CHEMISTRY DEPARTMENT ANNUAL SAFETY RETRAINING

February 24, 2015

COURSE
CO-Safety-1
(HP-IND-220 (Lab Standard) Equivalent)

Emergency: 911 or 2222

Department Office: 4301

ESH Coord: 4361 D. Cabelli

Research Space Manager: 4399 J. Anselmini

Facility Project Manager: 4311 S. Howell

Facility Support Rep: John Aloi

Environmental Compliance Rep: Joy Haskins

Safety and Health Services Division Rep: Sean Hannifin

ES&H Committee:

Jose Rodriguez (Chair)
Jim Anselmini *(ex officio)*
Diane Cabelli (*ex officio*)
Greg Hall (Hua-Gen Yu)

John Miller
Dmitry Polyansky
Kotaro Sasaki
Lee Walcott (*ex-officio*)

Departmental Personnel Safety Assignments

Experimental Review Coord: Diane Cabelli
Work Control Manager: Diane Cabelli
Work Control Coord: Jim Anselmini

Training Coord: Linda Sallustio

Laser Safety (BNL ALSO): Jack Preses

Sealed Source Custodian: Jim Wishart

Stockroom Chemicals: Diane Cabelli
90-Day Area: Joy Haskins, Jim Anselmini

Local Emergency Coord: Jim Anselmini
Deputy Local Emergency Coord: Lee Walcott

Alarms

When building alarms ring or strobes light up:

- Evacuate by nearest exit (*Do not use the elevator*)
- Proceed to building evacuation Assembly Point
- If possible, secure your workplace of additional hazards
- Do not enter building if strobe lights or alarms are on

Shelter-in-Place Assembly Pt: Lobby (TAR Room 200)

Evacuation Zone 8

Building Evacuation Assembly Pt: outside main entrance

If you evacuate by side or back door, please come to front assembly point so we can do a head count!

Local Emergency Plan: Operations, Chemistry Web Page

New Fume Hoods

- Verify hood alert monitor is green (indicating safe operating conditions) prior to use.
- Keep sash at minimum opening needed for access.
- DO NOT move the sash rapidly
- Avoid excess traffic (walking) in front of hood.
- DO NOT change damper or alarm settings.
- Raise large objects >1" above surface for air flow.
- Controllers use Occupancy Sensors - automatically closes sash when no activity in front of hood (30+sec)
- Alarm sounds when flow is below set point.
- Emergency exhaust button allows maximum airflow when sash fully closed. In event of large spill within the hood, fully close the sash, then push the Emergency Exhaust-

Accidents/Injuries

R=Recordable

D=DART
(Days Away Restricted or Transferred)

FA=First Aid

Slips, Trips and Falls

10/14 Employee fell from a truck and injured a wrist. R

9/14 employee slipped and fell over extension. FA

9/14 employee slipped and fell in office. FA

8/14 employee fell while walking in a hallway. FA

7/14 employee slipped and fell, injuring back. R-D

6/14 student riding bicycle to meeting and fell, injuring arm. FA

5/14 employee fell while walking in parking lot. FA

4/14 visitor fell while walking in front of NSLS. FA

2/14 Employee tripped/fell on steps, injuring hand/wrist. FA

Slips, Trips and Falls continued

2/15 employee fell on uneven surface. R-D

2/15 Employee injured leg while descending staircase. FA

2/15 Employee slipped/fell while carrying material R-D

2/15 Employee slipped/fell on icy surface. FA

1/15 employee fell on slippery surface/injured head. FA

2/14 employee injured leg descending staircase. FA

12/14 employee fell walking outside, fractured wrist. R-D

11/14 employee injured ankle walking in parking lot. FA

11/14 employee twisted ankle walking in parking. FA

11/14 employee tripped over pipe protruding from floor. FA

Repetitive Motion Injuries/Strains

10/14 employee reported injury from lifting papers. FA

9/14 employee was digging and developed back pain. R

8/14 employee injured arm using hand held power tool FA

5/14 employee strained arm while working overhead. R-D

5/14 Employee processing paperwork developed wrist pain. FA

4/14 employee reported leg/arm pain. FA

4/14 employee reported hand/arm pain after using non-powered hand tool. R-D

3/14 employee had leg problems from kneeling at work. FA

3/14 employee injured neck/shoulder from "repetitive work". R-D

3/14 employee reported hand pain from job R-D

3/14 employee vacuuming and developed pain in arm. R

10/14 employee injured arm moving heavy equipment. R-D

3/14 employee injured during physical fitness requirement.RD

Lacerations

1/15 employee stood up/struck head against equipment FA

12/14 employee lacerated a finger using a hand tool. FA

11/14 Employee received minor cuts while opening box. FA

11/14 employee injured hand operating equipment. FA

11/14 Employee received minor cuts while opening box. FA

11/14 employee injured hand operating equipment. FA

8/14 employee struck head against object in basement. FA

5/14 employee reported suspect foreign body in hand. FA

5/14 employee stood up and struck top of head against an electrical cabinet. laceration R

3/14 employee lacerated fingers on Shop equipment. R

3/14 employee cut thumb while positioning vehicle R-D

Assorted Injuries

1/15 employee injured chest while pushing on wrench. FA

11/14 employee knee injured entering/exiting vehicle. R-D

10/14 employee fractured finger while riding in elevator. R

10/14 employee struck in eye by particle. FA

9/14 employee moving equipment injured thumb. FA

9/14 employee struck by falling equipment R-D

9/14 employee injured while driving lab vehicle offsite. FA

6/14 employee struck in the eye by equipment. FA

7/14 employee struck arm against bolt. FA

4/14 employee injured arm while closing barn door. R

2/14 employee injured fingers when door closed on hand. R

2/15 Employee struck by falling piece of wood. FA

Insect Bites

10/14 employee was stung by a yellow jacket. FA

9/14 employee stung by yellow jacket. FA

8/14 employee stung by yellow jacket in office. R

7/14 employee bitten on the hand by a spider. FA

2/14 employee stung by a bee while sitting at desk. FA

2/14 guest stung by bee while unloading truck. FA

BES Injuries

12/14 collaborator disposing of chemical waste into container;some waste spilled on their lower extremities. FA

9/14 employee stung by insect. FA

7/14 employee turning valve and injured elbow. R

6/14 student handling material in lab, when part broke off and was imbedded in finger through glove. F/A

6/14 student in laboratory lacerated thumb on glass. FA

5/14 student reported burning sensation to face while working with chemicals. FA.

4/14 student assisting in removing bottles of chemical waste. 1 l bottle broke and waste hit lower extremities.FA

3/14 student received burn to thumb while heating quartz tube (while wearing heavy leather gloves). FA

Lessons Learned

Red and Yellow Barricade Tape: A Sign to Stop

Do not go into any barricaded areas unless you have specific permission by the person or group that erected the barricade.

Red Danger-Do Not Enter tape is used for potential serious injury or death situations. Only authorized personnel listed on the work planning documents are allowed to enter the restricted area.

Yellow Caution-Entry Requires Permission tape indicates less immediate or serious injuryhealth risk. A tag on the tape provides contact information. Only those with the permission of the barricade installer are allowed to enter the restricted area.

Never duck under, move, remove, or break barrier tape.

Find an alternate route to your destination or wait until the barricade has been removed.

Contact the name/group on the white identification tag if in doubt about how to proceed.

Berkeley 2009, 2008

1. Worker fell from ladder - serious arm injury

Worker disassembling equipment used wooden step ladder leaning against wall. Ladder was not opened and did not have anti-skid material on its feet. Worker was 3-4 feet above concrete floor.

Ladder slipped and worker fell to floor, sustaining serious injury to arm/shoulder.

2. Worker fell from ladder - serious back injury.

Worker was 3 feet above floor on 10-ft ladder, detaching fluorescent light fixture from the ceiling. Worker is permanently disabled as a result of the incident.

Using Lithium Aluminium Hydride, (LAH, Flammable Solid, Dangerous when wet) Monash 2009

LAH used in similar experiments; MSDS consulted and risk assessment completed.

Unopened bottle used, however it was old and contents had settled.

While using clean dry spatula to remove a few granules, exothermic reaction resulted from associated friction, bottle heated and pieces of LAH were ejected (LAH released H_2). The ejected LAH caused damage to the fume cupboard and charred the floor. Worker promptly placed jar into desiccator, stopping any further reaction.

The LAH before use was light grey instead of white; indicating hydration may have occurred.

- Inspect Water-reactive items
- Discard discolored compounds
- These are time-sensitive-do not store for long time, even when unopened.

Peroxide Explosion in Rotovap

Worker using rotary evaporator (rotovap) to remove organic solvents from azobenzene precipitate adjusted bottom flask which exploded; glass hit safety goggles and forehead. Student received stitches above eyes and and released.

Explosion likely resulted from peroxide contaminants in solvents concentrating. Tetrahydrofuran (THF) and diethyl ether were used-both form peroxides over time. THF had no stabilizer; sample from nearly empty 4-liter THF bottle contained > 100 mg/l peroxides.

Rotovap concentrated peroxides in bottom of glass flask-movement of flask could cause dry and shock sensitive peroxides crystals to explode.

Hydrofluoric Acid Burn from Trifluoracetic Acid

Worker picked up container of trifluoroacetic acid (TFA) with ungloved hand and didn't notice small residue on glass.

Several hours later, worker experienced pain in palm and inside aspect of thumb.

Worker had a serious burn that required skin grafting. Worker was not aware that this type of burn could result from handling TFA.

TFA can form hydrofluoric acid (HF) upon contact with moisture. HF can cause deep burns that may not be painful for hours.

- Know chemical hazards before handling them.
- Always assume containers are contaminated/wear appropriate gloves when handling them.

Failure to Remove Contaminated Clothing Exacerbates Chemical Burns

Laboratory workers spilled chemicals on pants.

Workers bypassed safety shower and removed pants and rinsed legs in restroom.

Workers put contaminated pants back on and either went home to rinse further or went to the clinic.

All resulted in second degree burns that could have been minimized by taking off the contaminated clothing and rinsing immediately using a safety shower.

- Remove contaminated clothing while rinsing.
- Wear appropriate PPE, including buttoned lab coat when working with hazardous materials.
- Do not put contaminated clothing back on.
- Wash clothing separately or discard. Discard contaminated leather items.

Electrical Shock from Laser Power Supply

Worker noticed condensation on high voltage power supply for laser.
With power still on, worker wiped moisture with tissue, making contact with exposed anode terminal at ~17,000 volts DC to ground.
Worker received severe electrical shock/second degree burns to right thumb and abdomen.
Witnesses heard loud "snap", scream and saw worker stagger out.
Worker had no pulse. CPR initiated and ambulance crew restored heartbeat with defibrillator.
Interlocks had been defeated and guards removed with no alternate guarding or precautions taken.

- Do not defeat machine safety interlocks.
- Do not work around energized exposed conductors.

This is the beginning of the
Lab Standard class

1991, OSHA established "Occupational Exposure to Hazardous Chemicals in Laboratories," (29 CFR 1910.1450/Lab Standard)/ pertains to BNL employees using hazardous chemicals *in the lab.*

- Increase worker awareness of risks of working with toxic substances
- Improve work practices
- Greater use of engineering and administrative controls
- Appropriate use of personal protective equipment (PPE)

Led to >10% reduction in minor accidents, lost workdays. Chronic illness, chemical based cancer

BNL's Responsibility is to Provide:

Information/training on physical/health hazards in workplace.

Information on chemical exposures prior to assignments

OSHA Laboratory Standard contents and appendices.

Access to Chemical Hygiene Plan – in Chemical Safety SA.

Reference material on hazards/safe handling/storage/disposal of hazardous chemicals – Chemical Management System web page.

Methods to detect presence or release of hazardous chemical.

Protective measures - work practices/emergency procedures/PPE

Principal Investigators are Responsible for Safety/Health of Personnel they Supervise and Must:

- Properly update hazard placards/postings at lab entrance.
- Ensure worker access to Safety Data Sheets (SDS).
- Ensure proper acquisition, use, storage, disposal of chemicals.
- Maintain chemical inventories in CMS.
- Train workers on hazards of materials used in work area.
- Ensure all experiments are reviewed for ESH issues (ESRs)
- Ensure activities follow guidance in Chemical Safety SA.

All BNL Personnel Must:

- Follow Chemical Safety Subject Area.
- Use appropriate personal protective equipment.
- Report symptoms of hazardous chemical exposure to supervisor/2222
- Take mandatory health and safety training (prior to working).

Topics in Lab Standard Training

- How to Obtain Hazard Information
- Categories of Hazardous Chemicals
- Particularly Hazardous Substances
- Chemical Labeling
- Chemical Storage and Handling
- Exposure Control

(Different methods of exposure control/PPE)

- Emergency Response

Obtaining Hazard Information

Labels
GHS requires pictogram on bottle label

CMS
(Chemical Management System)

SDS (Safety Data Sheets)
Formerly MSDS (Material Safety Data Sheets)

BNL Chemical Hygiene Plan
AKA
Chemical Safety Subject Area
Describes mandatory requirements for working with chemicals in laboratory

BNL home page https://intranet.bnl.gov.

1. Search for SBMS in Search BNL (top left corner)
2. Subject Areas by Alphabetical Listing
3. Click on Chemical Safety
4. There is an exhibit called "Chemical Hygiene Plan"

OR: search for Chemical Safety in Search BNL

Chemical Management System

CMS web site is primary source of information about chemicals.

- BNL's chemical inventory database (CMS Inventory)
- BNL's Safety Data Sheet (MSDS/SDS) Database
- Other reference material on hazards, safe handling, storage and disposal of hazardous chemicals

Access CMS: Search for <u>CMS</u> in Search BNL

Then choose appropriate query

Safety Data Sheet (SDS)

provided by manufacturers to transmit hazard info to users.

Obtain SDSs from:

- Your supervisor/ESH Coordinator/IH Rep
- The Industrial Hygiene Group (6387)
- through the CMS website/MSDS web page (enter search criteria in appropriate box (properly spelled!).
- GOOGLE

Safety Data Sheets contain

- 16 sections
- Sect 1: chemical identification/emergency contact info
- Sect 2: Hazardous Identification
- Sect 3: ingredients
- Sect 4-6: First Aid, Firefighting (fire extinguisher choice etc), Accidental Release measures respectively
- Sect 7-11: 7-Handling/Storage, 8-Permissible exposure limits/Threshold limits/precautions for handling and PPE, 9-Physical/chemical characteristics (bp, mp,color etc), 10-reactivity data, 11-health effects (routes of exposure etc)
- Sections 12-16: Ecological, Disposal, Transportation, Regulatory, Other requirements

Accessing Other Chemical Info

Health & Safety reference material on the hazards, safe handling, storage and disposal of hazardous chemicals from a variety of sources on CMS web site.

Click on the "CMS Reports" link
(top right side on CMS home page)

Examples

Chemical Hazards List-Search by Hazard Class
(list of chemicals in that class at BNL)
Chemical Hazards in Current Inventory
(list of which chemicals in that class are in which building and room)
NFPA Hazardous Material Table

Registering, deleting or transferring chemicals

go to the CMS system

At the BNL CMS web page go to web transactions and pick the appropriate job

You can register, delete or transfer many bar codes at once

You can only do web transactions from the login of the chemical owner!

Otherwise: email CMSteam@bnl.gov

OR: use the white forms

Hazardous Chemicals

Hazardous Chemicals

Definition: element, chemical compound or mixture that presents a physical (eg corrosives, explosive) or health (e.g. carcinogen) or environmental hazard to user.

- Original label will have hazard information.
- SDS will have hazard information.
- SHSD Rep/ESH Coord/Supervisor provide Hazard Information

All experiments involving hazardous chemicals must have a hazard assessment as part of the ESR – to identify hazards and controls

Globally Harmonized System

Hazard Classification : Definitions changed to provide specific criteria for classification of health and physical hazards, as well as classification of mixtures

Labels: Label must include a harmonized pictogram, signal word and hazard statement for each hazard class or category. Precautionary statements must also be provided

Safety Data Sheets: formerly called MSDS, they now have 16 section formats

There are 8 pictograms that show hazards

Flammables, Pyrophorics
Self reactive
Self-heating
Emits flammable gas
Organic peroxides

Oxidizers

Gas under pressure

Irritant, Dermal sensitizer
Acute toxicity (harmful)
Narcotic effect
Respiratory tract irritation

Explosives
Self reactives
Organic peroxides

Acute toxicity (severe)

Carcinogen
Respiratory sensitizer
Reproductive toxicity
Target organ toxicity
Mutagenicity
Aspiration toxicity

Corrosives

Flammable

Flammable solids

Can ignite through friction

Readily combustible solids are powdered or granular and can ignite by brief contact with match etc

Cerium, neodymium

Flammable

Pyrophorics

Materials that , even in small quantities,

ignite within 5 minutes of coming in contact with air

ıne, Diborane, Phosphine, Arsine, white phosphorus

Self heating –pyrophopric only with large amounts or long time

Magnesium turnings, zirconium powder, sodium dithionite

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www.onsafelines.com

Explosive

Explosives

chemicals that release pressure, gas, and heat upon sudden shock/pressure/high temperature

Picric acid, Nitroglycerin, Ammonium Nitrate, some Antimony mixtures, tetrazole

Flammable liquids

produce vapors through evaporation/volatization - in combination with air sustain a fire. OSHA - flashpoint below 199.4°F (93°C)

Gasoline
hexane

hazardous waste: RCRA flammable liquids have flashpoint equal/below 140°F.

Flammable

Flammable Class	Common Name	Flash Point °F
Class 1A	Ethyl Ether	-49
Class 1B	Toluene	40
Class 1C	O-Xylene	63
Class 11 (100-140	Acetic Acid	109 (combustible
Class 111A (140-200)	Cyclohexanol	153 (combustible)

<100°

100°C-200°C

Flammable gases

Gas having flammable range with air at 20C and 14.7 psi

hydrogen, ethylene, propane

All flammables: explosions and fires

avoid drips/spills;avoid ignition sources such as open flames, smoking, static electricity, electrical/mechanical sparks, hot surfaces

Oxidizers

Can cause other materials to combust more readily/upon contact/make fires burn by adding oxygen to reaction. Never mix oxidizer with combustible.

Chlorine gas, nitrous oxide, nitric acid, perchloric acid, Potassium permanganate, sodium hypochlorite

Acute Toxicity, severe

Have severe adverse effect following oral or dermal administration of a single dose or multiple doses within 4 hours or inhalation exposure of 4 hours

Phosgene, methyl isocyanate

Corrosives

Can cause visible destruction or irreversible alteration to skin, eye or respiratory system upon contact. Will damage or destroy metals

Acids (eg HCl, H_2SO_4) and bases (eg NaOH)

OSHA definition of corrosives limited to tissue effects

Self reactive Compounds (Reactives)

Thermally unstable and may undergo strongly exothermic decomposition w/o O_2. May include stabilizers.

Acetaldehyde, ethyl acrylate, Methyl acrylate ethylene oxide, hydrazine- trinitromethane

Water Reactives

React violently upon contact with water/may give off flammable gas (eg H_2) Must store away from water

Li Na K, aluminum bromide, calcium oxide, sulfur trioxide

Cryogenic Liquids

liquefied at temperatures below 0°F/ Can liquefy other gases

Can damage living tissue from frostbite and burns

Have very high vapor-to-liquid ratio (Liquid N_2 expands to ca 700 times initial volume leading to container rupture if vent fails; asphyxiation).

Liquid N_2; Liquid He

Personnel using cryogenic liquids must take Cryogen Safety (HP-OSH-025), web course.

Organic Peroxides

Liquid or solid containing O-O structure
with organic moieties attached.

Unstable/Flammable/Highly reactive/May be explosive/May be toxic

Methyl isobutyl ketone, Tetrahydrofuran
1,4-Dioxane, Ethyl ether

Storage/Handling

Store in Designated Area away from combustible materials

Separate from acids/metal carbide/reducing agents/amines.

Use ventilation to prevent buildup of vapors

Avoid friction/grinding near peroxides

Do not use metal spatulas – may lead to explosive decomposition.

NEVER open container if crystals around cap, friction from opening can cause explosion-contact me for removal.

Peroxide Storing

- Can store 24 months unopened
- Must open and test after 24 months
- Must discard by manufacturer's expiration date regardless of test results
- Must date and label material in secondary containers

Peroxide Testing

- Date when received/Date when opened
- Test every 3 months for List A/6 months for all others
- Chemical Safety SA for testing methods/recordkeeping/labels
- SHSD Rep will test if in designated Area
- Must test material in sure-seal bottles
- Must test material in non-manufacturer containers
- Please test material before wasting

Compressed Gases

- stored in cylinders under 29 psi or higher.
  - If cylinder is damaged/valve breaks, stored gas releases rapidly, creating explosion or becoming missile.
  - -danger of asphyxiation/haz. substance exposure.
- Hosing must be rated for regulator-must use low pressure regulator with low pressure hose!
- Use compression/ferruled fittings with high pressure applications
  - -clams and hose/pipe must be pressure rated

Label gas cylinders with contents/user name/date received/whether cylinder is "FULL", "IN USE", or "EMPTY."

Always secure cylinders properly.

Separate flammable from oxidizing and non-flammable gases.

Never store cylinders near flammables/combustibles/above 125°F/near radiators/heat sources.

lecture bottles should be barcoded

inspect all gas lines leading from cylinder.

Keep caps on except when cylinders in use.

Transport cylinders using suitable carts.

All employees using compressed gases must complete cbt Compressed Gas Safety Training (TQ-COMPGAS1).

Irritants (skin, eye, respiratory)

Cause reversible damage to skin after application for up to 4 hours: *Ammonia*

Causes reversible (within 21 days) change to eye: *benzoyl peroxide*

Reddening, swelling, coughing, pain choking to respiratory system. Long term exposure can cause chronic bronchitis: *ammonia, styrene, acetaldehyde*

Acute toxicity (harmful)

same as Acute toxicity (severe) but need higher doses

Ammonia, H_2S

Narcotic Effects

Primary anesthetics *depress the central nervous system*
chloroform, ether, Nitrous oxide

Target organ Toxicity

Produce injury or illness to specific organ
CCl_4 (liver), Hg (nervous system), CO (blood), Asbestos/Silica (lung)

Respiratory Sensitizers

Can cause hypersensitivity of the airways following inhalation, upon repeated exposure: *Toluene, diisocyanates*

Carcinogens

Agents that cause cancer as defined by IARC,

OSHA, ACGIH Must have carcinogen label on container

acrylonitrile, benzene, cadmium, formaldehyde, inorganic arsenic, methylene chloride (see carcinogen list in CMS webpage)

Reproductive toxins

Affect the reproductive system of men and women, either form mutations or abnormal fetal development (teratogens)

methylene chloride, nitrobenzene, ethyl acetate, toluene

Particularly Hazardous Substances

OSHA: Particularly Hazardous Substances

Carcinogens | Reproductive Toxins | Highly Acute Toxins

- Establish a Designated Area.
- Use of engineering controls (lab hoods or glove boxes).
- Establish procedures for safe removal of contaminated waste.
- Establish decontamination procedures.

Designated area: allow access only to authorized personnel (having Lab Standard training/escorted)/post warnings

Engineering controls: place signs on hood sash before handling chemical/on storage cabinet.

Decon procedures in Chemical Safety SA

All work MUST be carried out in certified fume hood with paper taped to sash to confirm flow or glove box.

Prior to maintenance work/installation in Designated Area, all hazardous chemical use must cease and area must be decontaminated.

Chemicals/Mixtures for which there is special training when used in large quantities

Methylene Chloride

Dichloromethane, Methylene dichloride, Methane dichloride

Formaldehyde (Methanal/Methyl Aldehyde/Formalin)

Arsenic

Inorganic arsenic is a poison-must amend ESR prior to use

Cadmium

Training module exists and must be taken for hazcom use

Etchant solutions

Training module exists-must take for any use

Beryllium

Beryllium is a carcinogen.

- Cancer • Acute Beryllium Disease • Chronic Beryllium Disease

Once sensitized, health effects may occur below DOE exposure limit.

Dust-producing activities prohibited without written permission from Laboratory Director/ES&H Directorate/Subject Matter Expert.

Handling of beryllium article permitted: beryllium (0.1% or greater) part pre-formed prior to arrival (no surface contamination)/Used in final shape/Not altered by methods producing airborne dust/fumes.

(Sample holders, beam windows, beam tubes, electrical contacts)

Use of beryllium on a "laboratory scale": labware designed to be easily and safely manipulated by one person (excludes production of commercial quantities of materials).

Lead

Lead is a carcinogen and a reproductive toxin.

Reusable Gloves must be in closed containers-haz waste

Do not tape lead-use foil or spray paint/epoxy

Only use as shielding-better material for doorstops!

Must follow provisions of lead subject area.

Engineered Nanoparticles

Training modules exist for workers and support personnel

Special section on ESR

Unbound nanoparticle use requires HEPA-filtered hood

Asbestos

Immediately dispose of any Asbestos Containing Material (ACM) in poor condition.

Only New York State Certified Asbestos Workers are allowed to disturb or dispose of ACM.

Mercury

mercury is a neurotoxin.

mercury spills must be cleaned by trained personnel.

nonmercury thermometers in stockroom-please use them!

Use secondary containment or enclose equipment.

Mercury vapors are poisonous.

Organomercury compounds very hazardous/absorbed through skin (Dimethylmercury-Dartmouth).

Hydrofluoric Acid (HF)

Hydrofluoric acid is a Highly Acute Toxin.

used for glass etching/metal cleaning/electronics manufacturing.

Severe Burns from:

Inhalation of HF fumes (>60% solution): High vapor pressure of HF acid (15 mm Hg at 20 C/1 atm) – pulmonary edema

Dilute HF may penetrate skin deeply before causing symptoms
Burns to fingers & nail beds may leave nails intact

Must have proper postings, a HF burn kit, a spill kit and specific description in ESR prior to use.

In event of exposure: flush area with large amounts of H_2O, apply calcium gluconate gel from HF burn kit.

Call 2222/911 or go to OMC – minutes count

Know location of HF burn kit prior to starting work

Labeling

Chemical Container Labels

communicate contents/eliminate need for costly analysis before disposal (or Hazmat response!)

Manufacturer Labels may not be removed/defaced unless replaced with equivalently worded label.

Labeling (lab standard only-not applicable to hazcom space)

May use code/number on bottle - must be defined in written record (logbook/sample sheet) to allow all users to know the contents of the container.

Upon transferring chemical into container you must label that container with the chemical contents (in English).

Best Practice: chemical name, your name, the date, particular hazard.

labeling a sample rack holding several small containers of similar chemicals with a group label is permitted.

Temporary Use Containers

container does not need label if all apply:

- **used only by person who filled it.**
- **no possibility for confusion with other containers.**
- **not used beyond one shift (after user leaves area).**
- **not left unattended in area where others work.**

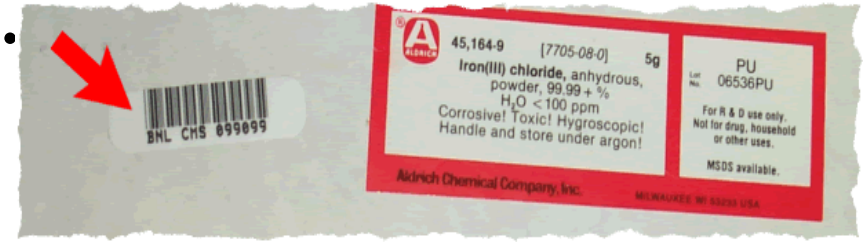
Chromatograph sample bottles/Graduated cylinders/beakers/flasks

CMS Barcode Labels

- container has unique CMS Barcode Label (now RFID tag) or "revolving inventory"

(location barcode for some high turn-over chemicals; some compressed gas cylinders, paints, epoxy etc).

- CMS barcode applied when chemical arrives at shipping or by you. It is location/owner based identification for use in emergency response/work planning



Hazardous Waste

Remove CMS barcode from spent or wasted container and return barcode to CMS, use web to delete barcode or email CMSteam@bnl.gov to eliminate chemical from active inventory.

You must take training prior to generating hazardous waste.

Chemical Storage and Handling

Chemical Handling/Storage Recommendations

Date chemical containers when received and when opened.
Dispose of chemicals when expiration date has passed.
Use safety carriers when transporting in case of breakage.
Routinely clean surfaces to reduce workspace contamination.
Use hood/exhaust vent to prevent vapor buildup

Use secondary containment for liquids: Non-breakable, Compatible with chemical, Large enough to contain contents of largest bottle.

"Shelves should have lips to prevent containers from falling"
Store materials in ventilated cabinets as necessary.
Consult MSDS for specific storage recommendations.

Store large bottles on low shelves.

Chemicals on the floor must have secondary containment.

Incompatible chemicals must not be stored together.

If storage is alphabetical, separate first by hazard class.

Alkalis separated from acids/Oxidants from reducing agents.

Acid Storage

Separate inorganic acids by compatibility/Separate inorganic acids from organic acids.

Store nitric acid separately. Store HF separately

Store large quantities in acid cabinet

Water-Reactives (Na, K) Storage/Handling

Store in air/watertight containers off floor away from combustibles

When possible, store water-reactive materials in desiccators, glove boxes. Don't open material past expiration date.

Combustible & Flammable Storage

Store large quantities in NFPA approved flammable storage cabinet.

Store away from oxidizers/Do not be store in ordinary refrigerators.

Use only in well-ventilated areas/Remove heat and ignition sources

Keep containers closed when not in use/Check for leaks.

Electrically bond and ground containers before transferring liquids from metal containers.

Fire Control

Must have suitable fire control where chemicals are stored

No open flames in storage area

Class A extinguisher	Wood, paper
Class B extinguisher	Flammable liquids such as grease, gasoline, oil
Class C extinguisher	Electrical fires – extinguishing agent is non-conducting
Class D extinguisher	Flammable metals – specific for type of metal – sodium is different from lithium etc. – no pictures so you must read the extinguisher

Gas Cylinder Handling/Storage

Inspect cylinders prior to use

Label gas lines from/into cylinders

Keep caps on at all times unless in use

Never drag cylinders

Never transport cylinders with regulators

Separate flammables from oxidizing/toxic/non-flammable gases

Store toxic gases (on list) in vented space (hood)

CO is unique – always use monitor

Incident - Indiana University:

anhydrous HF lecture bottle stored for ca 14 years. HF reacted with iron in the steel to form H_2 at psi 2400 – AHF should have been 1-15 psi

Incident - BNL:

corrosive gas reacted with valve material – led to evacuation

Exposure Control
Different methods of exposure control
PPE

Routes of Exposure

4 main routes chemicals enter body:

- Inhalation (breathing)
- Absorption (skin or eye contact)
- Ingestion (eating/smoking/biting nails)
- Injection-Puncture Wound (broken glass, needlestick)

Inhalation is considered the most common route of entry

Toxic effects classified by duration of exposure and onset of symptoms

Acute toxicity: sudden and severe – *carbon monoxide poisoning*

Chronic toxicity: prolonged/ repeated exposure - *lead poisoning*

Highly acute toxins cause damage based on short exposure/intense irritation and poisoning/fatal

sodium selenate, sodium azide, thallium sulfate, dimethyl sulfate, nicotine

Hierarchy of Controls (in this order):

1. Substitution
2. Engineering Controls
3. Administrative Controls
4. Personal Protective Equipment

Substitution: BEST control

Eliminates hazard by substituting non-hazardous chemical.

Not usually applicable in labs/check industrial items

Engineering Controls: mechanical systems control exposure

Lab fume hoods/Source containment/Automatic alarms/Glove boxes

built-in/automatic/provide protection regardless of training, supervision, experience, or carelessness.

Hoods: must be certified, picture by hood shows condition at certification, work 6" from edge, use secondary containment, sash set at marker, paper taped to sash to verify flow.

Administrative Controls

used where engineering controls are not practical.

effectiveness depends on cooperation of worker.

include policies/procedures limiting worker exposure to hazard.

- Pre-work planning/rehearsing to shorten duration of job
- Establishing time limitations
- Rotation of workers in/out of affected area
- Standard Operating Procedures (SOPs)
- Signs, postings, labels
- Access controls

Personal Protective Equipment (PPE)

- last line of defense against workplace hazards
- used when engineering/administrative controls are not feasible
- interim measure while controls are being implemented.
- selected to mitigate risk of hazards of work activity.
- level of protection must match anticipated hazards/risks
- unique hazards/risks identified in ESR.

Area-based PPE Requirements

- Placards will specify "Minimum Protective Equipment Required for Entry"
- PPE required regardless of whether you are working in the space
- May be supplemental PPE for doing certain work (specified in ESRs) known as Operation Based PPE

eg. Labcoat, safety glasses with side shields, long pants and closed shoes with socks required for entry; gloves required for work

Personal Protective Equipment (PPE)

The four major categories of PPE for chemical handling are:

Eye/face protection

Hand protection

Body protection

Respiratory protection

Eye and Face PPE

The minimum eye protection in laboratories where hazardous chemicals are present are <u>safety glasses with side shields</u>.

Additional eye protection when:

Pouring corrosive liquids (inorganic acids and bases): Splash-proof goggles/face shields

Face shield for some cases with particulate exposure or large quantities of acids. They must be worn with safety glasses.

Hand PPE

Appropriate hand protection must be worn when hands may be exposed to hazardous material/temperature extremes

Disposible gloves only for splash protection

Always replace disposable gloves upon chemical contact!

Primary considerations when selecting gloves:

Type of Use (immersion vs. splash)

Chemical Involved (benzene vs. hexane)

Glove Material (nitrile and PVC better than latex for most use)
(special gloves for DMSO with toxic chemicals or DMSO cleanup)

Glove Thickness

Choosing the BEST glove:

Long Breakthrough time (longer than time of exposure)

Lowest Permeation Rate possible

maximum thickness to prevent penetration/allow dexterity

Non-disposable gloves must be decontaminated after use

Used for large amts of highly toxic powders/conc inorganic acids bases

No glove will help if it is used improperly

Body PPE

Lab coats must be worn when entering posted laboratories (100% cotton/flame resistant for pyrophorics)
No lab coats worn in common spaces (lunchroom, bathroom)
Long pants, closed shoes, socks in labs
No laundering of labcoats at home – only BNL

With severe chemical exposure potential, you must complete cbt Chemical Protective Clothing User Training.

Respiratory PPE

airborne exposure controlled w/ lab hoods/gloves boxes

Respiratory protection used as last resort

ESR review determines if work requires exposure above occupational exposure limits

Training/fit testing/medical approval/selection/use/cleaning described in Respiratory Protection SA must be followed.

Selecting and Obtaining PPE

information on selection of PPE:

SHSD Rep/FS Rep/SBMS/Supervisor/ESH Coord./MSDS

Prescription eye glasses with safety shields - see Lee Walcott/me for forms/authorization (provided to employees free of charge if required for the job)- Wednesday 10am-4pm.

Labcoats – see Lee Walcott

Always inspect PPE before use to verify integrity

Good Housekeeping

Best way to ensure safe work environment is good housekeeping.

Exits are not blocked or locked

There is proper lighting in work and storage areas

Space heaters used only with prior approval

Emergency Response

Signs and Symptoms of Exposure

Signs of toxic poisoning observable by others:

change in eye/skin color; lack of coordination; change in demeanor; excessive sweating; difficulty in breathing/wheezing/coughing

Symptoms of toxic poisoning not observable by others:

Headaches; blurred vision; dizziness; cramps or diarrhea; irritation of eyes/skin/throat/respiratory tract

Detection of Hazardous Release

Fire or explosion

Cloud of condensed gas

Taste or Odor

Watering eyes/Nausea.

When potential for toxic exposure, atmospheric sampling can be provided/should be identified during work planning process.

Colored gas clouds are probably toxic: *bromine, iodine* NO_2

Occupational Exposure Limits

workplace respiratory airborne concentrations enforced at BNL:

- Threshold Limit Values (TLV) - established by ACGIH
- Permissible Exposure Limits (PEL) - established by OSHA

concentration measured over 8-hour workday/40-hour workweek without adverse health effect.

PEL/TLV values may differ/BNL enforces the lower limit.

information in "Hazardous Ingredients" section of MSDS/IH Group/RCD FS Rep/me

Eye Wash and Shower Stations

Required for corrosive chemical use

Check eyewash weekly or prior to hazardous chemical use

Flush for 15 minutes for splash

know where eyewash and shower stations are located BEFORE you need one.

Emergency Response: Fire

Assess type of material on fire/amount of combustibles in area/location (bldg/room #)

Use nearest pull box to activate the alarm and evacuate the building (front patio) (then call x2222 or x911)

If fire is small, call x2222/911/extinguish fire.

Do not attempt to fight fire if it is unsafe/blocks your egress/you do not have correct extinguisher

Always report use of fire extinguisher to J. Anselmini

Emergency Response: Injury

Assess type of accident (if witnessed)/degree of injury/state of victim (conscious/unconscious)/location (bldg/room #)

Call 2222 or 911 to report the injury-give location.

If no hazards present, stay with victim until help arrives.

OR transport to OMC 8:30-5:00 – to firehouse after 5:00

Emergency Response: Spill

Assess type and amount of material/hazard characteristics/ potential for release to environment/location (bldg/room #)

IF the spill:

Can be controlled by you and your procedures/equipment

Has NO risk of release to sinks/drains/environment

Will not present hazard to personnel

YOU can clean up and dispose of material using lab procedures.

(Spill Kits located in 90-day areas. Notify Jim A. or me if you use the kits.

IF the spill:

Cannot easily be controlled

Presents risk of release to sinks/drains/environment

Presents hazard to personnel,

Evacuate the vicinity/call 2222 to report spill/notify your supervisor

Working Alone

Obtain approval from your supervisor/Be cautious

Either verify that someone is in the area or

Notify Safeguards & Security (2238) at start/end of work.

Eating and Drinking in Labs

No eating/drinking/gum chewing/applying cosmetics/food in labs

No food in chemical fridge/chemicals in food fridge

No lab microwaves for food/food microwaves for chemicals

No lab coats in food areas (lecture rooms/cafeteria/alcoves)

No laboratory glassware for food/drink/No mouth pipetting

Update Hazard Information Placards

confirm information on hazards is accurate

3 people on placard/2 fulltime employees/Top person most aware of hazards in lab, regardless of status

Notify me as things change!

This is the end of the Lab Standard class

Remember: This training class is only the first step. You are not qualified to perform work until assigned and authorized to do so (this means ESRs and task-specific training as given by the PI or designee!!!!)

Working with Chemicals

Hoods must be certified and in condition where it passed (vents not blocked)
Work 6 inches inside the sash to have appropriate flow.
Our hoods have sinks – you must use secondary containment to prevent a potential release to sink.

CO detector will not protect you unless it is downstream of where you stand/work!
CO detectors must be activated-last 2 years only

Decontaminate areas where you work routinely/this is mandatory for work with carcinogens, reproductive toxins and acute toxins.

Solder in a tray whenever possible.

Work Planning and Control

All research must have Experimental Safety Review (ESRs)

- No work may begin until an ESR is completed and signed.
- New Work→new ESR/minor change→eMail me change.
- All personnel working on ESR must read and electronically sign.
- ESRs reviewed annually/All are now electronic
- Everyone working under ESR is assigned training requirements.
- The latest version is the Public ESR.
- All outside contractor work must be evaluated for work permit.

Transportation

- Onsite Transport of chemicals (small amts) in motor vehicle: must take TQ-MOVEHAZ.
- Transportation of rad material handled through FS personnel.
- No transportation of chemicals by you on commercial carriers.
- Mailed chemicals must have MSDS/proper packaging.

Retiring/Terminating/Leave of Absence (>6 mo.)

- You must clean up your work space
- You must dispose of your hazardous waste
- You must dispose of or have coworker accept responsibility for your equipment and apparatus.
- You must dispose of or have coworker accept responsibility for chemical, biological and rad material.
- You must transfer contents of your CMS inventory to willing coworker or dispose of chemicals
- You must properly assign laboratory notebooks, files and other records to your relevant BNL associate
- You must notify me if the HIP (Haz Placard) needs updating