



NMT Introduction to Laboratory Safety

Director of Hazardous Materials
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Lab Personnel Training Topics

- The Lab Standard Basics (OSHA 29 CFR)
- Chemical & Physical Hazards
 - What they are
 - Where to find info
 - How to protect lab workers
- Emergency Procedures
 - Fires
 - Exposures/Injuries
 - Spills
- Hazardous Waste Basics (EPA, NMED)



Related Topic Not Covered Here



- Bloodborne Pathogens ([OSHA 29 CFR 1910.1030](#))
Assume the worst – use Universal Precautions
 - Laser Safety
 - Radiation Safety
 - Biohazard Safety
- Classes for these topics are in the process of being developed.

“The Laboratory Standard”

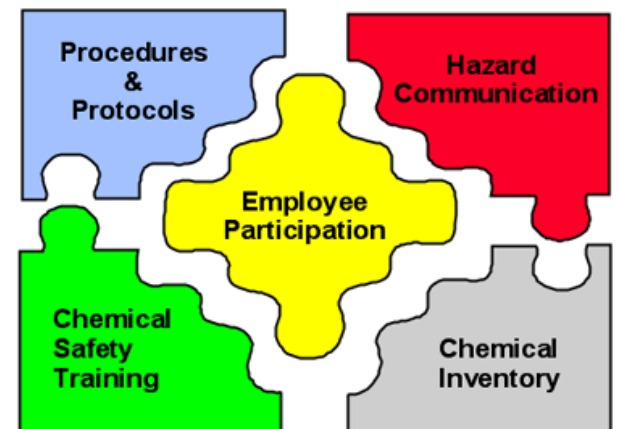
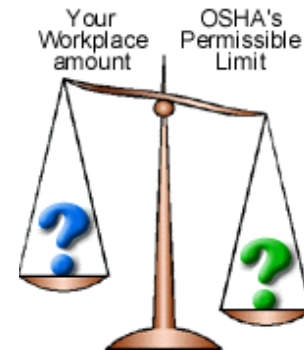


- Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450)
 - Hazardous Chemical – any evidence that acute or chronic effects occur due to exposure
 - Laboratory –
 - small quantities of hazardous chemicals
 - containers that are easily manipulated by one person
 - protective practices and equipment are in common use



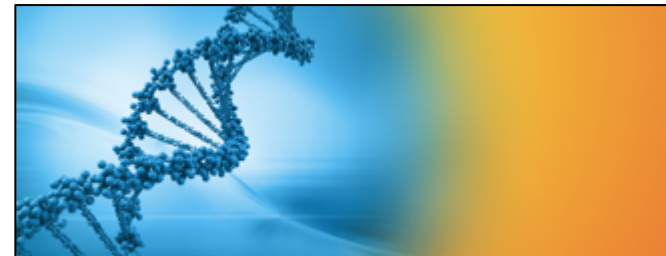
Laboratory Standard

- Permissible Exposure Limits [1910.1450(c)]
 - Tables found in the CFR
- Employee Exposure Determination [1910.1450(d)]
 - Initial, periodic & termination of monitoring
- Chemical Hygiene Plan (CHP) [1910.1450(e)]
 - Written plan designed to protect laboratory employees
 - Some mandatory elements



Laboratory Standard

- Employee Information & Training [1910.1450(f)]
 - Initial and refresher
 - The Standard
 - PELs & other exposure limits (TLVs)
 - Exposure Symptoms
 - SDS & other reference materials
 - Monitoring devices – mechanical & observational
 - Physical & health hazards
 - Measures for protection (practices, PPE, emergency procedures)



Laboratory Standard

■ Medical Consultation & Examination [1910.1450(g)]

- If symptoms develop due to exposure
- If exposure levels are regularly above limits
- If a spill, leak, explosion, etc. occurs
- Details on results of such consultations/examinations



■ Hazard Identification [1910.1450(h)]

- Manufacturing labels should not be removed or defaced (until bottle is empty)
- SDS maintenance
- Substances created in the lab
- Determine hazards and provide appropriate training/info
- If composition is unknown – assume hazardous & defer to NMT HAZMAT
- If produced for others – defer to Hazard Communication Standard (labeling, MSDS generation)



Chemical Hygiene Plan (CHP)

- Written plan to protect lab employees
- Must be readily available
- CH Responsibilities
 - Individual Labs - adopt this plan or write your own – requires approval by HAZMAT
 - Review annually



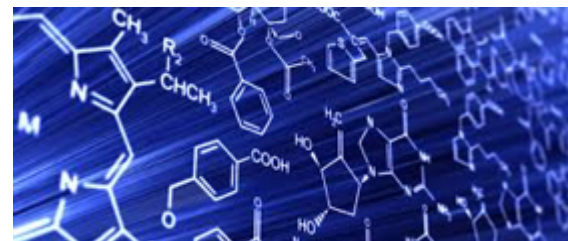
CHP-SOPs for the Use of Hazardous Chemicals



- Describes hazards & safeguards for handling
- General Guidelines
 - Prudent Practices (<http://www.nap.edu/openbook.php?isbn=0309052297>)
- Research Labs – PI responsibility
- Teaching Labs - lab manuals, syllabus
- NMT HAZMAT will develop generic SOPs and assist in generation of specific SOPs as needed

CHP - Control Measures to Reduce Exposures

- **Engineering controls**
 - Ventilation/Fume hoods
 - Proper storage facilities
- **Personal Protective Equipment (PPE)**
 - Individual responsibility – HAZMAT assistance
 - Any potential for chemical splash requires indirectly vented chemical splash goggle
- **Good Laboratory Hygiene/General Practices**
 - Cite Prudent Practices & ACS publications
- **Specific Laboratory Practices**
 - Chemistry Laboratory Safety Regulations or adopt own
 - Develop SOPs for “particularly hazardous chemicals” – NMT HAZMAT assistance
- **Other Services Provided**
 - Exposure monitoring, eyewash/shower stations, emergency procedures



CHP - Control Measures to Reduce Exposures

■ Fume Hoods & Other Protective Equipment

- Hoods certified & inspected annually (Bio cabinets not included)
- *Eyewashes/showers activated monthly*
- Fire extinguisher inspections
- Spill response equipment

■ Information & Training

- Every 2 year minimum
- Individual lab maintains access to SDSs
- NMT HAZMAT assistance & consultation



CHP-Control Measures to Reduce Exposures



- **Prior Approval for High Hazard Work**
 - Individual responsibility to identify
 - Departmental approval/SOP
 - EHS/CHC provides consultation
- **Medical Consultations** (per the Standard)
- **Provisions for Protection for Work with Particularly Hazardous Substances**
 - May require prior review
 - Designated areas
 - Containment devices (fume hoods, glove boxes)
 - Safe removal of contaminated waste
 - Decontamination procedures

Safety Symbols

- Know your safety symbols.
- What are the Hazards present in the lab?



Flammability

- Solid, liquid or gas
 - Hydrocarbons (especially with 9Cs or less)
 - Many alcohols, ketones and ethers
 - Some inorganic metals (K & Na)
 - Metal dusts
- Volatility – rate at which a material evaporates
 - Lower boiling point → higher volatility → more flammable
- Flash Point - lowest temperature at which a liquid has a vapor pressure that forms an ignitable mixture with air near the surface of the liquid
 - Lower Flash Point → Greater Hazard
 - >200 F
- Flashback –vapors extend away from the source and find ignition
 - Higher Volatility/Lower Flash Point → more risk of flashback



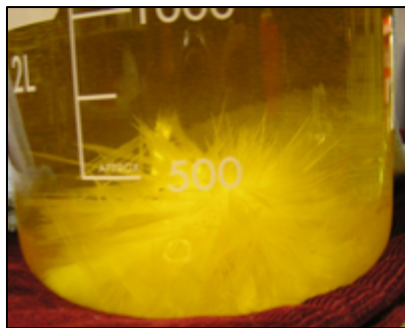
Fire Prevention

- Proper storage of flammable chemicals
 - Tight caps
 - Flammable cabinets and refrigerators
 - Away from ignition/heat sources
- Proper electrical grounding of equipment
- Bonding & grounding when transferring chemicals
- Basements cannot have flammables stored there



Reactivity

- Oxidizers – cause or contribute the combustion of other materials by providing oxygen to support the combustion process(chromates, nitrates, permanganates, perchlorates, peroxides, etc.)
- Water Reactive – react with water to release toxic gases, heat, O₂ or H₂. (IA & IIA metals (Li, Na, K, Ca), organometallics, etc.)
- Pyrophore - ignites with air contact (finely powdered Zn, Mg, P, C, organometallics, etc.)
- Explosive – goes boom(C-N, nitro groups, azides, metal-N bonds, epoxides, etc.)Dryness sensitivity (picric acid, nitrogen triiodide, organic peroxides)
- Unstable liquid - will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shocks, pressure, or temperature (styrene, vinyl chloride, etc.)



Reactive Issue Prevention

Segregate Incompatible Chemicals

- Charts (Prudent Practices, Flinn, RCRA)
- Golden Rules – segregate
 - Oxidizers from everything! (including acetic acid or acetate & HNO_3)
 - acids and bases
 - Inorganic acid from organic acids
 - acids and metals
 - corrosives and organic solvents
 - flammables and reactives/oxidizers or ignition sources
 - Acids and cyanides
 - Concentrated acids and water



Auto-oxidation – Formation of Explosive Peroxides

- Most common:
 - Diethyl ether
 - MIBK
 - Furan
 - Alkenes
 - THF
 - General Info on Peroxide formation <http://www.ilpi.com/msds/ref/peroxide.html>
- Stabilizers/inhibitors often added (free radical scavengers)
- Date upon receipt and when opened
- Test for peroxide formation every 3-6 months – test strips available.
- Adhere to Expiration Dates
- Concentrating procedures such as evaporation or distillation.
- Sources of Friction...unscrewing a lid, popping out a glass stopper, grinding solids with glass rods or spatulas



Toxicity

- **Toxic Chemical:** a chemical that will cause damage when it is in contact with a susceptible site
- “The dose makes the poison.” (dose x exposure time)
- Acute vs. Chronic, Local vs. Systemic
- **LD50** (lethal dose) - the dose of chemical that when injected, ingested or applied to skin of test animal, 50% of those animals die
- **LC50** (lethal concentration) - the concentration of a chemical in the air that will kill 50% of test animals
- **Permissible Exposure Limit (PEL)** - the concentration limit of a chemical in air in which most workers (interpreted as avg. 150 lb, healthy males) can be exposed during a normal work week without adverse effects (OSHA)



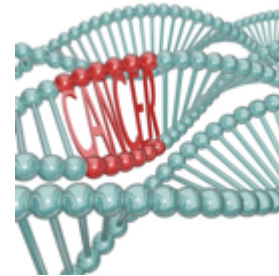
Toxicity

- Irritants (lots of inorganic & organic compounds)
 - Generally reversible effects
 - itching, mild burning, swelling, coughing, slight headache
 - Examples: NaCl, acetone
- Corrosives (strong acids, bases, oxidizers)
 - Sometimes reversible, sometimes irreversible tissue damage
 - itching, burning, tissue decay, ulcers, swelling, coughing, headache
 - Examples: HCl, H₂SO₄, HF, NaOH, NH₄OH, Br₂, Cl₂



Toxicity

- Allergens/sensitizers
 - First exposure may show little or no symptoms
 - Changes to tearing, swelling, and other irritations, but can lead to death
 - Examples: latex, formaldehyde, acrylates
- Asphyxiants
 - Displaces O₂ from lungs or blood cells
 - Dizziness, loss of consciousness, coughing/wheezing
 - Examples: CO₂, Ar, He, N₂, CO, HCN
- Carcinogens
 - Generally due to chronic exposure
 - NTP, IARC, OSHA lists
 - Examples: benzene, Cr(VI), Cd, As, dichloromethane, chloroform
- Reproductive/Developmental/Specific organ or system toxins
 - Directly affects specific bodily functions (reproductive, kidney/liver, CNS, blood cells)
 - Examples: Pb, Hg, toluene



Chemical Hazard Risk Assessment

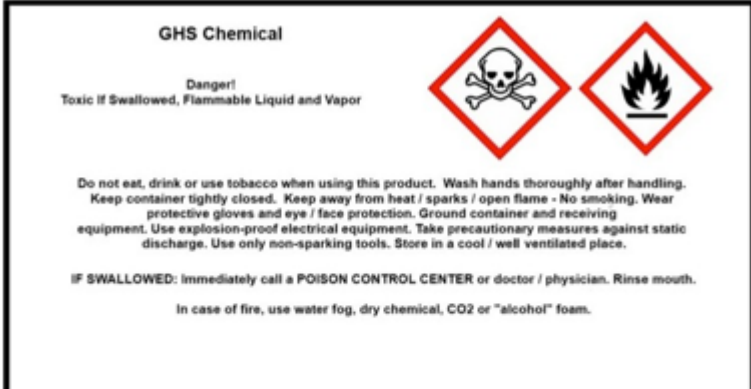
- Risk assessment is YOUR responsibility
- NMT HAZMAT available to assist
- Assess chemical hazards using references
 - SDS & Labels
 - Chemsafe website
 - Bretherick's, Merck, RTECS, etc.
- Assess procedures - hazards of chemicals may change due to procedure (heating, pressure, mixing, aerosol formation, etc.)



MSDS to SDS


- GHS: Global Harmonization System for Hazard Communication (HazCom)
- 2003: UN adopted system for chemical classification and chemical labeling .
- SDS has standard format, MSDS does not.

New



GHS Chemical

Danger!
Toxic if Swallowed, Flammable Liquid and Vapor

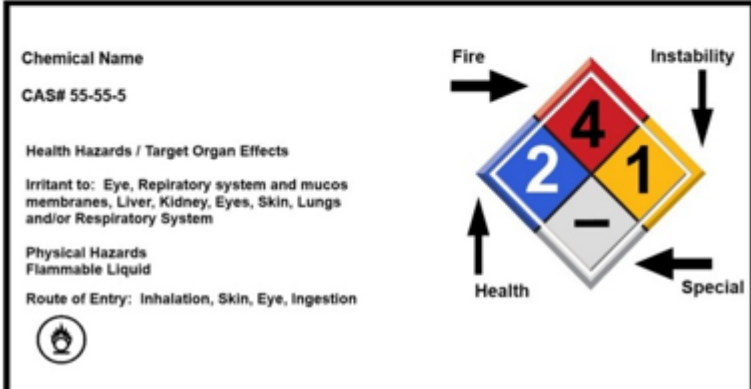


Do not eat, drink or use tobacco when using this product. Wash hands thoroughly after handling. Keep container tightly closed. Keep away from heat / sparks / open flame - No smoking. Wear protective gloves and eye / face protection. Ground container and receiving equipment. Use explosion-proof electrical equipment. Take precautionary measures against static discharge. Use only non-sparking tools. Store in a cool / well ventilated place.

IF SWALLOWED: immediately call a POISON CONTROL CENTER or doctor / physician. Rinse mouth.

In case of fire, use water fog, dry chemical, CO2 or "alcohol" foam.

Old




Chemical Name
CAS# 55-55-5


Health Hazards / Target Organ Effects
Irritant to: Eye, Respiratory system and mucos membranes, Liver, Kidney, Eyes, Skin, Lungs and/or Respiratory System

Physical Hazards
Flammable Liquid

Route of Entry: Inhalation, Skin, Eye, Ingestion



Fire → 4
Instability ↓ 1
Health ↑ 2
Special ← -



SDS: MUST BE READILY AVAILABLE

- Chemicals that are being reordered
- Should be shipped with or before the chemical
- If you fail to receive the SDS, contact NMT HAZMAT
- Always review before using a new chemical
- If you have concerns, please call us
- Quartz system



Container/Chemical Labels

- Keep manufacturer labels on where possible – they **SHOULD** be compliant, BUT old bottles are not grandfathered in (No label then you label them)
- Manufacturer and any secondary labels **NEED TO** have:
 - Name of chemical (not symbols)
 - Hazard warnings (any combo of words/pictograms)
 - Specific physical/health hazards, including target organs (1994)
 - Responsible party contact info in English and legible
- Defacing a label is prohibited – scrape it off if reusing

Components Of A GHS-Compliant Label

product identifier **AMMONIA**

signal word **DANGER**

hazard statement **TOXIC IF INGESTED**

precautionary statements
Wash hands thoroughly after handling. Keep container tightly closed when not in use. Keep away from heat, sparks and open flames - may explode when exposed to high heat. Use in an open area that is well-ventilated. Breathing in ammonia is irritating and corrosive. Wear protective gloves and safety goggles to prevent burns and irritation.

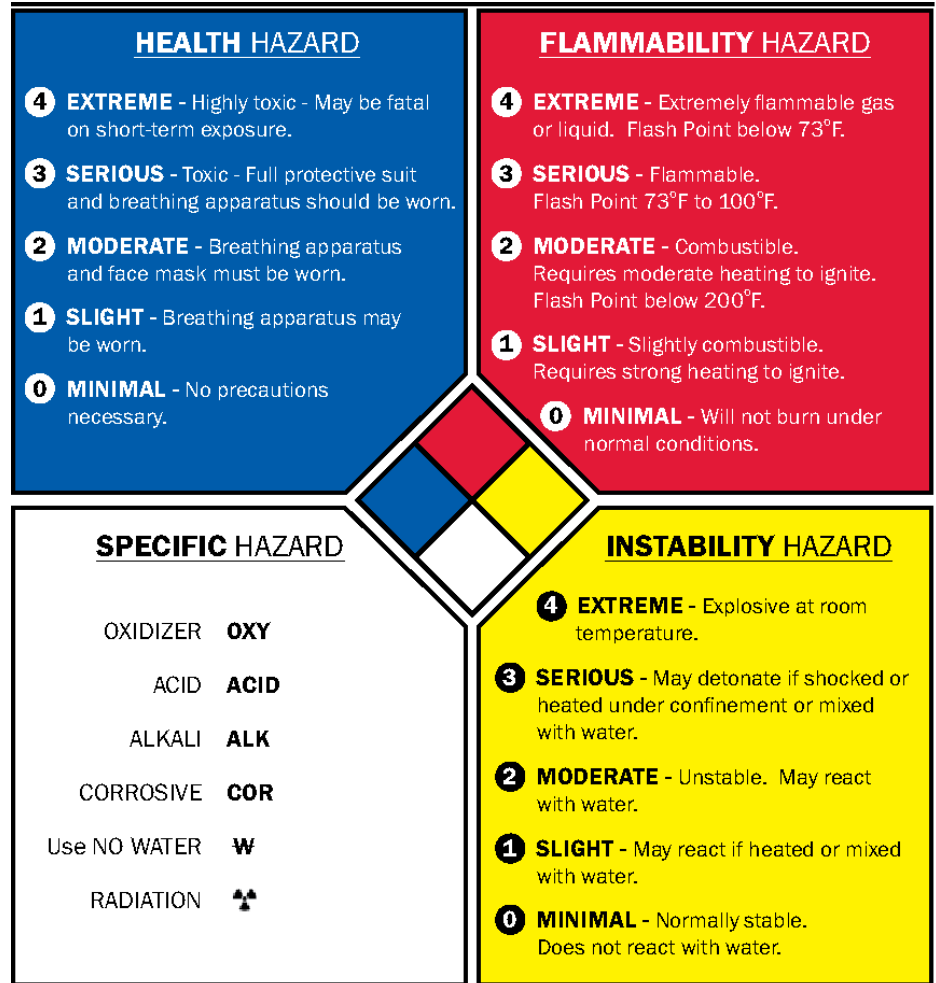
supplier information **ABC Chemicals - 123 Main Street - Cincinnati, OH - www.abcchem.com - 800-733-5252**

pictograms

See Safety Data Sheet (SDS) for further details regarding safe use of this product.

NFPA Symbol

- Color coded, numerical rating system
- Sometimes on labels
- Provided at-a-glance hazard information
- Flammable and Reactive Info is usually very good
- Health hazard not very informative



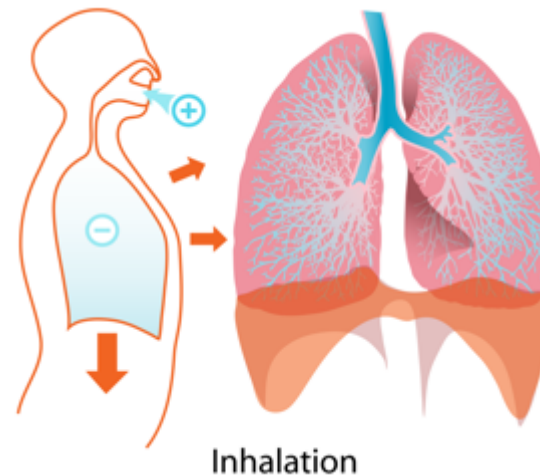
HMIS System

- Designed for work with certain chemicals
- Number rating system is similar to NFPA
- Designation for personal protective equipment needed for use

The image shows a standard HMIS (Hazardous Material Identification System) label. It is a rectangular label with a yellow border. The top section is white and contains the text "HMIS" in the center. Below this are three horizontal sections: "HEALTH" (blue background), "FLAMMABILITY" (red background), and "PHYSICAL HAZARD" (orange background). Each of these three sections has two white boxes for numerical ratings. Below these three sections is a white section labeled "PERSONAL PROTECTION". At the bottom of the label, there is a small line of text: "HMIS® ©2001 NPCA • Printed by JJK&A • Neenah, WI • 1-800-327-8868 383-HMI-T 7055". The label is surrounded by a repeating pattern of "HMIS" text in the background.

Routes of Exposure: Inhalation

- Inhalation of vapors, mists, dusts, etc.
 - Open containers
 - Opening/closing tubes or chemical bottles
 - Open centrifuges
 - Heating
 - Doing dishes
 - Inoculating loops
 - Syringes
 - Sweeping
- Local and systemic effects – depends on solubility
- Use fume hoods!



Routes of Exposure: Skin/ Eyes



- Contact with skin or eyes
 - Usually due to accidental spills
 - Effects largely based on tissue condition
 - Dry vs. moist
 - Cuts & abrasions
 - Location – thickness varies – worst in eyes, at groin, between fingers/toes
 - Local and systemic effects – depends on solubility
 - Wear chemical splash safety goggles & gloves!

Route of Exposure – Ingestion

- Ingestion
 - Usually accidental - bad hygiene
 - Local or systemic effects – depends on solubility
 - **NEVER eat, drink or chew gum in a lab!**
 - NEVER put your mouth on anything in lab! (pipetting!)
 - NEVER store anything you intend to ingest in the same room with hazardous chemicals
 - DO NOT store chemicals in food containers
 - WASH your hands frequently and always when you leave lab
 - Avoid spreading contamination – remove your PPE before you leave lab



Routes of Exposure – Injection

- Injection
 - Most dangerous, least likely
 - Broken glassware is biggest culprit
 - Syringes, razor blades, etc.
 - Biohazard vs. Chemical
 - Sharps Containers!



Signs of Exposure

- External
 - itching/rash/swelling
 - change in breathing/sneezing/coughing
 - discoloration of skin
 - mucous
 - vomiting
- Internal
 - pain/headache
 - queasy
 - taste
 - irritation to nose/throat
 - dizziness
- Longer Term Toxic Response
 - organ function/size
 - cell/tissue alteration
 - biochemical changes
 - behavioral changes



Exposure Prevention

- Know & understand the hazards of the chemicals and processes – if hazards unknown – assume the worst
- Substitute less hazardous chemicals and techniques
- Scale down experiments
- Use proper PPE & engineering controls
- DO NOT work alone in the laboratory – at least make others aware of your presence!
- Use common sense!



Personal Protective Equipment

- Eye Protection: always use eye protection when handling chemicals!
- Gloves
- Clothing



Eye Protection

- Indirectly Vented Goggles
 - The best option!
- Glasses with side shields
- Face shields – Use when extra face and neck protection is desired
 - Face shield is not adequate alone – also need goggles underneath!
 - Try not to wear contacts to the lab



Gloves

- Disposables



- Chemical Resistant



- Cut Resistant



- General Purpose



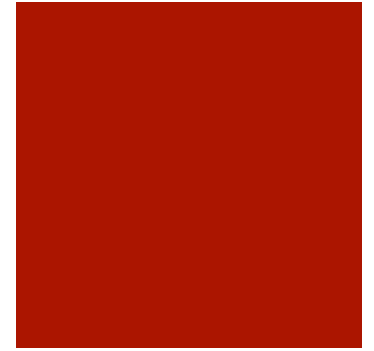
- Temperature Resistant



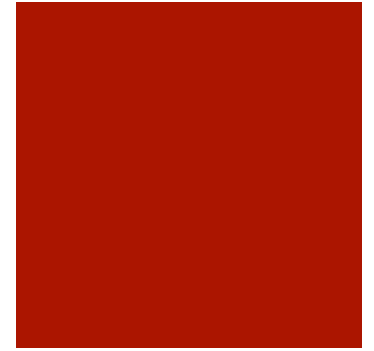
Use the Right Glove for the Job

- Glove Materials
- Latex: Not meant for complete chemical resistance
- Vinyl: Aqueous Solutions, alcohols
- Nitrile: Non-halogenated solvents
- Neoprene: Some acids
- Rubber

ALWAYS WASH HANDS AFTER USE



Protective Clothing



Full Coverage Clothing

- less exposed skin, less chemical exposure
- worst to have midsection & upper thigh exposed

Lab Coats & Aprons – choose the material to match the job

Closed Toe Shoes

- Glassware/physical hazards and chemical exposure

No jewelry

Engineering Controls

- Air flows through the face and out the vents in back
- Should be inspected every year. Should be noted that it has been inspected on the hood itself
- Factors that affect airflow:
 - Sash height
 - Drafts
 - Bulky objects inside



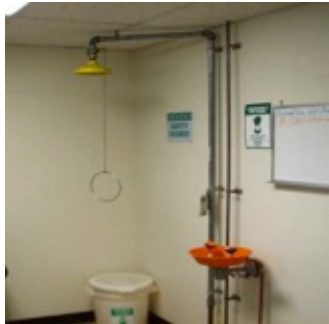
Fume Hood General Rules

- 80-120 fpm
- Work ~6" inside opening
- Sash height
- Avoid turbulence (movement, doors/windows)
- Do not overload with chemicals/equipment
- Always use with volatile chemicals
- Not to be used as eye protection!



Emergency Response Equipment

- Ask yourself:
 - Do I know where they are located?
 - Do I know how to use them?
 - Do I know how they work?
 - Are they accessible?



Dermal Exposure



- Rinse with tepid water for a minimum of 15 min.
 - Small Area vs. LARGE Area
- In all cases:
 - Remove jewelry/watches and any contaminated clothing (including socks/shoes if shower is used!)
 - Avoid spreading contamination – especially to the eyes! Cut off clothing if necessary!
 - Pull the SDS(s)– look for any special treatment and/or warnings about delayed reactions - Hazard Info & First Aid
 - NEVER apply neutralization solutions to acid/base exposures
 - NEVER apply creams, lotions, or sprays.

Dermal Exposure Follow up



- If no further irritation arises - the area can be washed with soap and water
- Mild irritation can be left exposed to the air after rinsing
- If the irritation gets worse or SDS states that medical attention should be sought immediately
 - Physician
 - Arrange for immediate transportation to Socorro Hospital – provide SDS
- Report all exposures to NMT HAZMAT
- Fill out accident report

Treatment for Chemical Contact With Eyes



- Flood the eyeballs with water for 15-20 minutes
- Force eyelids open using the thumb and forefinger
- Roll the eyeballs in all directions to allow water to rinse behind the eyeball and lids.
- Remove contact lenses to ensure rinsing behind them.
- Eyes can be covered with a dry, sterile material if desired.
- ALWAYS seek medical attention
- Report all exposures to CHC → Accident Report

Treatment for Chemical Ingestions



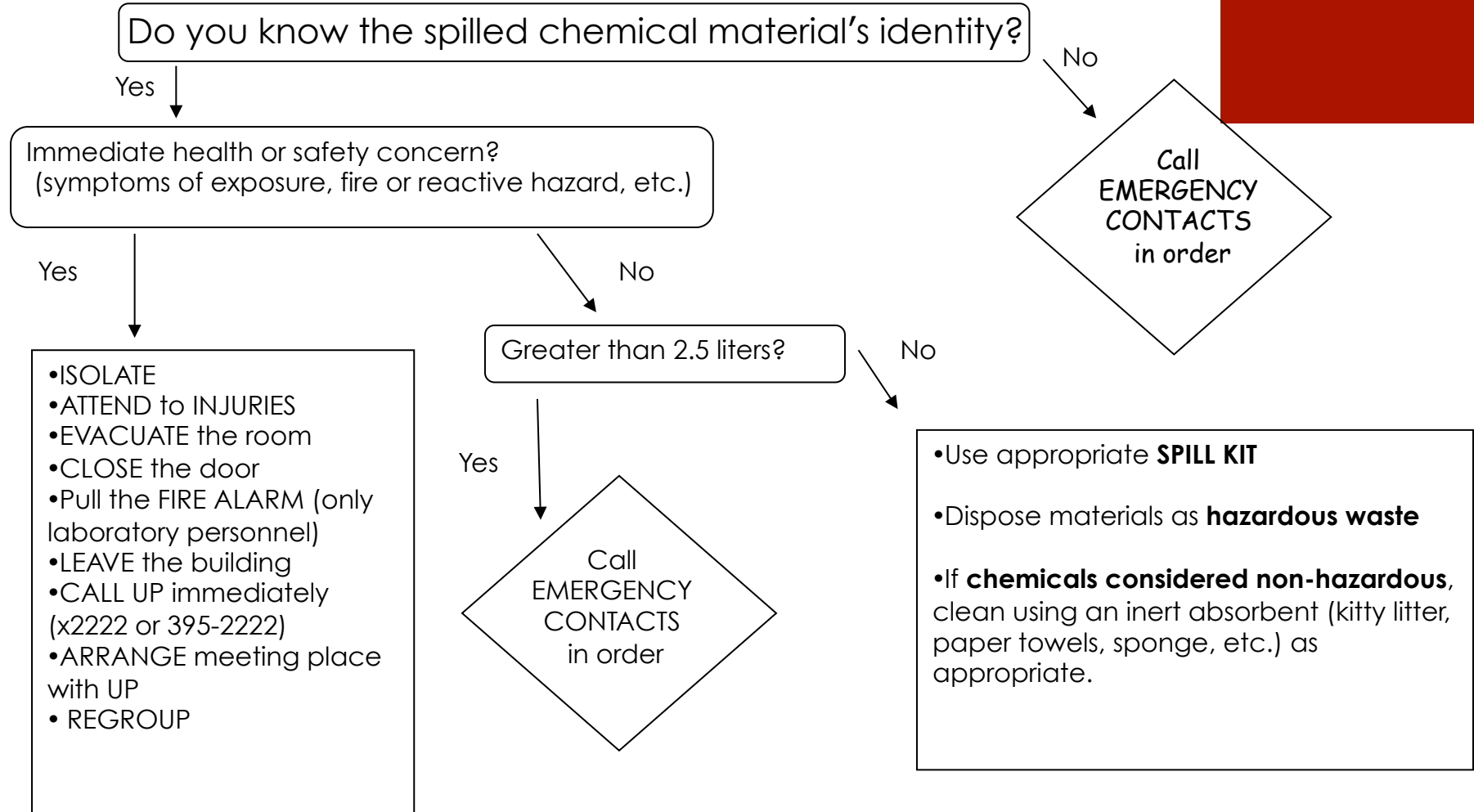
- **Contact the hospital immediately!**
- Send SDS with the injured party for emergency responders.
- If no head, neck or spinal damage, it may be advised to rotate the body to the side in case of vomiting.
- “DO NOT induce vomiting” unless the chemical is extremely toxic and will move to the blood stream very quickly.
- Mouth-to-mouth resuscitation may result in contamination of responder
- **Report all exposures to NMT HAZMAT → accident report**

Treatment for Chemical Inhalation



- Evacuate the area if there is a risk of exposure to others.
- Remove the injured party from the area and into fresh air.
- Often, fresh air or oxygen gas will ease the symptoms, but further medical attention is usually advised.
- Call emergency response (MUST SEEK MEDICAL ATTENTION) if fresh air is not enough or if multiple people exposed
- Send SDS with injured party for emergency responders
- Mouth-to-mouth resuscitation may result in contamination of responder
- Report all exposures to NMT HAZMAT → accident report

Chemical Spills



Emergency Contact: Lindsay Candelaria
505-320-9858
575-835-5842

Chemical Storage



- NO glass container chemicals higher than eye level or on the floor
- Do not separate your chemicals based on alphabetical order..... Separate them appropriately so that you are not storing incompatibles together!
- Flammable Cabinets
 - Unless immediately in use, store in designated cabinets
 - Limit flammables stored in any one cabinet & any one lab
- Corrosive Cabinets
 - Use for acids or bases, but not together
 - Nitric acid & organic acids (Acetic acid!) should be stored separate from one another
- Refrigerators
 - household vs. flammable vs. explosion proof
- Auto-oxidizers
- Inventory

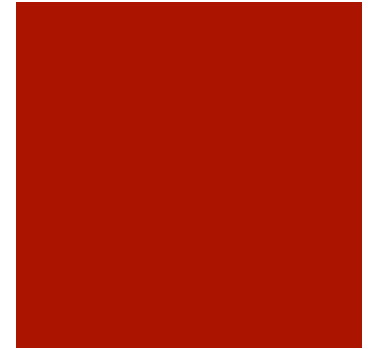
New Chemical Purchase

- Have you assessed the hazards before purchasing?
- Is there a less hazardous substitution?
- Do you have a proper storage place for this chemical?
- Don't buy anymore than necessary
- Email purchasing form to NMT HAZMAT prior to purchase
 - Will make sure there is not already an available source
 - Inventory
 - Need for SOP, special training, PPE, or first aid/spill equipment

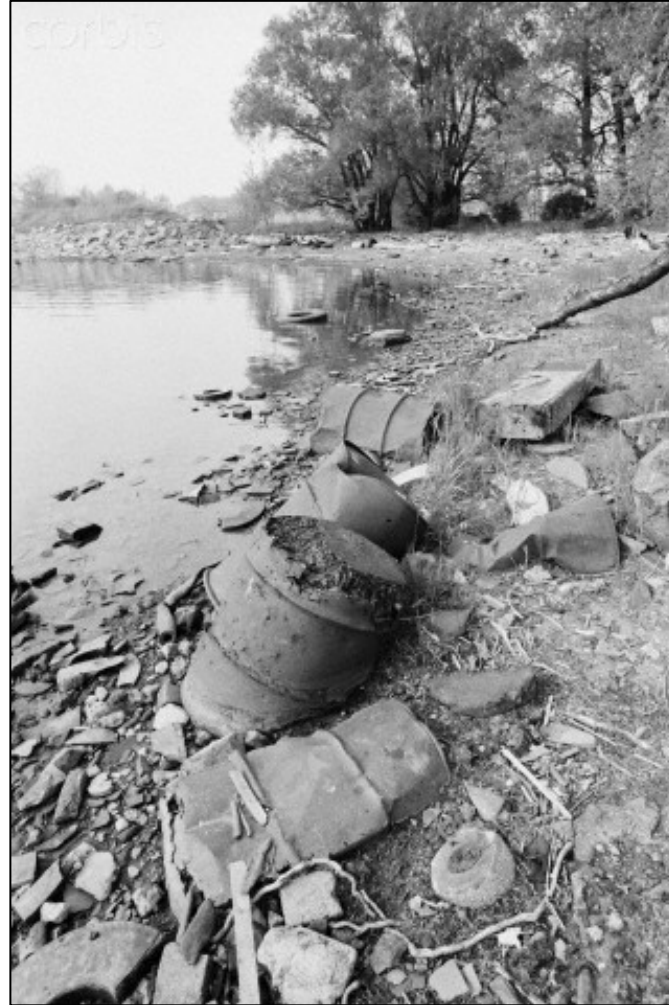


RCRA

- Resource Conservation and Recovery Act-1976
- Hazardous & Solid Waste Amendments-1984
 - Creates a cradle to the grave liability
 - Provides standards for those involved with hazardous waste generation and disposal.



Love Canal

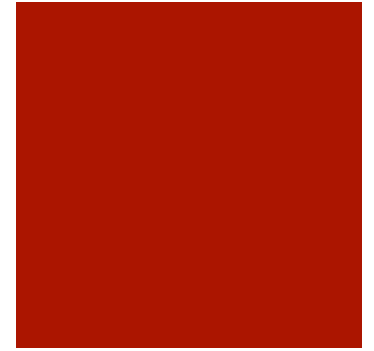


Waste

- Spent, cannot be used again
 - Cannot be discarded, recycled or abandoned
- Types of Waste
 - Trash, garbage, yard waste
 - Regulated non-hazardous waste
 - Hazardous wastes
- Solid waste
 - Gases
 - Liquids
 - Solids
- Regulated non-hazardous wastes
 - Sewage
 - Tires
 - Storm Water
- Solid Waste which are not hazardous waste
 - Household Waste
 - Nuclear waste
 - Laboratory samples (until testing is complete)
 - Universal wastes:
 - Light bulbs (excluding incandescent)
 - Other mercury devices
 - Certain pesticides
 - Batteries excluding alkaline
 - Used oil
- Hazardous Waste
 - Must be solid waste (40 CFR 261.2)
 - Not excluded from regulation (40 CFR 261.4)
 - Listed
 - Characteristic



Generator Status



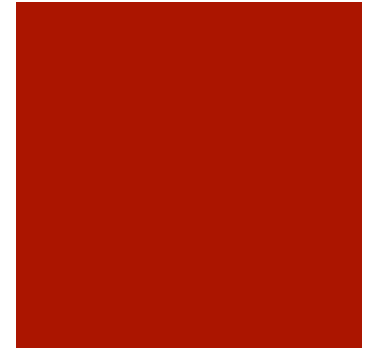
- Generators
 - Conditionally Exempt Small Quantity Generators (CESQG)
 - Small Quantity Generators (SQG)
 - Large Quantity Generators (LQG)
- Transporters
- Transfer Facilities
- Treatment, Storage & Disposal Facilities (TSDF)

Generator Status

- Generator Status is determined by month
 - Waste counts for the month it was generated in
 - NMT needs to meet requirements for generator status that month
- We have to count waste that
 - Is transported off-site for treatment, storage, or disposal
 - Is treated or disposed of On-site
 - Is accumulated prior to recycling, long-term storage, transporting, treatment or disposal
- We don't count waste:
 - Spent lead acid batteries sent for reclamation
 - Used oil that has not been mixed with hazardous waste and is recycled (does not include crude oil)
 - Fluorescent bulbs sent for recycling

CESQG

- Generates no more than 220 lbs of hazardous waste per month. ~25 gallons.
- Generates less than 2.2 lbs of acutely toxic hazardous wastes (P-listed: Arsenic, cyanide compounds) per month.
- Never accumulates more than 2200 lbs of hazardous waste at any time.



SQG

- Generates more than 220 lbs, but less than 2200 lbs of hazardous waste per month. ~25 gallons to 250 gallons
- Generates less than 2.2 lbs of acutely toxic hazardous wastes per month.
- Never exceeds 13,200 lbs)/180 day storage time limit.



LQG

- Generates more than 2200 lbs of hazardous waste per month. ~250 gallons
- Generates more than 2.2 lbs of acutely hazardous waste per month.
- Never stores hazardous waste greater than 90 days.



Chemical Waste Disposal

- Step 1: Determine what your wastes are:
 - Any chemical that has been used and is no longer considered useful
 - Any chemical that you are wanting to discard
 - Any reagents that are:
 - Old or Out-dated
 - Dangerous
 - Left-over
 - Decrepit
 - Incognito (unlabeled)
 - Otherwise useless
- No one needs a 100 year supply... So please don't buy what you don't need.
- Don't pour anything down the drain.
 - Metal pipes can react with azides, picrates and perchlorates to form very explosive salts.
 - Pretreatment standards for discharge to sewer are quite strict (permits). We don't have one of these nor will we be getting one in the future.



Chemical Waste Disposal



- Step 2: Make a Hazardous Waste Determination
- A chemical waste is a “hazardous waste” if it exhibits any of the following characteristics:
 - Ignitability
 - Liquid flash point < 140°F (60°C) (exception: <24% alcohol)
 - Ignitable solids & gases
 - Corrosivity: pH is < 4.0 or > 10
 - Elemental neutralization is allowed - recordkeeping
 - Reactivity reacts with water, can form potentially toxic gases, is unstable or explosive.
 - Toxicity EPA’s D-list of “toxic” chemicals. Determined by TCLP test for the presence of 40 chemicals

TCLP Maximum Concentrations of Contaminants

MAXIMUM CONCENTRATION OF CONTAMINANTS FOR TOXICITY CHARACTERISTICS

EPA HW Code	Contaminant	CAS No.	Regulatory level (mg/L)	EPA HW Code	Contaminant	CAS No.	Regulatory level (mg/L)
D004	Arsenic	7440-38-2	5.0	D032	Hexachlorobenzene	118-74-1	0.13
D005	Barium	7440-39-3	100.0	D033	Hexachlorobutadiene	87-68-3	0.5
D018	Benzene	71-43-2	0.5	D034	Hexachloroethane	67-72-1	3.0
D006	Cadmium	7440-43-9	1.0	D008	Lead	7439-92-1	5.0
D019	Carbon Tetrachloride	56-23-5	0.5	D013	Lindane	58-89-9	0.4
D020	Chlordane	57-74-9	0.03	D009	Mercury	7439-97-6	0.2
D021	Chlorobenzene	108-90-7	100.0	D014	Methoxychlor	72-43-5	10.0
D022	Chloroform	67-66-3	6.0	D035	Methyl ethyl ketone	78-93-3	200.0
D007	Chromium	7440-47-3	5.0	D036	Nitrobenzene	98-95-3	2.0
D023	o-Cresol	95-48-7	200.0	D037	Pentachlorophenol	87-86-5	100.0
D024	m-Cresol	108-39-4	200.0	D038	Pyridine	110-86-1	5.0
D025	p-Cresol	106-44-5	200.0	D010	Selenium	7782-49-2	1.0
D026	Cresol (total)		200.0	D011	Silver	7440-22-4	5.0
D016	2,4-D	94-75-7	10.0	D039	Tetrachloroethylene	127-18-4	0.7
D027	1,4-Dichlorobenzene	106-46-7	7.5	D015	Toxaphene	8001-35-2	0.5
D028	1,2-Dichloroethane	107-06-2	0.5	D040	Trichloroethylene	79-01-6	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7	D041	2,4,5-Trichlorophenol	95-95-4	400.0
D030	2,4-Dinitrotoluene	121-14-2	0.13	D042	2,4,6-Trichlorophenol	88-06-2	2.0
D012	Endrin	72-20-8	0.02	D017	2,4,5-TP (Silvex)	93-72-1	1.0
D031	Heptachlor	76-44-8	0.008	D043	Vinyl Chloride	75-01-4	0.2

Chemical Waste Disposal



- A chemical waste is a “hazardous waste” if it appears on one of the following RCRA lists:
 - B-list – PCBs (NYSDEC Regulation)
 - U-list – toxic chemicals: Pure chemical that is discarded, spilled or container residue.
 - P-list – acutely toxic chemicals
 - F-list – spent solvent mixtures: Acetone (F003). Wastes from non-specific sources.
 - K-list – Waste from specific sources: ie sludges and distillation bottoms from wood preserving and petroleum refining

Chemical Waste Disposal

- Step 3: Satellite accumulation area
- Container:
 - Compatible and in good condition
 - Has tight fitting closure.
 - MUST be closed at all times!!!!
- Label:
 - Clearly labeled “HAZARDOUS WASTE”
 - Name of chemical(s)
 - Concentration chemicals (DO NOT mix flammables with corrosives)



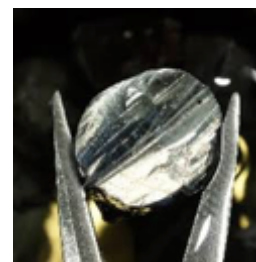
Chemical Waste Disposal



- **LABELING** - remove any old labels, small vials/bottles and correct identity of hazardous waste is clearly noted on the tag or bottle.
- **COMPATIBILITY!**
- **ALWAYS** keep container tightly closed when not in use!
- The right size for the right job
- Keep the bottle clean – wipes for P-listed chemicals are considered hazardous waste
- Allow head space for vapor expansion
- Store only in safe & secure areas
- Store only at the “**Point of Generation**”
 - Satellite accumulation point!
- If mixtures involved, record approximate % comp.
- Limits on amounts
- **ALL** spills with hazardous chemicals are hazardous waste!

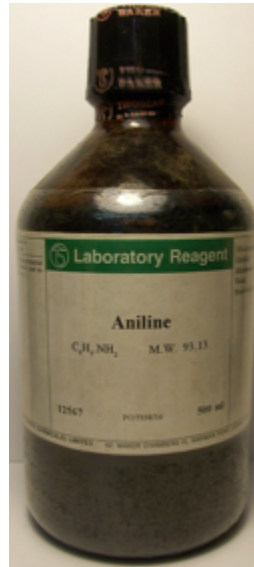
Priority Chemicals for Removal

- Water or air reactive solids
 - Potassium, sodium, white or yellow phosphorous
- Toxic inhalation hazards
 - Chlorine, bromine, chloroform (Chlorinated solvents: produce phosgene in a fire, suspected carcinogens), mercury, phenol
- Severe risk compounds with multiple hazards
 - Cyanide, hydrofluoric acid, perchloric acid
- Potential explosives
 - Ethyl ether, picric acid, tetrahydrofuran, dioxane (Be wary of peroxide formers)



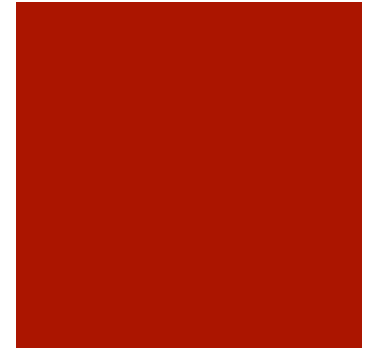
Acutely Toxic Chemicals

- Chemicals listed on EPA's 'p-list' are acutely toxic.
- Highly regulated and require extensive documentation and management
- Pose a SIGNIFICANT liability!
 - Arsenic acid
 - Beryllium powder
 - Carbon disulfide
 - Cyanides and salts
 - Osmium tetroxide



Consider These Options

- Is the chemical being used?
- Has it passed its expiration date?
- Is there more than a two year supply?
- Is the container in good condition?
- Is the chemical still pure?
- Is the chemical very dangerous?
- Are you sure you know what it is?



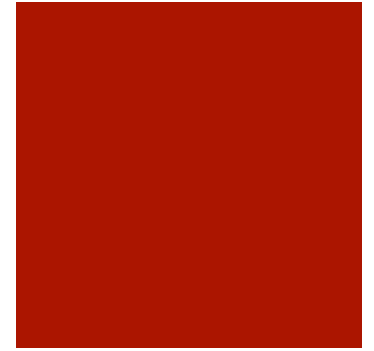
Other General Hazardous Waste Issues



- No evaporation of solvents up the fume hood
- Mixture rule (including saturated paper, filtering aides, etc.)
- Generally NO treatment of waste
- Waste oil
- Old chemicals – get rid of them!
- RCRA Empty
 - Chemical removed by conventional means – no more than 3% by weight of total capacity
 - 3x rinse – dispose of all as hazardous waste

Universal Waste

- Categories
 - Lamps
 - Batteries (other than alkaline)
- Rules
 - Closed containers
 - Labeling
- IF you have these, contact NMT HAZMAT for details on disposal



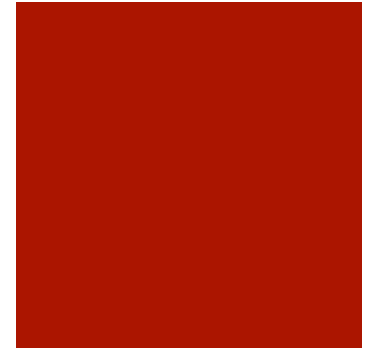
Lab Security

- Practical and legal issues
- Lock doors when no one is in the lab
- Limit key distribution



Physical Hazards in the Lab

- Electrical
- Temperature
- Pressure Work
- Glassware
- Refrigerators
- Centrifuges
- Tripping and falling objects



Gas Cylinders

- Gases are chemicals
 - Chemical Hazards – flammable, corrosive, explosive
 - Asphyxiation
 - Ventilation & PPE
 - Labeling
 - Shut off cylinder valve – Leaks
- Physical Hazards - Treat with respect
 - High pressure can create a rocket
 - NO homemade connectors to alter valves, fittings, or regulators
 - Transport on a secured cart – do not roll or drag
 - Secure gas cylinders when in storage or use



Cryogenics

- Same issues as compressed gas cylinders plus...
- Liquid O_2 can be condensed out of air
 - Liquid O_2 can be very dangerous – keep away from organic matter and flammable gases
- Extreme cold (effect on flesh as well as materials that can become brittle)
- Transfer from one container to another
 - Minimum of indirectly vented goggles – suggested face shield and full body coverage advised
 - Transfer slowly
 - Check hosing and containers used for transfers regularly



Lab Safety in a nut shell

- Contact Lindsay Candelaria with any questions or concerns.
- 505-320-9858 cell or 575-835-5842
- lcandelaria@admin.nmt.edu

