1. POLICY REGARDING HAZARDOUS CHEMICALS:

Procedures and equipment will be evaluated with respect to the hazardous nature of reagents and chemicals employed. There will be a concerted effort made to substitute less toxic chemicals or replace those chemicals all together whenever possible. These evaluations will be ongoing in an effort to reduce exposure and decrease hazardous waste generation. The Chemical Hygiene Plan is reviewed annually for its effectiveness by the facilities safety office, laboratory management and staff.

1. RESPONSIBILITIES:
2. Chief of Pathology and Laboratory Medicine (P&LMS):
* Acts at the Chemical Hygiene Office for PLMS and has the overall responsibility for the [Laboratory Safety](https://dvagov.sharepoint.com/sites/VHAALB/dt/lab/Gen/default.aspx?RootFolder=%2Fsites%2FVHAALB%2Fdt%2Flab%2FGen%2FShared%20Documents%2F80%20Safety%2FWaste%20stream%20analysis&FolderCTID=0x0120008B1BDBF0540978419C3F2B58B4198E70&View=%7b378D7305-426E-4A34-894F-1B21C93FC57A%7d) and Chemical Hygiene Plan.
* Assures that all aspects of safety are promoted and followed in accordance with

the [OSHA Laboratory Standard](https://dvagov.sharepoint.com/%3Aw%3A/r/sites/VHAALB/dt/lab/Gen/Shared%20Documents/80%20Safety/OSHA%20Laboratory%20Standards.docx?d=w2ceb368746c747159f51ef413a027c53&csf=1&web=1&e=iUyVIM) *):*

* Delegates the Safety and Chemical Hygiene responsibilities to the LaboratoryManager for oversight/assignment.
* Must review and approve all changes to the Safety and Chemical Hygiene Plan prior to changes and/or implementation
1. Facilities Safety Manager:
* Responsible for the overall safety of the facility.
* Addresses concerns and corrects as needed safety issues within the facility
1. Laboratory Manager:
* Responsible for developing, implementing and annually reviewing all the P&LMS safety policies with the aid of the Chief of P&LMS and the facility safety manager.
* Responsible for assuring that all safety concerns within P&LMS are addressed and corrected.
* Ensures that all P&LMS staff are trained and follow the Chemical Hygiene Plan
* Ensures that all work practices, engineering controls and personal protective equipment (PPE) are in place, in good working conditions and readily available at all times in order to reduce the potential for exposure to the lowest practical level.
* Works with the facility’s Safety Office including the GEMS coordinator to assure that the laboratory service is following all OSHA regulations for a safe work enviorment
* Ensures proper storage and disposal of hazardous waste is taking place.
* Assigns a qualified technologist to attend, report, and document at the facilities safety and infectious control committees.
* Records accident statistics at the monthly supervisors meetings for identification of trends and corrective actions for all areas within P&LMS.
1. Supervisors:
* Responsible for compliance with Chemical Hygiene Plan in each respective area.
* Ensure that laboratory employees and others entering the laboratory know and follow chemical hygiene rules, as well as:
	1. Appropriate protective equipment is provided, is in working order and is used
	2. Lab attire is appropriate for the technologist daily tasks.
	3. Appropriate training has been provided to all employees.
	4. Unsafe acts, conditions or inadequate protectionsis reported and documented
* Coordinate hazardous waste pick-up and disposal through the GEMS Coordinator.
* Review annually and as needed the [Carcinogenic Chemical List](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Carcinogenic%20Chemicals%20List.doc)
1. Employees:
* Read and comply with the Chemical Hygiene Plan and other safety related policies for the Stratton VAMC.
* Responsible for using PPEs when working in the laboratory
* Report all accidents, incidents, and/or exposures promptly to their supervisors
* Promptly report unsafe conditions or unsafe use of hazardous chemicals to their

supervisor.

* Remain aware of the hazardous materials used in the laboratory and use these

 materials in a safe manner. If unsure of a hazard or safety procedure – ASK!

* Know the location of their respected areas SDS sheets and are familiar with them
* Know location and how to use their areas eyewash stations, showers, spill kits

 and fire extinguishers.

* Responisble for completing all annual mandatory training.
1. STANDARD OPERATING PROCEDURES FOR HANDLING HAZARDOUS CHEMICALS

## Basic Rules and Procedures

1. [Accidents and Spills](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/AP/Shared%20Documents/Histology/80%20Safety/Chemical%20Spills.docx):
* Eye contact: Promptly flush eyes at eye wash stations and seek medical attention.
* Ingestion: Follow SDS instruction for chemical and seek medical attention.
* Skin contact: Flush affected area with water, remove contaminated clothing. Seek medical attention as soon as possible(employee health).
* Notify you supervisor
* Large spills should be referred to the Facilities Management services. The

 following provisions apply to all spills regardless of magnitude:

1. Avoid Routine Exposure: Avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals. Vent apparatus that may discharge toxic chemicals into local exhaust devices. Inspect gloves and test glove boxes before use. Do not allow the release of toxic substances in cold or warm rooms since these contain recirculated atmosphere.
2. Choice of Chemicals: Use only those chemicals for which the quality of the available ventilation system is appropriate.(See Attachments 1- regarding Chemical types)
3. Eating, Smoking, etc.: Eating, drinking, etc. is prohibited in all Laboratory areas except those designated Biosafe. Wash hands when leaving the work area for breaks, meals, personal hygiene, etc.
4. Equipment and Glassware: Handle all laboratory glassware with care to avoid damage. Do not use chipped glassware. Use extra care with evacuated glass apparatus and use equipment only for its designed purpose.
5. Exiting Area: Wash all areas of exposed skin carefully before leaving the Laboratory. Avoid practical jokes or other behavior, which might confuse, startle or distract another worker.
6. Personal Apparel, Housekeeping and Protection: Confine long hair and loose clothing. Do not wear sandals, perforated shoes, etc. Keep work area clean and uncluttered with chemicals and equipment properly labeled. Appropriate eye protection is to be worn by all persons, including visitors. Wear appropriate gloves for contact with toxic materials, and use other protective and emergency apparel and equipment as appropriate. Avoid use of contact lenses unless necessary, informing supervisor of their use so precautions can be taken. Always use [your personal](https://dvagov.sharepoint.com/%3Aw%3A/r/sites/VHAALB/dt/lab/Gen/Shared%20Documents/80%20Safety/Personal%20Protective%20Equipment%20%28PPE%29%20Policy.doc?d=wbe8f3d9a233d46149ea78f15a77cd0c8&csf=1&web=1&e=Z2QChI) protective equipment (PPE), i.e. gloves, eyewear, surgical masks and laboratory coats when working in the laboratory.
7. Planning: Seek information and advice about hazards. Plan protective procedures and positioning of new equipment before beginning any new operations.
8. Unattended Operations: Leave lights on, place appropriate sign on the door and provide for containment of toxic substances in the event of failure of a utility service to an unattended operation.
9. Use of Hood: Use fume hoods or other ventilation device when working with any volatile substance. Leave the hood on when not in use if toxic substances are stored there. Be alert to unsafe conditions and see that they are corrected when detected.
10. Waste Disposal: See the Facilities Chemical Waste Management Program.
11. Working Alone: Avoid working alone in a building and do not work alone in a laboratory, if the procedures are hazardous.

## Laboratory Facility Equipment and Protections:

1. The laboratory is equipped with an appropriate ventilation system with intakes and exhausts located so as to avoid intake of contaminated air; adequate, well-ventilated stockrooms, hoods and sinks and other safety equipment including eye wash fountains and drench showers.
2. Chemical hygiene related equipment such as hoods, etc. undergo continual appraisal and are modified if inadequate. The work conducted is appropriate to the physical facilities available, especially to the quality of ventilation.
3. The laboratory ventilation system provides a source of air for breathing and for input into local ventilation devices. The ventilation system ensures that the air is continually replaced and prevents the increase of air concentration of toxic substances during the workday. It is designed to direct airflow into the laboratory from non-laboratory areas and out to the exterior of the building.
* Ventilated storage cabinets, canopy hoods, etc. are provided as needed, each having a separate duct.
* Cold rooms and warm rooms have provisions for rapid escape in the event of electrical failure.
* Any alteration of the ventilation system is made only if testing indicates that worker protection from airborne toxic substances will remain adequate.
* 4 to 12 room air changes/hr is normally adequate general ventilation if exhaust systems such as hoods are the primary method of control.
* The general airflow is not turbulent and relative uniform throughout the laboratory; airflow into and within the hood is not excessively turbulent; hood face velocity is adequate.
* The quality and quantity of ventilation is evaluated upon installation, regularly monitored and re-evaluated whenever a change in local ventilation devices is made.
1. MEASURES TO REDUCE EXPOSURE
2. Chemical Procurement: Proper handling, storage and disposal are known before a substance is received. No container is accepted without adequate identification and all substances are initially received in a central location.
3. Stockrooms, etc.: Toxic substances are segregated in well-identified areas with local exhaust ventilation. Highly toxic chemicals or opened chemicals are in secondary containers. Stored chemicals are examined periodically for replacement, deterioration and container integrity. Hand carried chemicals are placed in an outside container or bucket; freight only elevators are used. Laboratory storage of chemicals is as small as practical. Storage on bench tops or in hoods is inadvisable and exposure to heat or direct sunlight is avoided. Periodic inventories are conducted, returning unneeded items to stock.
4. Housekeeping, Maintenance and Inspections: Floors are cleaned regularly and formal housekeeping and [chemical hygiene inspections](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Safety%20Guidelines.docx) are held at least quarterly and are continual. Eye wash fountains are tested weekly and safety showers are inspected and tested twice per year and other safety equipment on a regular basis. Stairways and hallways are clear and not used as storage areas. Access to exits, emergency equipment, etc. is open and never blocked.
5. Protective Apparel and Equipment: Each laboratory where hazardous chemicals are present have [Personal Protective Equipment](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Personal%20Protective%20Equipment%20%28PPE%29%20Policy.doc) (PPE) which includes gloves, goggles, face shields, aprons,fluid impervious gowns, masks, and respirators compatible with the required degree ofprotection for substances being handled
6. Protective apparel compatible with the required degree of protection for substances being handled.
7. An easily accessible drench-type safety shower.
8. An eye wash fountain/ station.
9. A fire extinguisher.
10. Respiratory protection, if indicated, fire alarm and telephone for emergency use.
11. Records: All accident records are written and retained. The Chemical Hygiene Plan records document that the facilities and precautions are compatible with the current regulations.
12. Signs and Labels: Prominent signs and labels of the following types are posted
13. Emergency telephone numbers.
14. Identity labels showing contents of containers (including waste) and the associated hazard.
15. Location signs for safety showers, eyewash stations first aid, etc., exits and areas where food and beverage consumption and storage are permitted.
16. Warnings at areas or equipment where special or unusual hazards exist.
17. Waste Disposal Program: See Pathology & Laboratory Medicine [Hazardous Chemical](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Hazardous%20Chemicals.docx) Action Plan for Disposal of Hazardous Chemicals.
18. FUME HOOD PERFORMANCE

Fume Hood: A laboratory hood with 2.5 linear feet of hood space per person is provided when precautions for using chemicals indicate such. If most of the employees’ time is spent working with chemicals, each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. Both fume hood and Biosafe cabinets are certified through Biomedical Engineering.

1. EMPLOYEE INFORMATION AND TRAINING

## All individuals at risk will receive training in chemical safety and will be adequately informed about the work in the laboratory, its risks and what to do if an accident occurs.

1. Employees may only perform procedures that are authorized by laboratory SOPs. Any changes to SOPs or any experimentation/research outside the scope of the SOPs must be approved by the section supervisor.
2. If an employee is exposed to a hazardous chemical/substance, s/he must proceed to the Employee Health Unit (the ER on non-administrative hours) for evaluation.
3. Every laboratory worker knows the location and proper use of the available protective apparel and equipment. All employees receive training in the proper use of emergency equipment and procedures. Additional basic life support (CPR) training is available for everyone who might need it.
4. Receiving and stockroom/storeroom personnel are informed about hazards, handling equipment, protective apparel and relevant regulations.
5. The training and education program is a regular on-going activity, not just an annual event.
6. Literature and consulting services (from the Medical Center Safety Manager) concerning chemical hygiene is readily available to Laboratory personnel who are encouraged to use these information sources.
7. A written emergency plan (for spills and accidents) is established and communicated to all personnel. It includes procedures for containment cleanup, and reporting, and the protocol for medical care follow-up. It also indicates the location of safety equipment in the lab sections.
8. There is an emergency alarm system to alert people in all parts of the facility including isolation areas such as cold rooms.
9. All accidents or near-accidents are carefully analyzed with the results distributed to all that might benefit.
10. APPROVAL OF LABORATORY ACTIVITIES
11. When working with chemicals of high chronic toxicity prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor.
12. When working with chemicals that contain lead compounds, formamide, etc. use a hood whose satisfactory performance has been confirmed and appropriate protective apparel to prevent skin contact. Review each use of these materials with the laboratory supervisor and review continuing uses annually or whenever a procedural change is made.
13. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
14. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.
15. MEDICAL CONSULTATION AND EXAMINATION
16. Regular medical surveillance should be established to the extent required by regulations.
17. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical will consult a qualified physician to establish a regular schedule of medical surveillance.
18. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby.
19. SPECIAL PRECAUTIONS FOR HAZARDOUS SUBSTANCES
20. Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.
21. When working with chemicals of moderate chronic or high acute toxicity:
22. Minimize exposure to these toxic substances by any route using all reasonable precautions.
23. Use and store these chemicals only in areas of restricted access with special warning signs. Always use a hood for procedures that may produce aerosols or vapors containing hazardous substances. Trap released vapors to prevent their discharge with the hood exhaust.
24. Always avoid skin contact by using gloves, wearing long-sleeved lab coats, and washing hands and arms immediately after working with these materials.
25. Maintain records of the amounts of these materials on hand, amounts used and names of the workers involved.
26. Be prepared to accidents and spills. Two people should be present at all times when the compound used is highly toxic or unknown. These substances should be stored in chemically resistant trays. Work and storage surfaces should be lined with removable, absorbent plastic backed paper.
27. Decontaminate, by chemical conversion if possible, contaminated clothing or shoes. If this is not possible, incinerate the articles. Store contaminated waste in closed suitable labeled, impervious containers.
28. Working with chemicals of high chronic toxicity:
29. Conduct all transfers and work with these substances in a “controlled area”. A restricted access hood or portion of the lab, designed for use of highly toxic substances.
30. Decontaminate vacuum pumps or other contaminated equipment including glassware in the hood before removing them from the controlled area before normal work is resumed there.
31. On leaving controlled area remove protective apparel (placing it in appropriate labeled container) and wash hands, forearms, face and neck.
32. If toxic substance was dry powder, use wet mop or vacuum cleaning with HEPA filter instead of sweeping.
33. Keep accurate records of the amounts of these substances stored and used, the dates of use and names of users.
34. Assure that controlled area is conspicuously marked with wording and restricted access signs, and that all containers of these substances are appropriately labeled with identity and warning labels.
35. Assure that contingency plans, equipment and materials to minimize exposures of people and property in care of accident are available.
36. Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled unbreakable, chemically resistant secondary containers.
37. Use chemical decontamination whenever possible; ensure that containers or contaminated waste are transferred from the controlled area in a secondary container under the supervision of authorized personnel.
38. [PROCEDURE FOR DISPENSING AND HANDLING LIQUID NITROGEN OR VERY COLD OBJECTS](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Dry%20Ice%20Safe%20Handling.docx)
	1. Liquid nitrogen is a hazardous substance that may cause frostbite, eye damage, or asphyxiation. Personal protective equipment (eye protection, cryogenic gloves, and lab coat) must be worn when dispensing and handling liquid nitrogen or very cold objects.
	2. Do not allow any liquid nitrogen or cold object to touch any part of your body.
	3. Do not touch any item that has been immersed in liquid nitrogen until it has warmed to room temperature.
	4. Store and dispense liquid nitrogen in an approved container. A tightly sealed container will build up pressure as the liquid boils and may explode after a short time. Thermos bottle is not approved for containing liquid nitrogen. Avoid common glass and large, solid plastic containers, as they may shatter.
	5. Liquid nitrogen in volumes of ≤ one quart may be disposed of by allowing it to evaporate from the container under an operating fume hood. For disposing of volumes greater than one quart, see guidance from the Medical Center Safety Officer.
39. ULTRAVIOLET LIGHT SAFETY
40. Ultraviolet (UV) light or “black light” as it is sometimes called, has wavelengths ranging from 180 to 400 nanometers. These wavelengths place UV light in the invisible part of the electromagnetic spectrum between visible light and X-rays. Excessive UV light exposure can cause painful sunburn, accelerate wrinkling and increase the risk of skin cancer. UV light can cause eye inflammation, cataracts, and retinal damage.
41. Because of their close proximity, laboratory devices, like UV lamps, deliver UV light at a much higher intensity than the sun and, therefore, can cause injury much more quickly. The greatest threat with UV light exposure is that the individual is generally unaware that the damage is occurring. There is usually no pain associated with the injury until several hours after the exposure. UV lamps for use in laboratory applications produce radiation at the harmful wavelengths so it is essential that they be used with the proper filter in place and in good condition.
42. It is the responsibility of each employee using equipment with a UV light source to follow posted operating direction. If required, personal protective equipment will be provided for safe equipment use. Any \*suspected) malfunction of UV-containing equipment must be reported to the area supervisor immediately. Biomedical Engineering will be contacted for repairs.
43. REFERENCES:
* The College of American Pathologists - General Checklist
* Complete Guide to Laboratory Safety 2nd ed, Terry Jo Gile, MT (ASCP), MA Ed.
* OSHA 29 CFR 1910.1450

XIII: APPENDIXES

* 1. [Allergens and Sensitizers – pg 10](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%201%3A%20Allergens%20and%20Sensitizers)
	2. [Chemicals of Moderate Chronic or High Acute Toxicity – pg 10](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%202%3A%20Chemicals%20of%20Moderate%20Chronic%20or%20High%20Acute%20Toxicity)
	3. [Chemicals of High Chronic Toxicity- pg 10](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%203%3A%20Chemicals%20of%20High%20Chronic%20Toxicity)
	4. [Poisons – pg 11](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%204%3A%20Poisons)
	5. [Flammables(organic solvents) – pg 11](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%205%3A%20Flammables%20%28Organic%20Solvents%29)
	6. [Reactive and Explosive Chemicals- pg 12](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%206%3A%20Reactive%20and%20Explosive%20Chemicals)
	7. [Miscellaneous and Special Problems- pg 14](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%207%3A%20Miscellaneous%20and%20Special%20Problems)
	8. [Storage Cabinets- pg 14](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%20%208%3A%20Storage%20Cabinets)
	9. [Carcinogens- pg 16](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%209%3A%20Carcinogens)
	10. [Compressed Gasses- pg 17](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2010%3A%20Compressed%20Gasses)
	11. [Flammable Gasses- pg 18](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2011%3A%20Flammable%20Gasses)
	12. [Toxic gasses- pg 18](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2012%3A%20Toxic%20Gasses%20-)
	13. [Radioactivity- pg 18](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2013%3A%20Laboratory%20Procedures%20Involving%20Radioactivity)
	14. [Acids and Bases- pg 18](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2014%3A%20Acids%20and%20Bases)
	15. [Formaldehyde- pg 18](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2015%3A%20%20Formaldehyde)
	16. [Reproductive Hazards- pg 19](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2016%3A%20Reproductive%20Hazards)
	17. [Biological Hazards- pg 20](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2017%3A%20Biological%20Hazards)
	18. [Chemical Procurement- pg 20](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2018%3A%20Chemical%20Procurement)
	19. [Chemical Storage – pg 20](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2019%3A%20Chemical%20Storage)
	20. [NFPA lableling system (National Fire Protection Associa.) – pg 25](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2020%3A%20National%20Fire%20Protection%20Association%20%28NFPA%29%20Labeling%20System)
	21. [Hazard Communication Standards Pictograms & Hazards(OSHA rev,2013)](file:///C%3A/Users/vhaalnSalisc/AppData/Roaming/Microsoft/Word/Appendix%2021%3A%20Hazard%20Communication%20Standards%20Pictograms%20and%20Hazards%20%28OSHA%20revised%202013%29) pg 26

Appendix 1: Allergens and Sensitizers

There are many substances (nickel, toluene, diazomethane, isocyanate, diiscyanate, bichromates, fungi, latex proteins) that may result in mildly or severely adverse allergic reactions including rash, blistering , and bronchial constriction.

1. Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

Appendix 2: Chemicals of Moderate Chronic or High Acute Toxicity

Examples: diisopropylfluorophosphate, hydrofluoric acid, hydrogen cyanide.

1. Aim: To minimize exposure to these toxic substances by any route using all reasonable precautions.
2. Applicability: These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities.
3. Location: Use and store these substances only in areas of restricted access with special warning signs. Always use a hood or other containment device for procedures which may result in the generation of aerosols or vapors containing these substances.
4. Personal protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.
5. Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.
6. If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment.
7. Waste: Thoroughly decontaminate or incinerate contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion.

Appendix 3: Chemicals of High Chronic Toxicity

Examples: dimethylmercury and nickel carbonyl (48), benzo-a-pyrene (51), N-nitrosodiethylamine (54), other human carcinogens or substances with high carcinogenic potency in animals (38).

1. Access: Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions.
2. Non-contamination/Decontamination: Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the controlled area before normal work is resumed there.
3. Exiting: On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.
4. Housekeeping: Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.
5. Medical surveillance: If using toxicologically significant quantities of such a substance on a regular basis, consult employee health concerning desirability of regular medical surveillance.
6. Signs and labels: Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
7. Spills: Follow SDS sheets
8. Storage: Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
9. Waste: Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area.

Appendix 4: Poisons

Sodium and Potassium Cyanide (NaCN and KCN).

Sodium Barbiturate and Barbituric Acid

Arsenic Trioxide

Drug standards

Appendix 5: Flammables (Organic Solvents)

1. Flammable solvents are defined as substances having a flash point below 140°F (60°C) and having a vapor pressure not exceeding 40 PSI [(absolute) @ 100°F (38°C].
2. All flammable solvents, except working supplies (small amount only-see OSHA and NFPA classes and amounts in following pages), are stored in the Flammable Storage Cabinets.
3. Toxic effects of some solvents (plus flammable properties) must be considered. The primary routes of entry are through inhalation and skin absorption.
4. Amounts needed for daily usage must be brought up to your work area in properly labeled containers.
5. Reagents in 500 mL or larger glass containers must be placed in a bottle carrier or cart when they are being transported from one area to another to lessen the danger of accidental breakage.
6. Record the date of receipt and date of opening on containers of solvents. Special procedures may be required for certain extremely hazardous chemical and wastes (e.g. phenol, osmium tetroxide and formaldehyde.)
7. Solvents and flammable liquids MUST be handled in a hood away from any flame or ungrounded electrical device. Only working amounts of these chemical should be stored outside explosion proof cabinets, explosion proof refrigerators, or solvent storage areas.
8. Transfer of flammables from one container to another should be preceded by electrical bonding (conductive cable or wiring to each container)in order to avoid a static spark that may result from pouring the solvent.
9. If used outside a fume hood, the permissible exposure limits (PEL) and the need for respiratory protection must be evaluated by the Industrial Hygienist.
10. Appropriate eye protection (e.g. goggles, face shield,) aprons and gloves must be worn. Evaluate the degradation and permeation rate of the solvents through various materials to determine type of gloves required.
11. When using flammable liquids, there must always be a Class III, CO2 or Halon fire extinguisher and absorbent nearby. Never use a water extinguisher on a liquid fire.
12. Volumes not used must be returned to the Solvent Storage Cabinet at the end of the work day. Return to proper shelf.
13. Only refrigerators rated (no ignition source) for flammables storage are used.
14. Ether: Ether or other flammables must not be stored in a closed area. Ether

 must not be kept in storage for more than one year unless it contains inhibitors

 known to prevent the formation of explosive peroxides. Opened containers of

 ether must be discarde within six months of date opened. Empty containers will

 be placed in fume hood with cap off overnight before discarding.

1. Perchloric acid: Banned from use in the Clinical Laboratory.

Appendix 6: Reactive and Explosive Chemicals

1. Reactive chemicals are those that are unstable under certain conditions, and therefore, present potentially dangerous conditions for the lab. Under certain conditions, such as confinement or through exposure to heat or friction they may result in explosions.
2. Pyrophoric Chemicals (e.g. phosphorous) are those which may spontaneously ignite in air.
3. Water Reactive Chemicals, such as sodium and metal hydrides, may explode upon contact with water or moist air.
4. Peroxidizing chemicals**:** A variety of chemicals can form highly explosive peroxide compounds as impurities when exposed to air over a period of time. This problem is most common in ethers, but also occurs in a variety of other organic compounds as well as in some alkali metals and amides. Preventing the formation of peroxides is dependent on careful inventory control of peroxidizable chemicals. Most are sold with inhibitors to prevent peroxide formation. This is effective until the container is opened, and the chemical comes in contact with air. Therefore, the following should be observed:
	1. Date all containers of the chemicals listed below with date when first opened; discard all containers exceeding the time limitations listed below.

**Severe peroxide hazard** – Peroxide hazard on storage (these compounds form peroxides that may explode even without being concentrated.)

**Discard within 3 months:**

Diisopropyl ether Divinylacetylene

Potassium metal Potassium amide

Sodium amide Divinyl ether

Vinylidene dichloride (1,1-dichloroethylene)

**High peroxide hazard** – Peroxide hazard on concentration (distillation, or most likely evaporation.)

**Discard with 6 months:**

Acetal Ethyl ether

Cumene Ethylene glycol dimethyl ethers (cellosolves & glymes)

Cyclohexane Furan

Cyclohexene Methyl acetylene

Cyclopenradiene Methyl cyclopentane

Cyclopentene Methyl isobutyl ketone

Diacetylene Tetrahydrofuran

Dicyclopentadiene Tetrahydronaphthalene

Diethyl ether Vinyl ethers

Dioxane

Peroxide hazard – Hazards due to peroxide initiation of polymerization: When stored as a liquid, the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should be considered as a peroxide storage hazard.

Discard within one year:

Butadiene Styrene

Chlorotrifluoroethylene Vinyl acetate

Tetrafluoroethylene Vinyl chloride

Vinyl acetylene Chloroform

Chloroprene (Chlorobutadiene) Vinyl pyridine

e. Picric acid and other polynitroaromatic compounds:

1. Polynitroaromatic compounds are relatively safe in the form that they are sold in. They are originally sold with 3 to 10% water added to stabilize them. They will become unstable when they dry out.
2. Picric acid will become explosive if it is allowed to form a metal salt. Never allow picric acid to be stored in containers with metal caps or to come in contact with any metal.

3. Polynitroaromatic compounds should never be opened when old or dry.

4. Sodium azide - This compound is not inherently unstable but may form highly

explosive heavy metal azides if contaminated or used improperly. Disposal of sodium

azide solutions to the sewer may cause the formation of lead or copper azide in the

plumbing. Care should be taken that sodium azide is not heated rapidly or stored in

containers with metal components.

f. Safety Measures:

1. Store and handle all reactive substances under the conditions that preclude such reactions (i.e. age, light heat, sparks, moisture, air, incompatible substances.)
2. Refer and adhere to guidelines found on warning labels on the container and SDS.
3. Each supervisor must maintain an inventory listing of the peroxidizable materials in the laboratory.
* The inventory shall be reviewed every three months, at which time samples of peroxide hazards can require testing for peroxides before turn-in for disposal.
1. Purchase peroxidizable compounds in packing sizes corresponding to use requirements. This will also minimize exposure to air from multiple openings of the container.

Appendix 7: Miscellaneous and Special Problems

1. Mercury - elemental mercury, Hg, is hazardous. Metallic Hg is slightly volatile even at room temperature. Vapors are toxic. Spilled and heated elemental Hg is especially hazardous.
2. The Stratton VAMC goal has been to eliminate mercury of any type. Mercury thermometers should not be used anywhere in the laboratory.
3. Other chemicals deserving special care due to toxicity, caustic action, etc. are: Hydrazine, Naphthalene, Picric Acid, Carbon disulfide

Appendix 8: Storage Cabinets

1. Must be approved for storage of the chemical being stored. Below are some general guidelines. Consult the institutional environmental manager if unsure about what storage cabinet to use or unsure about storage conditions.

|  |  |  |
| --- | --- | --- |
|   |  Flammable Liquids | Combustible Liquids |
| Container Type | Class IA | Class IB | Class IC | Class II | Class III(1) |
| Glass or approved Plastic (2) | 1 pt (3) | 1 gal | 1 gal | 1 gal |  |
| Safety Cans | 1 gal | 2 gals | 2 gals | 2 gals | 2 gals |

* Gravity feed containers not permitted.
* For those procedures where the required purity would be affected by storage in metal containers. Class 1A and Class 1B flammable liquids may be stored in glass containers not to exceed one gallon. Larger amounts should be stored in metal cans.
1. Definitions
* Flashpoint Temperature - the temperature at which the liquid gives off vapor sufficient to form an ignitable mixture with the air near the vessel.
* Flammable Liquid Classification:
	+ Class 1A Liquids - those liquids having flash point below 73 oF (23 oC) and boiling point below 100 oF (38 oC).
	+ Class 1B Liquids - those liquids having a flash point below 73 oF (23 oC) and a boiling point greater than 100 oF (38 oC).
	+ Class 1C Liquids - those liquids having a flash point at or above 73 oF (23 oC) and below 100 oF (38 oC) with a boiling point below 100 oF (38 oC).
* Combustible Liquid Classification:
	+ Class II Liquids - those liquids having a flash point at above 100o F (38o C) and below 140o F (60o C).
	+ Class IIIA Liquids - those liquids having a flash point at or above 140o F (60o C), but below 200o F (93o C).
	+ Class IIIB Liquids - any liquid that has a flashpoint at or above 200o F (93o C).

Condensed list of flammable liquids from *CRC Handbook of Laboratory Safety*:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Class IA | Class IB | Class IC | Class II | Class III |
| Acetaldehyde  | Acetone  | Hydrazine  | Acetic Acid  | Benzaldehyde  |
| Ethyl ether  | Acetonitrile  | Mesityloxide  | Acetic anhydride  | Cyclohexanol  |
| Furan  | Alcohol, -C1, -C4  | Nitromethane  | Cyclohexanone | Dimethyl sulfate  |
| Pentane  | Benzene  | Pentacols  | Decane  | DMSO |
| Ethylene Oxide  | Toluene  | Turpentine  | Dimethylforamide  | Dodecane  |
| Propylene Oxide  | Butyraldehyde | Xylene | Hexanols  | Glycol  |
| Ethyl Amine  | Esters thru C7  |   | 60% Peracetic acid | 37% Formaldehyde  |
| Dimethyl Sulfide  | Gasoline |   | Stoddard Solvent | Phenol |
| Collodion  | Isopropyl ether  |   |   |   |
| Petroleum Ether  | Pyridine  |   |   |   |

 \*\*\*\*\*\*\*\*See SDSs for specific information on all chemicals used in the laboratory.

**Appendix 9:** [**Carcinogens**](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Carcinogenic%20Chemicals%20List.doc)

1. Definitions: Many chemical substances may generate malignant tumors in test animals under severe, prolonged, or combined conditions. The term “carcinogenic” has different meaning when used in scientific versus regulatory contexts. Suspected and confirmed carcinogens are listed by the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP.) Other authoritative sources include OSHA (CFR 29:1910.1001 – 1047, 1450), NIOSH registry of Toxic Effects of Chemical Substances and MSDS’s.
2. The supervisor has the responsibility to:
3. Acquire the knowledge and information regarding the tumorigenicity of these chemicals.
4. Define laboratory procedures that minimize the hazards inherent in these chemicals.
5. Inform the employees using these chemicals of the significant risks.
6. Arrange for immediate medical attention in the event of an accident involving the ingestion, inhalation, or inoculation of one of these chemicals.
7. The employee has the responsibility to:
8. Comply with safety policies.
9. Report unsafe working conditions.
10. Report any accident involving one of these chemicals.
11. Safety Measures:
12. Eating, drinking, mouth pipetting is prohibited.
13. Use of protective apparel is required (e.g. gloves, masks or respirators, goggles, laboratory coats.) On leaving a designated area, remove protective apparel and thoroughly wash hands and skin surfaces.
14. Hand and forearm washing is required immediately after handling any chemical carcinogen. Following gross contact with carcinogenic material, thorough showering and clothing change is mandatory.
15. Certain chemicals are potentially carcinogenic if ingested or absorbed in quantity through the skin. See listing following this section. Specific regulations have been established by OSHA regarding the handling of those substances listed as Federally Regulated Carcinogens.
16. All procedures using select carcinogens or probable carcinogen (those listed in OSHA, NTP & IARC) will only be used in designated areas on disposable surfaces.
17. All work, including transfers, shall be performed in controlled area with restricted access, such as hoods, glove boxes, or portions of a laboratory specifically designated for the purpose.
18. Work surfaces shall be covered with dry absorbent plastic-backed paper that shall be disposed of after each procedure. Alternatively, the work surface shall be constructed of impervious material and thoroughly decontaminated after each procedure.
19. Clean work surfaces after any task using carcinogens, especially the balance area.
20. Carcinogenic chemicals should be segregated from other materials when possible. Due to the number of substances that are known or suspect carcinogens, segregation may not be feasible. In lieu of segregation, a system must be set up whereby lab staff are aware of the location and identity of chemical carcinogens, through area labeling, obvious container labeling, or through the maintenance of a list of carcinogens present in the lab.
21. Labeling of the chemical and the work area where carcinogenic risk is significant is mandatory. The recommended precautionary label shall include the following warning:
22. Limitations: Medical Center laboratories may not be able to meet all of the requirements for compliance with federal regulations. As a bare minimum it is recommended that:
23. An inventory of reagents and materials is taken.
24. Substances identified as carcinogenic are set aside in a special area for proper labeling and controlled access.
25. The use of these reagents be reviewed and limited to critical procedures.

**Appendix 10: Compressed Gasses**

1. Cylinders must be secured to rigid structures at all times, so they cannot fall.
2. Valve safety covers should be left on until pressure regulators are attached.
3. Containers must be labeled clearly with name of contents and hazards.
4. Hand trucks or dollies with securing device installed must be used when moving cylinders.
5. The use of oil, grease, or lubricants on valves is prohibited due to the potential fire risk, especially on oxygen cylinders.
6. Repair of damaged cylinders and/or forcing of frozen cylinder valves shall not be attempted. Valves and regulators for specific gasses shall not be exchanged with those used on other gas cylinders.
7. Cylinders shall be stored and used with consideration given to their compatibility with other substances.

**Appendix 11: Flammable Gasses**

1. No more than two cylinders should be manifold together; however, several instruments or outlets are permitted for a single cylinder.
	1. When more than one cylinder of a highly flammable gas is to be used in one room, specific approval by the Medical Center Safety Office must be obtained.
2. Standby cylinders (full or empty) are not to be stored in the laboratory.
3. Valves on all flammable gas cylinders or gas utility feeds shall be shut off when the unit is unattended.
4. Like other flammable materials, flammable gasses must be used only under controlled circumstances, avoiding leakage beyond the working point, avoiding outside sources of ignition, and used away from flammable, combustible or reactive chemicals.
5. Flammable gasses must be segregated form oxygen cylinders, unless manifold together.

Appendix 12: Toxic Gasses - Consult the Safety Manager and Safety Data Sheet(SDS) before using any toxic gas.

Appendix 13: Laboratory Procedures Involving [Radioactivity](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/AP/Shared%20Documents/Histology/80%20Safety/Radioactive%20Specimens.docx) - Contact the Radiation Safety Officer (RSO,) ext. 66656, for any question regarding the use or handling of radioactive material (e.g. tissues, fluids, samples, culture material, etc.)

Appendix 14: Acids and Bases

1. Aprons, gloves, and eye protection shall be worn, as recommended on Material Safety Data Sheets, when handling highly corrosive materials. Eye protection (splash-proof chemical goggles and/or face shield) shall be worn. The primary routes of entry are the skin and eyes.
2. Care should be taken so that vapors are not inhaled. Whenever possibility of vapors and splashing exist, use chemicals in a fume hood.
3. Dilution: Great care must be taken and reagents should be added slowly. Always add acid to water. Allow acid to run down the side of the container and mix slowly by gentle rotation. Avoid overheating.

Appendix 15: [Formaldehyde](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/AP/Shared%20Documents/Histology/Storage%20of%20Laboratory%20Reagents.docx)

1. Formaldehyde solutions, gas, or mixtures in concentrations greater than 0.1% are regulates as potential carcinogens.
2. The OSHA Permissible Exposure Limit (PEL) for inhalation is not to exceed 0.75 ppm as averaged over an eight-hour work shift. OSHA’s action level (triggering Medical surveillance) is 0.5 ppm; OSHA’s short-term exposure limit (STEL) is 2.0 ppm, as measured over 15 minutes.
3. The employer must assure that no employee is exposed to an airborne concentration exceeding 0.75 parts formaldehyde per million part air as an eight hour time weighted average (TWA). This is to be accomplished by
4. Mechanical control, e.g. hoods, etc.
5. Proper work practices
6. Respiratory protection
7. Employees at risk of potential over-exposure to formaldehyde will be monitored on a semi-annual basis and, if positive, then quarterly thereafter. In the event of an over-exposure, the employee must be notified in writing within 15 days of results of sampling.
8. Exposed sampling media will be sent to an AIHA accredited laboratory for analysis.
9. Abatement plans must be implemented to reduce exposure.
10. Areas identified as exceeding permissible exposure limits, or where ambient levels may exceed 0.5 ppm must be identified with the following warning:

FORMALDEHYDE DANGER: IRRITANT AND POSSIBLE CANCER HAZARD.

AUTHORIZED PERSONNEL ONLY.

1. The Safety Manager is responsible for the coordination of the monitoring and submitting the results to the Chief, Pathology and Laboratory Medicine Service and the Anatomic Pathology Supervisor.

Appendix 16: Reproductive Hazards

1. Many substances pose harm to the reproductive system. Consult SDS’s for information regarding non-specific male and female reproductive health hazards.
2. Embryotoxins (examples: organomercurials, lead compounds, formamide)
3. Store these substances, properly labeled, in an adequately ventilated area in an

unbreakable secondary container.

1. All employees of child-bearing age should pay particular attention to mutagens and handle them using stringent precautions:
2. Women of childbearing age should handle these substances only in a fume hood whose satisfactory performance has been confirmed, using appropriate (Personal Protective Equipment (PPE), especially gloves,) to prevent skin contact.
3. Decontaminate all surfaces that have had contact with these substances.
4. Scrupulously follow procedures for removal of contaminated PPE and avoid recontamination.
5. Conduct frequent hand washing between procedures and prior to leaving the lab.
6. Women shall be aware of the risk posed by working around chemical during pregnancy and should be extremely careful about minimizing exposure to all harmful substances.
7. While there is no reproductive policy regarding chemical exposure, nothing precludes pregnant employees from discussing work alternatives or additional protections that minimize excessive chemical exposures with their supervisors.
8. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

Appendix 17: [Biological Hazards](https://vaww.visn2.portal.va.gov/sites/alb/dt/lab/Gen/Shared%20Documents/80%20Safety/Infection%20Control%20Policy.doc) - Numerous biological hazards exist (e.g. *M. tuberculosis*, Human Immunodeficiency Virus, hepatitis, and other infectious agents.) and procedures that do not fall under the scope of the Chemical Hygiene Plan. Separate policies and procedures address some of these exposures, including

* CDC publication entitled “Biosafety in Microbiological and Biomedical Laboratories.

[www.cdc.gov/biosafety/publications/bmbl5/BMBL.pdf](http://www.cdc.gov/biosafety/publications/bmbl5/BMBL.pdf)

Appendix 18: Chemical Procurement

1. Every effort should be made to find suitable substitutes for hazardous chemicals. Contact the Industrial Hygienist for information regarding “GEMS” (Green environmental Management System)” the VA Environmental Program.
2. All chemicals used the in laboratory must have a Safety Data Sheet (SDS.)
* Paper copies are available in the laboratory department where the chemical is used.
1. Quantities of flammable solvents larger than one quart must be stored in safety cans or in flammable resistant cabinets.

Appendix 19: Chemical Storage - Storage of reactive chemicals by class (rather than alphabetically) ensures that individual chemicals receive the proper storage measures warranted by their reactivity.

1. Chemicals should be stored away from direct sunlight or heat.
2. Store chemicals in containers that are not degraded by the contents. For example, corrosive chemicals may degrade metal cans.
3. All chemical containers should be properly labeled, dated upon receipt, dated when opened and have an expiration date on them.
4. Always inspect chemical containers for leakage, corrosion, oozing, fuming, formation of crystals, and ensure that caps are securely fastened.
5. Store hazardous chemicals below shoulder height.
6. Separate solids from liquids
7. Shelves should be made of chemicals resistant material.
8. Shelves should have lips on them tall enough to retain containers.
9. Do not use chemical fume hoods as storage facilities.
10. As reasonably as possible, store chemicals with respect to their compatibility.
11. Below are examples of chemical groups that can be used to categorize storage. *(Note: reactive chemicals must be more closely analyzed since they have a greater potential for violent reactions)*
12. Acids:
	* Segregate acids from active metals such as sodium, potassium, magnesium, etc.
	* Segregate oxidizing acids from inorganic acids, flammable and combustible materials.
	* Segregate acids from chemicals that generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, and calcium carbide.
	* Separate acids from bases
	* Store concentrated acids on lower shelves in chemical resistant trays or in a corrosive cabinet that can contain an initial spill or leak.
13. Bases:
* Store bases away from acids, metals, explosives, organic peroxides and easily ignitable materials.
* Store concentrated bases on lower shelves in chemical resistant trays or in a corrosive cabinet that can contain an initial spill or leak.
1. Flammables:
* Store in approved flammable storage cabinets.
* Segregate from oxidizing acids and oxidizers
* Use only explosion-proof or intrinsically safe refrigerators and freezers for storing limited quantities of flammable liquids.
1. Oxidizers:
* Keep away from combustible and flammable materials.
* Keep away from reducing agents such as zinc, alkali metals and formic acid.
1. Cyanides:
* Segregate from acids and oxidizers.
1. Peroxide-forming Chemicals:
* Store in airtight containers in a cool, dark and dry place.
* Label containers with date received, date opened and expiration date.
* Peroxide-forming chemicals should be properly disposed of before date of expected peroxide formation (typically 6-12 months after opening).
1. Water-reactive Chemicals:
* Store in a cool; dry place away from any water source.
* Class D fire extinguisher should be available nearby.
1. Pyrophoric Substances: *(Materials which will react with the air to ignite when exposed, e.g. white phosphorus)*
* Store in a cool, dry place making provisions for an airtight seal that is checked weekly.
1. Toxic Compounds:
* Compounds should be stored according to the nature of the chemical, with appropriate security employed when necessary.
1. Incompatible Chemical Storage: The following is a list of some examples of incompatible chemicals. Storage should be segregated such that they do not come in contact with incompatible chemicals if container is broken. This list is adapted from the Dangerous Chemicals Code, 1951, Bureau of Fire Prevention, City of Los Angeles Fire Department. This list is not complete nor are all incompatible substances shown. Refer to each SDS for further information.

|  |  |
| --- | --- |
| **Chemical** | **Chemicals Not Compatible** |
| Acetic Acid  | Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates. |
| Acetylene  | Chlorine, bromine, copper, Fluorine, silver, mercury. |
| Alkaline metals, such as powdered aluminum, magnesium, sodium, or potassium | Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, and the halogens potassium. |
| Ammonium nitrate  | Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials. |
| Aniline  | Nitric acid, hydrogen peroxide. |
| Azides, inorganic |  Acids, heavy metals & other salts, oxidizing agents. |
| Bromine  | Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals. |
| Calcium oxides  | Water |
| Carbon, activated  | Calcium hypochlorite, all oxidizing agents. |
| Carbon tetrachloride  | Sodium |
| Chlorates  | Ammonium salts, acids, metal powders, sulfur finely divided organic or combustible materials. |
| Chromic acid and Chromium trioxide | Acetic acid, naphthaline, camphor, glycerin, turpentine, alcohol, flammable liquids in general. |
| Chlorine  | same as Bromine. |
| Chlorine dioxide  | Ammonia, methane, phosphine, hydrogen sulfide. |
| Copper  | Acetylene, hydrogen peroxide. |
| Cumene hydroperoxide  | Acids, organic and inorganic. |
| Cyanides, inorganic  | Acids, strong bases. |
| Flammable liquids  | Ammonium nitrate, chromic acid, hydrogen peroxide, the halogens. |
| Fluorine  | Isolate from everything. |
| Hydrocarbons (butane, propane, benzene, gasoline, turpentine, etc.)  | Fluorine, chlorine, bromine, chromic acid, sodium peroxide. |
| Hydrocyanic acid  | Nitric acid, alkali. |
| Hydrofluoric acid  | Ammonia, aqueous or anhydride. |
| Hydrogen peroxide  | Copper, chromium, iron, most metals or their salts, alcohol's, acetone, organic materials, aniline, nitromethane, flammable liquids, combustible materials. |
| Hydrogen sulfide  | Fuming nitric acid, oxidizing gases. |
| Hypochlorites | Acids, activated carbon. |
| Iodine  | Acetylene, ammonia (aqueous or anhydrous) hydrogen. |
| Mercury  | Acetylene, fulminic acid, ammonia. |
| Nitrates  | Sulfuric acid. |
| Nitric acid  | Acetic acid, aniline, chromic acid, hydrogen sulfide, flammable liquids, and gases. |
| Nitroparaffins  | Inorganic bases, amines. |
| Organic compounds  | Oxidizing agents, bases. |
| Oxalic acid  | Mercury & its salts, silver and its salts. |
| Perchloric acid  | Acetic anhydride, bismuth and its alloys, alcohol, paper, wood. |
| Peroxides, organic  | Acids (organic & mineral), avoid friction, store cold. |
| Phosphorous  | Oxidizing agents, oxygen, strong bases. |
| Potassium  | Carbon tetrachloride, carbon dioxide, water. |
| Potassium chlorate  | Sulfuric and other acids. |
| Potassium perchlorated (also see chlorates)  | Sulfuric and other acids. |
| Potassium permanganate  | Glycerin, ethylene glycol, benzaldehyde, sulfuric acid. |
| Selenides  | Reducing agents. |
| Silver  | Acetylene, oxalic acid, tartaric acid, ammonium compounds. |
| Sodium  | Carbon tetrachloride, carbon dioxide, water. |
| Sodium nitrites  | Ammonium nitrate & other ammonium salts. |
| Sodium peroxide  | Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural. |
| Sulfides  | Acids. |
| Sulfuric acid  | Potassium chlorate, potassium perchlorate, potassium permanganate, (or compounds with similar light metals, such as sodium or lithium). |

Appendix 20: National Fire Protection Association (NFPA) Labeling System

* Instant warning system for hazardous materials

**Health (Blue) Flammability (Red)**

0 – No hazard 0 – Will note burn

1 – Can cause irritation if not treated 1 – Ignites after considerable heating

2 – Can cause injury. Requires prompt treatment 2 – Flashpoint: 100 F to 200 F

3 – Can cause serious injury despite medical 3 – Flashpoint: <100 F

 treatment 4 – Flashpoint: <4 F

4 – Can cause death or major injury despite

 medical treatment

**Reactivity (Yellow)**

0 – Normally stable. Not reactive with water

1 – Normally stable. Unstable at high temperature & pressure. Reacts with water.

2 – Normally unstable. Will not detonate.

3 – Can detonate or explode, but requires strong initiating force or heating under confinement.

4 – Readily detonates or explodes.

**Special Notice key:**

* POI – poison
* W – water reactive
* Car – carcinogen
* Corr - corrosive
* OXY – oxidizing agent
* RED – Reducing agent
* EXP – Explosive heat or shock sensitive

**Appendix 21: Hazard Communication Standards Pictograms and Hazards *(OSHA revised 2013)***

* Please refer to [www.osha.gov/dsg/hazcom/pictograms/index/html](http://www.osha.gov/dsg/hazcom/pictograms/index/html)

