SAFETY DATA SHEET

Chloroform

Component	CAS Number	Value	Control Parameters	Basis
Ethanol	64-17-5	TWA	1,000 ppm 1,900 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1,000 ppm 1,900 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		STEL	1,000 ppm	USA. ACGIH Threshold Limit Values (TLV)
				Confirmed animal carcinogen with unknown relevance to humans
		TWA	1,000 ppm 1,900 mg/m3	USA. NIOSH Recommended Exposure Limits
		PEL	1,000 ppm 1,900 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
				STEL – Short term exposure limit

SAFETY DATA SHEET

Chloroform

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Body Protection

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

SAFETY DATA SHEET

Chloroform

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SAFETY DATA SHEET

Chloroform

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

pH is in section 9.1.d

9.2 Other safety information

SECTION 10: Stability and reactivity

10.1 Reactivity

10.2 Chemical stability

10.3 Possibility of hazardous reactions

10.4 Conditions to avoid

10.5 Incompatible materials various plastics, Rubber, Strong oxidizing agents

10.6 Hazardous decomposition products

SAFETY DATA SHEET

Chloroform

11.1 Information on toxicological effects

- **Acute toxicity** No data available
LD50 Oral - Rat - male - 908 mg/kg
Inhalation: No data available
Acute toxicity estimate:
Inhalation - Expert judgment - 4 h - 3.1 mg/l
- **Skin corrosion irritation**
- **Serious eye damage/eye irritation**
- **Respiratory or skin sensitization**
- **Germ cell mutagenicity**
- **Carcinogenicity**
 - **Carcinogenicity**
Suspected of causing cancer.
IARC: 2B - Group 2B: Possibly carcinogenic to humans (Chloroform)
NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.
- **Reproductive toxicity** No data available
Suspected of damaging the unborn child.
No data available
- **Specific target organ toxicity - single exposure**
- **Specific target organ toxicity - repeated exposure**
- **Aspiration hazard**
- **Specific target organ toxicity - single exposure**
No data available
- **Specific target organ toxicity - repeated exposure**
No data available

SAFETY DATA SHEET

Chloroform

11.2 Additional Information

- **Repeated dose toxicity** - Rat - female - Oral - NOAEL (No observed adverse effect level) - Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity **No data available**

Toxicity to algae static test ErC50 –
Chlamydomonas reinhardtii (green algae) -
13.3 mg/l - 72 h Remarks: (ECHA)
(Chloroform)
Toxicity to bacteria Remarks: (ECHA)
(Chloroform)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as
chemical safety assessment not
required/not conducted

12.6 Other adverse effects

**An environmental hazard cannot be
excluded in the event of unprofessional
handling or disposal. Harmful to aquatic life
with long lasting effects. No data available.**

SAFETY DATA SHEET

Chloroform

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Offer surplus solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

DOT (US) UN number: 1888

Class: 6.1

Packing group: III

Proper shipping name: Chloroform

Reportable Quantity (RQ): 10 lbs

Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG UN number: 1888

Class: 6.1

Packing group: III

EMS-No: F-A, S-A

Proper shipping name: CHLOROFORM

IATA UN number: 1888

Class: 6.1 Packing group: III

Proper shipping name: Chloroform

SAFETY DATA SHEET

Chloroform

SECTION 15: Regulatory information

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

Chloroform CAS-No. 67-66-3

Revision Date 2008-11-03

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

Chloroform CAS-No. 67-66-3

Revision Date 2008-11-03

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Reportable Quantity D022 lbs

Massachusetts Right To Know

Components No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Chloroform CAS-No. 67-66-3

Revision Date 2008-11-03

SECTION 16: Other information Further information

Copyright 2020 Sigma-Aldrich

DOT Hazard Classes
Section 14 On SDS (Transportation)

<u>Class</u>	<u>Hazard</u>
1.1 – 1.6	Explosives ordered by severity and sensitivity
2.1 – 2.3	Compressed Gas
3	Flammable Liquid
4.1 – 4.3	Flammable Solid, Spontaneously Combustible, or Dangerous when Wet
5.1 – 5.2	Oxidizers or Organic Peroxides
6.1 – 6.2	Toxic or Infectious Substances
7	Radioactive
8	Corrosive
9	Miscellaneous

HAZARDOUS WASTE DISPOSAL

- On the URI Request for Hazardous Waste Pickup form there is a column for you to list each chemical's "Hazard Class".
- On the SDS, the DOT Hazard Class is in Section 14: Transportation. In this case it is 6.1.
- Use the decode from the previous slide and list the hazard class as Toxic.

Chemical Spills & Emergency Response



What do you do if you have a spill?

**It depends on the size of the spill, the chemical spilled
and if you have taken OSHA 40-hour training.**

EMERGENCY RESPONSE

YOUR HAZWOPER AWARENESS LEVEL TRAINING

HAZARDOUS WASTE OPERATIONS

What's a Non-emergency Response?

- A bench top spill is a small spill of a hazardous chemical *that can be controlled at the time of the release by students or employees in the immediate area.*
This is not considered an emergency response.
- No special training is required

HAZWOPER AWARENESS LEVEL

HAZARDOUS WASTE OPERATIONS

What's an Emergency Response?

- Response by designated emergency responders *from outside the immediate release area*
- Special training and PPE required

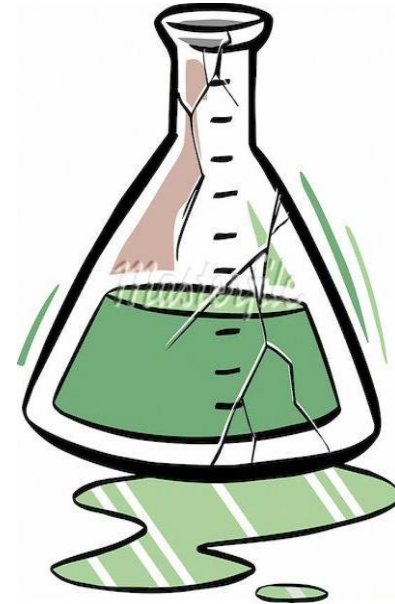


HAZWOPER TRAINING

FIRST RESPONDER AWARENESS LEVEL

Identify there has been a hazardous substance release (not a bench top spill)

- Initiate emergency response procedure by calling URI Police Dispatch
- **Do not respond to the release or try to clean it up**
- Report to the first fire truck on the scene to provide details



POLICE DISPATCH – CALL 911

HOW CAN YOU DETECT THE RELEASE OF A HAZARDOUS CHEMICAL?

- **Odor**
- **Visual Appearance**
- **Monitoring**



EMERGENCY SITUATIONS

POLICE DISPATCH – CALL 911

- Fire or explosion
- Injury where medical attention is needed
- Natural gas leak (strong odor in or outside the lab)
- Release of large volume (> 100 mL) of biohazardous material in the lab or a release of any volume outside the lab

NON-EMERGENCY SITUATIONS

- **Trash can fire that has been fully extinguished**
Call Fire Safety (401) 874-7020 to replace your fire extinguisher
- **Injury that can be treated by first aid in the lab**
- **Chemical release that does not meet above criteria for emergency release**

FIRE EXTINGUISHERS

- **Contrary to popular belief, fire extinguishers are not there for you to put out the fire but to get you out the door; they are only suitable for use on a trash can fire.**
- **Our modern buildings (CBLS, Pharmacy, Beaupre, Fascitelli Engineering, OSEC at GSO) all have systems that are activated when the fire alarm pull stations are activated; this restricts airflow into the area and helps contain the fire.**
- **The best thing you can do if there is a fire in the lab is leave immediately, hit the pull station and evacuate the building.**
- **This will do two important things: first, it gives all the other occupants in the building time to get out and second, leave the firefighting to Kingston Fire and Narragansett Fire Dept. Both are 3 minutes away. They are fully trained professionals, let them do their jobs.**

DEPARTMENT/LAB EMERGENCY PROCEDURES LARGE SPILLS

- **Notify Police Dispatch – call 911** from a safe location.
- Evacuate the area and secure the site to prevent accidental exposure or spreading the released chemical
- Activate the fire alarm pull station, leave the building and proceed to the designated evacuation assembly point.
- For exposed personnel, wash/decontaminate the affected area for a minimum of 15 minutes. You may need to use a safety shower/eyewash in a nearby lab if your lab has been evacuated.
- Notify Principal Investigator and **Department First Responder**
- Report to first fire truck on-scene or command post to brief responders
- For chemical spills or exposures, provide Safety Data Sheet to responders

DEPARTMENT FIRST RESPONDERS

- **Pharmacy (Avedisian)**

Ian Lester

- **CBLS, Woodward and Coastal-Kingston**

Nasir Hamidzada

- **Fascitelli Engineering + Bliss**

Mike Trottier

- **Beaupre**

Tippawan Markmaitree

- **GSO**

Seth Pilotte

EHS PROCEDURES

- EHS reports to first fire truck on-scene or incident command post
- Assesses the magnitude of the event and potential **threat to human health and environment**
- Contacts spill response contractor, if necessary
- Makes required notifications to state/federal agencies
- Provides clearance to Police/Security for re-entry into the building after KFD and EHS determine the building is safe

CBLS FIRE



CBLS FIRE

- A student was plating on the middle lab bench next to the aisle late one afternoon. He was using Ethanol with a small Bunsen burner.
- Out of the corner of his eye he noticed smoke, looked down and realized his trash can was on fire.
- He remembered seeing a fire extinguisher over in the teaching wing, grabbed the trash can and took off up the hall.
- He saw his dept. chair in the hallway and she asked him where he was going in such a hurry. He told her about the fire and put the trash can down so she could see.
- She said “Here, let me help you with that” and started patting the flame with her bare hands. This is someone who had been doing research for 50 years!
- She had burns on her hands and had to go to the hospital, but remembered there was a kitchenette with a sink at the far western end of the building; they were able to put out the fire.

CBLS FIRE

It didn't have to happen this way but his PI had not told him the fire extinguisher was in a niche on the opposite wall, 6 feet from where he was sitting.

The Takeaway:

- When things go wrong your brain will scramble. That's just the way it is, accept it.
- Your first instinct will be to do something. It will probably be wrong so don't do anything in those first seconds!!
- Take a few deep breaths to get grounded then mentally scroll through your lab's Emergency Action Plan to find the appropriate response for your particular situation.
- Then take the appropriate action.

Lab Safety Equipment

Do you know where it is and how to use it?

Sink drench hose



Fire alarm pull station



**Recessed fire extinguisher
shower, eyewash**



KNOW THE DIFFERENCE BETWEEN A HAZARD AND RISK

THEY ARE USED INTERCHANGEABLY BUT ARE VERY DIFFERENT

HAZARD (actual)

- A hazard causes harm
- A hazard can be eliminated but not reduced – it's either there or it isn't

RISK (theoretical)

- Risk is the probability that a hazard will cause harm
- Risk associated with a hazard can be reduced

RISK ASSESSMENT

IDENTIFY ALL HAZARDS BEFORE BEGINNING WORK

CHEMICALS

Acids, Bases

Solvents

Ethidium bromide

Formaldehyde

HAZARD CLASS (FROM SDS)

Corrosive

Ignitable, Toxic, Corrosive

Mutagen, Toxic

Carcinogen, Ignitable

Other things to think about:

- **Physical properties (oxidizer/reducer/reactive)**
- **Concentration of chemical (dose in case of exposure)**
- **Contact or exposure time; acute or chronic exposure**

EHS RISK ASSESSMENT CLASS

- EHS has posted a new class to introduce you to the discipline of Risk Assessment and help you learn how to minimize risk in your lab.
- This straightforward simplified version will give you the basics.
- Register through the EHS Training Registration web page.
- If you want more advanced training, the American Chemical Society has a detailed free program on their website.

HIERARCHY OF CONTROLS: 5 TOOLS TO MANAGE RISK IN THE LAB

These two are preferred but may not always be practical:

1. Source elimination (*hazard removed, risk eliminated*)
Remove hazardous materials from system if possible
2. Substitute for a less hazardous material (*risk is reduced*)

TOOLS TO MANAGE RISK

MINIMIZE EXPOSURES IN THE LAB

3. Engineering Controls (*hazard removed/isolated; risk eliminated or reduced*)

Air flow: chemical fume hoods, biological safety cabinets and exhaust fans

Others: Sharps containers, hand washing stations

4. Administrative Controls (*hazard managed/removed; risk reduced or eliminated*)

Ensure regulatory compliance and a safe workplace

Institutional policies

Safe Work Practices

Lab Policies

Standard Operating Procedures (SOP's)

TOOLS TO MANAGE RISK

MINIMIZE EXPOSURES IN THE LAB

5. Personal Protective Equipment (PPE) *does not remove the hazard*

Reduces risk by creating a physical barrier between researcher and hazard:

Gloves that are compatible with chemical

Safety goggles/safety glasses with side shields, face shields

Lab coat/barrier lab coat/flame resistant lab coats

WHAT IF

What if?	Answer	Probability	Consequences	Recommendations
You enter an empty laboratory without wearing safety glasses?	Explosion possible in empty lab from delayed failure of over-pressurized containers or equipment	Low	Extreme severity if explosion when lab is entered and protective equipment not used	Always wear eye protection when entering a lab, even when there is no apparent work in progress

PREVENTING LAB ACCIDENTS

- **Develop good situational awareness**
- **Follow SOP's and lab policies, use safe work practices**
- **Identify 3 most hazardous chemicals and know the properties that make them so hazardous**
- **Develop a lab Emergency Action Plan**

SITUATIONAL AWARENESS

- Situational Awareness (SA) involves being aware of what is happening around you to understand how information, events, and your own actions will impact your goals and objectives, both now and in the near future.
- **Know what's going on around you in the lab** (think like Jason Bourne!)
<https://www.youtube.com/watch?v=ljrWOZby8s8>
- Is anyone working with highly reactive or flammable materials? Biohazards?
- What are you going to do in an emergency? Do you know your escape route? Is it clear?
- **No headphones, ear buds or texting in the lab!!**
You won't hear the fire alarm and texting is too distracting

Why is having good SA so important?

Bad things happen very quickly

- Sheri Sangji - UCLA lab death

The first criminal case resulting from
an academic laboratory accident

(willful violation of safety regulations)

https://en.wikipedia.org/wiki/Sheri_Sangji_case



- Michele Dufault

Yale University lab death

<https://yaledailynews.com/blog/2011/04/13/michele-dufault-11-dies-in-sterling-chemistry-laboratory-accident/>



PROCESS HAZARD ANALYSIS

SHORT VERSION: 2 QUESTIONS

Q: What's the worst thing that can go wrong?

Q: Are you prepared to deal with it?

Don't proceed till you have a clear understanding of what's needed to complete each step of your work safely

In industry: PHA – Used to help minimize/prevent

- **Physical injury**
- **Fire**
- **Explosion**
- **Hazardous chemical release**

SAFE WORK PRACTICES

- **Never work alone!!**
If there's a spill or an accident, you will need help
- **Work with smallest volumes possible**
Don't order 1 gallon bottles if you only use 10 ml at a time
How much do you want to clean up if there's a spill?
- **Minimize the distance chemicals are moved**
Store solvents under the hood when possible. Use containment (a pail with secure lid) if carrying down the hall.
- **Avoid flames and sparks when working with organic solvents and flammables**
- **Use chemical fume hoods and wear proper PPE, including safety glasses**

IDENTIFY THE 3 MOST HAZARDOUS CHEMICALS THAT YOU WORK WITH

- Read SDS's to be sure you understand the properties that make those chemicals hazardous
- Organic solvents are usually flammable but some are not:
> 80% Chlorine (Chloroform, Methylene chloride) have no flash point but they do pose health risks (both are probable carcinogens)
- Chemicals can be lighter or heavier than air
Heavier will seek the lowest point and may reach a spark
- Does the chemical have a low flash point?
Ethyl ether flash point - 46°F Gasoline -36°F

Q: The vapor of one gallon of gasoline = how many sticks of dynamite?

A: 20

EMERGENCY ACTION PLAN

- At lab meetings talk about specifics so you know what to do when things go wrong
- Consider all possible scenarios and develop an appropriate plan for each

What would you do in the following situations?

- Spill
- Spill with exposure to personnel, including eyes
- Fire
- Explosion

Situations that are unique to your lab?

GETTING HELP

POLICE DISPATCH – CALL 911

Things to tell Dispatch

- **Your name, building and room number where incident occurred, name of your PI**
- **Also provide chemical name, volume spilled and container size**
- **Was anyone injured? How badly? Did the chemical get in anyone's eyes? Does anyone need to be transported to the hospital? (Always go to the hospital if there's been an eye exposure)**

IMMEDIATE ACTION

Large spill of a solvent or chemical with a strong odor

- **Evacuate**

Alert others in the lab and direct/assist them in leaving.

- **Ventilate**

Open windows. Do not walk through the spill.

- **Confine**

Close all doors and isolate the area.

- **Report**

From a safe place call

911 Kingston

911 Bay Campus

(401) 277-5155 Providence

- **Secure**

Block off areas leading to the spill and notify PI if not in lab.

CHEMICAL SPILLS & EMERGENCY RESPONSE



**What do you do
if you have a spill?**

MINOR SPILL CLEAN-UP

Bench top Spill: Assumes no contamination or injury

- **Use yellow pads to absorb spill**
- **Double-bag the pads**
- **Hazardous waste label on bag if a hazardous chemical**
- **Put bag in SAA and send EHS a Request for Pick-up**

MAJOR SPILL

YOU HAVE NOT BEEN TRAINED TO CLEAN UP A MAJOR SPILL

Assess the hazards and dangers. Assume the worst and evacuate.

- **Tend to injured or contaminated person**
- **Contain or limit the spill if possible**
- **Call POLICE DISPATCH - 911 - for emergency response 24/7
(ambulance, fire or clean-up)**
- **Notify supervisor immediately**

EYE DECONTAMINATION

Use eyewash 15 minutes at 15 psi

Hold eyelid open to ensure proper flushing

SAFETY IN THE LAB

- **Practice good work habits**

Stay focused, don't work when you are tired. If you are tired you don't belong in a lab. You will make bad decisions that will have bad outcomes! We want positive outcomes! Ask if you are unsure. Don't ever be afraid to ask questions. You are students, PI's expect you to ask questions.

- **Use safe work practices**

Sort chemicals by hazard class (not alphabetically) and use appropriate controls from SDS

SAFETY IN THE LAB

Plan ahead

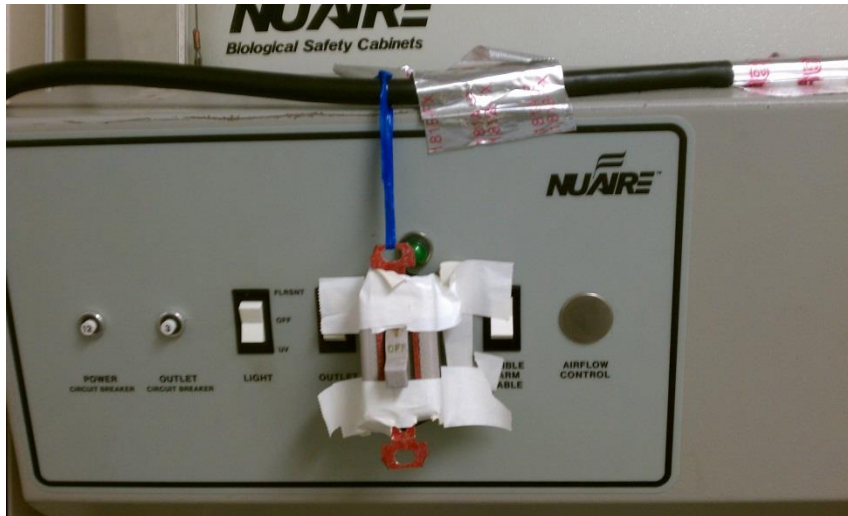
- Learning good time management is one of the hardest things to learn when you start working in the lab.
- Allow enough time for each phase of your work, including time to manage your hazardous waste each day (2 min).
- How much is enough time for your experiment? Break it into its component parts, add up how long the parts should take then add 40-50% to that total.
- This will give you enough time to adjust when things go wrong, and also time to interact with your lab mates. Labs are complex, dynamic places with people coming and people going. You don't all arrive at the same time so you want to catch up with everyone and that takes time. Just build it into your schedule so you won't be rushed. When you are rushed you will make mistakes and that brings us back to bad outcomes. We want positive outcomes!

SAFETY IN THE LAB

- **Read Safety Data Sheets (SDS)**
Know the hazards and controls you need to use before beginning work
- **Read and follow written SOP's, wear appropriate PPE, use safety resources available in the lab**
- **If you do all of these things, you will have a safe and rewarding lab experience here at URI!**

Show and Tell

WHAT'S WRONG HERE?



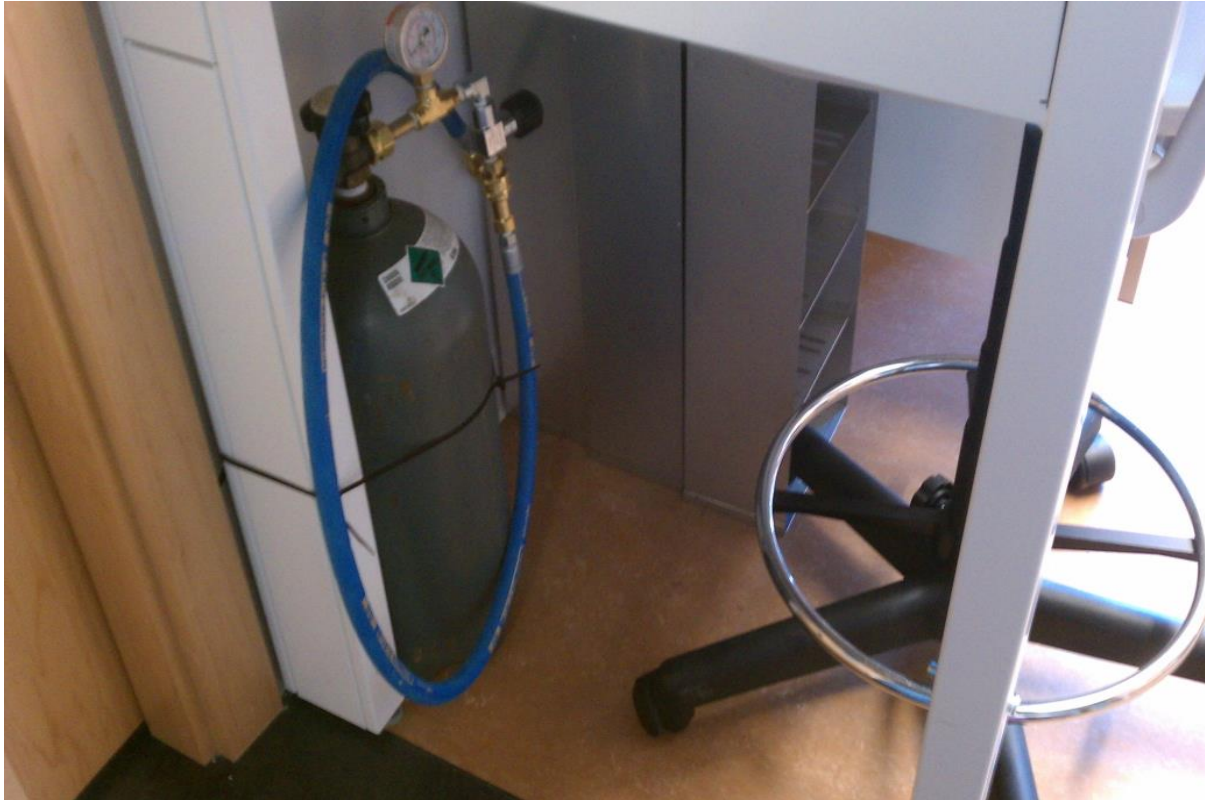
- This is the control panel of a biosafety cabinet that had a bad switch
- Instead of the PI paying for a service call (at that time about \$750), he said “I can fix that”
- This is what we got and the researcher saw nothing wrong with that

WHAT'S WRONG HERE?



- Two glass flasks on the floor (don't store glass on the floor!). Trip hazard.
- Flasks are connected by clear plastic tubing which is also on the floor.
- When entering a room, most people are looking ahead at where they are going, not down at the floor.

WHAT'S WRONG HERE?



- This is a “stubby” gas cylinder secured by a zip tie! A single, skinny zip tie!
- What if the zip tie lets go? Not designed for that type of load.
- Always use proper cylinder restraint. They are missiles waiting to become airborne and blast through a wall or worse.

WHAT'S WRONG HERE?



- This is the lab's electric panel.
- Access to the panel is blocked.
- In an emergency when seconds count, all this stuff would have to be moved before someone could get in and turn off the power supply.

WHAT'S WRONG HERE?



- Improperly secured gas cylinders
- Unsecured gas cylinders

FOGARTY

A CAUTIONARY TALE

We are at a university, surrounded by a lot of really smart people who, unfortunately, sometimes do really stupid things.

- A CHO from EHS had to drop off an inspection report to a PI on the 2nd floor, Fogarty. The CHO smelled residual smoke on exiting the elevator, delivered the report to the PI and went immediately to the PI's second lab across the hall. She went straight into a small lab (10 ft wide x 8 ft deep) in the very back and said "I knew it, I knew those guys had a fire in here." There was fire extinguisher foam all across the bench top, of course she knew!
- The second CHO was standing in the doorway, next to what looked like a large drum. She walked around and read the label, Acetone. There was a 55 gallon drum of Acetone stored in an occupied building where there had been a bench top fire not 8 feet away!!

FOGARTY

A CAUTIONARY TALE

It turned out it was an innocent mistake but it could have had fatal consequences. The PI ordered a 5 gal container of Acetone and Fisher shipped him a 55 gallon drum. The PI should have put it in the building's outside flammables storage shed, instead he wheeled it into the building and stashed it upstairs in his smallest lab, out of sight.

The message? People don't mean to do stupid things. They just get hyper-focused on their own stuff, forget about everyone else and don't think about possible consequences.

Please don't be that person.

EHS Contact Info

■ Hazardous Waste	Nancy Paterson	874-2592
	Nic Englehart	874-5740
■ Biological Waste	Connie Heird	874-7019
■ Radioactive/Lasers	Sangho Nam	874-9439
■ General information	Pam McCarthy	874-7993

EMERGENCIES: POLICE DISPATCH - 911

Questions srm@etal.uri.edu

EHS web page <https://web.uri.edu/ehs/>

QUESTIONS?
cheird@uri.edu

