



Things That Go  
**BOOM**

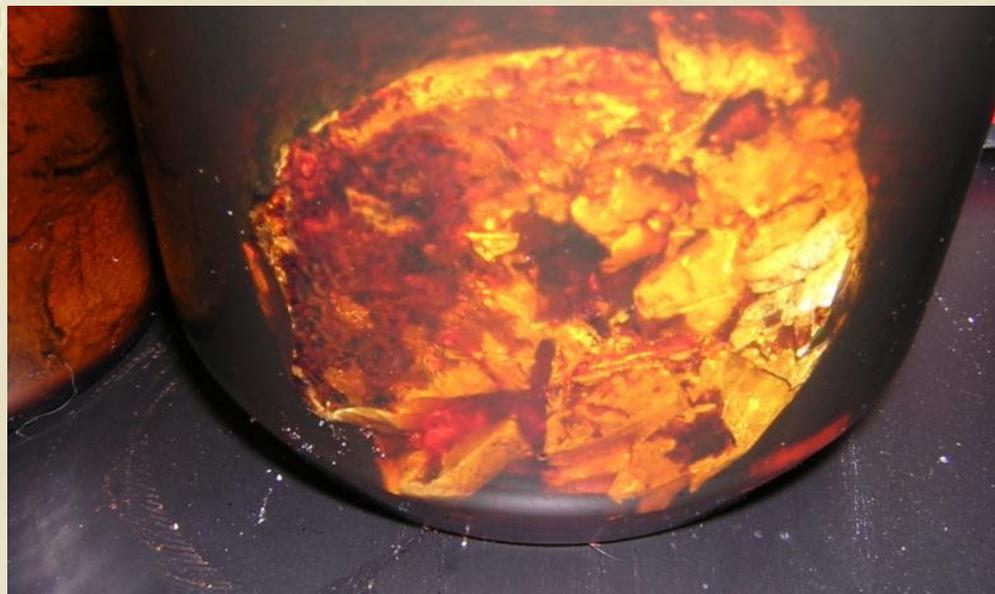
Dave Waddell  
NAHMMA

Waddell Environmental LLC  
[waddellenviro@yahoo.com](mailto:waddellenviro@yahoo.com)



# Part One:

## Highly Reactive and Unstable Chemicals



# Goal 1. Keep you out of trouble



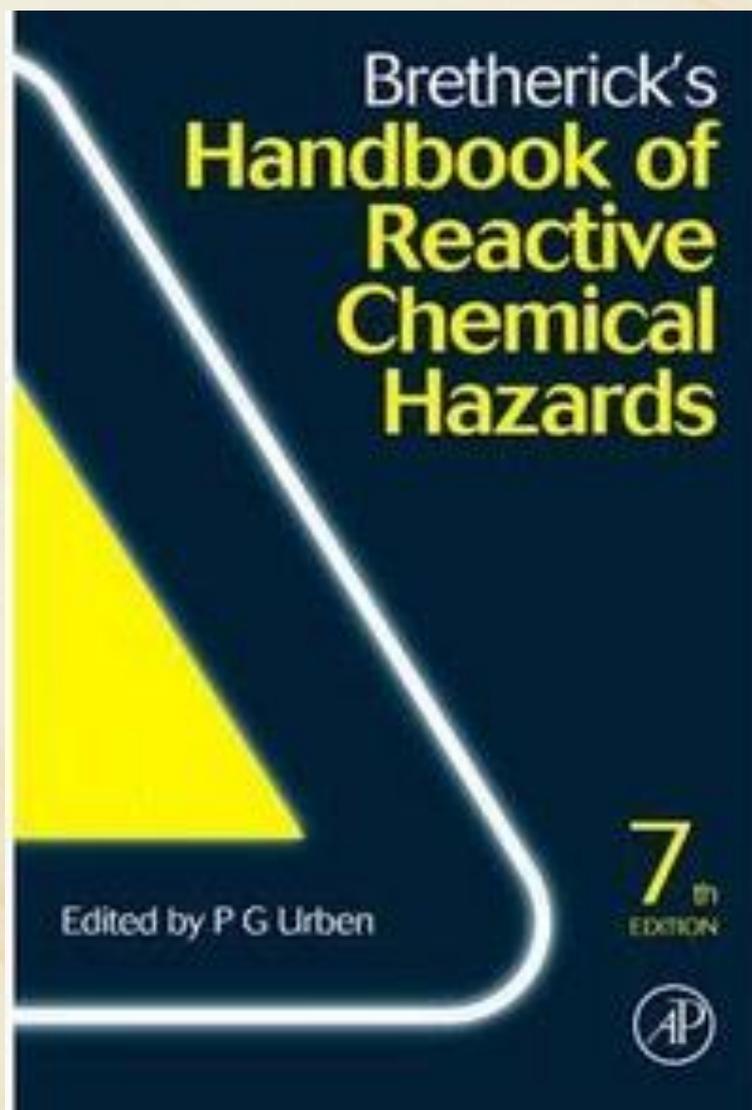
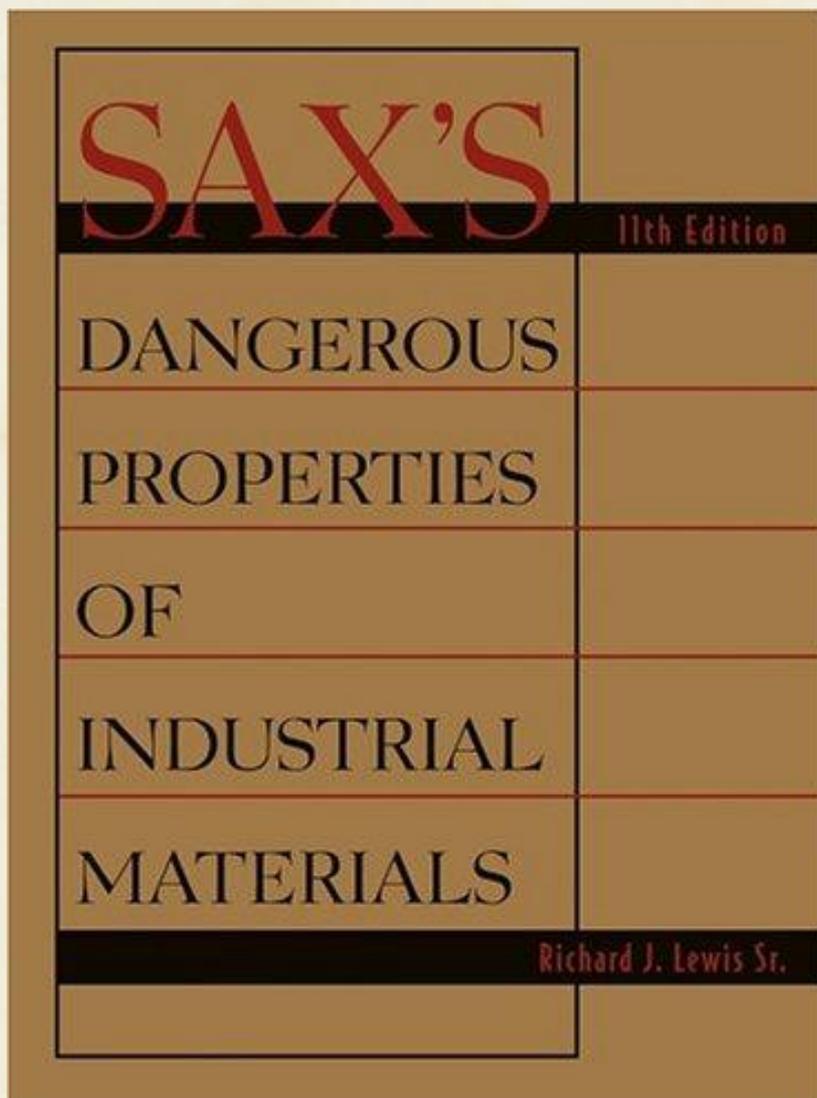
## Goal 2. Keep you awake



# Goal 3. Keep it light (bomb squad humor)



# Handbooks of Reactive Chemicals



# University Websites - Great Resources



ENVIRONMENTAL PROTECTION

*University Safety and Assurances*



Safety & Health

Risk Management

Environmental Protection

Animal Care Program

Institutional Review Board

Navigation Menu is Empty

## Reactive Chemicals

Laboratory workers must be trained to recognize those chemicals which they may come across which are potentially reactive or explosive. Reactive chemicals, for the purpose of this page, are defined as those substances which can, in contact with air, water or other common substances, vigorously or violently give off heat, energy or toxic gases or vapors. Some of the classes of chemicals which can contain reactive chemicals include:

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- [Air Reactive Chemicals-Pyrophoric](#)
- Blasting Agents
- Cyanide containing compounds
- [Explosives](#)
- Fuming Acids
- Heat Sensitive
- Organic Peroxides
- [Peroxide Formers](#)
- [Polymerizing Chemicals](#)
- Pyrotechnics
- Shock Sensitive
- Spontaneously combustible
- [Water Reactive Chemicals](#)



# Household Hazards Line Gets a Call



- My father died.
- Found old chemicals in the basement
- Can I drive them to the HHW site?

# HHW Staff Asked for a List

- Two chemicals stood out
  - Ethyl Ether
  - Picric Acid
- Don't come to us, we'll visit you!

# First Impression





- Crystals

- Corks

- Residue on shelf

- Tripping hazards



COCHINEAL

POISON

POTASSIUM  
FERROCYANIDE  
 $K_4Fe(CN)_6$

AMMONIUM  
OXALATE  
(NH<sub>4</sub>)<sub>2</sub>C<sub>2</sub>O<sub>4</sub>

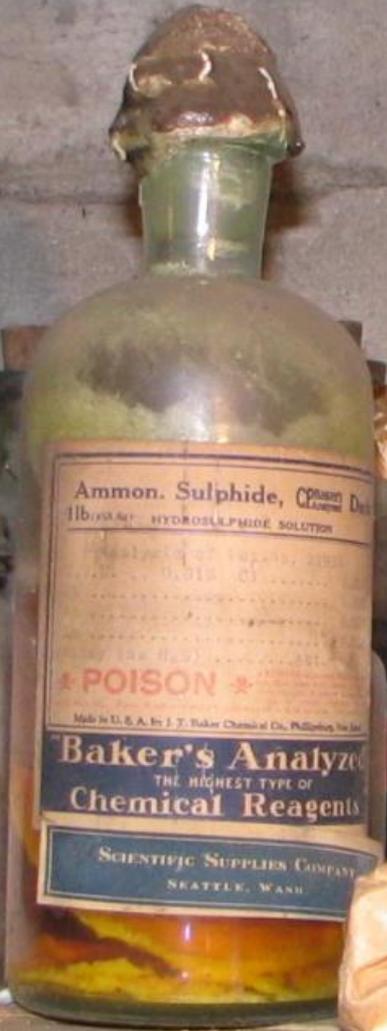
Red  
Phosphorus

LEAD  
NITRATE  
Pb(NO<sub>3</sub>)<sub>2</sub>

FERRIC  
AMMONIUM  
CITRATE

The world's  
most sought-  
after hair-  
aucty

The Golden State  
1928 and 1929 - Class 172





SOLE  
PREPARED

SOLE  
PREPARED

ALUMINUM  
HYDROXIDE

SODIUM  
PERMANGANATE  
4 OZ.  
Fischer-Frank Drug Co.

SODIUM  
ALUMINATE

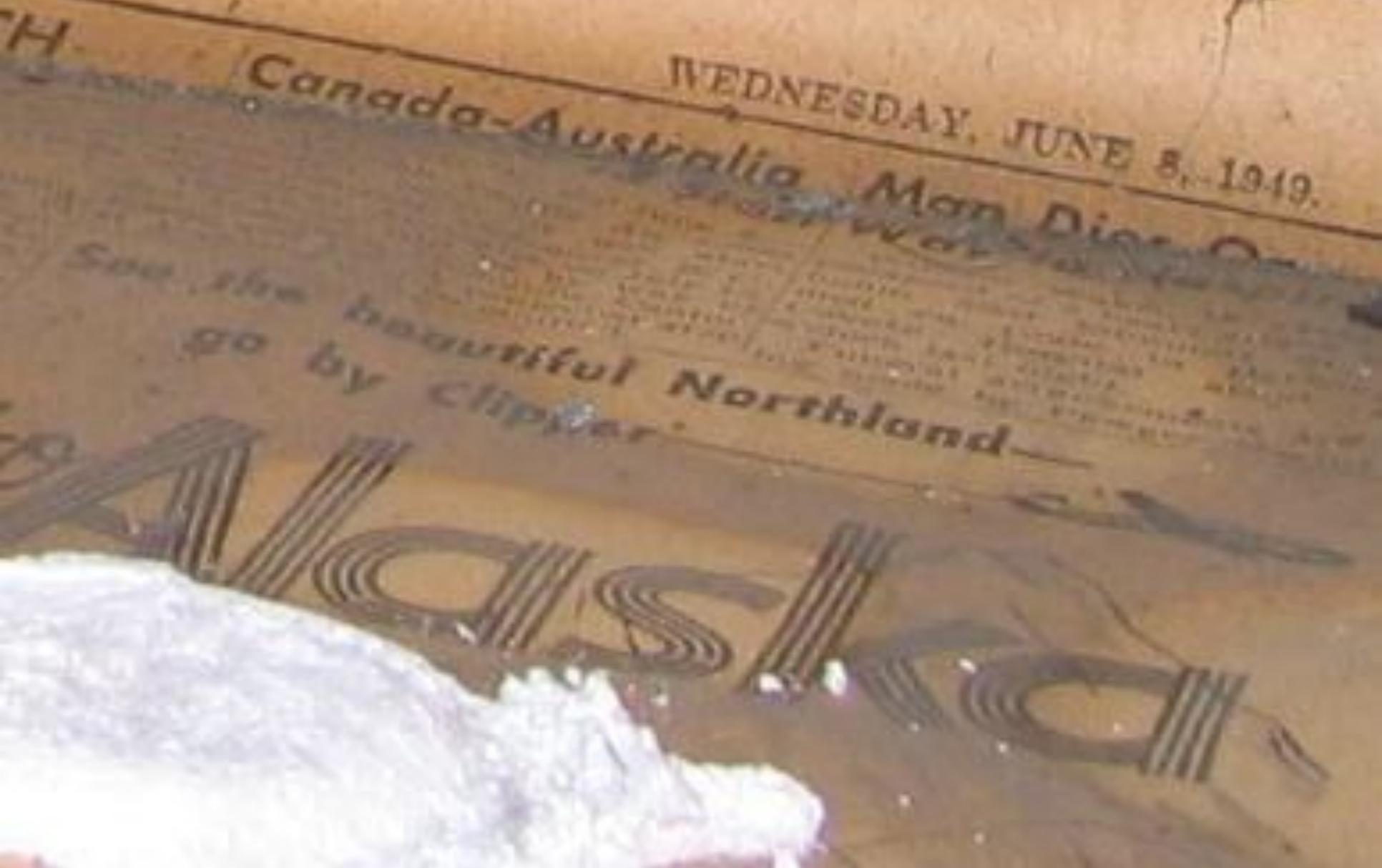
ANTHRACENE

Small quantities last, you get regular



- Gilbert Chemistry Kit
- “Not for children who can’t read”
- Copyright 1936
- 75 chemical containers

June 8, 1949 paper under bottles



WEDNESDAY, JUNE 8, 1949.

Canada-Australia Man Dies On Ship  
Start War

See the beautiful Northland  
go by Clipper

Adverts

# Potential Explosives



Located 8 blocks from my office



# An interlude with “Dr. Boom”

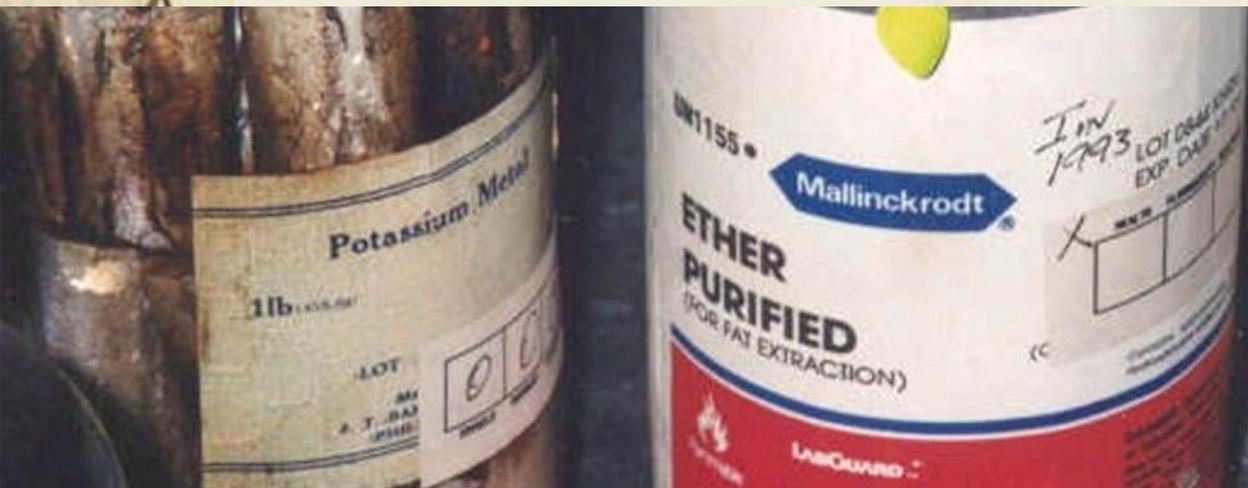
- An Introduction to Reactive & Explosive Materials
  - Hazard Productions, Inc.
  - <http://www.rhr-inc.com/hazpro.htm>
  - \$350 for the DVD

Do we know each chemical's hazards?



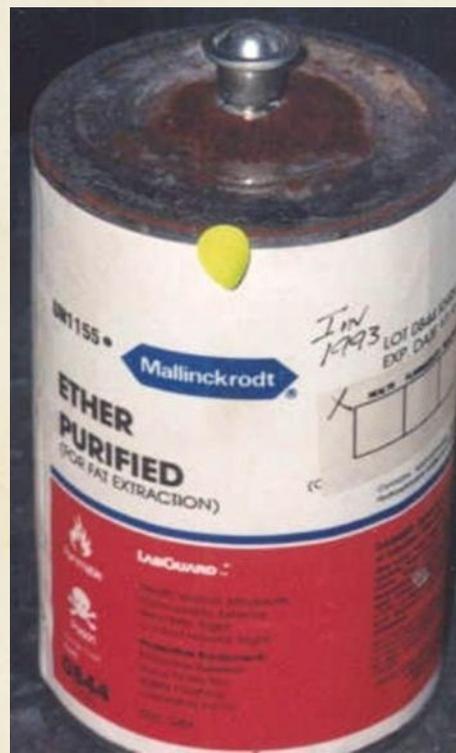
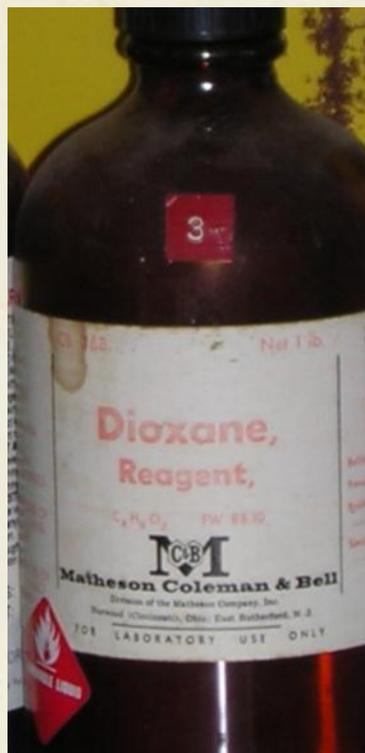
# Common Explosive Chemicals

- Peroxide-formers
- Nitro organics
- Organic peroxides
- Contaminated compounds



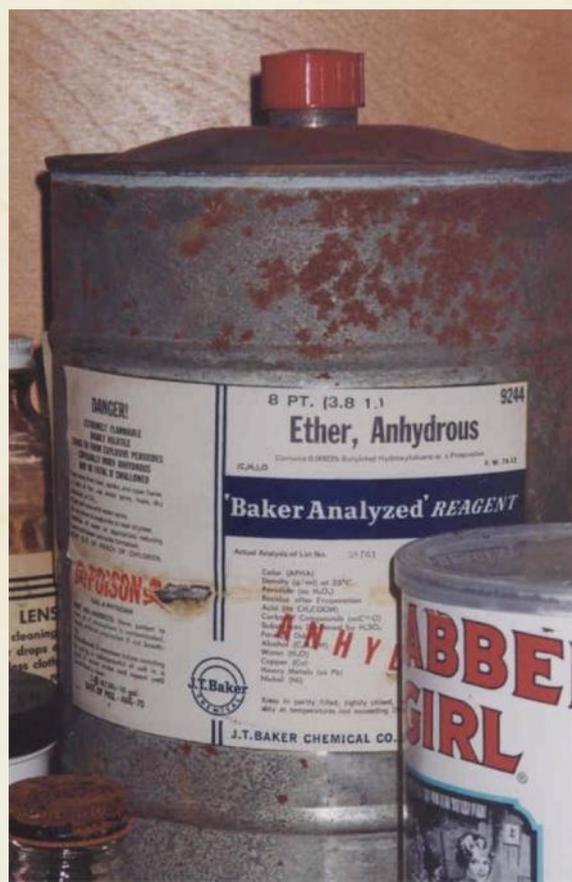
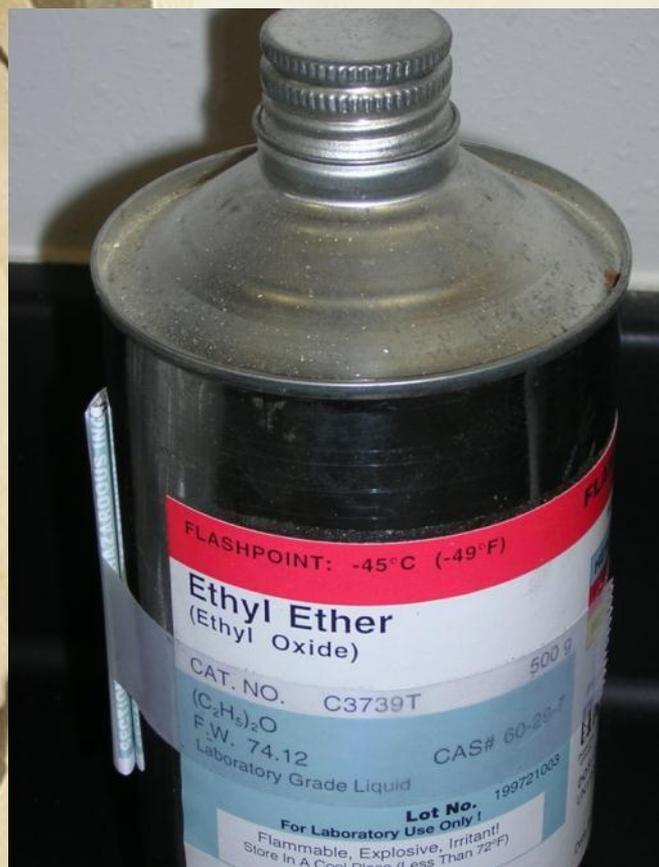
# Peroxidizable Solvents

- Peroxides form when vapors mix with oxygen – usually in cap's threads
- Shock sensitive explosives



# Diethyl Ether is Most Common

- aka – Ether, Ethyl Oxide, Ethyl Ether
- Used as anesthetic & organic solvent



# Scariest One You May Find

Isopropyl Ether = Bomb Squad

They took bottle outside, spontaneously shattered

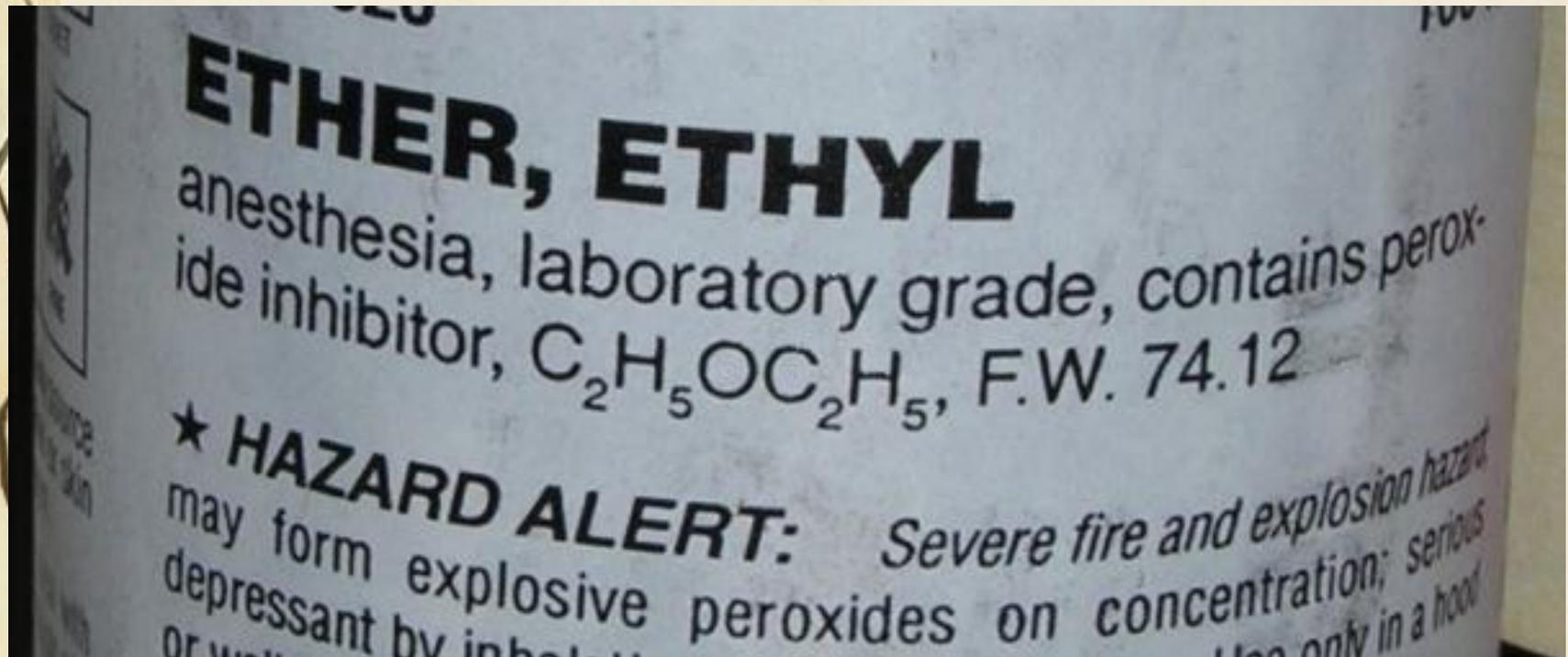


# It then Auto-Detonated Shock and Light-sensitive



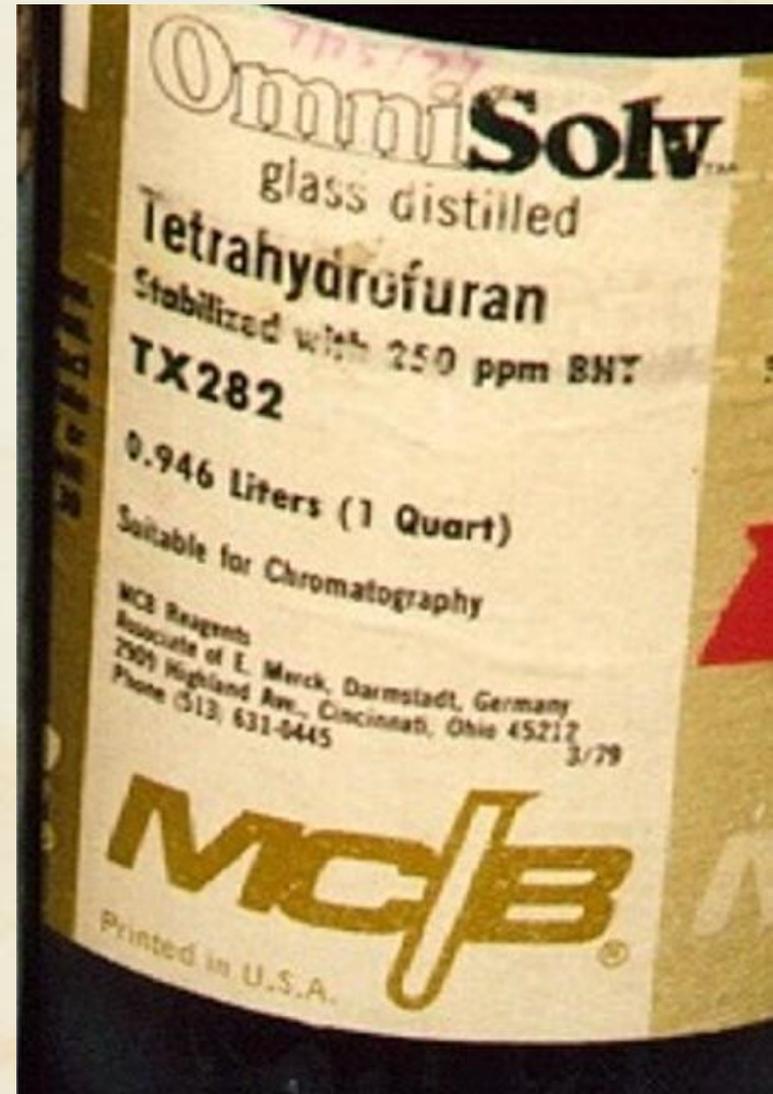
# Peroxide Inhibitors

- Typically around 200 ppm BHT
  - Butylated Hydroxytoluene
- >200 ppm peroxides form, BHT is gone



# How Storage Can Affect Hazards

- Flammable
- Peroxide former
- Stabilizer: BHT
- Stored in a freezer
- BHT is temp. sensitive
- THF flash point = 7° F
- Enhanced explosion risk



# One way to test ether for peroxides

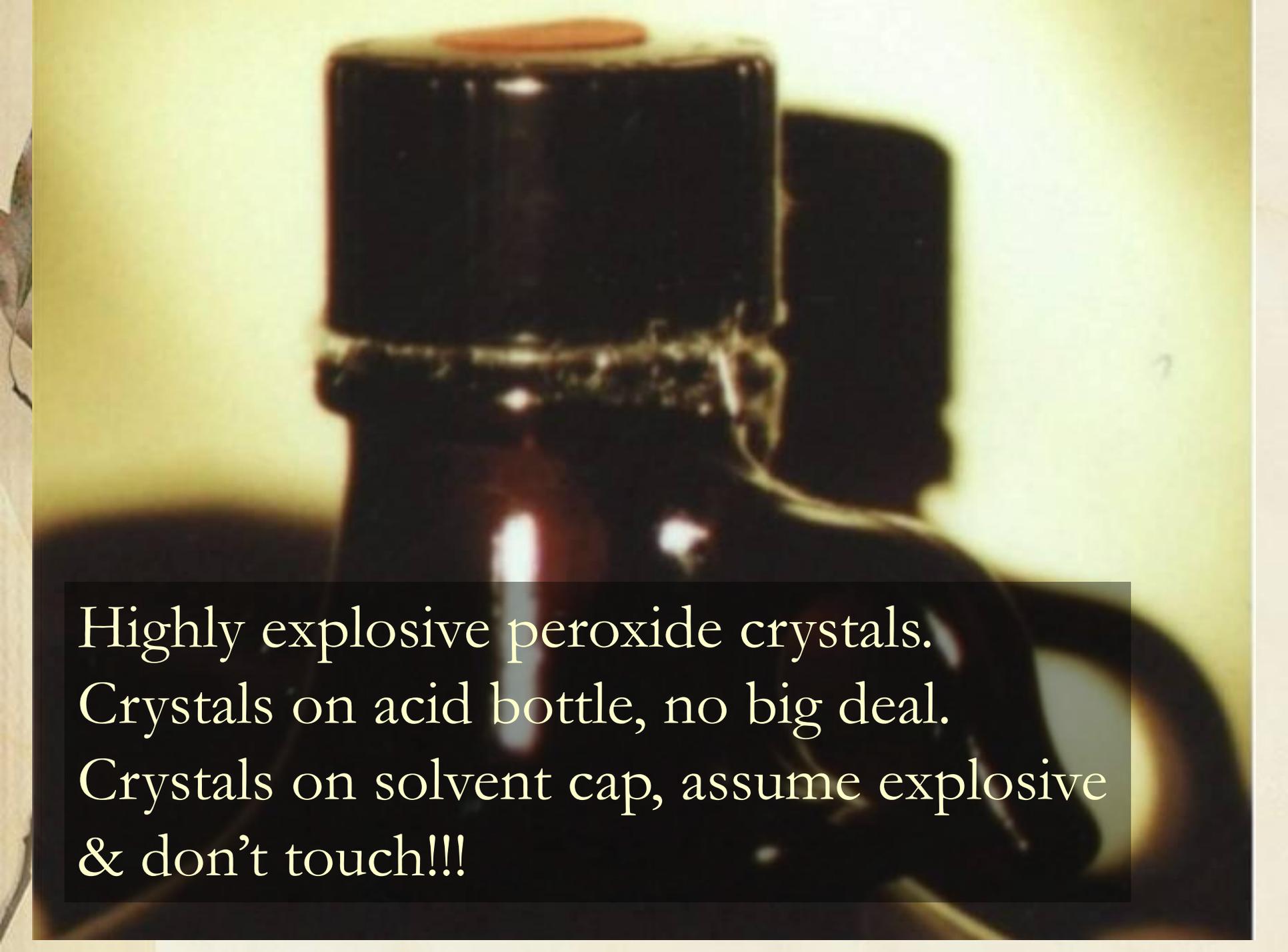


# Half Pint of Ethyl Ether



# 25 Foot Fireball





Highly explosive peroxide crystals.  
Crystals on acid bottle, no big deal.  
Crystals on solvent cap, assume explosive  
& don't touch!!!

“Grandpa died, left a full garage”



- Chemicals on front porch
- Garage too full to hold them
- Grandpa worked in mining
- Acids, adhesives, etchants, metal powders, unknowns



# Unknown Lumps in Jar

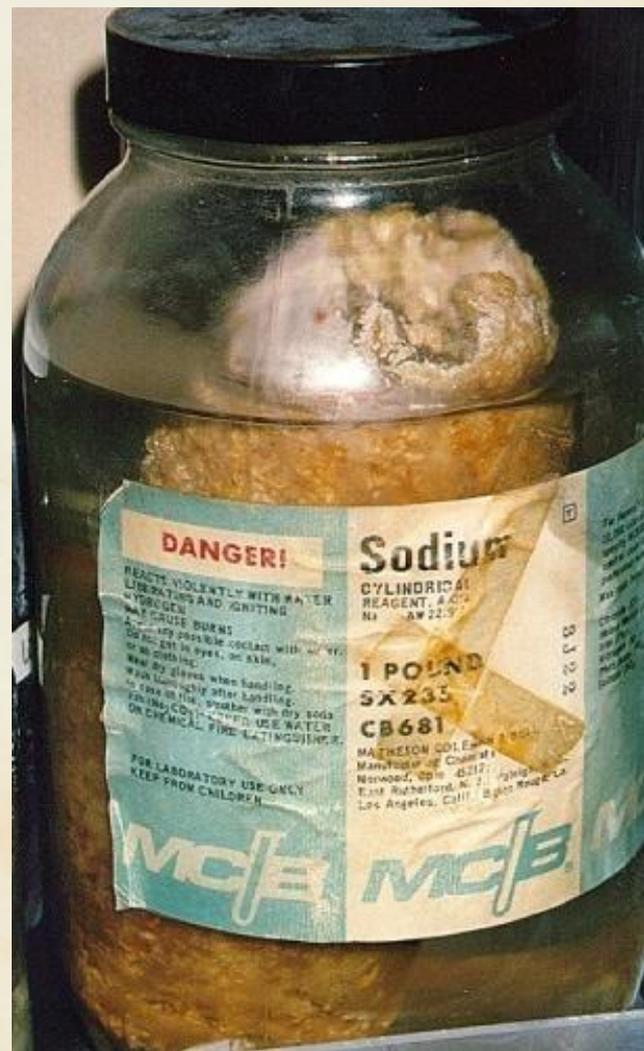


“I think that may be potassium.  
I saw a label somewhere”

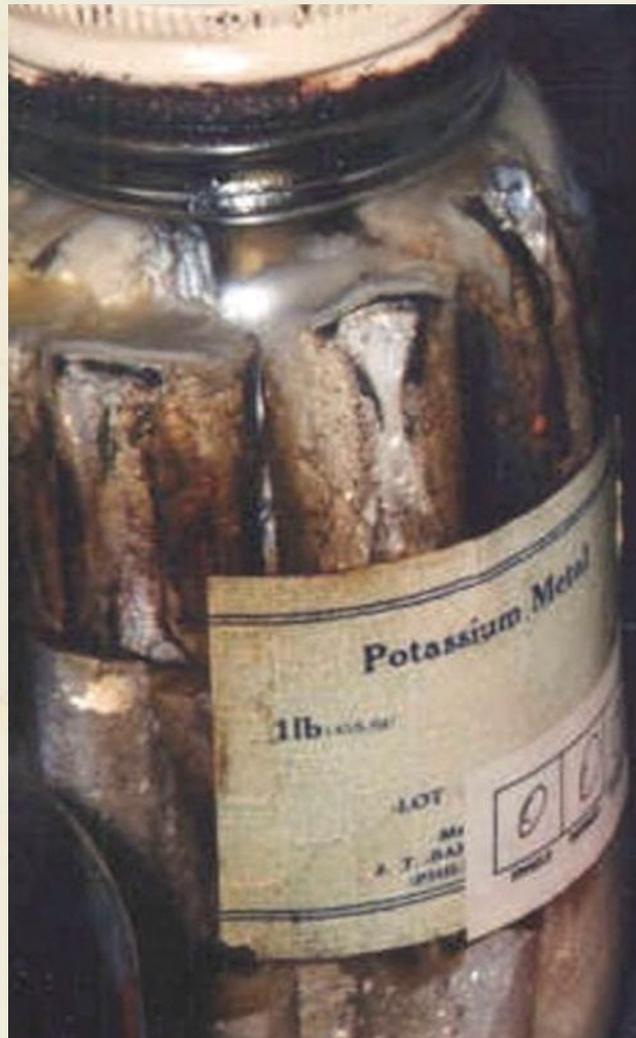
- Diagnostic lumps
- Our labeling
- Purple spot



# Potassium & Sodium Oxidizing



# Solid Potassium Metal Peroxide Former & Water Reactive



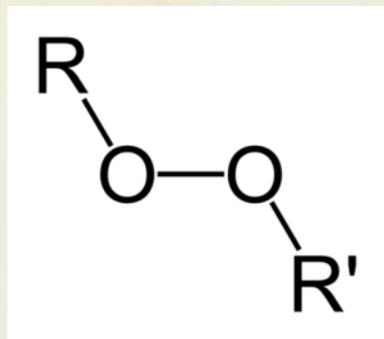
# Potassium Metal ( $K_2$ ) – Color Key

- Silver – Potassium metal -Water Reactive
- White – P. Hydroxide – Corrosive
- Yellow/Orange – P. Superoxide  
– Water reactive, corrosive, unstable
- Red – P. Ozonide - Highly reactive, explosive



# Peroxidizable Solvents I've Seen

- Peroxides without concentration
  - Isopropyl Ether
  - Potassium Amide
  - **Potassium Metal**
  - Sodium Amide
- Peroxides if concentrated by evaporation & distillation
  - **Acetaldehyde**
  - Benzyl Alcohol
  - Cumene
  - Cyclohexanol
  - **Cyclohexene**
  - **Diethyl Ether**
  - Dioxane
  - Methyl Isobutyl Ketone
  - **Tetrahydrofuran**
  - Vinyl Ether



## Office for Research Safety

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Home **EMERGENCIES** Training Forms Safety Information ISIS About ORS Contacts

Home >> Safety Information >> Chemical >> Hazard Groups >> Peroxidizable Compounds

## Hazard Groups

Corrosives: Acids and Bases

Flammable and Combustible Liquids

Compressed Gases

Cryogenic Liquids and Liquefied Gases

Highly Reactive Chemicals

Note: The following is an excerpt of the [Chemical and Biological Safety in Laboratories](#).

## Peroxidizable Compounds

## List of Peroxidizable Compounds

Acetal	Diethyl ether	Isopropyl vinyl ether
<b>Acetaldehyde</b>	Diethyl fumarate	2-Isopropylacrylaldehyde oxime
Acrylamide	Diethylene glycol dimethyl ether	Isovaleraldehyde
Acrylic Acid	Diethylketene	<b>Limonene</b>
Acrylonitrile	Diglyme	1,5-p-Menthadiene
Allyl ethyl ether	2,3-Dihydrofuran	Methoxy-1,3,5,7-cyclo octatetraene
Allyl phenyl ether	2,3-Dihydropyran	2-Methoxyethanol
Allyl vinyl ether	Diisopropyl ether*	2-Methoxyethyl vinyl ether
1-Allyloxy-2,3-epoxypropane	1,1-Dimethoxyethane	Methyl acetylene
Benzyl-1-naphthyl ether	1,2-Dimethoxyethane	<b>Methyl methacrylate</b>
Benzyl butyl ether	1,1-Dimethoxypropane	4-Methyl-1,3-dioxane
Benzyl ethyl ether	2,2-Dimethoxypropane	2-(1-Methylheptyl)-4,6 dinitrophenyl crotonate
Bis(2-ethoxyethyl) ether	3,3-Dimethoxypropene	2,3-Methyl-2-methylene butanal
Bis(2-methoxyethyl) ether	2,2-Dimethyl-1,3-dioxolane	4-Methyl-2-pentanone
1,3-Butadiene	2,6-Dimethyl-1,4-dioxane	2-Methyltetrahydrofuran
1,3-Butadiyne	1,3-Dioxane	Methyl vinyl ether
<b>2-Butanol</b>	1,4-Dioxane	2-Penten-4-yn-3-ol
Buten-3-yne	1,3-Dioxep-5-ene	a-Pentylcinnamaldehyde
Butyl ethyl ether	1,3-Dioxol-4-en-2-one	Potassium* (forms yellow potassium peroxide on the surface)
Butyl formate	Dipropoxymethane	Potassium amide
Butyl vinyl ether	Dipropyl ether	<b>2-Propanol</b>
2-Chloro-1,3-butadiene	Divinyl acetylene*	Propionaldehyde
1-Chloro-2,2-diethoxyethane	Divinyl ether	2-Propyne-1-thiol
2-Chloroacrylonitrile	1,2-Epoxy-3-isopropoxy propane	Sodium 5,8,11,14,-eicosatetraenoate
2-Chloroethyl vinyl ether	1-Ethoxy-2-propyne	Sodium amide*
Chloroethylene	2-Ethoxyethanol	Sodium ethoxyacetylde
		Styrene

# Ether Starter Fluid

- Blend of ethyl ether & hexane or heptane
- Not peroxide forming



# Petroleum Ether

## Commonly found in schools

- Not a true ether
- Doesn't form peroxides



Collodion = Ether + Nitrocellulose



# Collodion

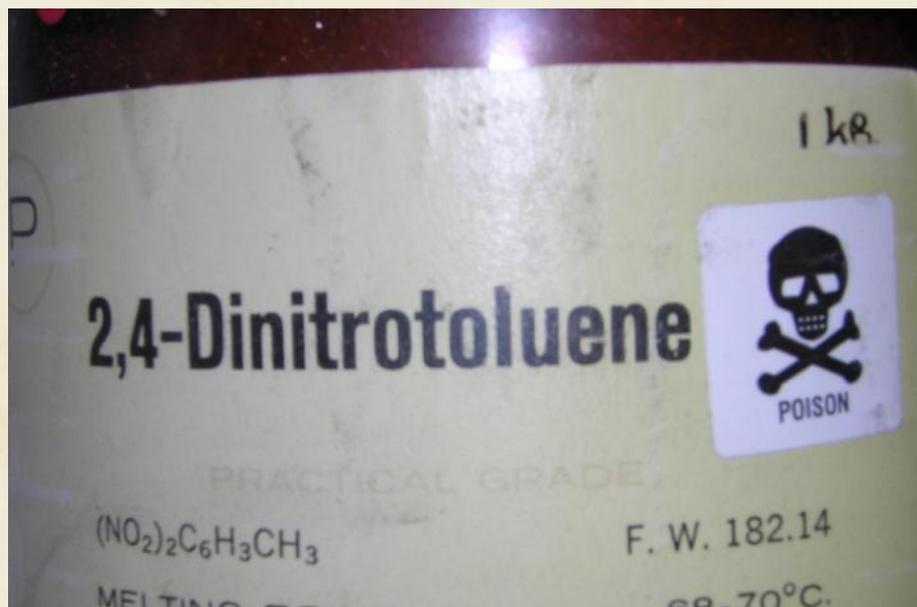
Used in Photochemistry, Science labs

- Peroxide formation risk
- Explosive reaction with nitric acid
- Shock and static sensitive



# Nitro Organics

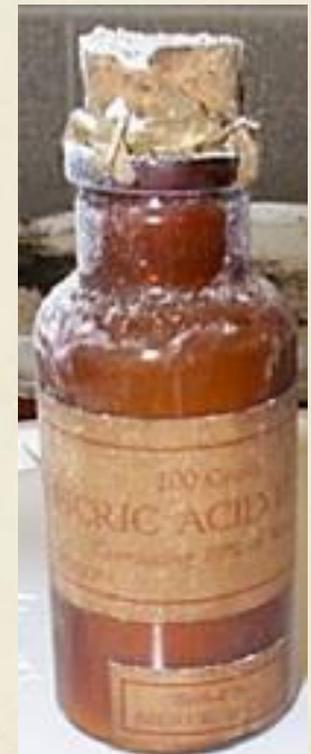
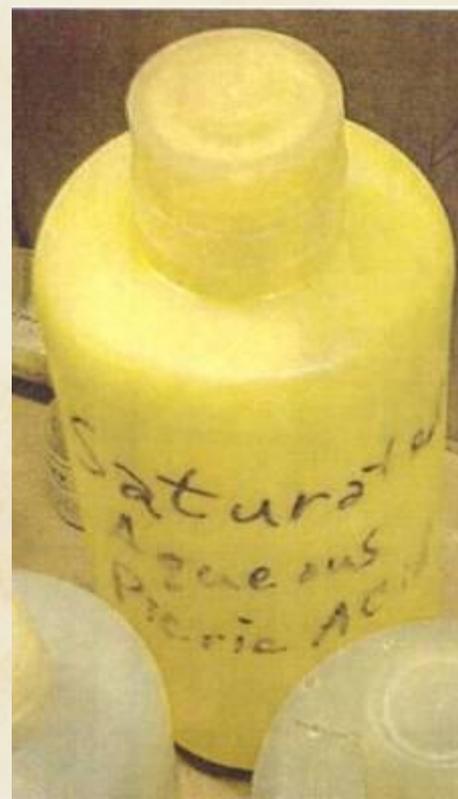
- Trinitrotoluene (TNT)
- 2,4-Dinitrotoluene
- Trinitrophenol (Picric Acid)



# Picric Acid – Trinitrophenol

(Constituent of Bouin's Fluid)

- Shock-sensitive high explosive **when dry**
- In medical labs (stains brain cells) and schools



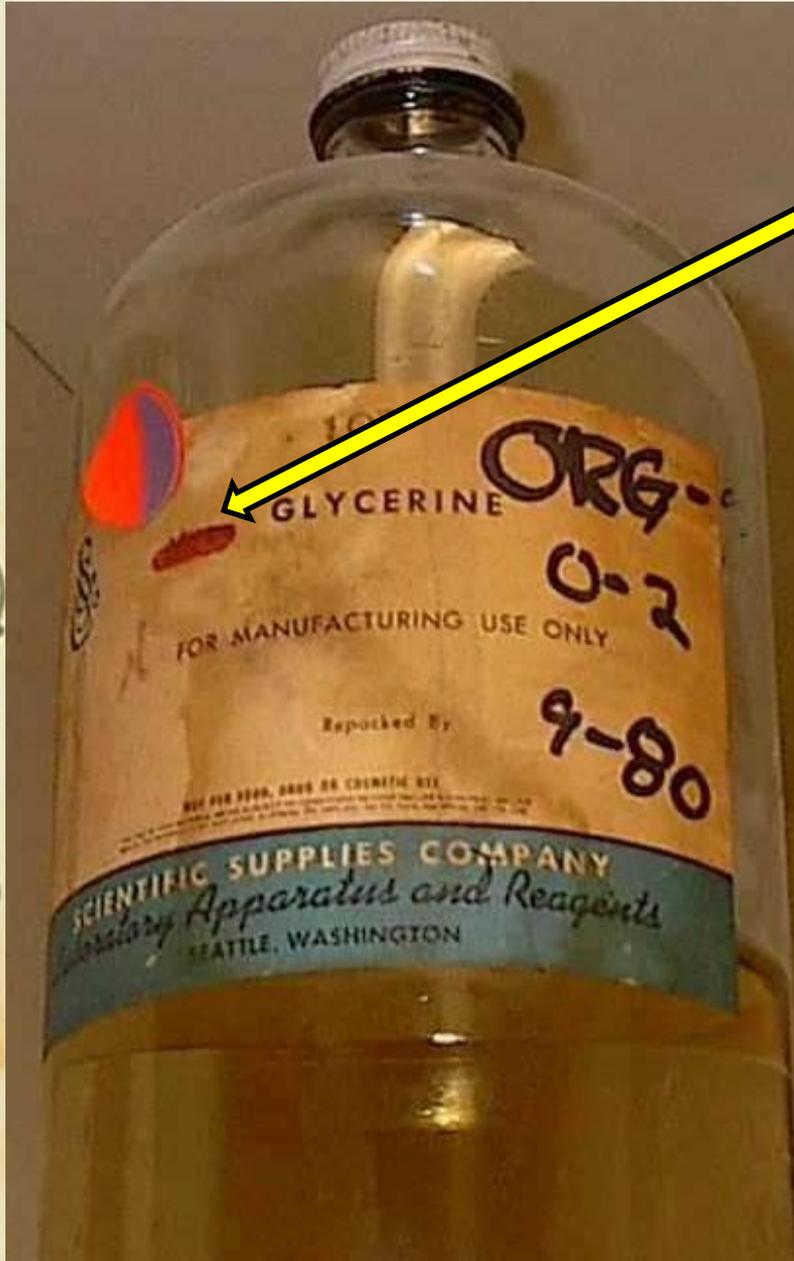
# Nitro Organics

- Picryl compounds
- Nitromethane 
- Fulminates of metals
  - Fulminate ion



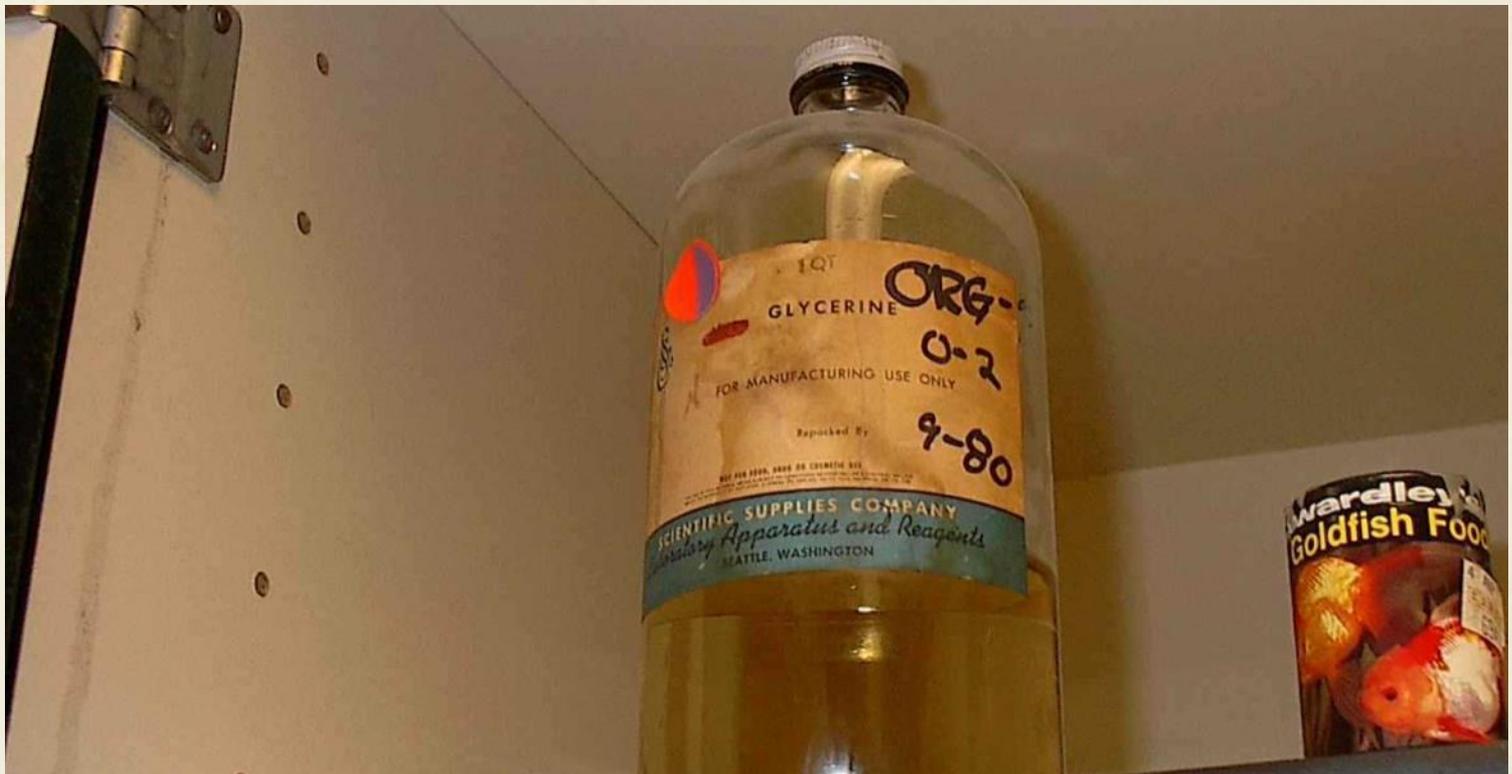
# Washington State Middle School

Hand written word "NITRO" under red dot



# Glycerine Formula $C_3H_5(OH)_3$

- Tested for nitrogen – sky high levels
- Yep, it's homemade nitroglycerine!



# HIGH EXPLOSIVES

## PRIMARY HIGH EXPLOSIVES

LEAD AZIDE

LEAD STYPHNATE

MERCURY FULMINATE

DDNP

TETRAZENE

## SECONDARY HIGH EXPLOSIVES

### BOOSTERS

PETN

RDX

### MAIN CHARGE

DYNAMITE

BINARY EXPLOSIVES

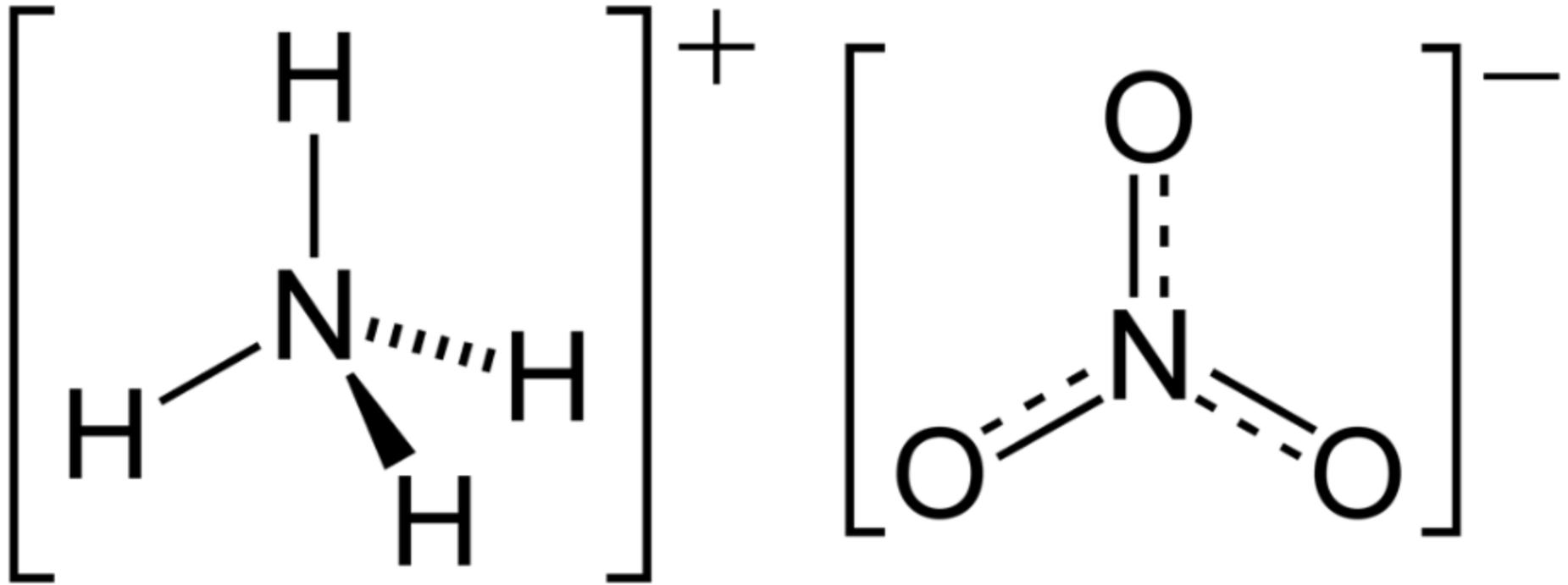
WATER GELS

EMULSIONS

TNT

ANFO

# Nitrogen Rich Oxidizer



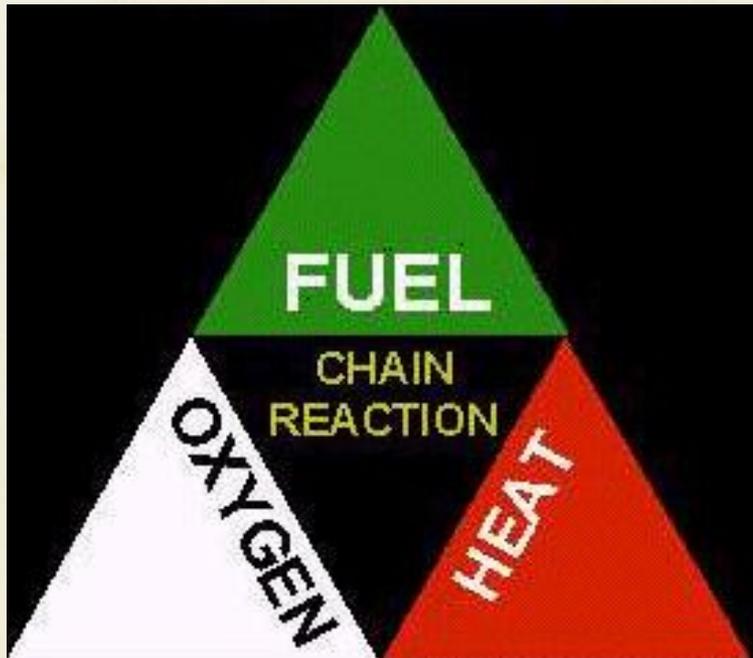
Ammonium

+

Nitrate

# ANFO

- Ammonium nitrate & fuel oil mixture
- Oxidizer + organic generates heat





# Silver Nitride (aka Ammoniacal Silver Nitrate)

## Tollen's Test for Aldehydes

- Waste contains silver fulminate
- Must immediately acidify solution
- If not, shock sensitive explosive
- Used in histopathology labs
- Used in mirror making





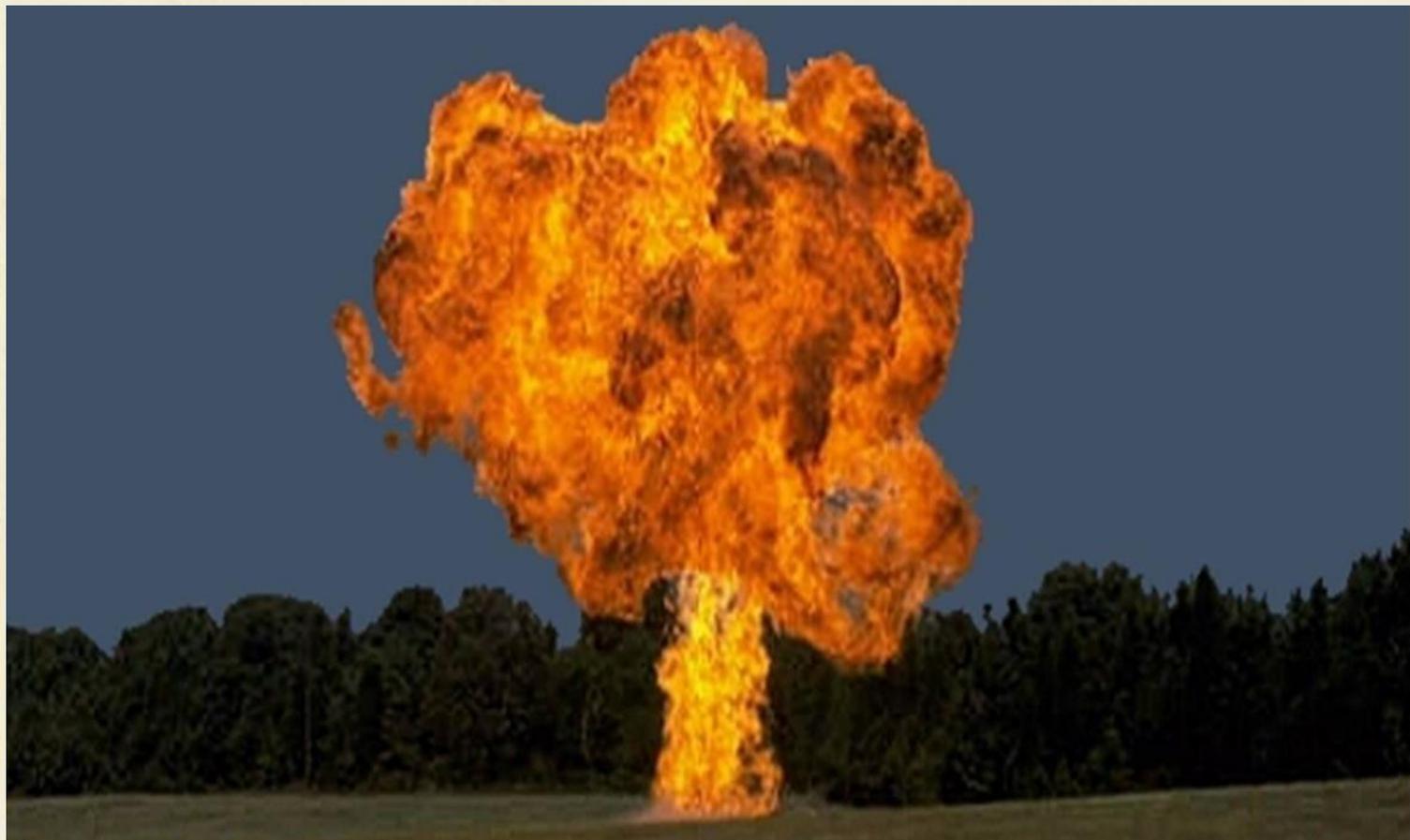
# Disposing of Explosive Chemicals

- Can be very expensive
- Available options
  - Blow it up
  - Deactivate it
- Contractors are available, not cheap
- Local emergency management can help

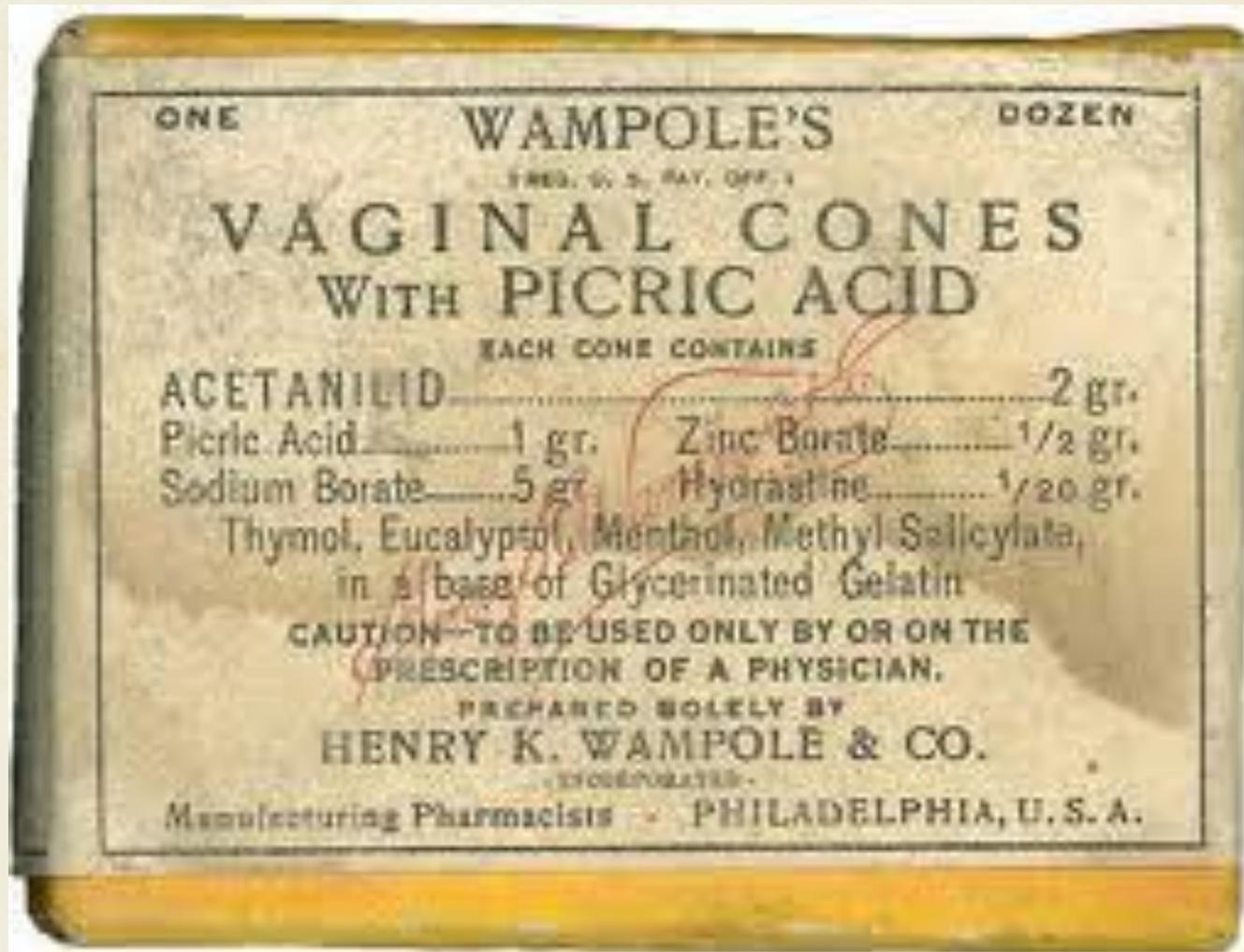
# Blowing It Up Option

Usually OK for peroxidized solvents

Serious downside if things go wrong!



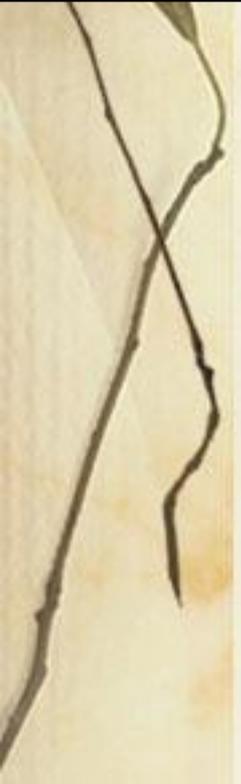
Not Recommended for Solids  
Tends to be incomplete explosion



**Chemical Deactivation:  
Focus Environmental has the  
WA state contract.**

**[zimz@aol.com](mailto:zimz@aol.com) or 815-621-2398**

**Only should be done by  
trained professionals!!!**



# Three Forms of Phosphorus

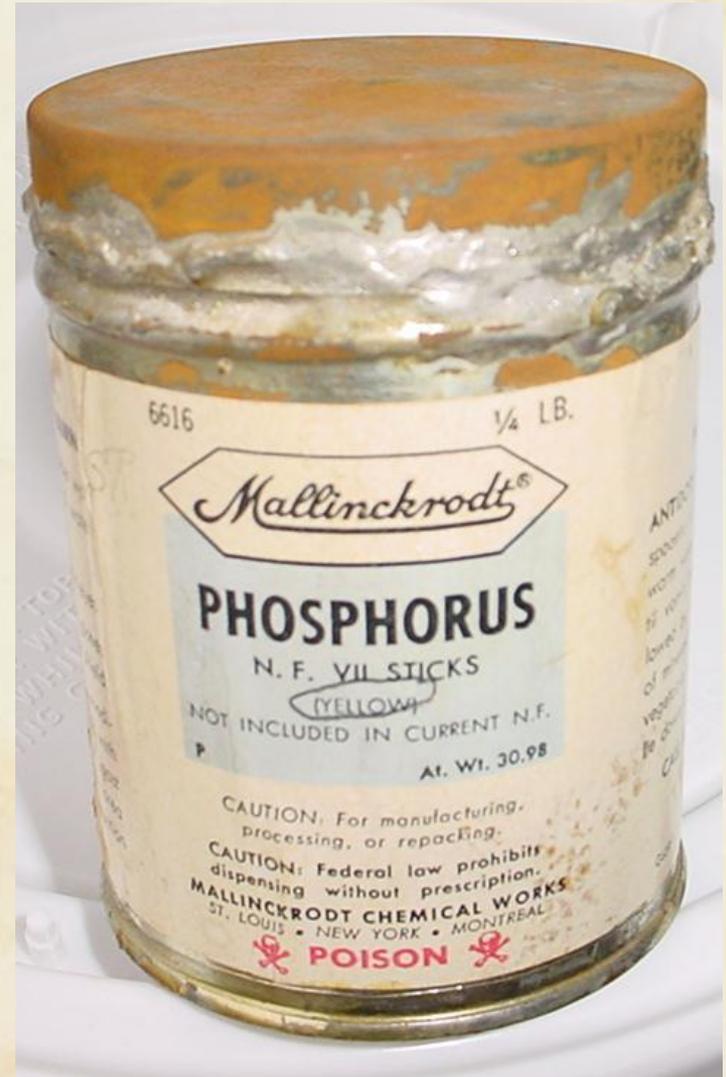
## White Allotrope

- Red P – not air reactive
  - Poison
  - Flammable solid
- White & Yellow P
  - Spontaneously ignites in air (pyrophoric)
  - Stored under water
  - Note water level in jar



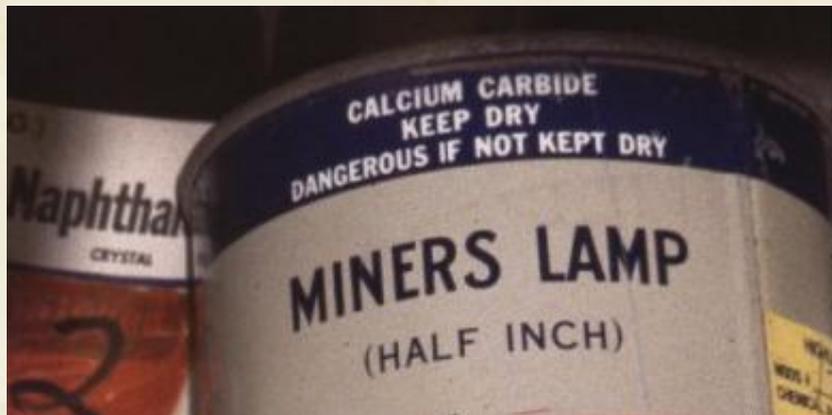
# Yellow Phosphorus Containers

Can is full of water & eventually dilute acid



# Common Water Reactives

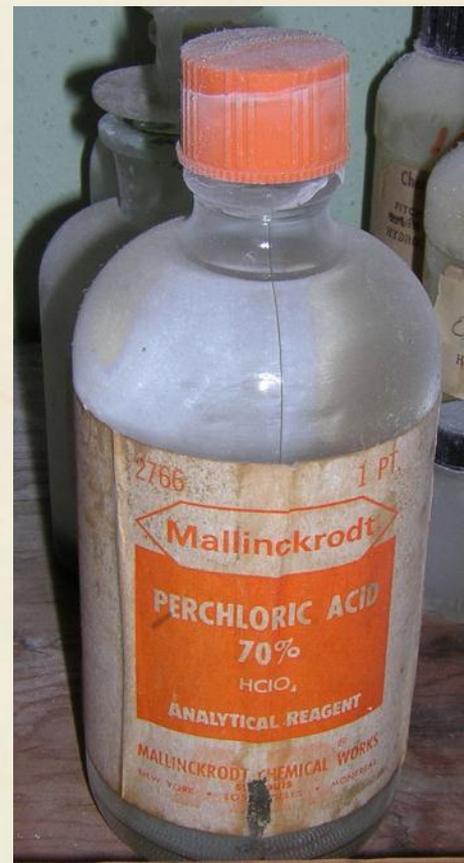
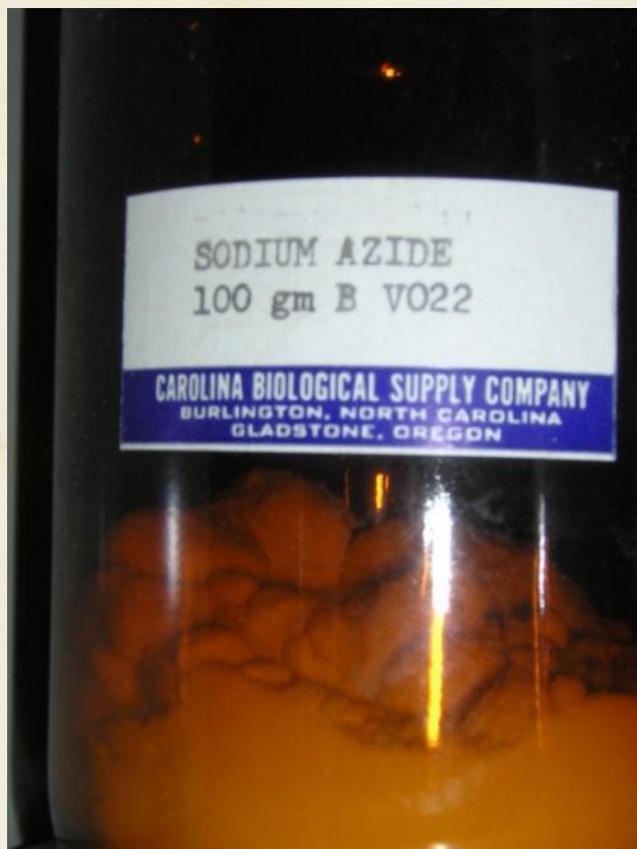
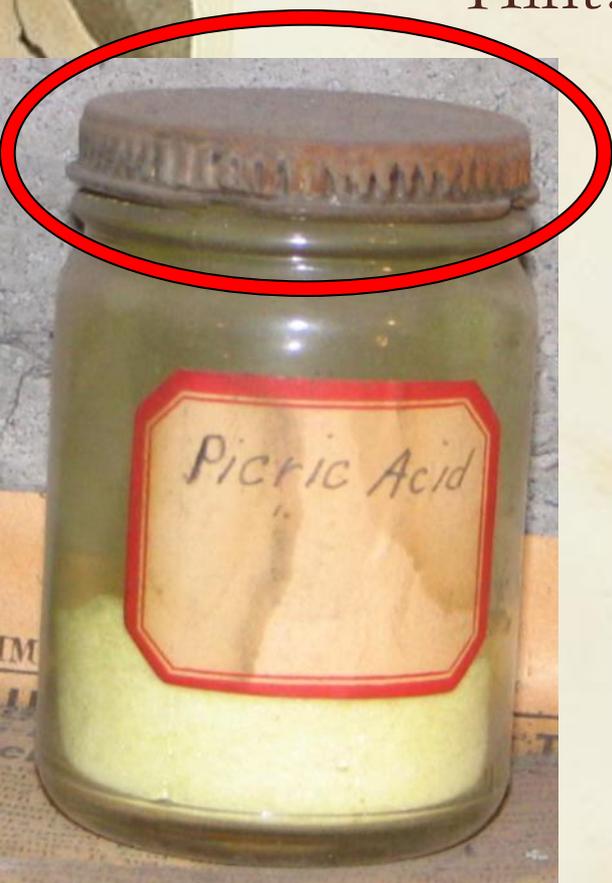
- Sodium Hydrosulfite (aka sodium dithionite)
- Elemental, lithium, sodium, potassium, aluminum (powder)
  - Teaching & research labs
- Calcium carbide (mining, research)
  - Releases acetylene gas





# Picrates, Perchlorates, Azides

- Much more explosive as metal salts
- How can they mix with metals?
  - Hint...



# Sodium Azide Contaminated Pipes

- Solution reacts with metal pipes
- Unused sink goes dry
- Plumbers change P-trap – **BOOM!**



# Perchloric Acid

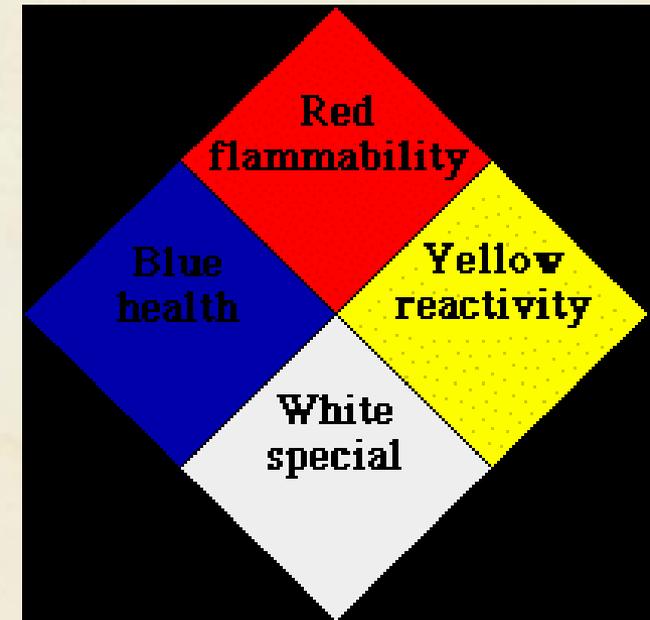
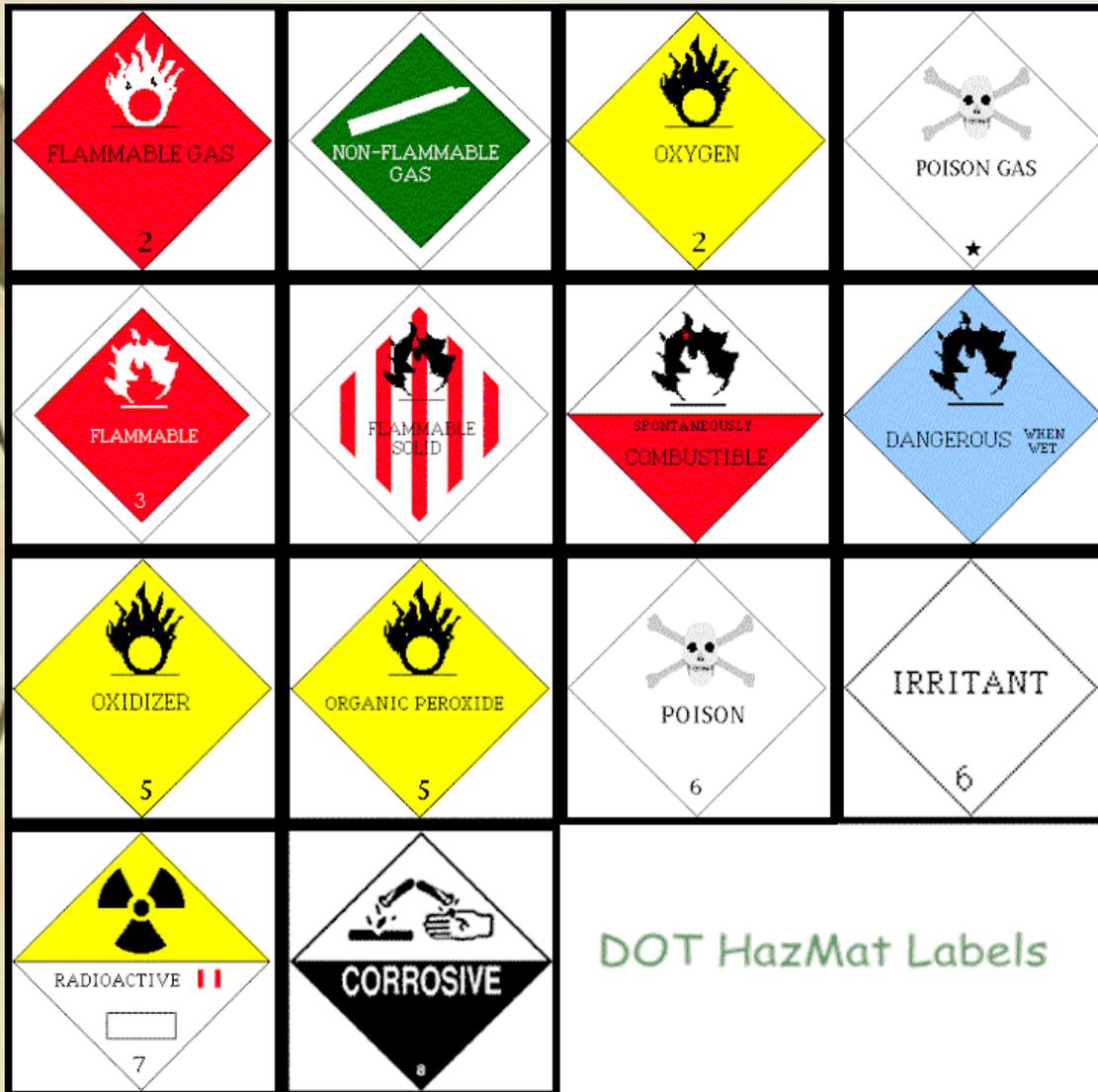
- Powerful oxidizer
- Violent reaction with flammable organics
- If spilled on metal, metal perchlorates form
- Never store on metal shelving



Let's Take a Break  
Be back in 10 minutes



# Signs of Hazardous Chemicals USA



# Signs of Hazardous Chemicals European Union



H19A-S



H22A-S



H20A-S



H18A-S



H21A-S



H15A-S



H13A-S



H16A-S

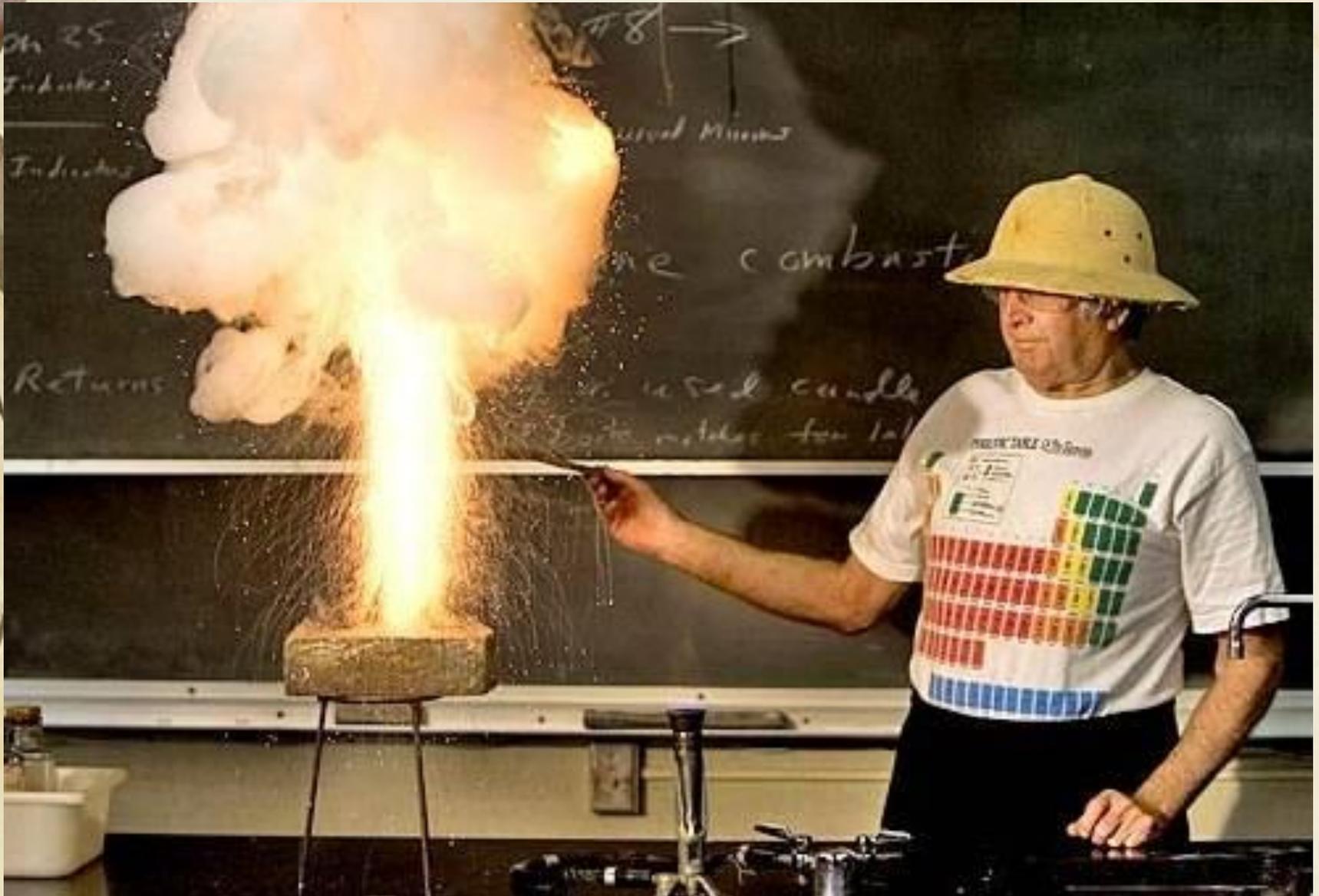


H14A-S



H17A-S

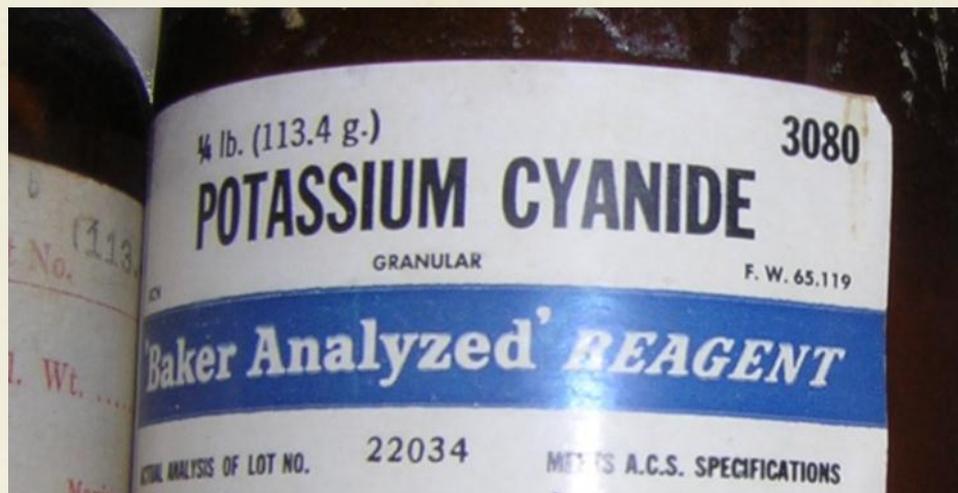
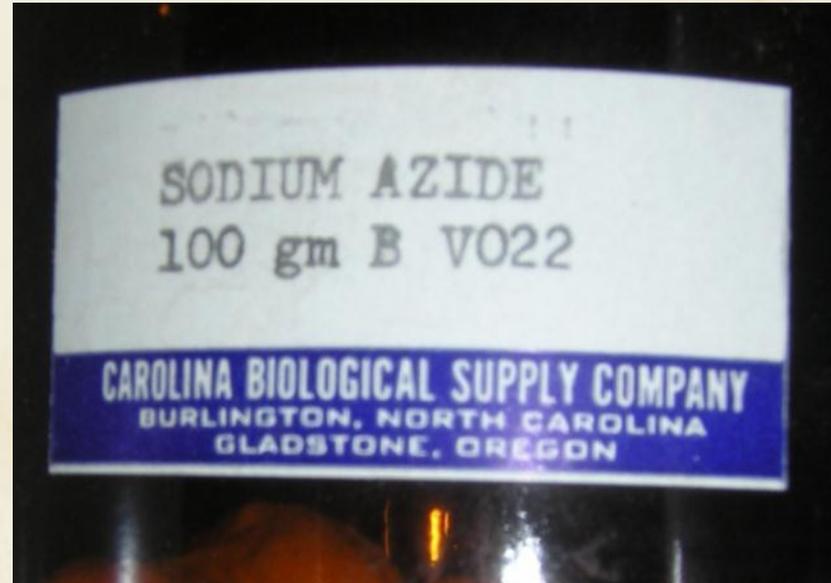
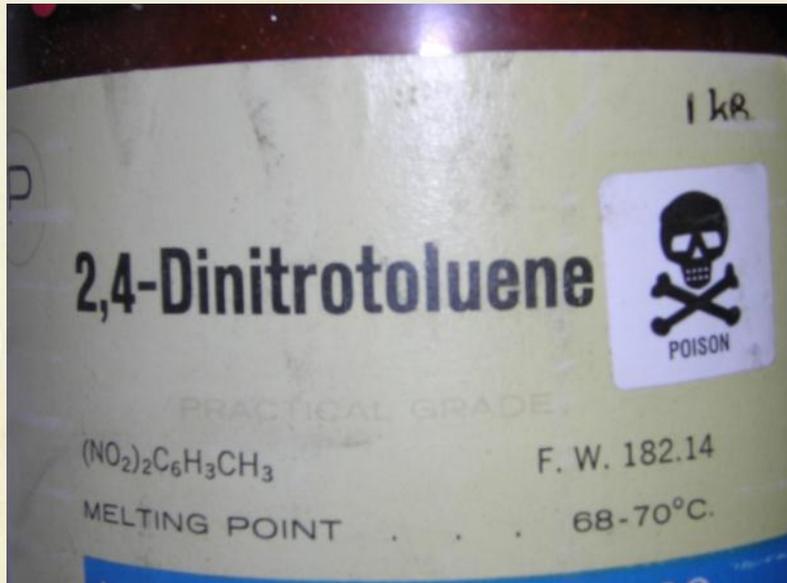
# Signs of Hazardous Chemicals - Schools



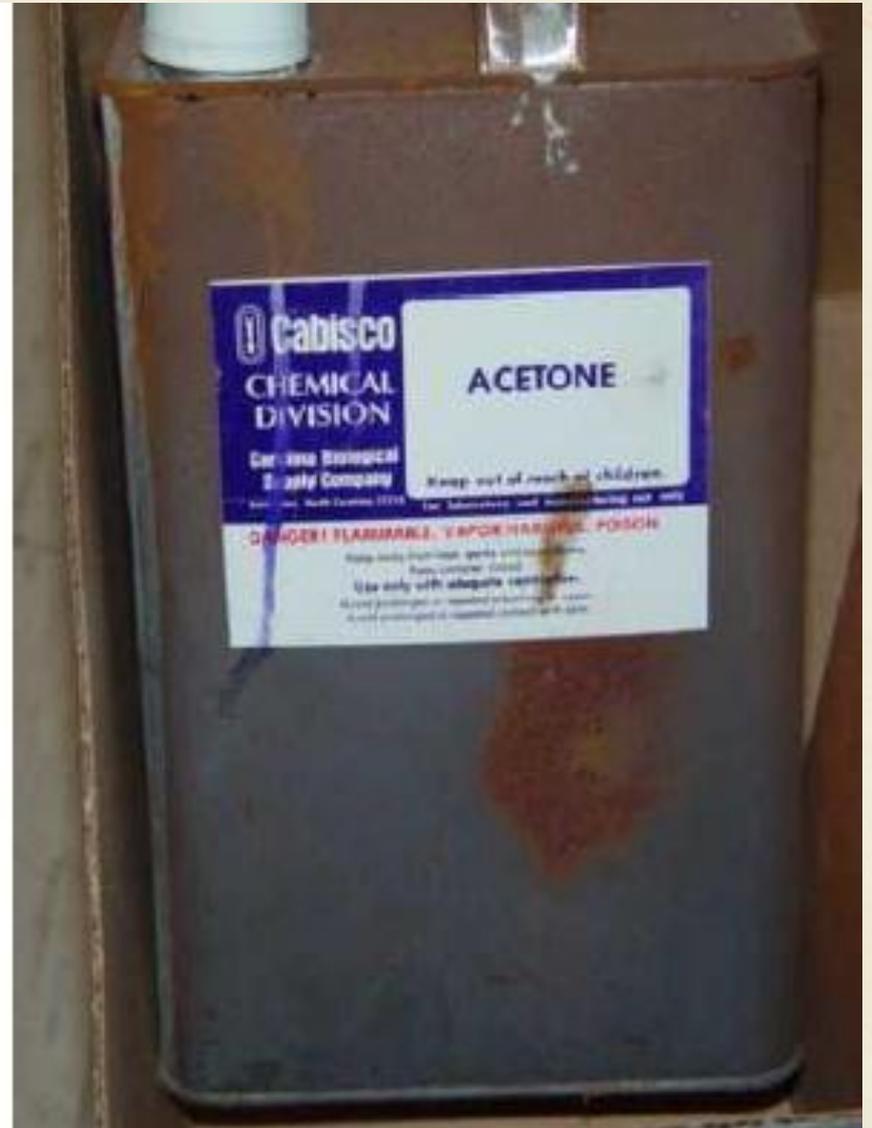
We routinely find highly reactive chemicals in secondary schools



# Nebraska



# Tennessee



# Missouri



# Virginia



Iowa



# Florida



# Oregon



# Washington



# Colorado



# School Chemicals Database

## Info on 1037 Chemical Compounds

[www.lhwmp.org/home/educators/chemlist.aspx](http://www.lhwmp.org/home/educators/chemlist.aspx)

Search:

1 2 3 4 5 6 7 8 9 10 ... >> | (View All) | ...You are viewing page

Chemical Name	Acute Exposure Hazard	Chronic Exposure Hazard	Environmental Toxicity	Hazard Rank	Minimum Grade Level Restrictions
<a href="#">Abscisic Acid</a>	No acute toxicity data reported	No confirmed human disease-related or reproductive hazard data reported	No fish toxicity data	1	Elementary demonstrations only
<a href="#">Acetal</a>	Explosive. Peroxide forming compound. Flammable. Slightly toxic by ingestion & skin contact. Irritant.	No confirmed human disease-related or reproductive hazard data reported	No fish toxicity data	5	Ban Candidate
<a href="#">Acetaldehyde</a>	Explosion risk from peroxide formation. Flammable. Slightly toxic by inhalation, ingestion and skin contact. Irritant to eyes.	Liver function impairment	Toxic to fish	5	Ban Candidate



school chemical list

About 84,800,000 results (0.15 seconds)

Everything

Images

Videos

Hazardous Chemicals in Schools - Local Hazardous Waste Management ...

Home >> Resources for Schools >> Schools Chemical List ... Chronic lung impairment, Non-toxic to fish, 2, Middle School, 0-1, Stoichiometry. Mole ratio. ...

www.lhwmp.org > Home > Resources for Schools - Cached

# HAZARDOUS CHEMICALS IN SCHOOLS

Home >> Resources for Schools >> Schools Chemical List

--- Download results as... ---

BAN CANDIDATE

Page 1 of 23 | 227 records |

<u>Chemical Name</u>	<u>Acute Exposure Hazard</u>	<u>Chronic Exposure Hazard</u>	<u>Environmental Toxicity</u>	<u>Hazard Rank</u>	<u>Lowest Grade Level Allowed</u>
<a href="#">Acetal</a>	Explosion risk from peroxide formation. Flammable. Slightly toxic by ingestion & skin contact. Irritant.	No confirmed human disease-related or reproductive hazard data reported	No fish toxicity data	5	Ban Candidate
<a href="#">Acetaldehyde</a>	Explosion risk from peroxide formation. Flammable. Slightly toxic by inhalation,	Liver function impairment	Toxic to fish	5	Ban Candidate

Search:

## Chemical Name

## Acute Exposure Hazard

Acetal

Explosion risk from peroxide formation. Flammable. Slightly toxic by ingestion & skin contact. Irritant.

Acetaldehyde

Explosion risk from peroxide formation. Flammable. Slightly toxic by inhalation, ingestion and skin contact. Irritant to eyes.

Acetylene

Explosive, especially in contact with metals. Flammable gas.

Search:

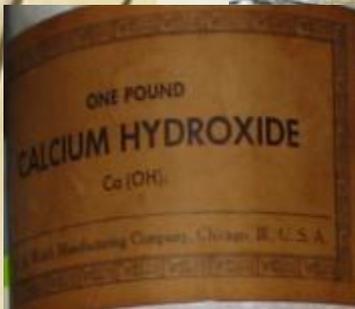
Chemical Name	Acute Exposure Hazard	Chronic Exposure Hazard
Acetonitrile	Flammable. Toxic by inhalation. Reacts with acids to form poisonous cyanide gas.	No confirmed human disease-related or reproductive hazard data reported
Ammonium Bifluoride	Corrosive. Toxic by ingestion. Targets brain, bones, kidneys and heart. Reacts with water to form poisonous hydrofluoric acid.	Chronic exposure to fluorine can damage bones, joints & teeth
Ammonium Polysulfide	Corrosive. Toxic by ingestion, skin contact. Reacts with acids to form poisonous and flammable Hydrogen Sulfide gas.	No confirmed human disease-related or reproductive hazard data reported

Search: 

1 2 3 4 5 6 7 8

Chemical Name	Acute Exposure Hazard	Chronic Exposure Hazard
<a href="#">Acrylamide</a>	Neurotoxin by ingestion & skin contact	Carcinogen
<a href="#">Acrylonitrile</a>	Flammable. Poison by inhalation and skin contact. Toxic by ingestion.	Carcinogen. Teratogen.
<a href="#">Aminodiphenyl, 4-</a>	Toxic by ingestion. Irritant.	Carcinogen. Mutagen.
<a href="#">Ammonium Chromate</a>	Oxidizer. No acute toxicity data reported. Irritant.	Carcinogen
<a href="#">Ammonium Dichromate</a>	Oxidizer. Corrosive when wet. Assumed to be toxic by ingestion based on data for Sodium Dichromate.	Carcinogen

# Antiques Require Care





1910



1920



1940



1950

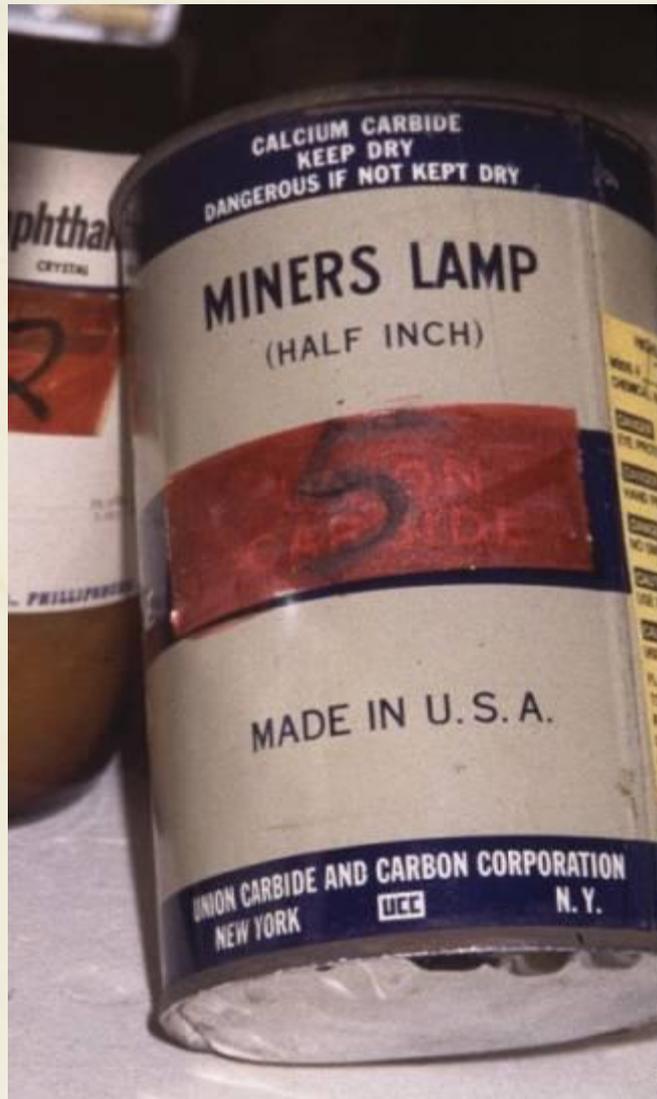


# So what if they're old? Containers & contents degrade



# Bulging Containers

Pressurized contents? – Incompatibles mixed?

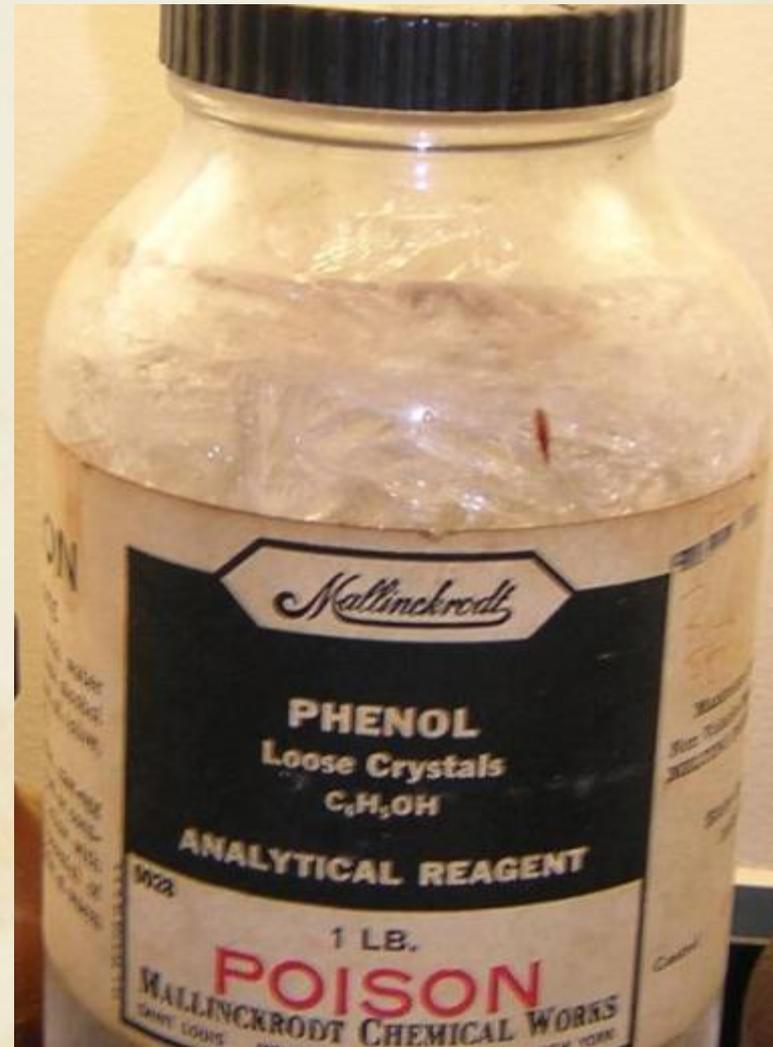


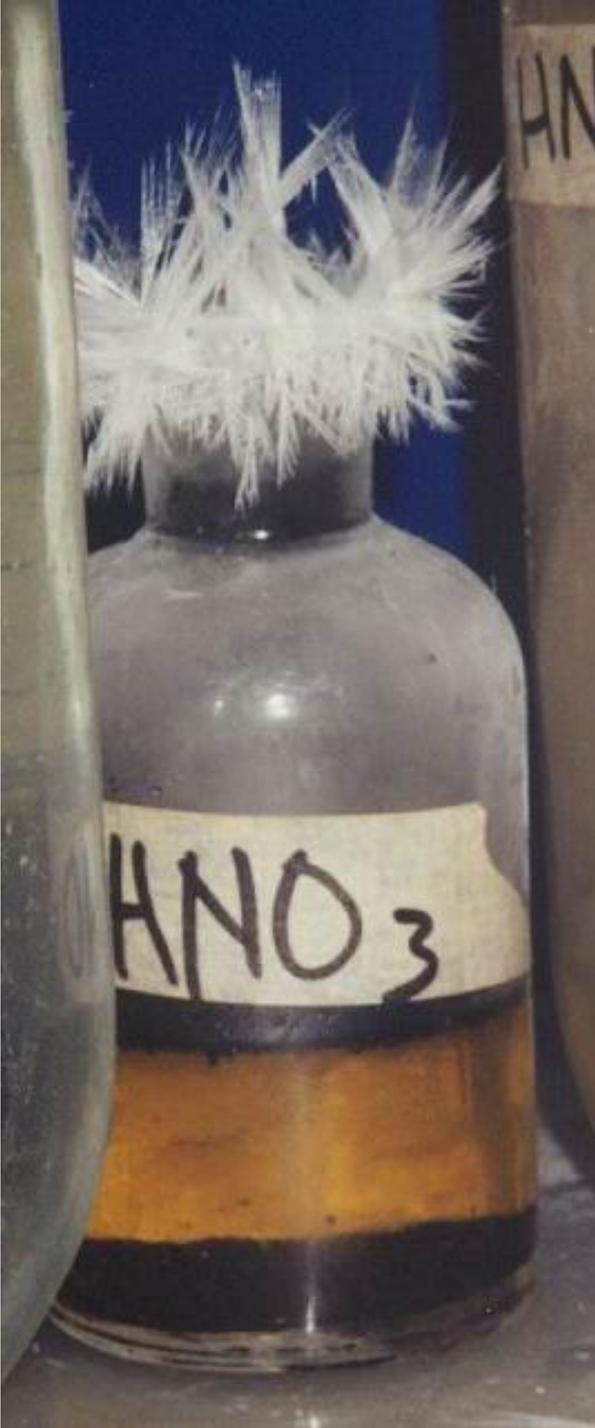
# Tool to Open Bulging Containers

40 feet of line attached to it.

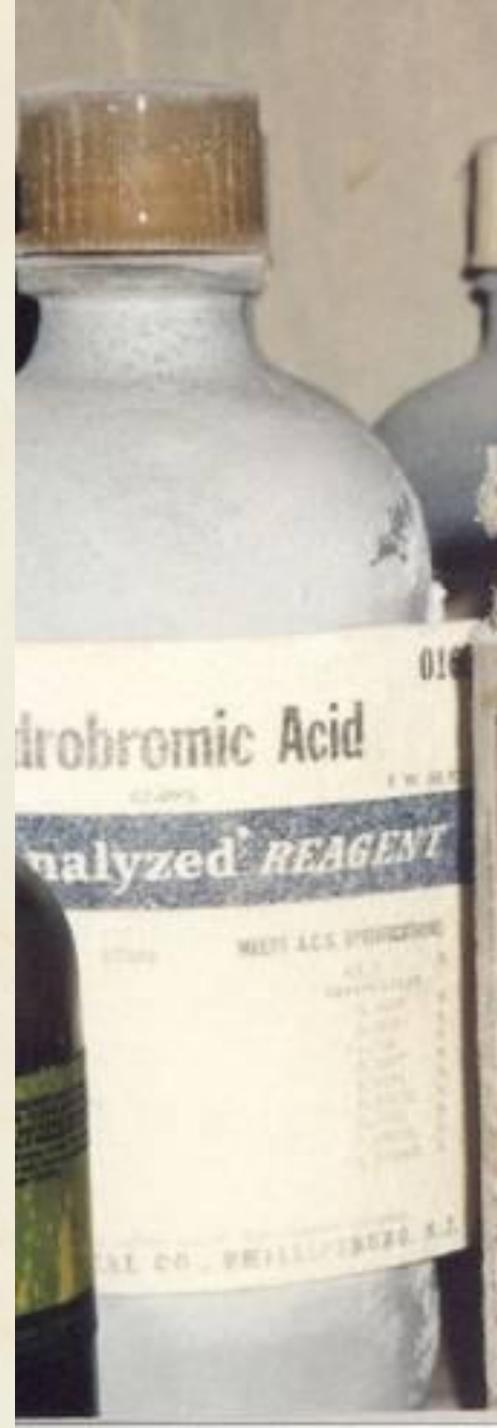


# Skin Contact Hazards





Something's  
wrong in the  
Acid Cabinet



Funky looking acid bottles  
This is NOT normal



# Hydrofluoric Acid

- Anesthetic
- Bone disintegration
- Dissolves glass
- Extreme pain,
- Gangrene, amputation

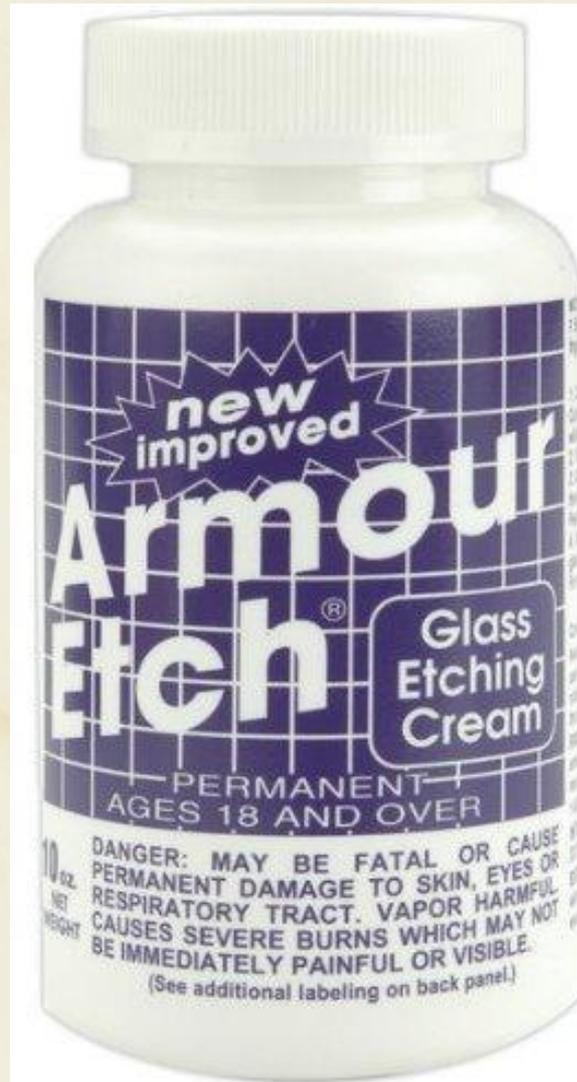


# Hydrofluoric (HF) Acid Spill 1995

- 200 mls of HF on both thighs
- Burns to 9% of body, despite washing legs
- Contaminated clothing not removed
- Right leg amputated 7 days later
- Died 8 days later



# Ammonium Bifluoride Etch

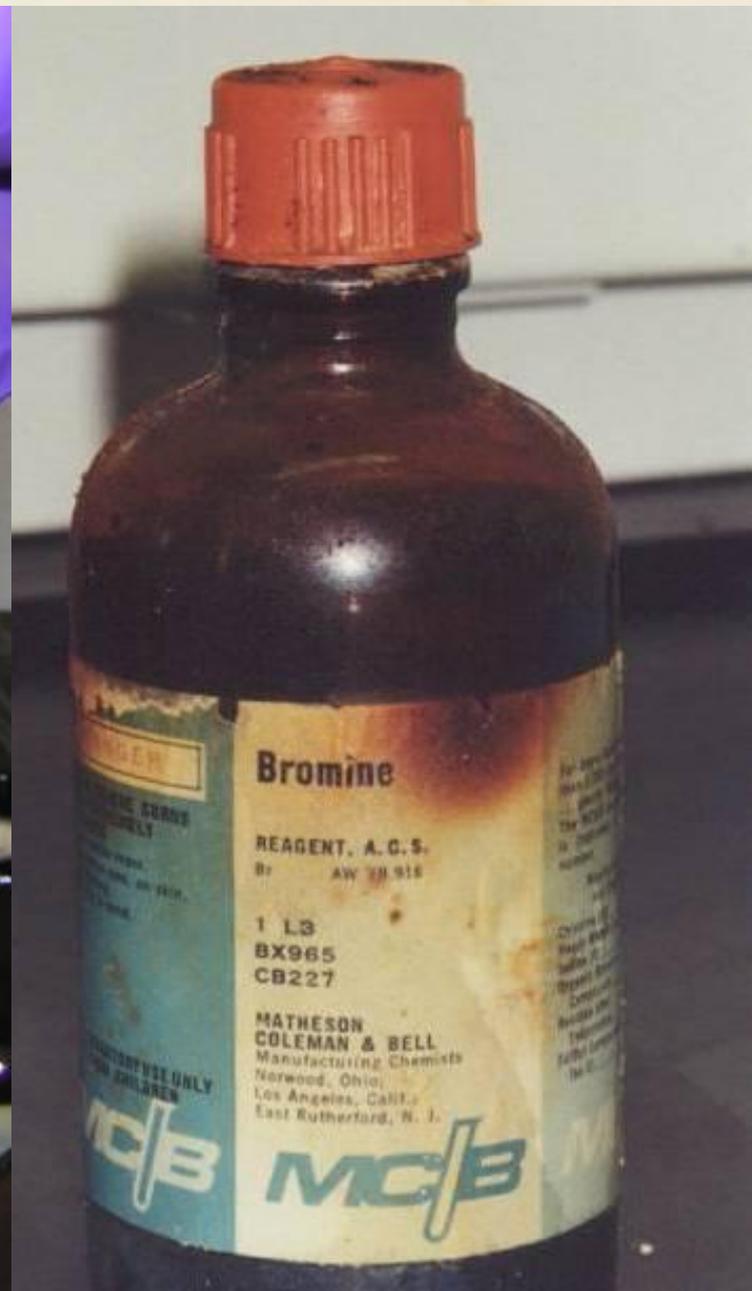


# Nitric Acid ( $\text{HNO}_3$ )

## Oxidizer, Corrosive & Cap Eater



# Toxic Inhalation Hazards

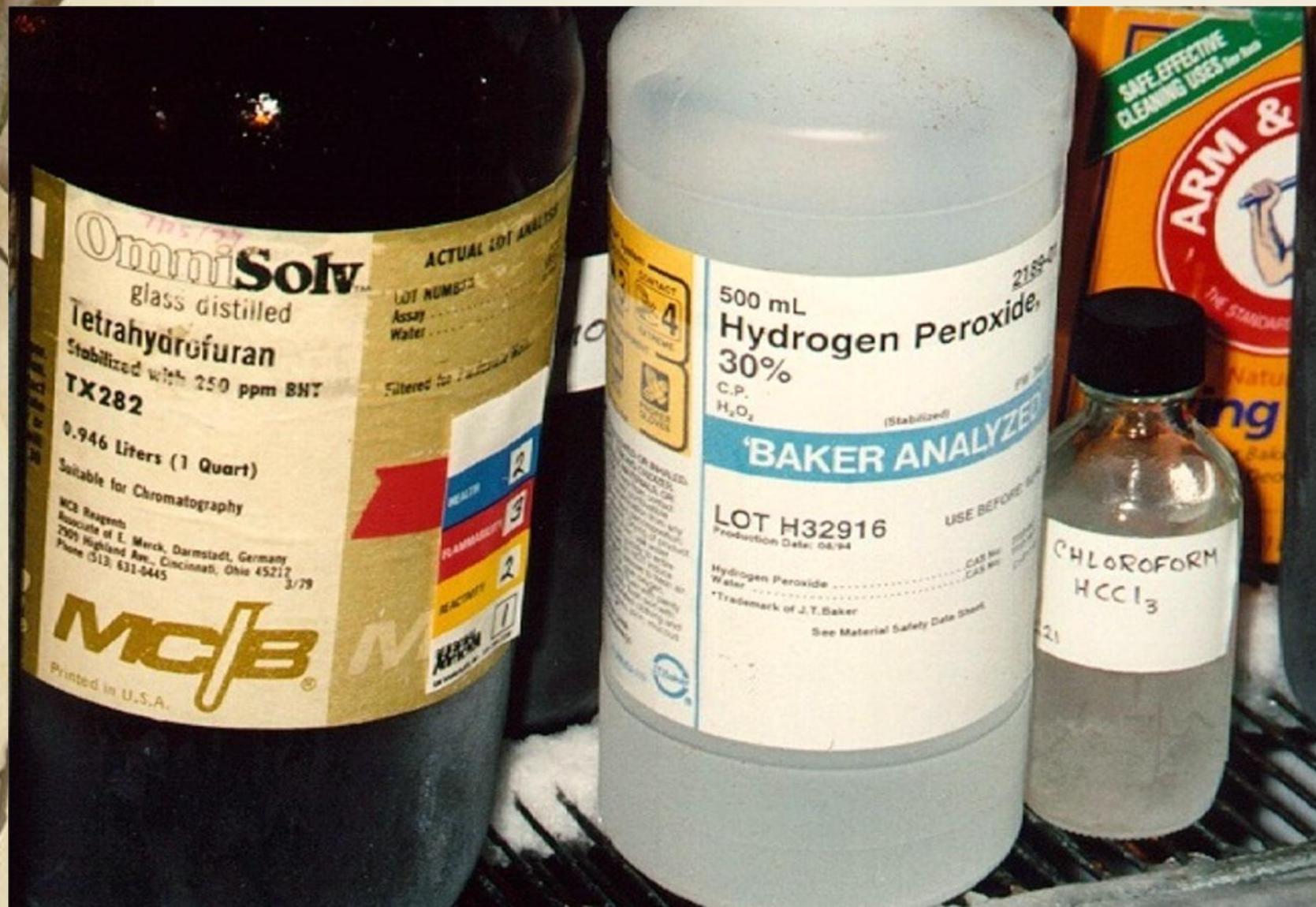




## Chloroform

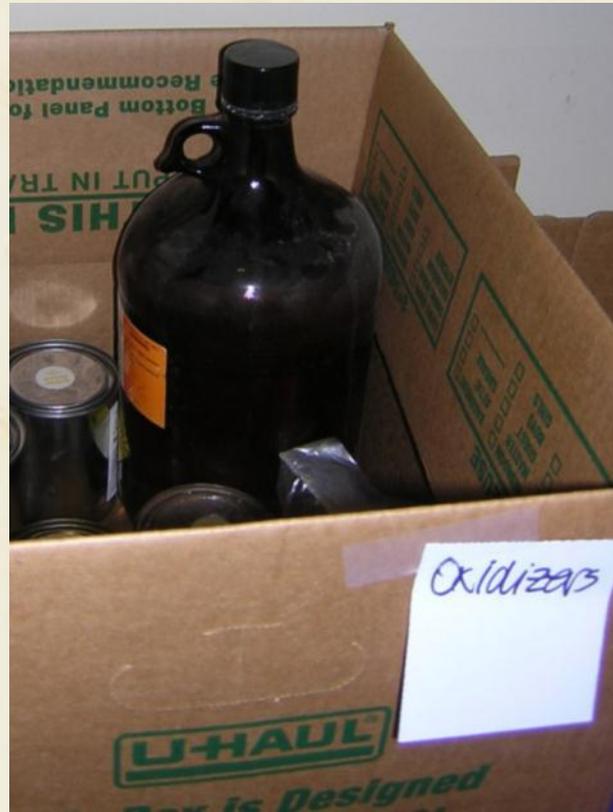
Slightly toxic by ingestion & inhalation. Reacts with light to form poison phosgene gas. Carcinogen

What's wrong with this picture?



# Unfortunate Mixtures

- Incompatibles together in lab or car
- Combine chemicals to fill bottles



**HHW COLLECTION**



PENNSSTATE



Pesticide Education Program

# Heading to the HHW Site?



# Fortunately This Was Just Latex Paint





# Dirty Dynamite in Missouri Farm



# HHW Phone Calls Can Offer Clues

- Spouses of certain deceased professionals
  - Pharmacists, doctors, teachers
- Hobby chemists



“My dead uncle was an alchemist”



“This guy’s a hoarder with a warehouse full of chemicals”



“My schizophrenic physicist brother dabbled in chemistry in mom’s garage”





# A CAUTIONARY TALE.

FARMER  
DAVE'S  
COWS



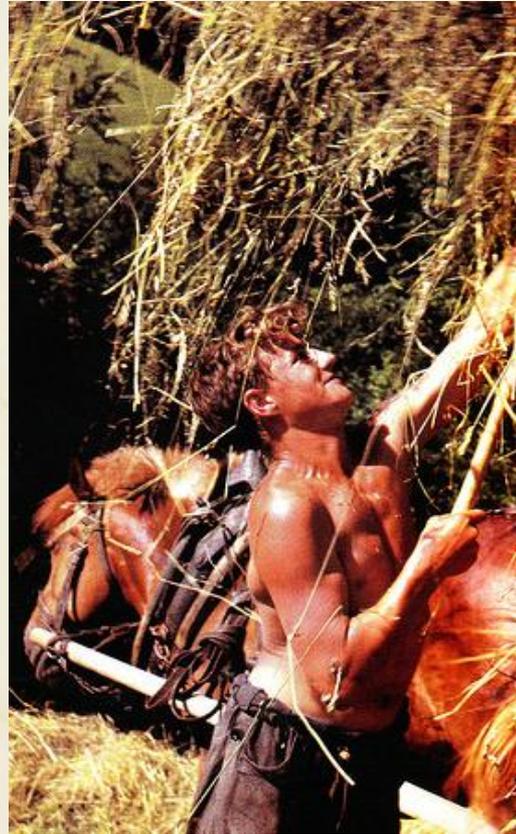
# Meet Farmer Dave



# Dave Owns 17 Cows



# Farmer Dave Has Three Sons

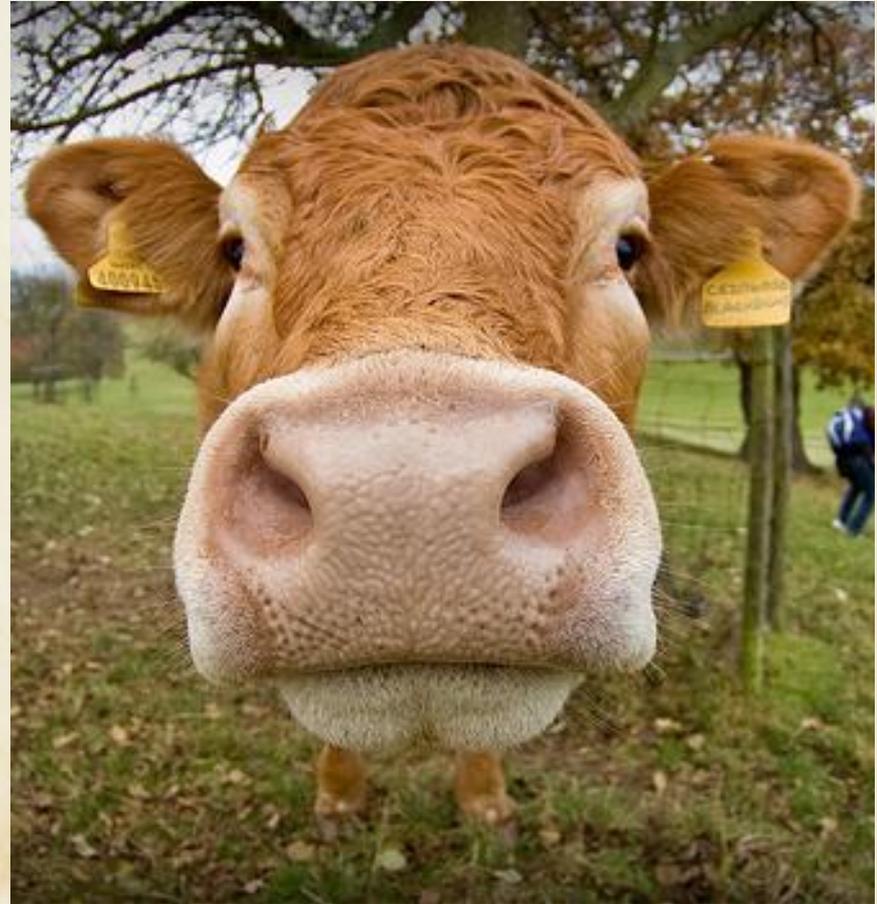


# Dave's Not Looking Healthy!



# He Wills 17 Cows to His Sons

- $1/2$  to eldest
- $1/3$  to middle
- $1/9$  to youngest



# It Doesn't Work – Tempers Rise!

- $17/2 = 8.5$
- $17/3 = 5.7$
- $17/9 = 1.9$



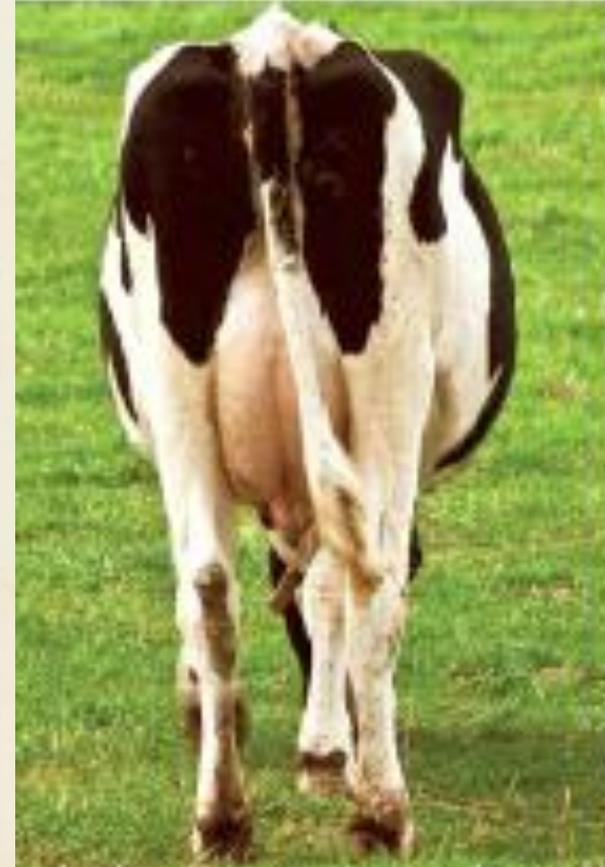
# Neighbor Pam Hears the Ruckus

- “I can fix this”
- Goes to her farm
- “You can have my biggest cow”



# They Do The Math

- $18/2 = 9$
- $18/3 = 6$
- $18/9 = 2$
- 17 cows
- Everybody's happy
- Pam takes her cow home



# Be Careful of Initial Assumptions

- Ask questions before handling
- Do you have any lab chemicals?
- Anything weird I should know about?
- Did you combine chemicals together?



# Familiarity Breeds Contempt

- Don't be chemically complacent



Let's Take a 10 Minute Break



A dried leaf on a stem is positioned on the left side of the page, extending from the top left towards the bottom left. The leaf is dark brown and curled, while the stem is thin and dark. The background is a light, textured surface with subtle, wavy patterns in shades of beige and cream.

## Part Two

# High Explosives and Scary People

# Explosion (Detonation)

- A sudden, violent release of energy from a confined region
- Shockwave is the principal characteristic





# Low Hazard Explosives

- Flares
- Fireworks
  - EXCEPT M80's in groups of 4 or more
- Ammunition
- Smokeless Powder, a.k.a. rifle powder
- Hobby rocket motors

# Low Hazard Explosives







# High hazard explosives (call bomb squad immediately)

- Bombs
  - pipe bombs, other home-made devices
- Dynamite
- Military Ordnance (grenades, shells, etc.)
- Flash Powder / Black Powder
- Blasting Caps
- Detonation Cord





# Dirty Dynamite in Missouri Farm





# Detonation Cord



# Det cord with caps attached



A vertical strip on the left side of the image shows a dried botanical specimen, likely a branch with several leaves, mounted on a light-colored, textured paper background. The leaves are dark green to brownish, and the stem is thin and woody.

Ether plus  
det cord



# More det cord styles



More det cord



# Guncotton Tins



# More scary stuff – Ancient detonators





124 NO. 0032  
EXPLOSIVE, BLASTING, TYPE A  
BLANDSPRANGAMNE TYP A  
SPRENGSTOFF TYPE A

Plastikkasse / Plastikkasse / Plastikkasse  
No. 124/124/124  
124/124/124  
124/124/124



124/124/124

# NOBEL PRIME

DYNO  
Dyno Nobel



Made in Norway

Dyno Nobel Europe  
N-3412 Landshnda, Norge  
S-7113 82 Nors, Sverige

# NOBEL PRIME

DYNO  
Dyno Nobel





# Two part explosives

- Kinepak binary explosive
- Nitromethane
- Ammonium nitrate





# Managing High Explosives

- Advertise that you don't accept them
  - Define what they are clearly
- Have a process in place to bring help to the homeowner who found it
- If they bring them, be on your toes to identify them (interview, observation)
- Have them pull off to the side
- Link with your bomb squad contacts asap



# Praxair Fire Video



# Compressed gas cylinders

- Among the most hazardous wastes disposed of in MSW



Chlorine with rusted valve

# Compressed gas cylinders

- Definition: Heavy-walled metal cylinders
- Vapor pressure  $> 40$  psi
- Typical pressures  $\sim 2,400$  psi
- Some as high as 6,000 psi
- Aerosol cans not included

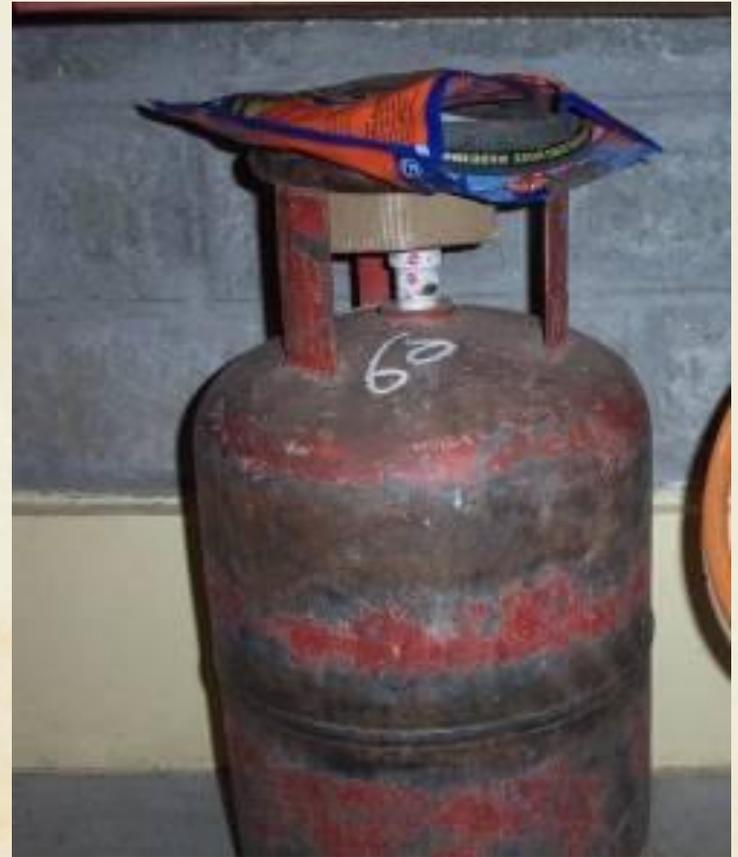
# What's in cylinders?

- Substances in gas phase under pressure
- Liquefied gases
- Liquids under normal conditions along with a compressed propellant gas
- Extremely hazardous materials not under pressure
  - Often in smaller cylinders



# Most common HHW cylinders

- Propane
- CFC refrigerants
- Helium
- Oxygen
- Acetylene
- Hydrogen
- Ammonia
- Ethylene oxide



Helium cylinder on its way to your site



# Lecture Bottles



**Chlorine!**



The "Box O Gases"



# Exploded hydrogen fluoride cylinder -from hydrogen build-up & pressure



# Cylinder Releases

- Old, rusting, or damaged cylinders
- Slow or sudden
  - Can propel a cylinder like a rocket
  - Creates flammable or toxic atmosphere
  - Displace oxygen
  - Generate extreme cold



Hole in a concrete floor that was made by a gas storage cylinder (cryogenic) that ruptured its bottom and jetted upward through the ceiling and into the room above. The gas discharge also blew out the walls of the lab where the tank was stored.

Very scary cylinder  
-it wants to get out!



# Propane Cylinders

- “OPD” –overfill prevention device
  - Required for 4 - 40 lb propane cylinders
- Older type phased out, may be in trash
  - Began 1998, completed April 2002
- If they’re run over by MSW equipment
  - Serious explosions and fires

# Half-full propane tank explosion



# Drug Lab Cylinders

- Propane cylinders with corrosion
- Unusual modified cylinders
- Shouldn't show up often – but new homeowner may find one



# Meth Lab remnants



Blue green corrosion on tanks  
Hydrogen chloride corroding brass valve



# Handling / Storage

- Required by OSHA & Fire Code
  - Chained / stored to prevent falling over
- Recommended
  - Keep dry
  - Restrict access
  - Post warning signs
  - Wear safety glasses or goggles, gloves

# Disposal is Expensive!

- Up to several thousand dollars each
- Alternatives:
  - Return to manufacturer/distributor
    - Look for labels, engraved abbreviation
    - Check with local companies
    - Look for DOT, CGA info
  - On-site removal/recycling
    - Propane & CFCs



# Venting - another disposal option

- Only when pre-approved
- Inert gases
  - Nitrogen, carbon dioxide, compressed air, helium, argon, neon, xenon, or krypton
- After venting, cylinder is scrap metal
- Vendors usually require cylinder be cut in half or valve removed

# Caveats to Self-Management

- Safety procedures are critical
- Ice plugs may form in valve or valve may become inoperative
- Cylinder may seem empty
- Rapid pressure release can be highly hazardous



# What if contents are not known?

- Ask the manufacturer/distributor
- Give them dimensions, color, valve style, labels, ICC/DOT number
- Clues:
  - UN/NA number (see DOT "Emergency Response Guidebook")
  - Warning labels (see CGA guide)
  - Valve and cylinder style (see CGA, DOT)





# Identifying unlabeled cylinders

- When in doubt, have a sample taken and an instrumental analysis done
- Costs big bucks
- You can't trust the color of the cylinder to be definitive, yet.

## BOC Scientific - Gas mixtures

Legislation aimed at standardising gas cylinder colours across Europe is being introduced. As a result, the following top colours will apply to cylinders containing Special Products mixtures.

Color  
system  
for  
cylinders?

Coming  
in Europe

Red	= Flammable
Yellow	= Toxic or corrosive
Light blue	= Oxidising
Bright green	= Inert
Red and yellow	= Flammable and toxic
Yellow and light blue	= Toxic and oxidising



Flammable



Toxic or corrosive



Oxidising



Inert



Flammable and toxic



Toxic and oxidising



# Erwin's House of Horrors

Use caution if you do a home visit

# The Kitchen



# The Living Room



# The Bedroom

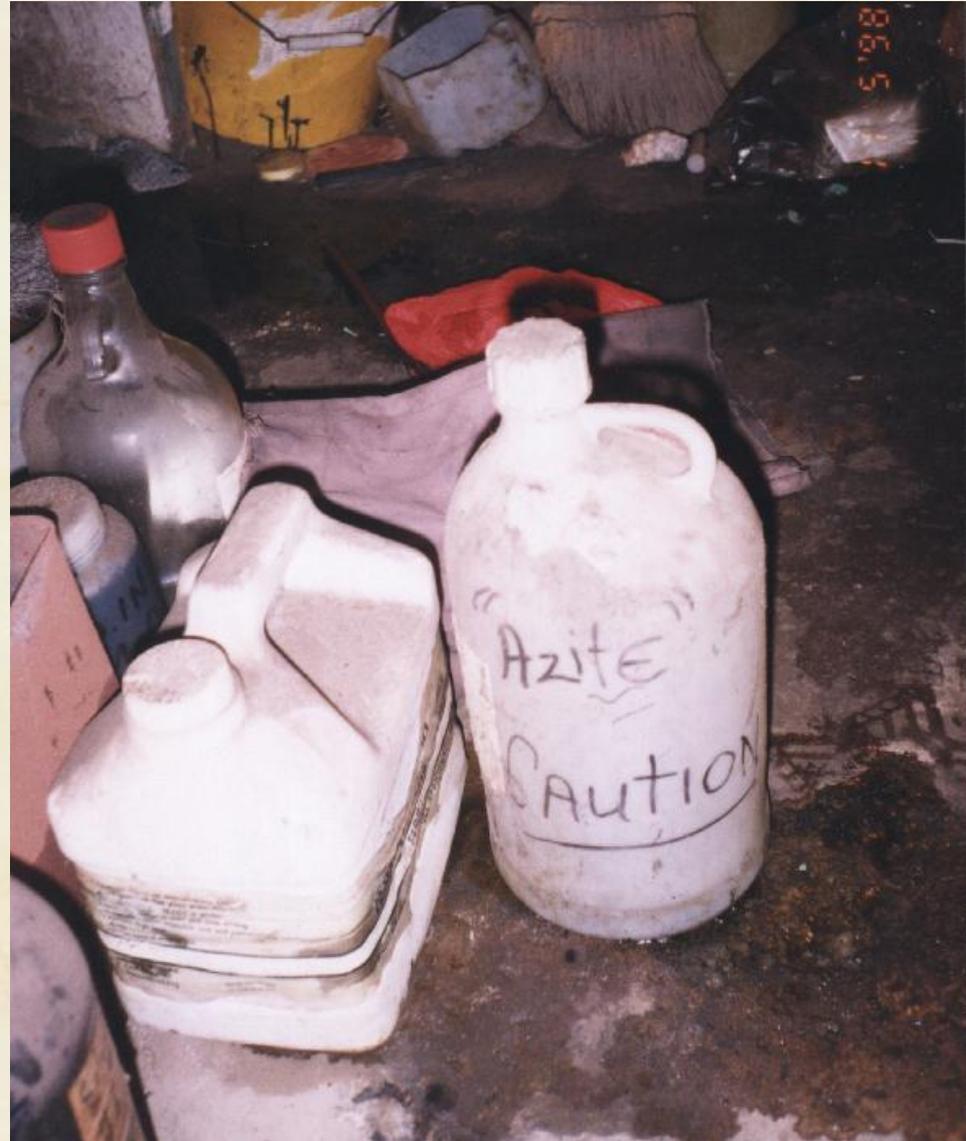


# The Other Bedroom



# The Lab

- There's no such thing as "Azite"
- Not selling anything
- Just loves chemicals
- Chemical hoarders are more common than you think







# The “Foundry”

Exhausts directly on the garden



# The Garden



# Dust & Soil Samples

Description	Constituents Detected	Concentration (mg/kg)
Cyanide residue from Warehouse 2	Total Cyanide	4,600
	Arsenic	52.9
	Barium	209
	Cadmium	12.5
	Chromium	124
	Lead	2,410
	Mercury	4.96
	Silver	246
Soil/ash from garden	Total Cyanide	0.49
	Arsenic	8.50
	Barium	512
	Cadmium	4.98
	Chromium	203
	Lead	861
	Mercury	4.12
	Silver	25.9
Floor dust composite, Living Area	Total Cyanide	34
	Arsenic	79.1
	Barium	274
	Cadmium	30.7
	Chromium	660
	Lead	3,620
	Mercury	318
	Silver	198
Floor dust composite, SE of Warehouse 2	Total Cyanide	73
	Arsenic	54.0
	Barium	366
	Cadmium	49.5
	Chromium	528
	Lead	6,470
	Mercury	21.45
	Silver	376

Cyanide 4,600 ppm

Arsenic 79 ppm

Lead 6,420 ppm

Mercury 318 ppm

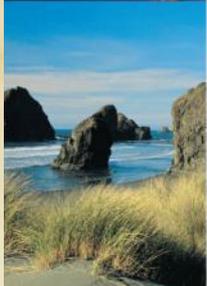
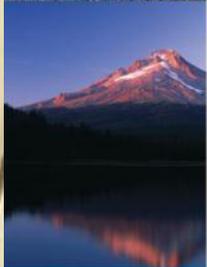
Kids lived here

Pregnant woman lived here

So, keep an eye out for each other  
Stay alert – Have fun out there



Any Questions?



SEPTEMBER **26-30** PORTLAND, OREGON  
**2017** **SAVE THE DATE**  
**2018** NAHMMA NATIONAL CONFERENCE

