

# Basic Chemical Safety Training

Purdue University

August 2012

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**To get your attention...**

**Video from the U.S. Chemical Safety Board**

**DESCRIPTION**

Four major accidents illustrate the dangers from uncontrolled chemical accidents.

<http://www.csb.gov/>

- Provide employees with knowledge to understand the hazards of the chemicals with which they work.
- Provide a safer and healthier workplace for all employees.
- Ensure regulatory compliance with the State and Federal Right-To-Know Law, 29 CFR 1910.1200.

Anyone who gets a paycheck from Purdue is covered

- To be informed about the known health and physical hazards in your work area
- To be trained to use proper safety techniques and hygiene practices
- To inform your Designated Training Individual (DTI) about accidents or hazardous situations in your work area without fear of repercussions from your supervisor or the university
- To file a formal complaint with IOSHA

Indiana Department of Labor  
Indiana State Government Center South  
Indianapolis, IN 46204-2287  
317-232-2655

- To use the available information and to stay informed about the hazards in your work area
- To use the safety techniques and hygiene practices as a routine part of your daily activities
- To attend the training sessions conducted by your DTI

- The Written Compliance Manual is located at:

**LOCATION:** \_\_\_\_\_

- The Chemical Inventory and Material Safety Data Sheets (MSDS) are located:

Outside the door of each lab



- Local
  - Involves one site in the body, usually the point of contact
    - Skin irritation or burns
    - Eye irritation or burns
    - Upper respiratory tract irritation
- Systemic
  - Involves more than one part of the body, not just the point of contact
    - Central nervous system: headaches, dizziness, nausea, etc.
    - Organ damage: liver, lungs, etc.
    - Cancer

- Guidelines established to protect the average healthy worker from health effects.
  - Based on 8 hour days, 40 hour weeks, 40 year working lifetime
  - Assumes worker is an average healthy person
- Two types used in the U.S.
  - Threshold limit value (TLV)
  - Permissible exposure limit (PEL)
- The TLVs are a voluntary guideline established by the American Conference of Governmental Hygienists (ACGIH)
  - Updated more frequently
  - Tend to be more protective
  - Not mandated by law
- The PELs are the mandatory limits established by OSHA
  - Mandated by law, legally enforceable
  - Not updated as frequently



- Physical state of the product
  - Gas, liquid, solid
- Concentration of the product
  - More concentrated, more damage in a given time frame
- Length of exposure (time) to the product
  - The longer you are exposed to a product at a given concentration the greater the chance of health effects
- Route of exposure
- Individual sensitivities
- Other exposures

- Ways to reduce exposure to chemical products
  - Personal protective equipment
    - gloves
    - goggles
    - respirators
    - etc.
  - Engineering
    - local exhaust ventilation
    - remote handling of materials
  - Administrative
    - limit work time
    - rotate work groups
    - break areas separate from work areas
    - no eating, drinking, or applying cosmetics in work area

- Material Safety Data Sheets (MSDS) provide information specific to a chemical, chemical product or mixture of chemicals
- MSDSs are provided by the manufacturer or distributor
- Copy provided to Purdue when the product is initially purchased
- Different formats
  - Original – 9 sections
  - ANSI – 12 sections
- Appearance not mandated by OSHA. Only the base information required



# MSDS WD-40



# WD-40



## MATERIAL SAFETY DATA SHEET

### I. PRODUCT IDENTIFICATION

Manufacturer:	WD-40 Company	Telephone:	
Address:	1061 Cudahy Place (92110) P.O. Box 80607 San Diego, California 92138-0607	Emergency only:	1-(800) 424-9300 (CHEMTREC)
		Information:	(619) 275-1400
		Chemical Name:	Organic Mixture
		Trade Name:	WD-40 Aerosol

### II. HAZARDOUS INGREDIENTS

Chemical Name	CAS Number	%	Exposure Limit ACGIH/OSHA
Aliphatic Petroleum Distillates	8052-41-3	45-50	100 ppm PEL
Petroleum Base Oil	64742-65-0	15-25	5 mg/M <sup>3</sup> TWA (mist)
LVP Hydrocarbon Fluid	64742-47-8	12-18	1200 mg/M <sup>3</sup> TWA
Carbon Dioxide	124-38-9	2-3	5000 ppm PEL
Non-hazardous Ingredients		< 10	

### III. PHYSICAL DATA

Boiling Point:	323°F (minimum)	Evaporation Rate:	Not determined
Vapor Density (air=1):	Greater than 1	Vapor Pressure:	110 ±5 PSI @ 70°F
Solubility in Water:	insoluble	Appearance:	Light amber
Specific Gravity (H <sub>2</sub> O=1):	0.832 @ 72°F	Odor:	Characteristic odor
Percent Volatile (volume):	74%	VOC:	412 grams/liter (49.5%)

### IV. FIRE AND EXPLOSION

Flash Point:	131°F Tag Closed Cup
Flammable Limits:	(Solvent Portion) [Lel] 1.0% [Uel] 6.0%
Extinguishing Media:	CO <sub>2</sub> , Dry Chemical, Foam.
Special Fire Fighting Procedures:	Contents Under Pressure
Unusual Fire and Explosion Hazards:	FLAMMABLE - U.F.C. level 3 AEROSOL

### V. HEALTH HAZARD / ROUTE(S) OF ENTRY

<b>Threshold Limit Value</b>	Aliphatic Petroleum Distillates (Stoddard Solvent) lowest TLV (ACGIH 100 ppm.)
<b>Symptoms of Overexposure</b>	
<b>Inhalation (Breathing):</b>	May cause anesthesia, headache, dizziness, nausea and upper respiratory irritation.
<b>Skin contact:</b>	May cause drying of skin and/or irritation.
<b>Eye contact:</b>	May cause irritation, tearing and redness.
<b>Ingestion (Swallowed):</b>	May caused irritation, nausea, vomiting and diarrhea.
<b>First Aid Emergency Procedures</b>	
<b>Ingestion (Swallowed):</b>	Do not induce vomiting, seek medical attention.
<b>Eye Contact:</b>	Immediately flush eyes with large amounts of water for 15 minutes.
<b>Skin Contact:</b>	Wash with soap and water.
<b>Inhalation (Breathing):</b>	Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.
	Pre-existing medical conditions such as eye, skin and respiratory disorders may be aggravated by exposure.
<b>DANGER!</b>	
<b>Aspiration Hazard:</b>	If swallowed, can enter lungs and may cause chemical pneumonitis. Do not induce vomiting. Call Physician immediately.
<b>Suspected Cancer Agent</b>	The components in this mixture have been found to be noncarcinogenic by NTP, IARC and OSHA
Yes ___ No <u>X</u>	

### VI. REACTIVITY DATA

Stability:	Stable <u>X</u>	Unstable ___
Conditions to avoid:	NA	
Incompatibility:	Strong oxidizing agents	
Hazardous decomposition products:	Thermal decomposition may yield carbon monoxide and/or carbon dioxide.	
Hazardous polymerization:	May occur ___	Will not occur <u>X</u>

### VII. SPILL OR LEAK PROCEDURES

<b>Spill Response Procedures</b>	Spill unlikely from aerosol cans. Leaking cans should be placed in plastic bag or open pail until pressure has dissipated.
<b>Waste Disposal Method</b>	Empty aerosol cans should not be punctured or incinerated; bury in land fill. Liquid should be incinerated or buried in land fill. Dispose of in accordance with local, state and federal regulations.

### VIII. SPECIAL HANDLING INFORMATION

Ventilation:	Sufficient to keep solvent vapor less than TLV.
Respiratory Protection:	Advised when concentrations exceed TLV.
Protective Gloves:	Advised to prevent possible skin irritation.
Eye Protection:	Approved eye protections to safeguard against potential eye contact, irritation or injury.
Other Protective Equipment:	None required.

### IX. SPECIAL PRECAUTIONS

Keep from sources of ignition. Avoid excessive inhalation of spray particles, do not take internally. Do not puncture, incinerate or store container above 120°F. Exposure to heat may cause bursting. Keep can away from electrical current or battery terminals. Electrical arcing can cause burn-through (puncture) which may result in flash fire, causing serious injury. Keep from children.
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### X. TRANSPORTATION DATA (49 CFR 172.101)

<b>Domestic Surface</b>	
Description:	Consumer Commodity
Hazard Class:	ORM-D
ID No:	None
Label Required:	Consumer commodity (ORM-D)

### XI. REGULATORY INFORMATION

All ingredients for this product are listed on the TSCA inventory.	
SARA Title III chemicals:	None
California Prop 65 chemicals:	None
CERCLA reportable quantity:	None
RCRA hazardous waste no:	D001 (Ignitable)

SIGNATURE: \_\_\_\_\_ R. Miles *R. Miles* TITLE: \_\_\_\_\_ Technical Director

REVISION DATE: \_\_\_\_\_ NOVEMBER 2003 \_\_\_\_\_ SUPERSEDES: \_\_\_\_\_ MARCH 2001 \_\_\_\_\_

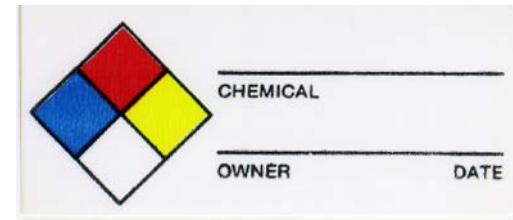
NA: Not applicable NDA: No data available ◀ = Less than ▶ = More than

We believe the statements, technical information and recommendations contained herein are reliable. However, the data is provided without warranty, expressed or implied. It is the user's responsibility both to determine safe conditions for use of this product and assume loss, damage or expense, direct or consequential, arising from its use. Before using product, read label.

MSDS-A

- Incoming containers must be labeled by manufacturer or distributor
  - Required minimum information:
    - Product name
    - Manufacturer/distributor
    - Address
    - Hazard information
- Labels must be intact and attached to the container, prominently displayed on the container, and written in English
- Never remove or deface labels unless container is empty
- Inspect containers on a regular basis to ensure labels are secure and still legible
  - If label is partially coming off, reattach with adhesive or clear packing tape
  - If label is becoming illegible, use an approved University secondary container label to re-label the container

- All must be labeled
  - Product name as it appears on the MSDS
  - Hazard information
    - health
    - flammability
    - reactivity
    - special hazard
    - personal protective equipment
- Labels are available from Radiological and Environmental Management (REM)
  - Uses NFPA diamond hazard identification system

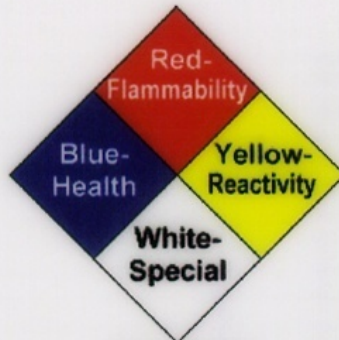


## Hazard Warnings

### Quick Visual Identification

Based on NFPA 704 Warning Diamond

This guide is intended to provide a quick reference to the relative hazards of chemicals based on label information. In emergencies leave the area and contact local emergency response.



Color Coded



Black and White

Number Rating	Signal Word	Hazard Warning Class	Number Rating	Signal Word	Hazard Warning Class
Health Hazard (Blue)			Reactivity (Yellow)		
4	Danger/Deadly	May be fatal on short exposure. Special PPE required.	4	Danger	May detonate. Explosive material at room temperature
3	Extremely Hazardous	Corrosive, sensitizer, or toxic. Avoid skin contact and inhalation. Use appropriate gloves and eye protection. Respiratory PPE may be needed.	3	Danger	Shock and heat may detonate. May be explosive if shocked, heated under confinement, or mixed with water
2	Hazardous	May be harmful if inhaled or absorbed	2	Warning	Violent chemical change. Unstable or may react violently if mixed with water.
1	Slightly Hazardous	May be irritating to eyes, skin, and mucous membranes. Appropriate gloves should be worn. Eye PPE may be needed.	1	Caution	Unstable at elevated temperature. May react if heated or mixed with water but not violently.
0	Normal	No unusual hazards.	0	Stable	Not reactive when mixed with water.
Flammability (Red) [flash points]			Special Notice/Special Hazard Information (White)		
4	Danger	Flammable gas or extremely flammable liquid. [ $< 73^{\circ}\text{F}$ ]	<b>W</b>	Water reactive	<b>RAD</b> Radiation Hazard
3	Extremely Hazardous	Flammable liquid [ $73-100^{\circ}\text{F}$ ]	<b>OXY</b>	Oxidizer/Oxidizing agent	<b>Acid</b> Acid, pH $< 7$
2	Hazardous	Combustible liquid [ $100 - 200^{\circ}\text{F}$ ]	<b>COR</b>	Corrosive	<b>ALK</b> Alkali, basic pH $> 7$
1	Caution	Combustible if heated	<b>SENS</b>	Sensitizer	<b>CARC</b> Carcinogen
0	Normal	Not combustible/will not burn			

- The DTI for your work area is:

NAME: \_\_

ROOM: \_\_

PHONE #: \_\_\_\_\_

EMAIL: \_\_ <https://engineering.purdue.edu/>\_\_

- The written compliance manual is in: \_\_
- MSDSs and chemical inventories are located near the door of your lab
- All containers must be labeled
- Secondary labels available from DTI
- Ask questions when you're not sure about a product



- You are responsible for you own safety
- You are responsible for everyone else's safety
  - Do not rush
  - Ask questions
  - Do things carefully and correctly
  - Know your surroundings before starting an activity
  - Stop unsafe activities
  - Do not touch or operate systems you are not familiar with or do not need for your operations
- Clean up every day
- Put tools away after every use
- Wear safety glasses at all times when working in test cells or in buildup areas

# Know your surroundings

- Locate:
  - Safety shower
  - Fire extinguishers
  - Emergency exit(s) (and path to it)
  - First aid kit
  - PPE (Personal Protective Equipment)



- Wear hearing protection
- Report defective or worn equipment
- Lock doors and/or gates if last to leave
- In the event you are injured:
  - Do not hesitate to seek medical care.
  - Notify \_\_\_\_\_ immediately so that appropriate paperwork can be completed to assure proper insurance coverage is applied to your treatment.

# If you need to dispose of a chemical

- Establish and identify an area to accumulate hazardous waste near the point of generation.
- Identify and separate the hazardous waste by hazard class.
- Select an appropriate container for the waste.
- Label all the hazardous waste containers with the words **.HAZARDOUS WASTE.** and the chemical name and percent composition of each constituent.
- The chemical waste containers must be tightly capped at all times, except when adding waste.
- Segregate containers according to compatibility.
- For the removal of the chemical waste, send to REM a complete Hazardous Material Pickup form ([HMM-001](#)).
- Call REM at 49-40121 for further information.
- Call Purdue Police at 911 in an emergency.

# Using Gases Safely

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# The Right Range of Supply Modes

## Cylinders



300 / 200 Size  
304 / 228 SCF

## Dewars



230 / 180 Liter  
61 / 48 Gallon  
5,658 / 4,428 SCF

## MicroBulk



230 - 2,000 Liter  
61 - 528 Gallon  
5,658 - 49,162 SCF

## Tube Trailers, Bulk



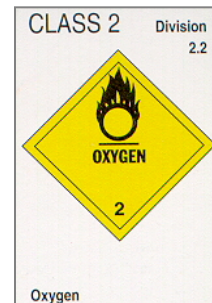
TT 45,100 / 181,155 SCF  
Bulk 500 - 13,000 Gallon  
46,500 - 1.2 mm SCF

Size

\*\* SCF expressed in nitrogen volumes

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# What's at Purdue University?



# General Hazards

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- **Non Flammable**
  - Asphyxiation
- **Flammable**
  - Fire, asphyxiation
- **Oxygen**
  - Oxygen rich environment
- **Inhalation Hazard**
  - Inhalation, ingestion, absorption



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# Compressed Gas Cylinders



# Labels



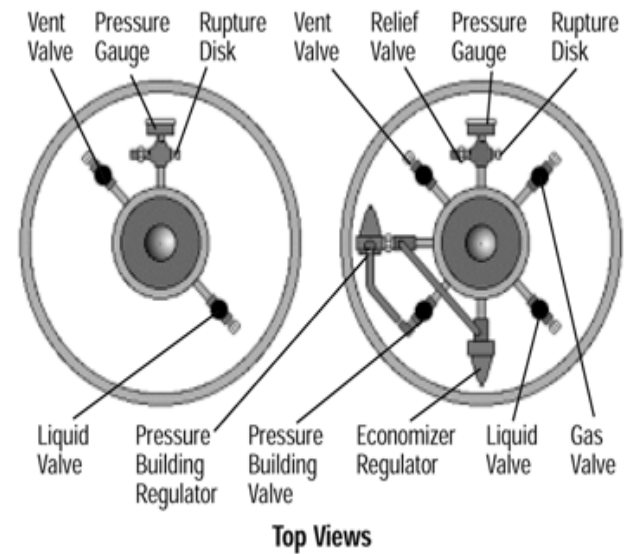
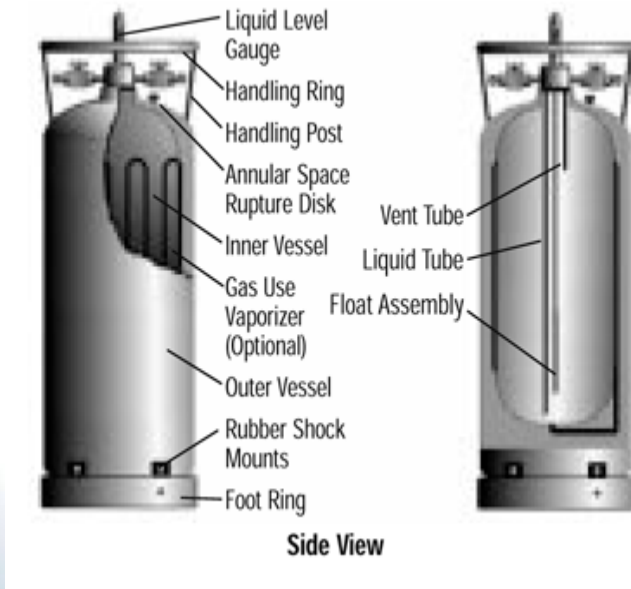
# Compressed Gas Cylinders

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- Regulated by D.O.T.
- Owned by Airgas
- Must have label to transport
- Extremely high pressure
- Stored upright, nested and chained with cap in place

# Liquid Cylinders

- Operation of Container



# Liquid Cylinders

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- Plenty of Product
  - 160 liter Nitrogen – 4,059 cu ft
  - 230 liter Nitrogen – 5,658 cu ft
- Very Heavy: 600 – 900 lbs
- Contents Extremely Cold (-300 deg)
- Easily damaged by drops or falls from any height
- Filled by weight – only way to assess how much product remains in cylinder

# Normal Evaporation Rate

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- Normal Evaporation Rate (NER)
  - Indication of how well the insulation system performs its ability to hold cryogenic liquid.
  - Set by manufacturer and very optimistic
  - Nitrogen – 1.8%

# Liquid Cylinders

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- Outlet Connections
  - Secured with anti-tampering devices or silver soldered.
  - CGA fittings designed for your safety.
- Pressure Relief Devices
  - Do not block or alter.

# Plugged Pressure Relief Device

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*“I Needed More Pressure”*



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# Expansion Rate (Nitrogen – 696x)

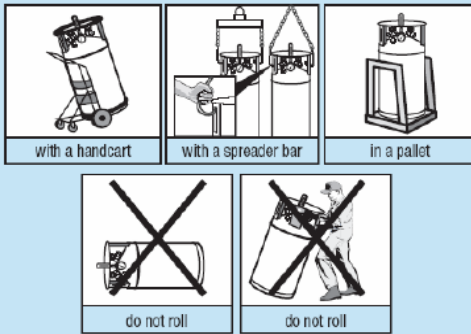


View of freezer in Room 803A  
source of explosion

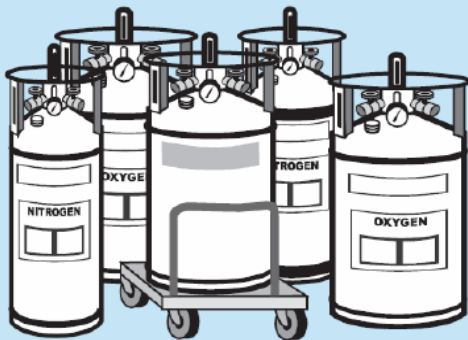
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# Moving Liquid Cylinders

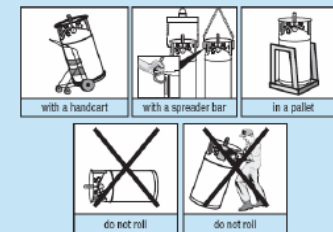
**Figure 3**  
How to Handle Liquid Containers



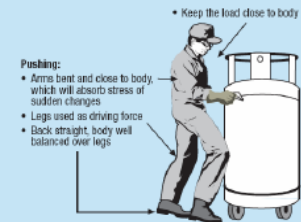
**Figure 2**  
Containers May Be Supplied with Various Wheel Configurations



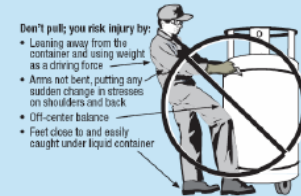
**Figure 3**  
How to Handle Liquid Containers



**Figure 4**  
Moving Liquid Containers: Push, Don't Pull



If the container tips over... let it go!



# Liquid Cylinder Handling

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- Use adequate personal protective equipment when hooking up or unhooking.
- Always use carts designed for liquid cylinder movement.
- Keep liquid cylinder upright.
- Watch out for direction of pressure relief device – it releases without warning.
- Get help when needed.

# Liquid Cylinders

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- Don't become a casualty!
  - Beware of confined spaces where a liquid can could displace oxygen.
    - Pit
    - Deep depression
    - Closet
    - Elevator
    - Lab

# CGA Fittings & Regulators

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- Don't
  - Use lubricants
  - Force regulators
  - Use adaptors
  - Rely on color of cylinder for contents
- Always read the label

**DO NOT USE ADAPTERS!**

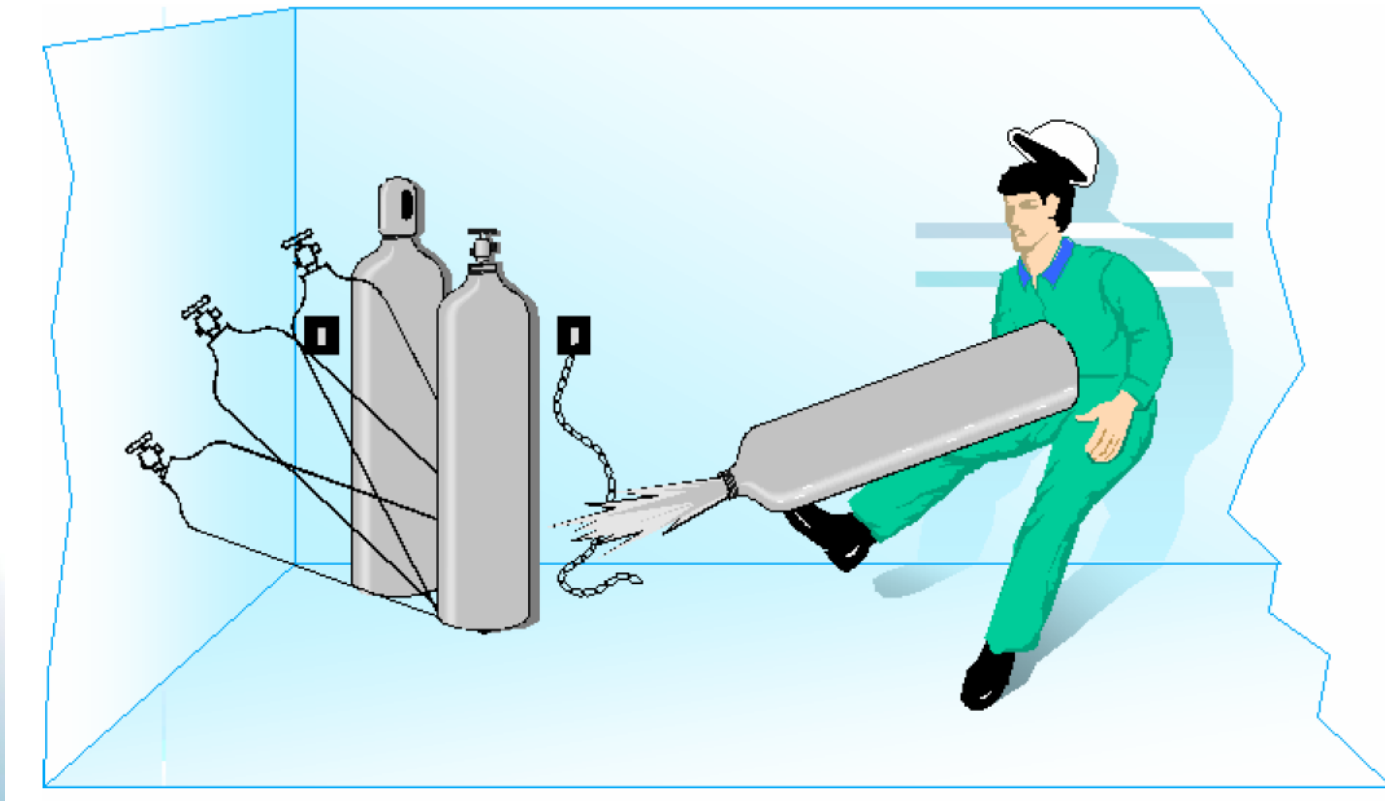


# Storage of Gases

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# Pressure

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# Storage of Gases

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- Cap in place
- Nested and chained
- Flammables and oxidizers separated by at least 20 feet
- Away from heat sources
- Maintain below 125 deg F



# When Things Go Wrong

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# AERO Team

**A**irgas

**E**mergency

**R**esponse

**O**rganization



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# AERO Team

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- Trained to Hazardous Materials Technician level, 29 CFR 1910.120(q)
  - Airgas – 207 Technicians
  - National Welders – 10 Technicians
- Skilled in compressed gases
  - Confinement and Containment
  - Product Transfer
  - Product Remediation
- Largest ER Network in the industry



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# AERO Team Equipment

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- PPE – Up to Level A (vaportight suits and SCBA)
- Monitoring equipment
- High Pressure Containment
- Low Pressure Containment
- Mitigation Equipment



# Summary

## Understand the properties

They will give you confidence that your method is safe and effective

## Inform your employees of the hazards

Fulfill employer requirements by providing a simple, documented, “Right-to know” training session

## Store the cylinders in a safe place

Keeping secured cylinders out of high traffic areas avoids accidents

## Follow the instructions

Each MSDS provides instructions on the safe use of gases

