WELCOME TO BASIC HAZARD CATEGORIZATION

U.S. EPA Region 7

On-Scene Coordinator:

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Introductions

Emergency Response & Removal Program

Basic Hazard Categorization

Case Studies

Why you should know this stuff…..

- You da man!
- You da only man!
- Contractors, you can't live without 'em!

2pm on a Friday afternoon


4/29/2003

Quick categorization

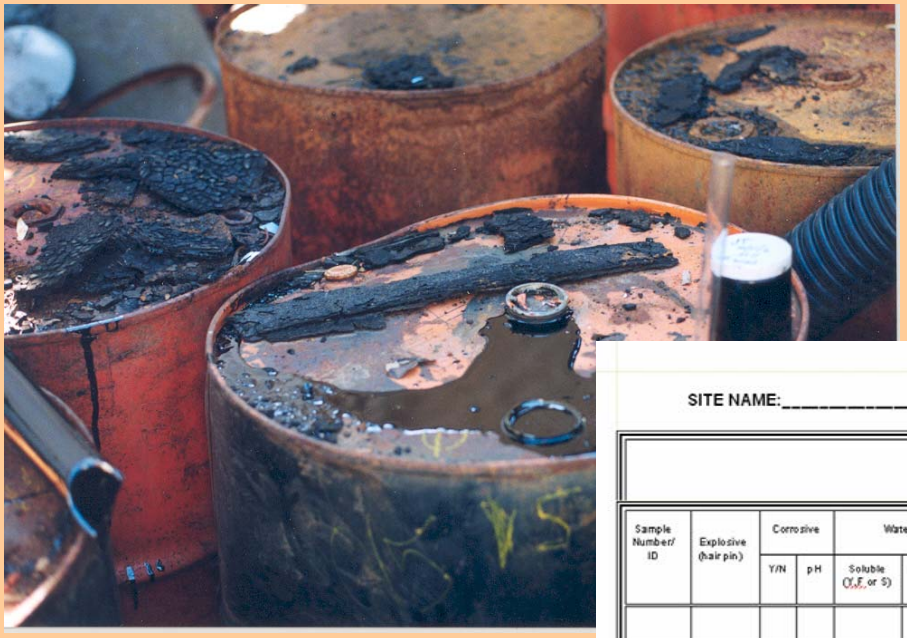
EPA may be the last or best option

Utilized the HazMat ID

Traditional Drum Sites

Monitoring contractor activities

Maintain project control



SITE NAME:_____ DATE:_____OSC: _____

EPA REGION 7
FIELD SCREENING DATA SUMMARY SHEET

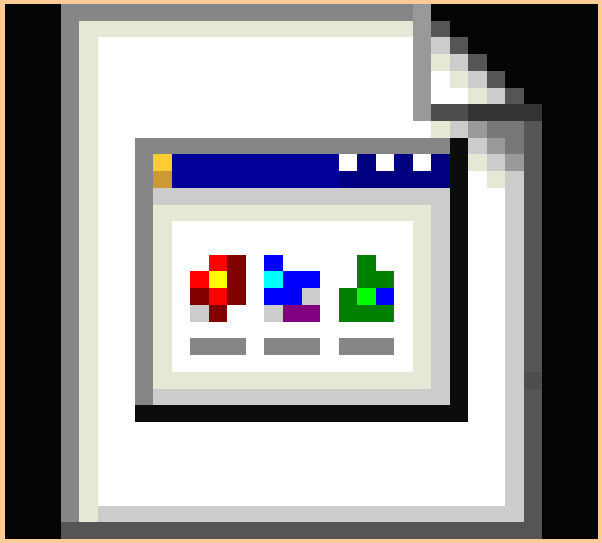
Sample Number/ ID	Explosive (hair pin)	Corrosive		Water		Cyanide (if pH greater than 7)	Oxidizer (KI) Y/N	Sulfide (Lead Acetate) Y/N	Flammable (Y/N)	Organo-Halide/ Copper Wire (if water insol.) Y/N	Other Tests (FID,PID, Draeger, Etc.)	Sample Description and Comments
		Y/N	pH	Soluble (Y,F, or S)	Reactive (Y/N)							

Hazard Categorization Uses

- **Identify containers with like contents**
- **Segregate based on hazard**
- **Sample based on screening results**

Field Screening

DOT Hazard Classes Explained



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OBJECTIVES

- Become familiar with the major chemical families
- Understand why field screening is used
- Become familiar with the field screening tests
- Use field screening results to determine general hazards or identity of a material

HAZARDOUS MATERIALS INCIDENT'S CLUES:

Occupancy, Location, Container Size & Shape, Placards, Labels & Markings, and Senses(careful)

Application Notes

- Hazcat™

Need to ID chemical

Pure material (not real good for wastes)

Must know tests very well

Others?

- Field Screening

General “physical” hazards

Works well for wastes

Further Testing

Others?

DRAFT Hazard Evaluation Flow Chart for Unknowns

Early Considerations!!
Evaluate scene & situation, Cordon off area, Isolate, Evacuate, Disable HVAC, Seal doors and cracks, Delineate hotzone (wind direction and intensity), Turn on radiation meter while preparing entry, Approach uphill/upwind/upstream, Follow H&S plan, Sampling plan, & Decontamination procedures for personnel/sample containers/equipment, consult with Incident Commander and law enforcement (if on-scene)

↓

Calibrate instruments/Take background readings

↓

Team dons Level A or B PPE (consult with H&S Manager)

↓

Team enters hot zone (Photo/video documentation)

Air	Liquid/Solid
1st Entry: CGI/O_2*, Radiation Meter, PID/FID, pH, APD 2000/AP2C, Camera, Video camera	1st Entry: CGI/O_2*, Radiation Meter, PID/FID, pH, Oxidizer test, APD2000/ AP2C, M8/M9, Camera, Video camera
2nd Entry: Drager Tubes, SAM 935, Exploranium, Particulate Monitor (RAM), Oxidizer test	2nd Entry: Biological Test Kits, Solubility, M256, Drager Tubes, SAM 935, Exploranium, Pancake Probe (α and β)
Additional Monitoring: Portable GCMS, PCR, FTIR	Additional Monitoring : Portable GCMS, PCR, FTIR

* intrinsically safe

↓

Combustible Atmosphere and Oxygen
O_2 Normally 20.8%

- CGI >10% LEL, O_2 <19.5% or O_2 > 23.5% → **STOP! Exit hotzone**

↓

Radiological
Radiation Background
Normally 5-15 µR/hr

- > 10,000 µR/hr → **STOP! Exit Hot Zone Consult with Health Physicist**

↓

Biological

(+) or (-)

↓

Chemical
- Chemical Agents
- Industrial Chemical Field Tests

If (+) and not in level A, exit and don level A

↓

- (-) Bio, (+) Chem Agents → Send to Chemical Agent Lab **
- (-) Bio, Chem Agents, (+) Industrial Chem → Send to commercial chemical lab **
- (+) Bio, (-) Chem → Send to Bio Lab **
- (+) Bio, (+) Chem → Re-assess situation and consult with proper officials

** Send to lab if Radiation < 3x background. If above, consult with lab prior to shipping.

Chemicals of Concern by Incidents:

- Combustible liquids 20,492
- Adhesive, Resin, Tar: 13,335
- Waste Water : 11, 315
- Paint & Related: 10,660
- Sulfuric Acid: 7,505
- Anh. Ammonia: 7, 350
- Antifreeze: 6,436
- PCB: 6,221
- Hydrochloric Acid: 5,952
- Sodium Hydroxide: 5,233
- Chlorine: 3,800
- Sulfur Dioxide: 3,652
- Gas (NOS): 3,566
- Resin Solution: 3, 056
- Manufactured Gas: 3,428
- Petroleum Dist: 2,957

The Periodic Table

metals

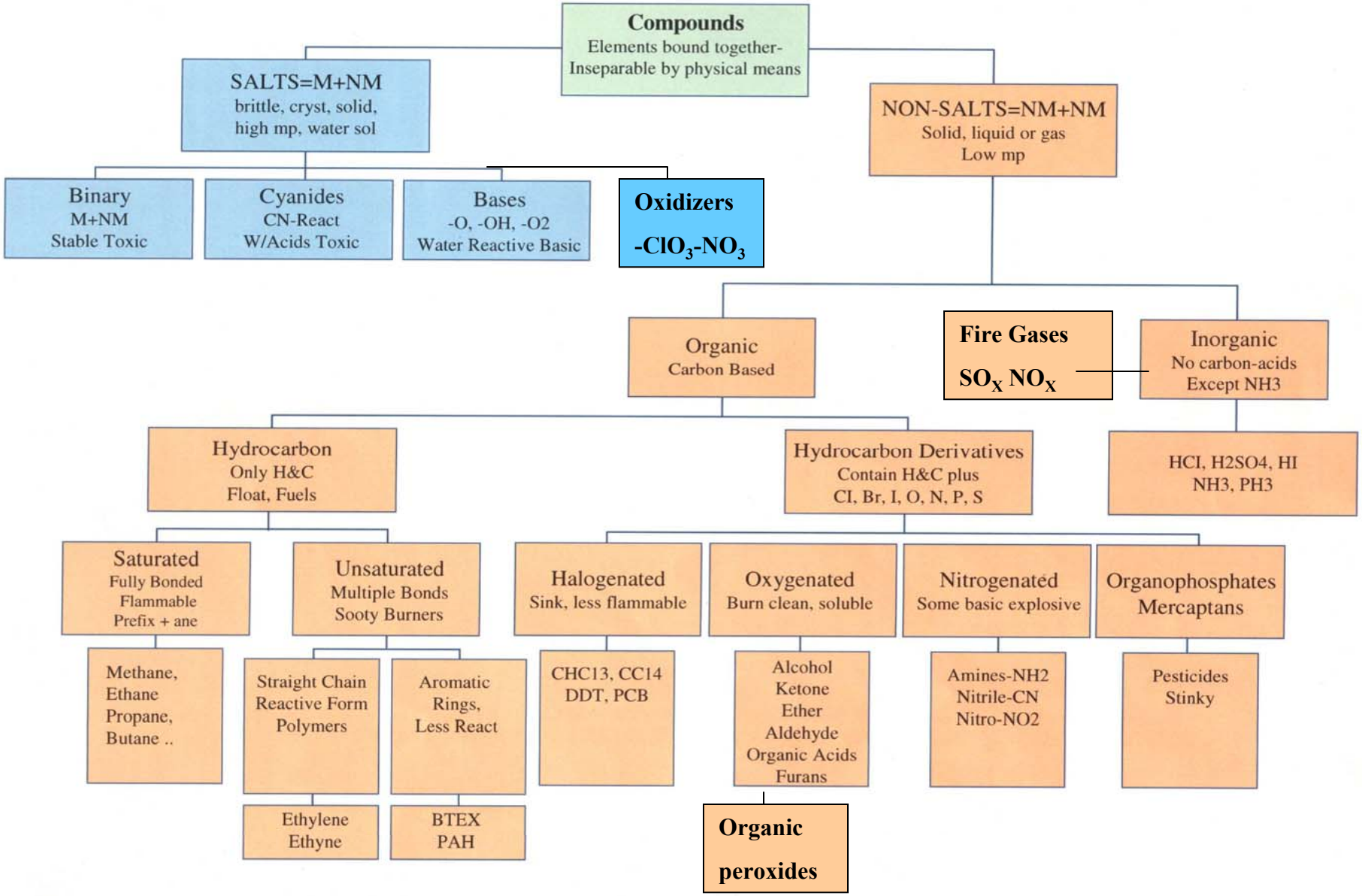
non-metals

noble gases

1 H 1.008																	2 He 4.0026
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.0107	7 N 14.00	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9897	12 Mg 24.3050											13 Al 26.9815	14 Si 28.0855	15 P 30.9737	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938	26 Fe 55.845	27 Co 58.9332	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.921	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9058	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 La 138.90	72 Hf 178.49	73 Ta 180.947	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.966	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)									

58 Ce 140.116	59 Pr 140.90765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.03588	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Figure 2: Chart of Major Chemical Families



FIELD SCREENING TESTS

- EXPLOSIVE?
- CORROSIVE?
- WATER SOLUBLE?
- WATER REACTIVE?
- CYANIDE?
- OXIDIZER?
- HALIDE?
- OTHER TESTS
- DESCRIPTION
- SULFIDE?
- FLAMMABILITY?

SITE NAME:_____ DATE:_____OSC: _____

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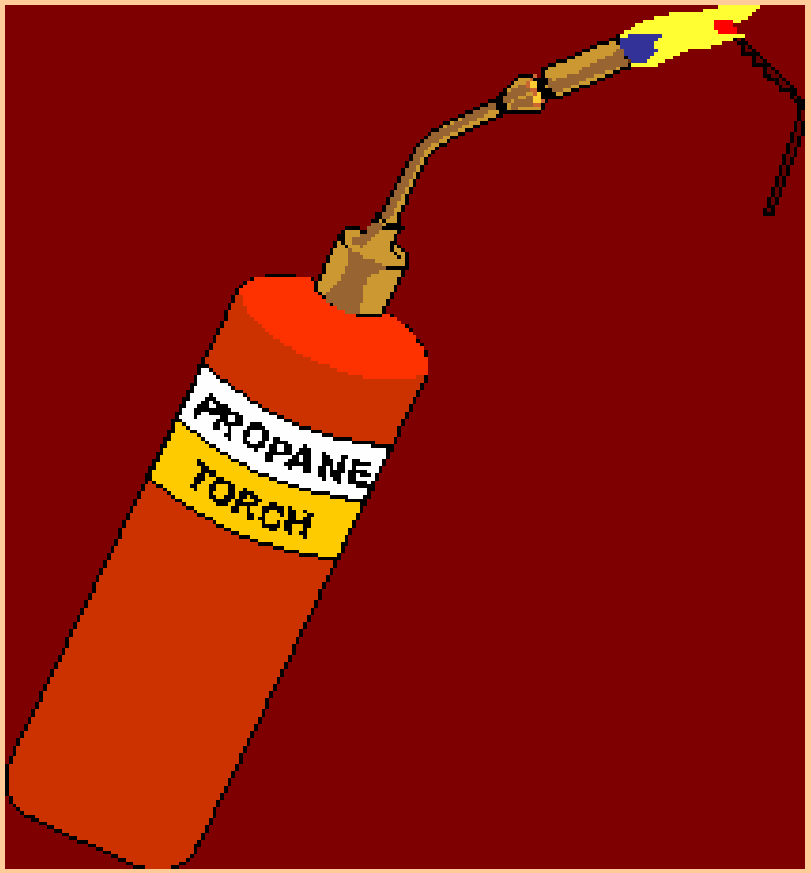
		Y/N	pH	Soluble (Y,F or S)	Reactive (Y/N)							

EXPLOSIVES

- High rate of burning
- Use hairpin test
- If positive for explosives STOP!!



What are explosives/explosions?

Explosive: chemical that can produce the extremely rapid release of gas and/or heat.

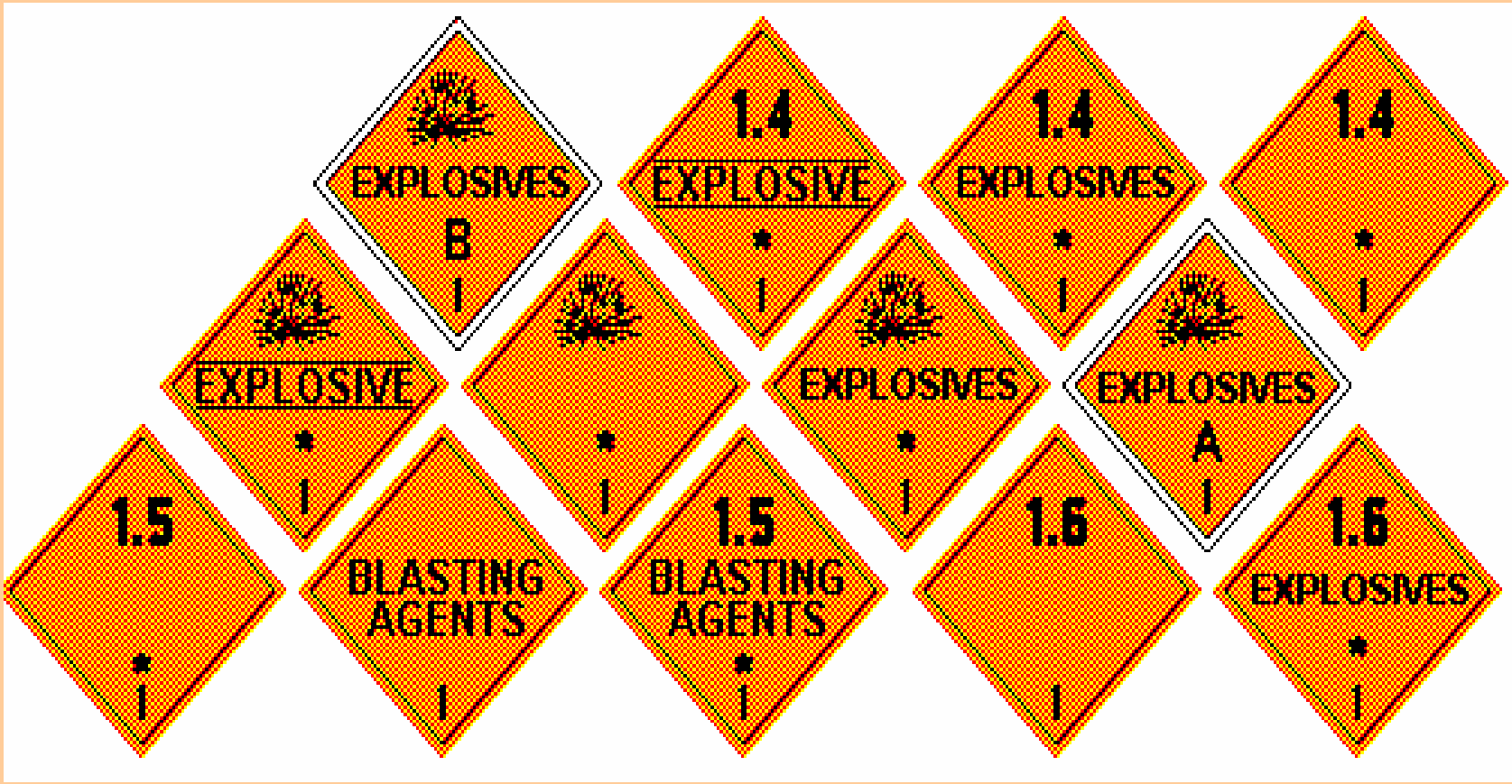
Explosion: sudden, violent release of mechanical, chemical, or nuclear energy

)ppdbs.av

Four Basic Types:

- Pressure Relief
- Rapid Oxidation
- Runaway Polymerization
- Molecule Decomposition

DOT Classes


EXPLOSIVES
B
1
1.4
EXPLOSIVE
*
1
1.4
EXPLOSIVES
*
1
1.4
*
1
EXPLOSIVE
*
1
*
1
EXPLOSIVES
*
1
EXPLOSIVES
A
1
1.5
*
1
BLASTING
AGENTS
1
1.5
BLASTING
AGENTS
*
1
1.6
1
1.6
EXPLOSIVES
*
1

CLASS 1: EXPLOSIVES

1.1 Explosives with mass explosion hazard

1.2 Explosives with a projection hazard

1.3 Explosives with predominantly a fire hazard

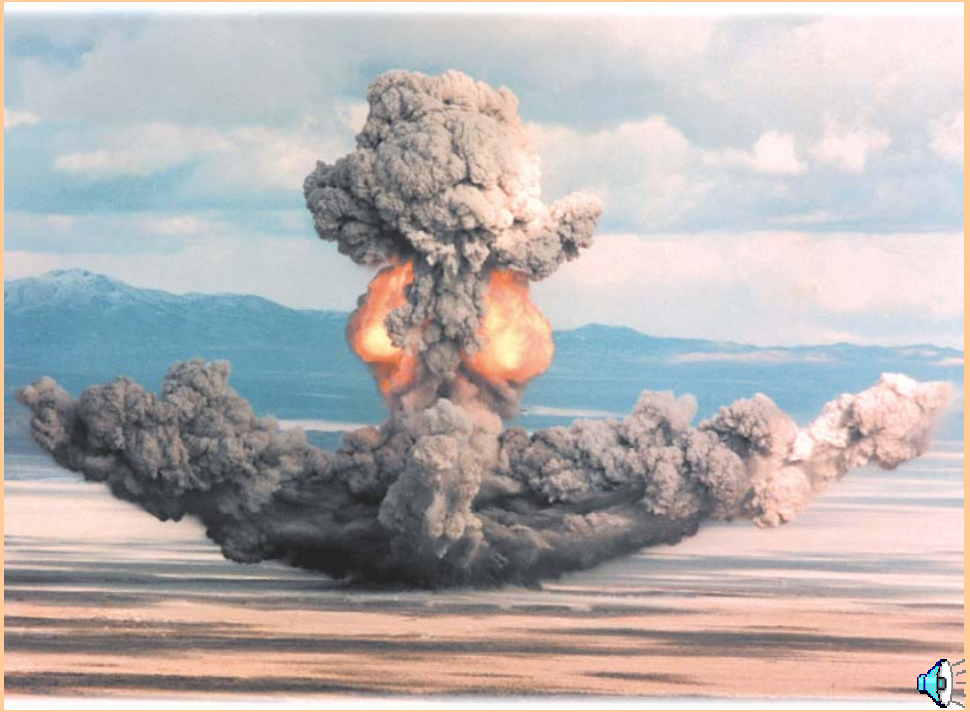
1.4 Explosives with no significant blast hazard

1.5 Very insensitive explosives; blasting agents

1.6 Extremely insensitive detonating articles

Explosive?

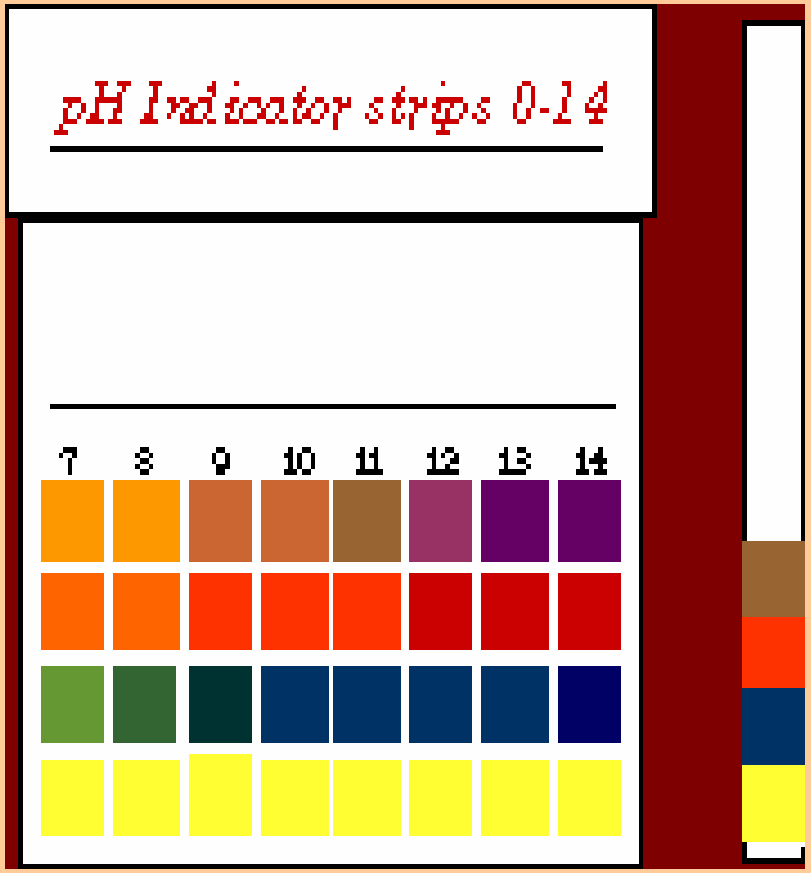
- Consult ERG
- Hair pin test
- Other references
- Orange DOT label
- Nitro- compounds
- Explosives kits



CORROSIVE

- pH paper
- 0-6 Acid
- 7 Neutral
- 8-14 Base

- **Bleach?**
- **High concentrations?**



pH of Common Items

	14.0	Strong Bases: NaOH, KOH, $Ca(OH)_2$
	12.5	RCRA haz. waste
BASIC	12.0	Household ammonia
	10.0	Detergents and Baking Soda
	8.0	Seawater
	7.4	Blood
NEUTRAL	7.0	Pure water
	6.0	Rain
	4.0	Beer
	3.0	Orange juice, vinegar, wine, acid rain
ACIDIC	2.0	RCRA haz. waste/lemon juice, stomach acid
	1.0	Strong acids: HCl, HF, HI, H_2SO_4, HNO_3
	0.0	Very acidic

CLASS 8: CORROSIVE MATERIALS

- Corrosive = a liquid or solid that causes full thickness destruction of human skin at the site of contact with in 14 days or
- exhibit a corrosion rate on steel or aluminum exceeding 1/4 inch per year

Copper Metal and Acid

$Cu(s) + HNO_3(aq) \rightarrow CuNO_3(aq) + H_2(g)$

$Cu(s) + HCl(aq) \rightarrow$ No Reaction

Cu_acid.mov

Recognition of Common Corrosives

ACIDS

- Begin with Hydrogen "H"
- End in non-metal or nonmetal oxide
- Exceptions: Organic Acids (end in COOH), Phenol
- Examples: HCl, H_2SO_4, CH_3COOH, HF, HNO_3
- Usually liquids or a gas dissolved in water

BASES

- Metal + Hydroxide (OH)
- Metal + Oxygen
- Active Metal (column 1-2 on periodic table)
- Exceptions: Ammonia (NH_3), Amines, Carbonates
- Examples: NaOH, K_2O, Li, KOH, $Ca(OH)_2$, $NaHCO_3$
- Usually solids or solids dissolved in water

WATER SOLUBILITY

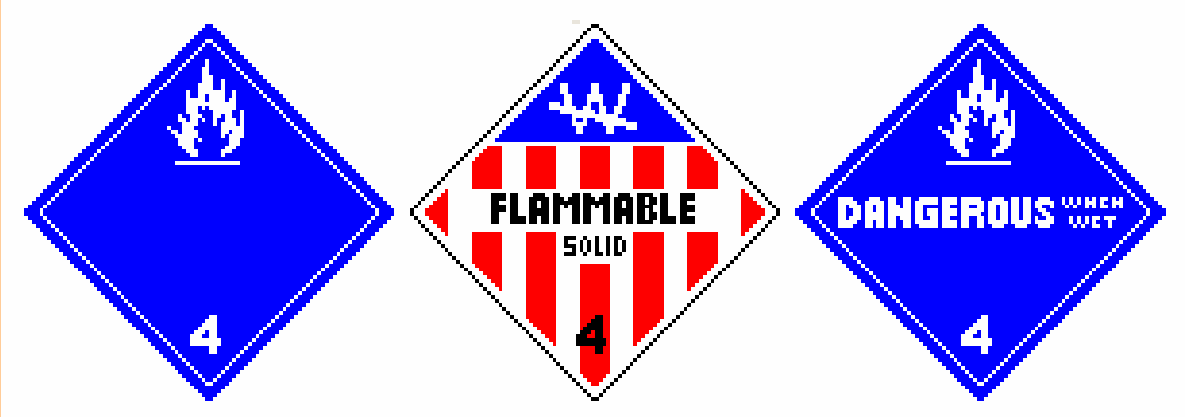
- DISSOLVES (Y/N)
- FLOAT (hydrocarbons)
- SINK (halogenated hydrocarbons)
- EMULSIFY (coffee creamer)
- REACTIVE—
  - HEAT
  - BUBBLES (flammable, toxic?)

Potassium (K) + Water (H_2O)

Kpond.avi

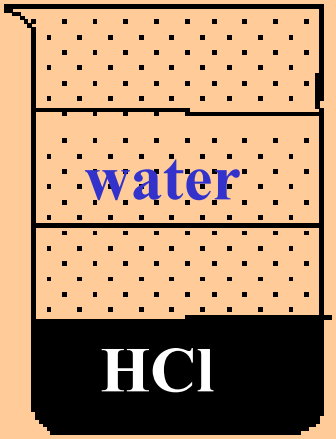
REACTIVES

- Normally unstable-reacts violently
- Mixes with water to form toxic or flammable gases
- Capable of detonation at STP or if heated in confinement
- Contains cyanide or sulfide and generates toxic gases, vapors, or corrosive fumes



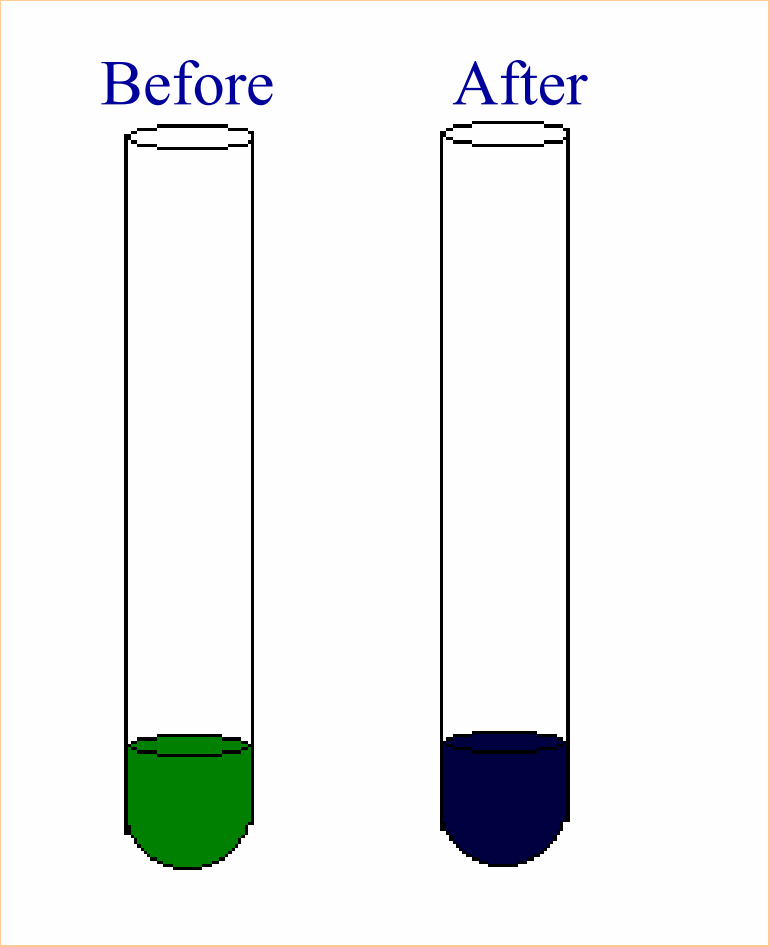
Preparing Acid Test Solution

- Directly purchase 3N HCl solution
- Add 250ml of 12N HCl to 750ml of distilled water
- Dropper bottle preferable—watch contamination
- One of the more frequently used tests



CYANIDE

- Only if pH is greater than 7
- Use cyanide test by adding solid cyanide test test 2 to a test tube with 1/4 inch cyanide test 1
- Add a pea size (or ¼ inch) amount of the unknown
- Add 3-5 drops of Acid Test solution
- Deep Prussian blue indicates cyanide



TOXICITY

- Toxicity Characteristic Leaching Procedure (TCLP) identifies 39 chemicals to test for in wastes for their ability to leach out and contaminate ground water
- Acutely hazardous wastes: (1) Oral LD_{50} less than 50 mg/kg, (2) a dermal LD_{50} of less than 200 mg/kg, or (3) an inhalation LC_{50} of less than 2 mg/kg.

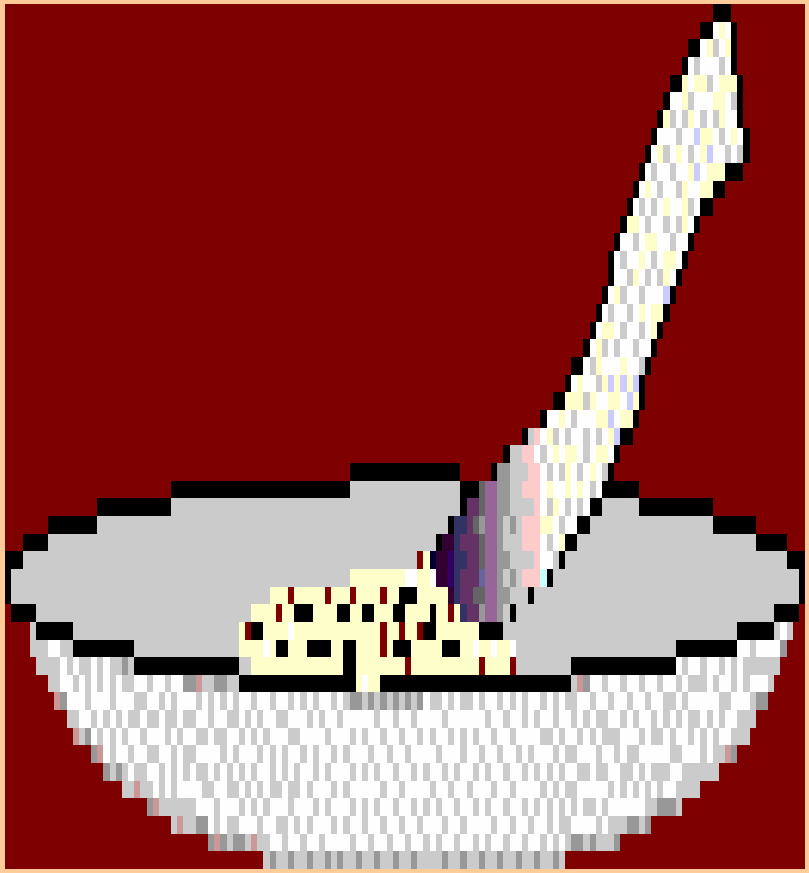
Preparing Cyanide Tests

- Cyanide Test #2 –Use directly crystals of ferrous ammonium sulfate

- Cyanide Test #1– 20g ferrous ammonium citrate in 100ml of water
- Saturated Solution—takes a while to dissolve

OXIDIZER TEST

- Use Potassium Iodide (KI) paper
- Acidify KI paper with 2-3 drops of acid test
- Hold paper over then touch unknown with paper
- Blue/black or purple color indicates an oxidizer



CLASS 5: OXIDIZERS AND ORGANIC PEROXIDES

5.1 Oxidizers-a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials

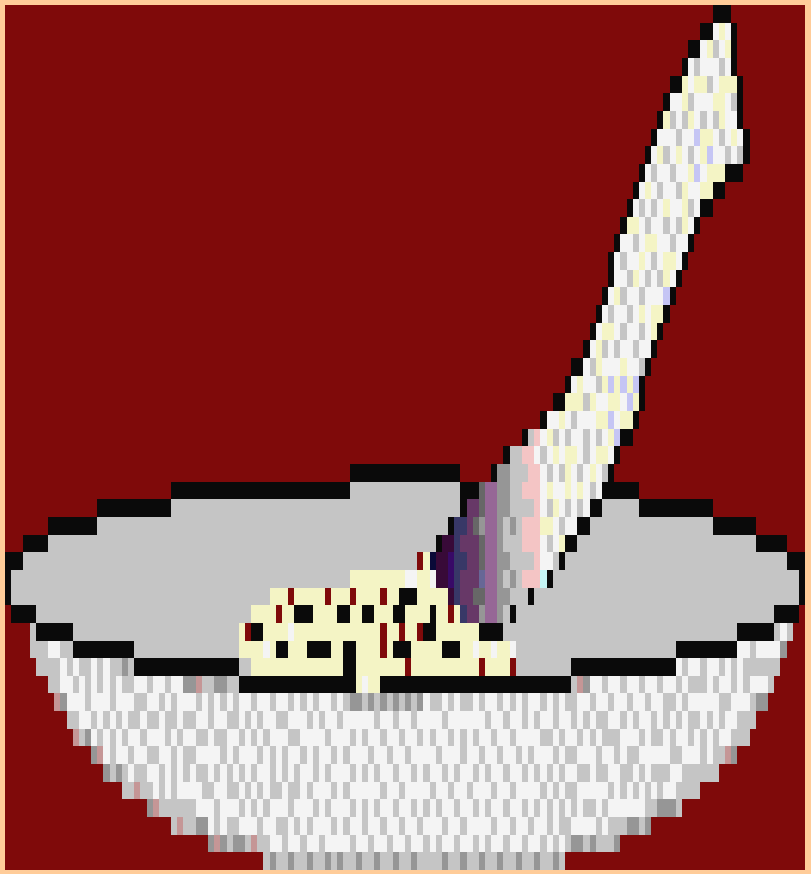
5.2 Organic peroxides-an organic compound containing the bivalent -O-O- structure

$$Zn(s) + I_2\,(s) \rightarrow ZnI_2(s)$$

Zni.mov

SULFIDE TEST

- Wet Sulfide Test Paper (Lead Acetate) with a few drops of water
- Touch paper to acidified unknown on watch dish
- Color change from white to brown indicates sulfide (lead may cause a black or silver color)

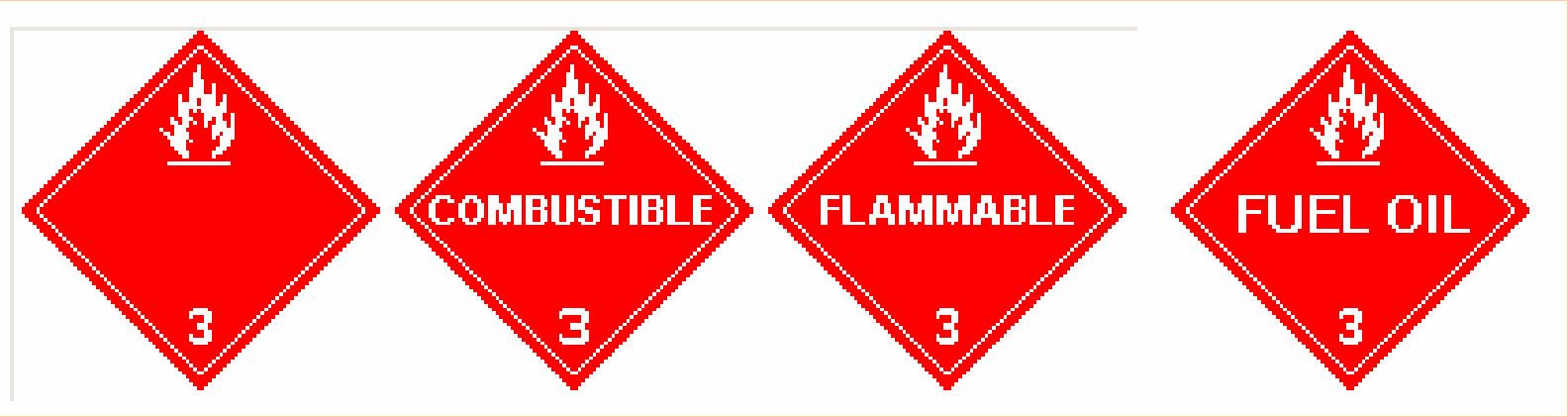


FLAMMABILITY

- Place a pool the size of a 50 cent piece on watch dish
- Bring a lit match slowly towards the watch dish
- Ignites B4 the edge
- Ignites when touched
- Match acts as wick

CLASS 3: FLAMMABLE & COMBUSTIBLE LIQUIDS

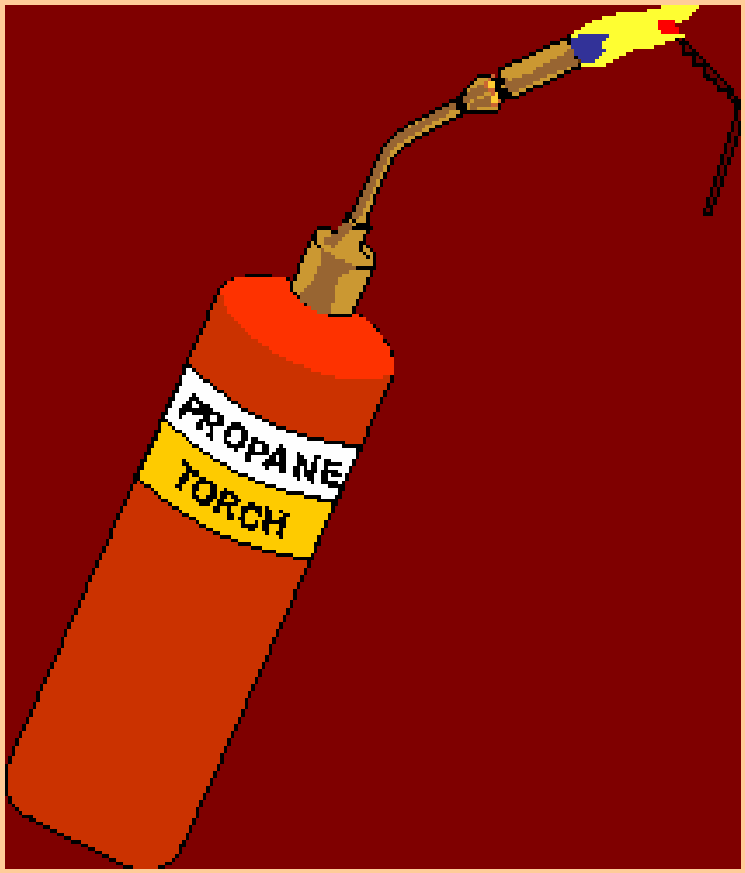
- Flammable Liquid = flash point between 100°F and 141°F
- Combustible Liquid = flash point above 141°F and below 200°F



HALIDE TEST

- Only if not water soluble
- Clean off copper wire in flame until only red/yellow flame
- cool wire
- place a few drops of sample on the coil and heat in flame
- green color = organo halide

(~ 125-1000ppm MDL)



Copper Wire Test

- Curve one end of an 8 inch piece of 10 gauge wire.
- Strip 6 inches of insulation off the other end of the 10 gauge wire
- Wrap the the bottom inch of the stripped end with 20 gauge wire

OTHER TESTS

- CGI - Combustible Gas Indicator
- PID - Photoionization Detector
- FID - Flame Ionization Detector
- Colorimetric Indicator (Drager) Tubes
- Oxygen Sensor

Colorimetric Indicator Tubes

- Measures: Compounds or Family of Compounds
- Units: PPM or % for Quantitative Measurements
- Range: Varies; Example: 1 Compound - 5 Different Tubes With Different Ranges

Photoionization Detector

- Measures: Organic and Inorganic Air Contaminants (Must have an Ionization Potential Below the Measuring Probe)
- Units: Indicates in PPM
- Range: .5 to 2000 ppm
- Probes: Hnu: 9.6eV, 10.2eV, and 11.7eV

Flame Ionization Detector

- Measures: Organic Atmospheric Contaminants (Compounds That Will Burn In a Flame)
- Units: Indicates in PPM
- Range: .5 to 1000 ppm

Chemical Weapons Identification

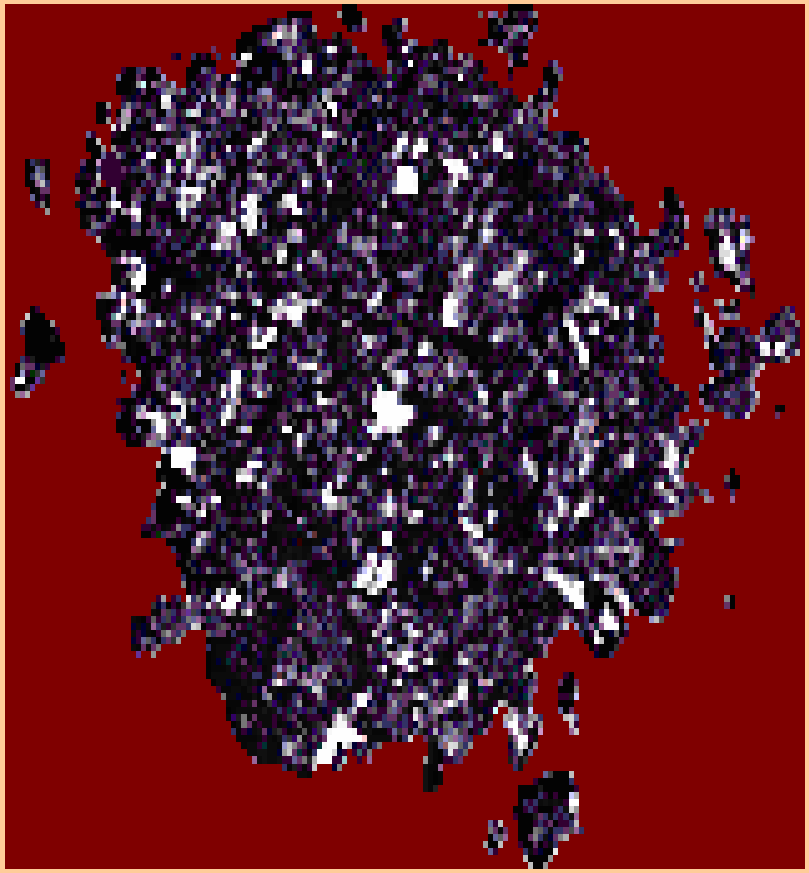
- M8/M9/M256
- Colorimetric
- PID/FID
- APD 2000
- AP2Ce
- SensIR
- Hapsite
- SaphaIRe

SensIR—Solid/Liquid ID of Covalently bonded (non-metals) compounds (mainly organics)


AP2Ce—Simultaneous V,G, & H
10 X Sensitive as APD for G
5 X Sensitive as APD for H
'USE'
FAIL
READY
BAT
DANGER !
CAUTION !
TURN ON
TURN OFF
EJECT H2
STORAGE DEVICE

SAMPLE DESCRIPTION

- Physical and Chemical Properties
- Solid (crystals?), liquid, gas
- Color
- Odor
- Viscosity
- Other?



Information Resources

- Compare observed properties of the unknown material to the properties of a likely match or matches
- Test a few unique properties of the material to confirm or deny the identity
- Compound specific references are necessary, preferably more than one

WHAT IS IT?

- Category versus identity?
- Apply knowledge of chemical families
- Narrow the range of possibilities
- Major Hazard Group

WHY FIELD SCREENING?

- Hazards
- Bulking
- Disposal
- Transport
- Storage
- Mixtures

Chemical Segregation

- Use specific information on MSDS, NIOSH, etc.
- DOT Chart (note: acids and bases are both Class 8 (corrosives) but, they should be stored seperately.
- Summary

idiots mix stuff.wmv

SEGREGATION TABLE FOR HAZARDOUS MATERIALS

Class or division		Notes	1.1 1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas zone A	2.3 gas Zone B	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG I zone A	7	8 liquids only
Explosives	1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives	1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives	1.4		*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives.	1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives.	1.6		*	*	*	*	*													
Flammable gases	2.1		X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases.	2.2		X			X														
Poisonous gas Zone A	2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas Zone B	2.3		X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids	3		X	X	O	X				X	O					O		X		
Flammable solids	4.1		X			X				X	O							X		O
Spontaneously combustible materials.	4.2		X	X	O	X				X	O							X		X
Dangerous when wet materials.	4.3		X	X		X				X	O							X		O
Oxidizers	5.1	A	X	X		X				X	O	O						X		O
Organic peroxides	5.2		X	X		X				X	O							X		O
Poisonous liquids PG I Zone A.	6.1		X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials	7		X			X		O												
Corrosive liquids	8		X	X	O	X				X	O		O	X	O	O	O	X		

Notes: **O = Must have a separation between the materials**

X = Must not be shipped in the same vehicle

*** = See Compatibility Table for Class 1 (Explosive) Materials**

A = Ammonium Nitrate and ammonium nitrate fertilizer may be loaded or stored with Division 1.1 or 1.5 materials

Summary

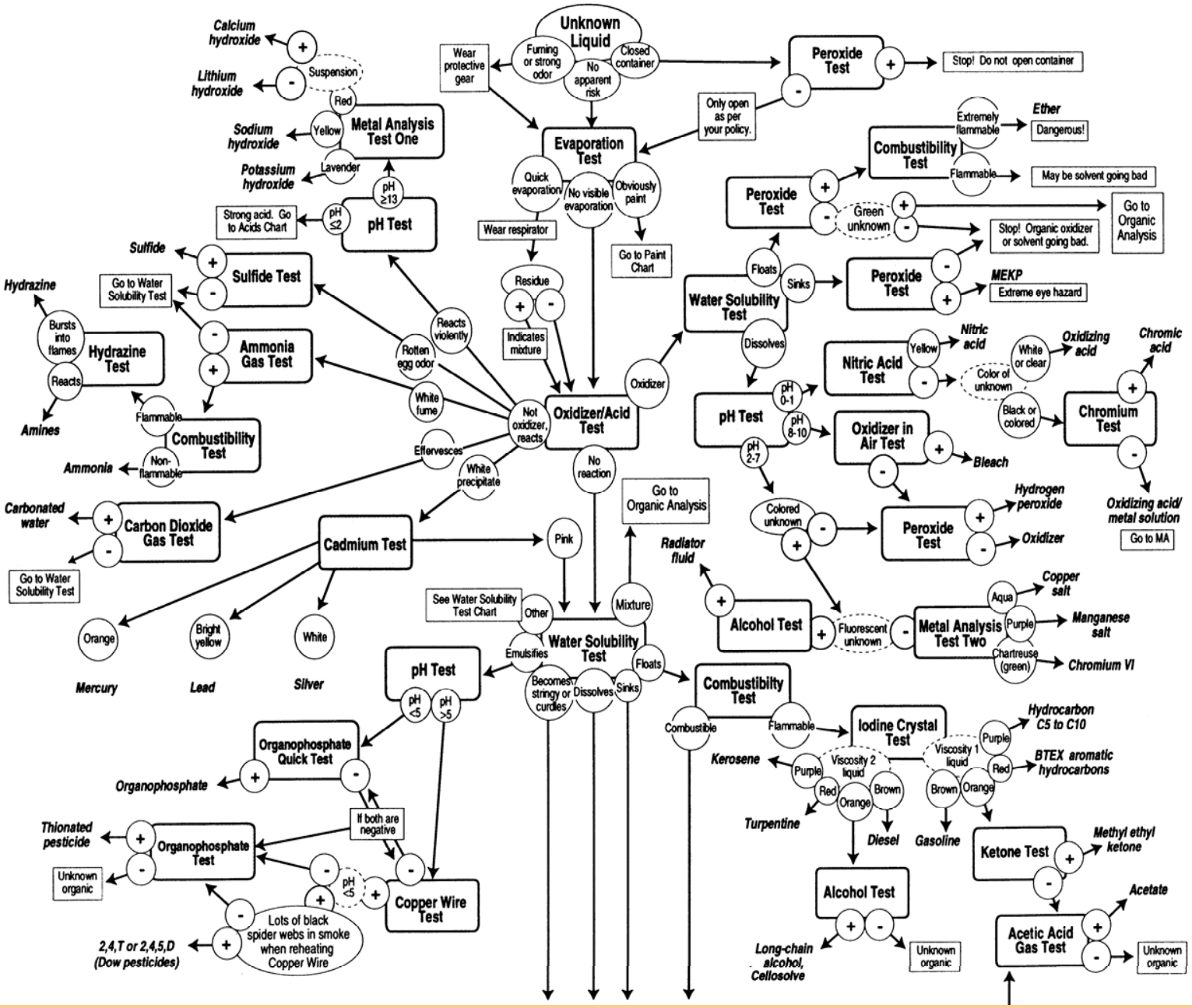
- Separate into the 9 DOT Classes
- Separate acids and bases
- Separate oxyacids from non-oxyacids
- Separate oxidizers from flammables
- Separate water reactives from water based solutions
- Multiple Classes are a separate class


FIELD IDENTIFICATION
OF UNKNOWN
MATERIALS

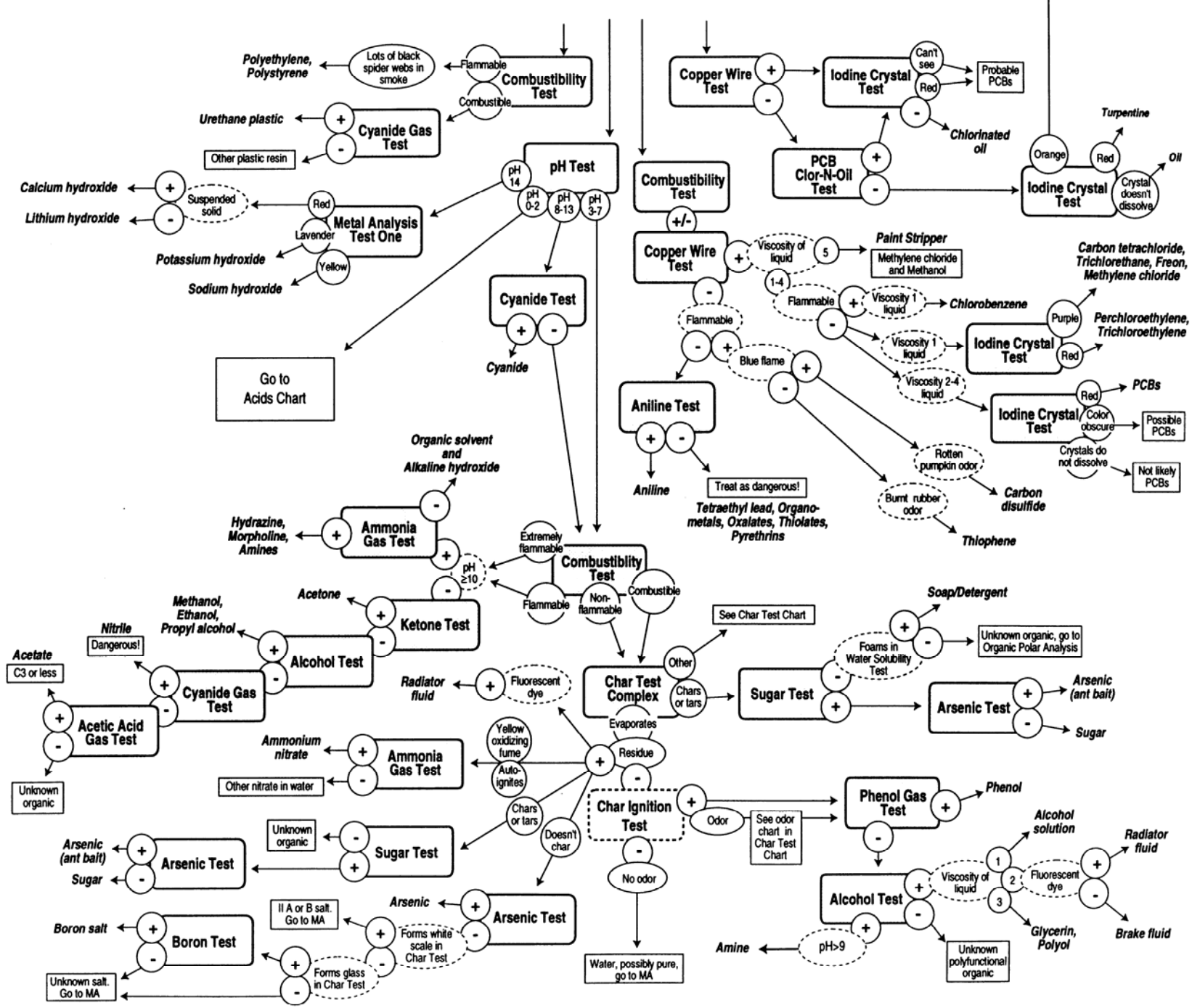
OBJECTIVES

- Become familiar with the major tests on the HazCat (TM) flowchart
- Interpret the results of the major tests on the HazCat (TM) flowchart
- Apply HazCat(TM) flowchart and manual to identify unknowns

Unknown Liquids Chart



HazCat® Chemical Identification System



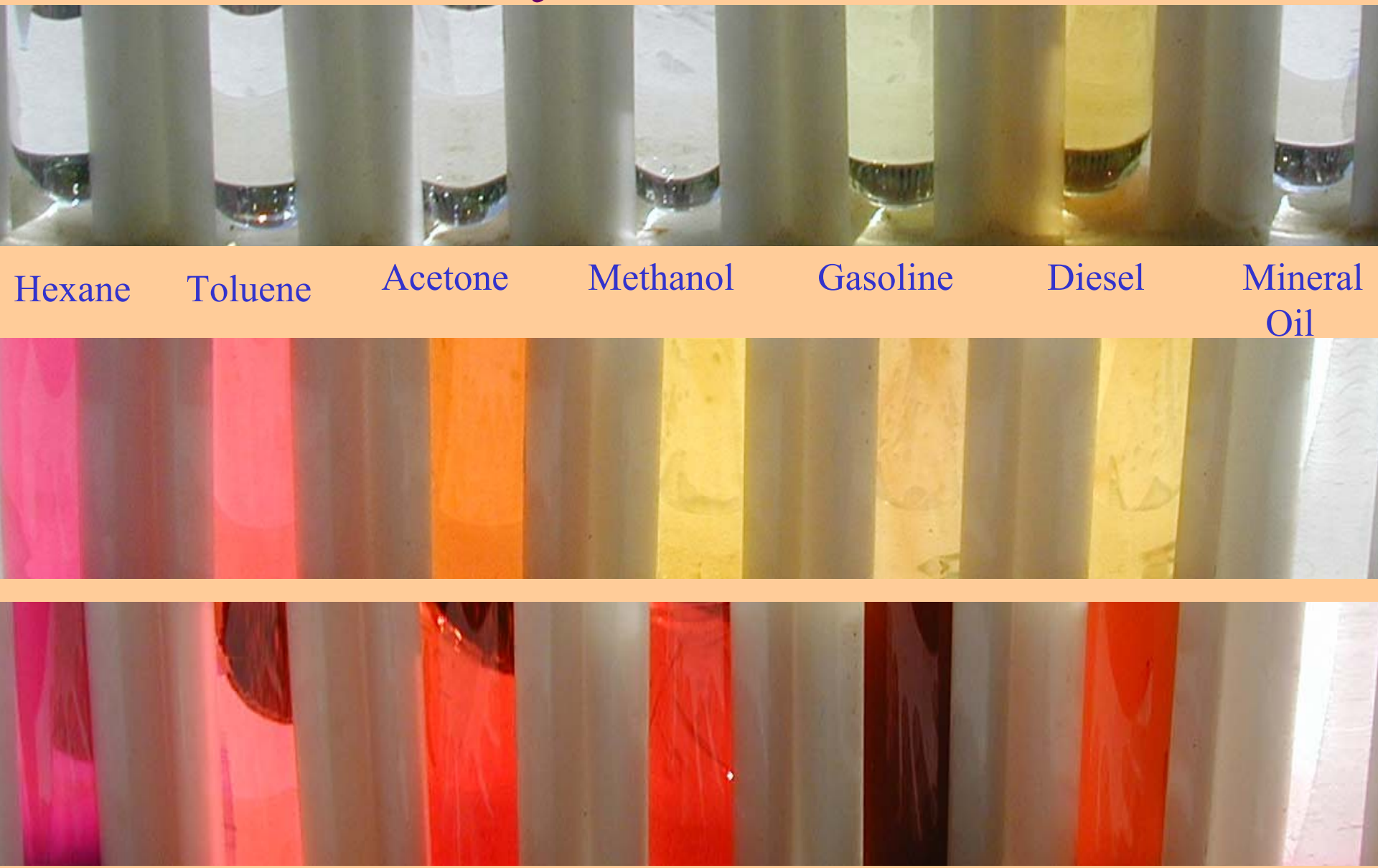
HazCat® Chemical Identification System

Oxidizer/Acid Test

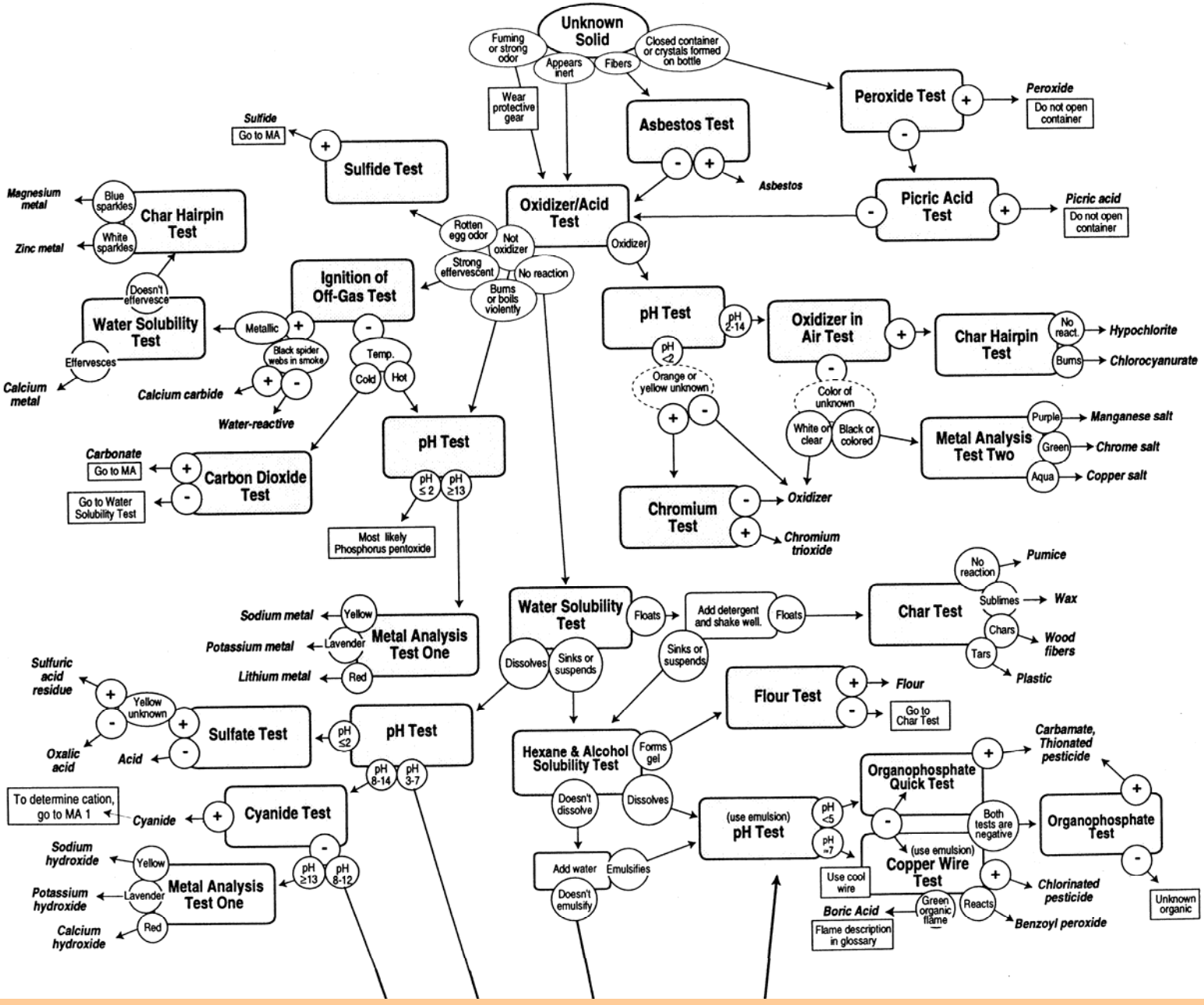
- Same oxidizer test as in field screening

- Acid test determines if the unknown reacts (bubbles, fizzes, boils, pops, etc.)

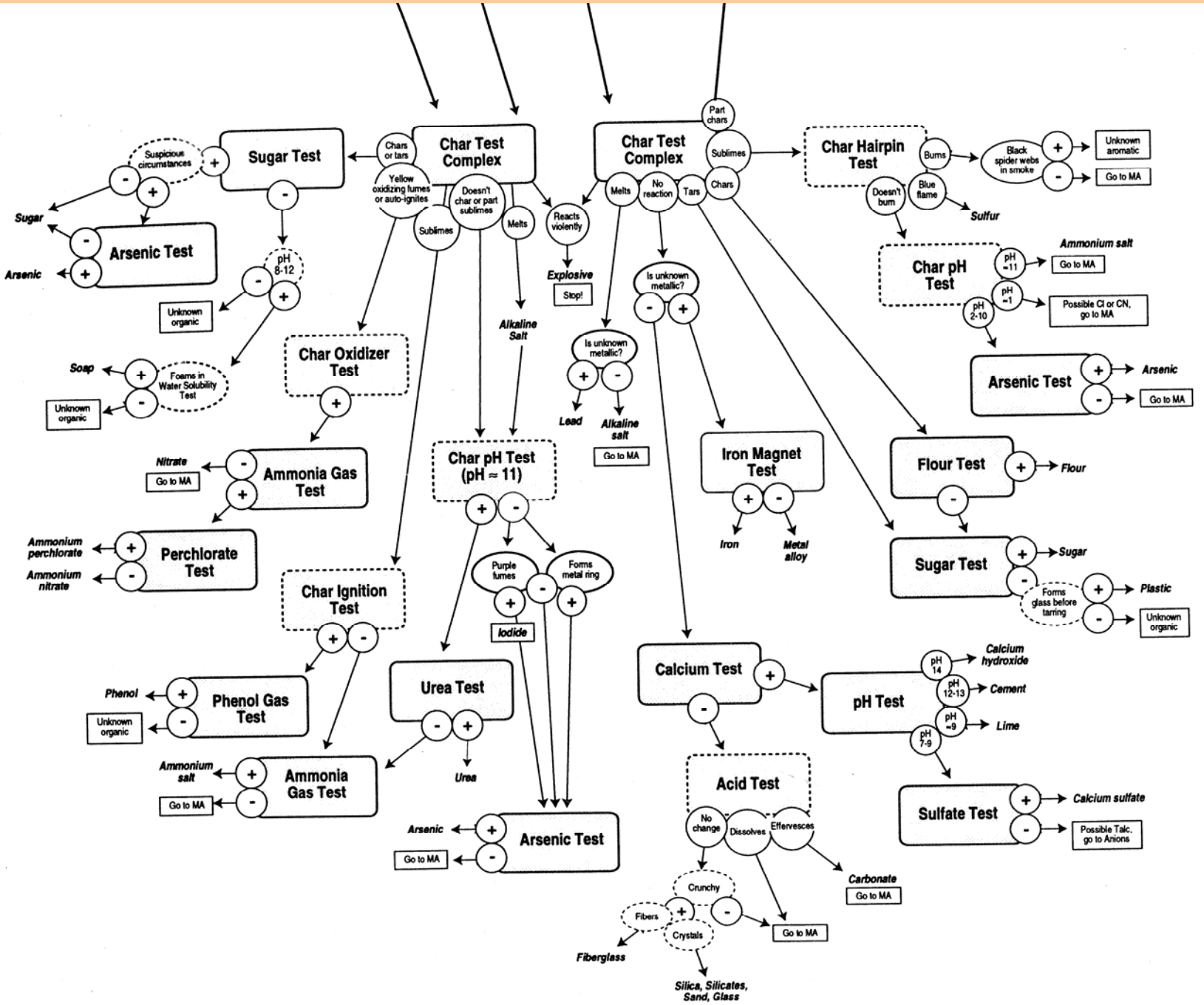
Iodine Crystal Test Results



Unknown Solids Chart



HazCat® Chemical Identification System



HazCat® Chemical Identification System

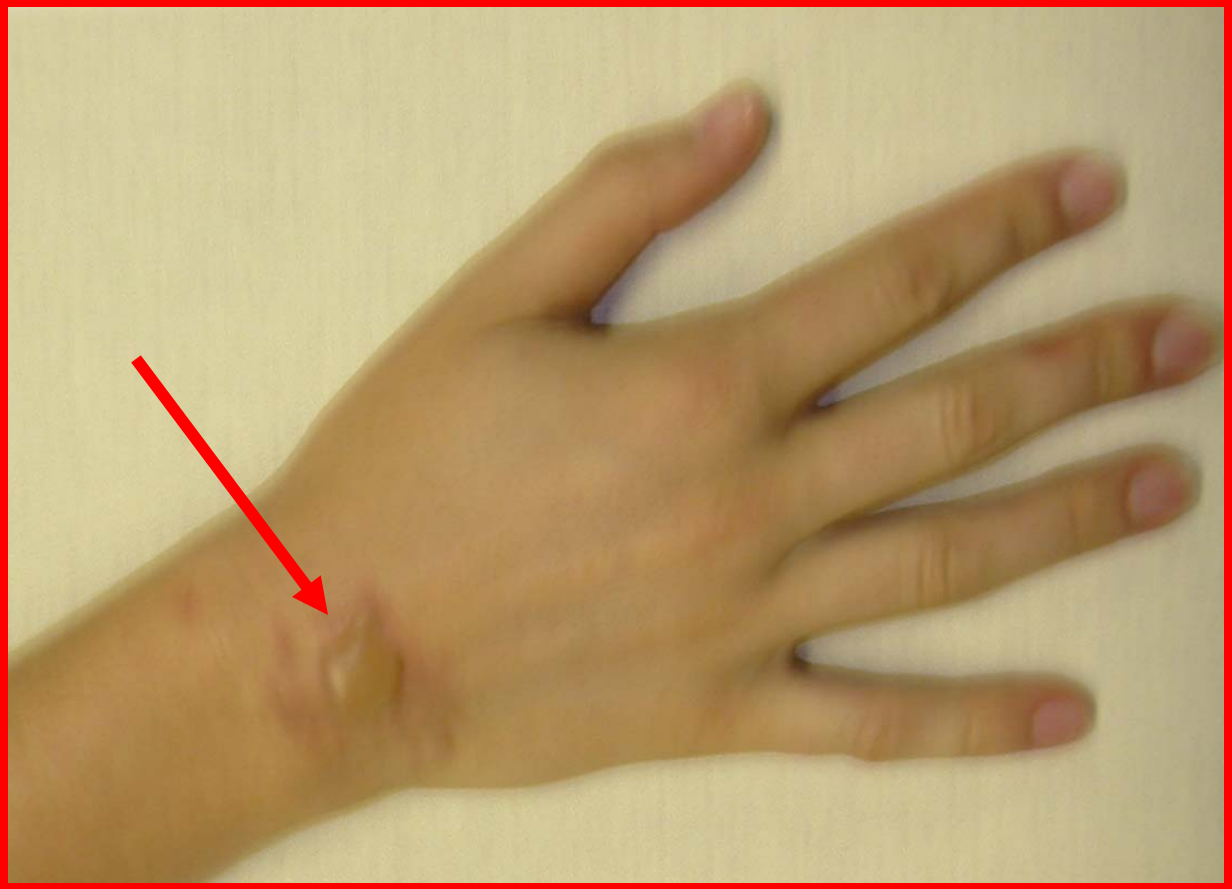
CONCLUSION

- If properly applied the HazCat(TM) flowchart can assist in identifying materials in the field
- The large number of compounds and mixtures makes it difficult to always identify the unknown material
- Reference materials can also assist in the identification of materials in the field

QUESTIONS?

LABORATORY SAFETY

Case Studies



LABORATORY SAFETY
Planning

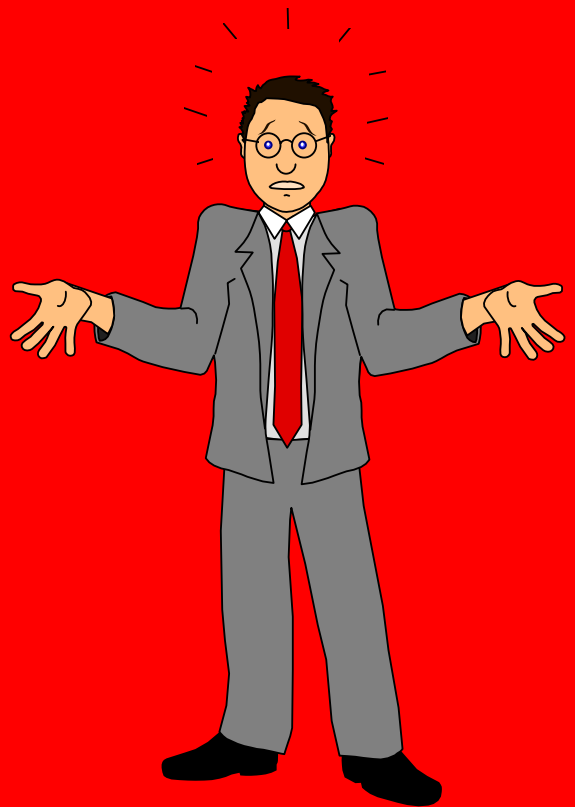
- Primary and secondary exits
- Emergency equipment
  - Eyewash
  - Shower
- Keep access to emergency equipment and exits clear
- Keep aisles clear

LABORATORY SAFETY
Behavior

- Listen to & follow directions
- Read & follow instructions
- Read **all** of the test steps before starting the actual test
- Think about why each test is being completed

LABORATORY SAFETY
Behavior

- Pipette materials onto test papers/wires
  - Do not place tests into test tubes
- Think about test results
  - Do they make sense?



LABORATORY SAFETY
Behavior

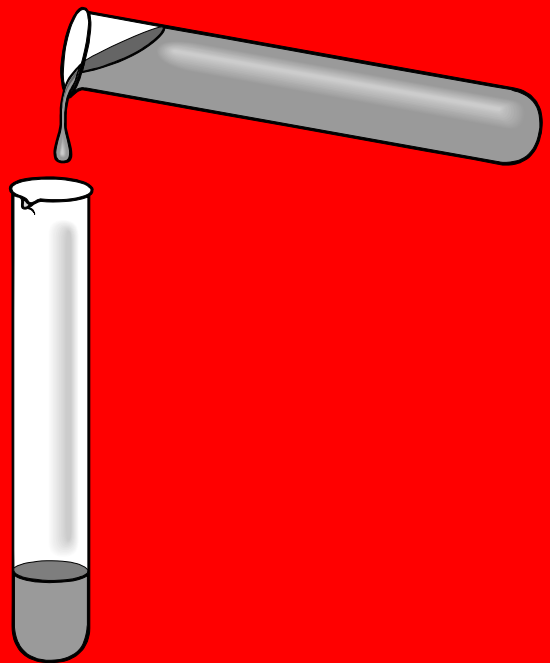
- Treat unknowns as hazardous
- Avoid practical jokes
- Always wear PPE
- Be careful with glassware - avoid injury
- Inspect glassware for damage
  - Remove if chipped, cracked, or badly etched

LABORATORY SAFETY
Behavior

- Point heated test tubes away from all personnel
- Use tongs or special gloves to move hot glassware
- Clean up broken glassware immediately
- Do not pick up broken glass with bare hands

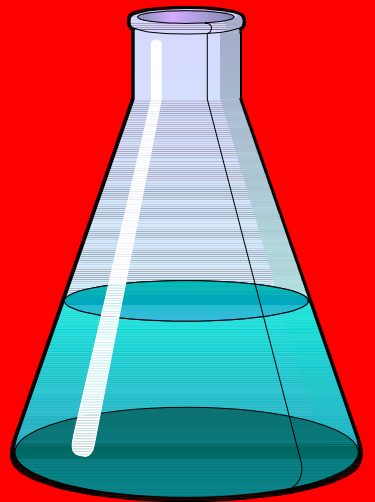
LABORATORY SAFETY
Behavior

- Be careful of slips, trips, and falls
- No pouring or shaking of test tubes
- Use small amounts of unknown
- Scoop or pipette materials
- BE ALERT



LABORATORY SAFETY
Behavior

- Point all flames away from personnel
- Do not dispose of any hot materials in trash
- Do Char Hairpin test before doing the Char test!!!!
- Add the unknown to water
- Follow instructions



LABORATORY SAFETY
Clean Up

- Keep work areas clean and uncluttered
- Keep work surfaces clean and cleared
- Decon all non-disposable PPE