CITY COLLEGES OF CHICAGO

Chemical Safety and Hygiene Plan

City Colleges of Chicago

Prepared for

City Colleges of Chicago

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Final

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CITY COLLEGES OF CHICAGO

Chemical Safety and Hygiene Plan
Awareness Certificate

Chemical Safety & Hygiene Plan Awareness Certification for CHP of _____ (Department/ College).

The Occupational Safety and Health Administration (OSHA) requires that laboratory employees be made aware of the Chemical Hygiene Plan at their place of employment (29 CFR 1910.1450). The City Colleges of Chicago has prepared this Chemical Hygiene Plan for laboratories using chemicals at CCC as a guideline or framework for establishing the CCC's policy for safety in the laboratory environment. Each CCC college and department with chemicals in a laboratory setting must adhere to this CHP and develop supplemental or additional procedures customized to their hazard and laboratory settings.

After reading the CCC CHP, complete and return a copy of this form to your Department Chair and Vice President (of the College). By signing below, you acknowledge that you are aware of the CHP and the policies and procedures applicable to the OSHA standard (29 CFR 1910.1450). Your supervisor will provide additional information and training as appropriate.

Name:

ID:

Email:

Department:

Job classification:

Building/Room:

Supervisor

Signature/Date:

Commitment

CCC is committed to establishing a safe and hazard controlled environment for all staff, students, and professionals. It is the policy of CCC to take every reasonable precaution to provide a safe work environment for its laboratory employees in accordance with 29 CFR 1910.1450. The CHP is intended to address protection of laboratory workers, students, staff, professionals and others from the health hazards associated with the hazardous chemicals used in the laboratory.

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1.0 Elements of the CHP

The CHP addresses worker safety involving physical and chemical hazards in compliance with Title 29 CFR 1910.1450. The safe use and handling of biologicals should be addressed under a Biological Safety Manual. The CHP also is intended to satisfy the Hazard Communication Rule (29 CFR 1910.1200). The safe storage, use, and disposal of chemicals in the laboratory require policies for the protection of workers, students, and the environment. This CHP forms a foundation for the safe use of chemicals in the City Colleges of Chicago system.

1.1 Defining a hazard

A chemical is a physical hazard if there is scientifically valid evidence that it is a flammable, a combustible liquid, a compressed gas, an explosive, an organic peroxide, an oxidizer, pyrophoric, unstable material (reactive) or water reactive. A chemical is a health hazard if there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees, such as carcinogens, irritants, corrosives, etc. Hazardous chemicals can be found listed in 29 CFR 1910 subpart Z.

For purposes of this CHP, a hazardous chemical will be defined as a chemical with permissible exposure limit (PEL) as defined by OSHA or Threshold limit values (TLV) as defined by the American Conference of Governmental Industrial Hygienists (ACGIH) and a NFPA rating of 2 or higher in health, flammable, or reactivity. Both these qualifications will be identified from the MSDS provided with the chemical at purchase from the manufacturer or distributer.

Laboratory workers will use safe work practices and engineering controls (such as fume hoods) to protect themselves from exceeding PELs. PELs are defined as that maximum concentration of an OSHA regulated substance in breathing air to which a laboratory worker may legally be exposed as an 8-hour time-weighted average. The laboratory prep work for chemical handling is typically completed in a much shorter timeframe than 8 hours and therefore, PELs would not typically be exceeded, however, the CCC policy is to use fume hoods when mixing chemicals with known PELs to protect against exposure. Exposure to chemicals above PELs is not expected based on lab prep with chemicals requiring small increments of time, typically less than 2 hours.

1.2 Roles and Responsibilities

Responsibility for chemical hygiene rests at all levels from the City College's district office supporting the individual colleges with safe chemical hygiene policies to Department Chairs, Professors, Laboratory Managers, and visitors working and learning in laboratory prep areas.

1. The City Colleges of Chicago district office has commissioned the completion of this chemical hygiene plan to identify policies and practices for safe storage, handling, and disposal of hazardous chemicals. The district office may identify a Chemical Hygiene Officer (CHO) to update the CHP, implement the CHP, and assist each college with preparation and implementation of each site specific CHP. The following outlines some roles and responsibilities of the CHO.
    a. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;
    b. Monitor procurement, use, and disposal of chemicals used in the lab;
    c. Oversee that appropriate audits and training are conducted;
    d. Address worker exposure issues as presented from Department Chairs;
    e. Develop standards for space renovation that will include chemical hygiene safety;
    f. Know the current regulations for laboratory safety; act as a resource for Department Chairs for laboratory safety issues; and
    g. Update and improve the chemical hygiene plan and program as needed.
2. Department Chair or designated representative will act as the Laboratory supervisor, who has overall responsibility for chemical hygiene in the laboratory.
    a. Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided;
    b. Require regular and documented chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;
    c. Know the current requirements concerning regulated substances; and
    d. Ensure that facilities and training for use of any material being ordered are adequate.
3. Laboratory Manager, who is responsible for:
    a. Developing safe chemical hygiene practices for everyday handling and storage of chemicals and waste product in the laboratory prep and classroom areas.
    b. Implementing the safe chemical hygiene practices. Laboratory storage should include hazard notification signage, emergency procedure signage, and safety equipment identification. Safety practices should be written for general handling, storage, and disposal of chemicals.
    c. Securing the storage of hazardous chemicals. In general hazardous chemicals should be stored in locked cabinets or locked storage rooms with emergency equipment

within general (100 feet) proximity. Lab managers will work with Department Chairs or direct supervisors to determine the security for hazardous chemicals.

d. Attending training provided by CCC and understanding the policies and safe work practices.

1.3 General Principles for Work with Laboratory Chemicals

1. It is prudent to minimize all chemical exposures. Because laboratory personnel handle numerous chemicals with various hazards, general precautions for handling all laboratory chemicals should be adopted. Laboratory personnel should be aware of specific guidelines for hazardous chemicals.
    a. Skin contact with chemicals should be avoided as a cardinal rule.
    b. Inhalation exposure to chemicals should be avoided or minimized and work areas should have adequate ventilation. Fume hoods should be used to minimize exposure.
    c. Ingestion exposure to chemicals should be avoided. Eating, drinking and gum chewing should not be conducted in laboratory prep areas or while chemicals are being handled.
2. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices.
3. Laboratory personnel should use personal protective equipment when appropriate, such as safety glasses or goggles, gloves, and fume hoods.
4. Observe the PELs, TLVs. The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded. PELs should not be exceeded as they are based on a time-weighted average of 8 hours and laboratory personnel would not be expected to have exposure to one single chemical for an 8 hour period of time.
5. Address minor spills with safety equipment and cleanup equipment on hand, determine if the release warrants emergency procedures. Follow SOPs.
6. Use and store compressed gas safely, following the SOPs.

1.4 The Laboratory Facility

1. The laboratory facility should include adequate and secure space for chemical storage and prep area. Storage rooms and prep areas should be properly ventilated. General laboratory ventilation should provide a source of air for breathing and that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day; direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.

a. A laboratory fume hood should be monitored and checked for appropriate performance. Fume hood checks and maintenance should be documented.
b. Other emergency equipment should be checked and tested on a regular basis and documented, a standard procedure should be the guideline for checks and documentation.
c. Secure compressed gas with chains or carts, ensure proper labeling of gases, use in adequate ventilation, keep cylinders away from extreme temperatures, handle appropriately.

2. The laboratory facility should have adequate cabinets for storage of the various chemicals. Cabinets or rooms should be locked for security. Cabinets should be fixed or secured to the wall to prevent tipping or bumping hazards. A flammable chemical should not be purchased without available space in a flammable cabinet for storage. Store acids in an appropriate acid cabinet. The condition of the cabinets should be reported to the Department Chair, notifying the college of cabinets in poor condition. Cabinets in poor condition show signs of rust or deterioration or broken locks or other degradation.
3. The laboratory facility should have safety equipment including fire extinguisher, fume hood, spill kit, eye wash, first aid kit, and safety shower. Special chemicals may require special safety equipment, such as a mercury spill kit, if mercury is used in the laboratory.

1.5 The Chemical Inventory and Storage

CCC facilities will be required to keep an updated chemical inventory, which should include the chemical name, CAS #, estimated quantity, NFPA classification, location (room, cabinet, and shelf) and MSDS (a blank inventory sheet is provided in Appendix A). The chemical inventory will be actively updated upon purchase and disposal of chemicals and reviewed each semester. CCC will be moving towards a computer based inventory tracking system. All chemical storage areas should be labeled for potential hazard (flammable, corrosive, health/poison, or reactive). Example chemical hazard signs are presented in Appendix B. All chemical containers should be properly labeled with contents, hazard, and physical state. Label all chemical solutions with the chemical name and concentration, have hazard information accessible with the chemical solution. The inventory should be available on cabinets to identify each cabinet's contents. Acids should be stored separate from flammables or other hazard categories in appropriate cabinets. Flammable organics should be stored in an appropriate flammable (fire safe) storage cabinet. Storage should be based on reactivity of compounds (Example of Chemical Storage Classification from MIT and Flinn Scientific, Inc. attached in Appendix B).

1.6 MSDS

Material Safety Data Sheets (MSDS) will need to be on hand for all chemicals stored and used at a CCC facility. The CHP strongly recommends that the MSDS be reviewed prior to handling the

chemical in preparation of laboratory materials and that the MSDS be kept with the laboratory materials until the experiment is discarded or chemical returned to the inventory.

1.7 Standard Operating Procedures (SOPs)

SOPs should be prepared for routine handling of chemicals to document safe handling, storage, transport and disposal of chemicals. SOPs should also be prepared for emergency procedures, including emergency response to spills and emergency response to exposure. Response to an alleged over exposure should be a written procedure. SOPs may be developed for routine checking of safety equipment and routine review of MSDS. Example SOPs are included in Appendix C.

1.8 Personal Protective Equipment

Personal Protective Equipment (PPE) includes gloves, safety glasses (or goggles), aprons or lab coats. The use of PPE for chemical handling is dependent on the chemical, hazards, and the activity. Standard use of gloves, safety glasses, lab coats, and gloves are encouraged when handling any chemical with a PEL and an NFPA rating above 2.

Respirators are a form of personnel protective equipment. If respirators are required for job function, the institution must have a respiratory program in compliance with 29 CFR 1910.134 and all employees using a respirator must be properly trained and medical monitoring is required. Respirators are not expected to be a required element for laboratory practices.

1.9 Environmental Monitoring

By using safe chemical handling practices, it is believed that environmental monitoring is not required. Chemicals should be stored in secure containers with no emissions while in storage. If a storage container is breached, the chemical should be transferred to a secure and appropriate container. Chemical use during lab prep is for a short period of time and should not exceed PEL or TLV, any concern for vapor exposure (through inhalation) should be managed through the use of a fume hood. Storage and prep areas should be adequately ventilated.

2.0 Medical Monitoring Program

If an emergency exposure to the skin, eyes, inhalation, or ingestion occurs, apply lab emergency procedures (wash hands, flush eyes, shower) as necessary. If appropriate, call 911 for emergency medical assistance.

Laboratory workers employed by CCC, who are injured or have experienced over exposure to a hazardous chemical, may obtain a medical examination related to the exposure incident at no

cost. The medical examination must be performed by a licensed physician recommended or approved by the college. It is recommended that the employee provide the MSDS of the suspect chemical to the medical personnel. CCC will expect to receive a report of the findings from the physician. An injury or over exposure incident must be reported to the college Vice President on the form attached in Appendix C and follow the written procedure.

Respirators are not required for chemical laboratory activities at this time. The use of respirators in the work place would warrant a medical monitoring program. Exposure to chemicals above PELs is not anticipated, based on lab prep with chemicals requiring small increments of time. No routine medical monitoring program is included in this CHP.

3.0 Training and Documentation

Laboratory managers and laboratory prep personnel must be provided safety training and safe chemical practices. All staff will work together to create safe work practices for chemical handling, storage, and use of chemicals. Training must be documented. Training records should include personnel trained, date of training, and type of training (the type of training should be linked to a set of course materials or description of topics covered). A chemical hygiene training record and description is attached in Appendix D. Safety training should include training for the use of safety equipment. Laboratory managers should understand how to use safety equipment; such as fire extinguishers, eye wash, safety shower, and spill kits. Safety training and documentation of safety equipment can be combined with SOPs for routine checks.

Specialized or additional training may be needed for acutely toxic chemicals, highly flammable chemicals, highly reactive chemicals, carcinogens, and or reproductive hazards. In general, the chemicals used in the CCC laboratory settings are not considered acutely or highly toxic, highly flammable or in other ways hazardous to laboratory workers' health.

4.0 Follow a Chemical Waste Disposal Plan

The chemical waste disposal plan specifies how waste is to be collected, segregated, stored, and removed from the facility for disposal. Transport and disposal must be in accordance with current laws and regulations. It is recommended that a waste disposal plan or recommendation be provided from the manufacturer or distributer for each chemical purchased. The manufacturer or distributer should be able to suggest proper disposal by sink or special waste disposal company in order to meet current laws and regulations. The Resource Conservation and Recovery Act of 1976 requires cradle to grave tracking of hazardous waste and the manufacturer of a hazardous chemical is required to provide an MSDS with disposal

information. Guidelines for sink/drain disposal are included in the Chemical Waste Disposal Plan.

Chemicals in containers that have been compromised should be checked for continued use and may need to be separated for disposal. Maintain chemical stock in good condition. Containers in poor or compromised condition include rusted containers, broken lids, cracks, and/or containers with residue. Containers with missing labels may need to be separated for disposal and may need special handling. Empty chemical containers should follow the chemical waste disposal plan for collection and disposal.

5.0 Review of the CHP

The contents and nature of the CHP should be reviewed annually by the Chemical Hygiene Officer, Department Chair and the Laboratory Manager. The CHP may need updates for new laws or regulations, to include new or revised SOPs, updates to chemical inventories should be checked, training, and waste disposal should be reviewed.

Appendix A - Chemical Inventory Sheet Blank

Chemical Inventory List

Prepared by: _____

Date: _____

Facility Location (College and Department): _____

Chemical storage location (Room and cabinet#): _____

Facility Representative: _____

Photograph Taken: _____

List of emergency and safety equipment within 100 feet (hand sketch of storage area and safety on back):

_____

Size & Description (i.e. storage cabinet with three shelves, free standing, unlocked)

_____

Name	Physical State (solid/liquid/ crystals)	CAS/ Manufacturer	Container (size & type - glass - 1 liter) (estimated)	Quantity (#, full, partial)	Condition	Shelf Location	MSDS	Notes (Damage or Handling instructions or precautions (NFPA classification))

Containers in good condition are not rusted, labels are legible, no crystallization on the cap, etc.

_____

Appendix B – Chemical Hazard Signs

Caution

Hazardous Chemicals

In case of emergency:

Notify: {insert lab manager name and phone number}

Notify: {campus security}

College:

Department:

Room:

Potential chemical hazards include:

_____ **flammables**

_____ **reactives**

_____ **corrosives, poisons, toxics**

Caution

Hazardous Chemicals

Flammable

Caution

Hazardous Chemicals

Reactive: Unstable or Reacts with water

Caution

Hazardous Chemicals

Health: Caustic or Poison or Toxic

Caution

Hazardous Chemicals

Health: Caustic or Poison or Toxic

Caution

Compressed Gas

HANDLE WITH CARE

High Pressure-may explode

Hazardous Signs

- Post Hazardous Signs

- Label cabinets and shelves
  - Cabinets numerical and shelves alphabetical

Hazardous Signs

- Flammable cabinet 1
- or acid cabinet 1

- Post chemical lists on cabinets or near
  - (review pictures)

SAFETY FAX!
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Chemical Storage Classification

Suggested Chemical Storage Pattern

Storage of laboratory chemicals presents an ongoing safety hazard for school science departments. There are many chemicals that are incompatible with each other. The common method of storing these products in alphabetical order sometimes results in incompatible neighbors. For example, storing strong oxidizing materials next to organic chemicals can present a hazard.

A possible solution is to separate chemicals into their organic and inorganic families and then to further divide the materials into related and compatible families. Below is a list of compatible families. On the next page you will find this family arrangement pictured as shelf areas in your chemical stores area. The pictured shelf arrangement will easily enable you to rearrange your inventory into a safer and more compatible environment.

Inorganic

1. Metals, Hydrides
2. Acetates, Halides, Iodides, Sulfates, Sulfites, Thiosulfates, phosphates, Halogens, Oxalates, Phthalates, Oleates
3. Amides, Nitrates (except Ammonium Nitrate), Nitrites, Azides
4. Hydroxides, Oxides, Silicates, Carbonates, Carbon
5. Sulfides, Selenides, Phosphides, Carbides, Nitrides
6. Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide
7. Arsenates, Cyanides, Cyanates
8. Borates, Chromates, Manganates, Permanganates, Molybdates, Vanadates
9. Acids (except Nitric) (Nitric Acid is isolated and stored by itself.)
10. Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide
11. Inorganic miscellaneous

Organic

1. Acids, Amino Acids, Anhydrides, Peracids
2. Alcohols, Glycols, Sugars, Amines, Amides, Imines, Imides
3. Hydrocarbons, Esters, Aldehydes, Oils
4. Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide
5. Epoxy Compounds, Isocyanates
6. Peroxides, Hydroperoxides, Azides
7. Sulfides, Polysulfides, Sulfoxides, Nitriles
8. Phenols, Cresols
9. Dyes, Stains, Indicators
10. Organic miscellaneous

Notes

- If you store volatile materials (ether, hydrocarbons, etc.) in a refrigerator, the refrigerator must be explosion-proof. The thermostat switch or light switch in a standard refrigerator may spark and set off the volatile fumes inside and thus cause an explosion.
- This list is not complete and is intended only to cover the materials possibly found in an average school situation. This is not the only method of arranging these materials and is only offered as a suggestion.

Flinn Compatible Chemical Family Codes

When you assign compatible chemical family data you may wish to use the system created by Flinn. The family designations are listed below and in more detail on the following pages. Family designations for individual chemicals are found in the individual chemical listings of this Catalog/Reference Manual.

Flinn Inorganic Compatible Family Codes

I1 – Metals, Hydrides

I2 – Acetates, Halides, Iodides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens

I3 – Amides, Nitrates (except Ammonium Nitrate), Nitrites, Azides

I4 – Hydroxides, Oxides, Silicates, Carbonates, Carbon

I5 – Sulfides, Selenides, Phosphides, Carbides, Nitrides

I6 – Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide

I7 – Arsenates, Cyanides, Cyanates

I8 – Borates, Chromates, Manganates, Permanganates

I9 – Acids (except Nitric) Nitric Acid is isolated and stored by itself.)

I10 – Sulfur, Phosphorus, Arsenic, Phosphorous Pentoxide

IM – Miscellaneous

Flinn Organic Compatible Family Codes

O1 – Acids, Amino Acids, Anhydrides, Peracids

O2 – Alcohols, Glycols, Sugars, Amines, Amides, Imines, Imides

O3 – Hydrocarbons, Esters, Aldehydes, Oils

O4 – Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide

O5 – Epoxy Compounds, Isocyanates

O6 – Peroxides, Hydroperoxides, Azides

O7 – Sulfides, Polysulfides, Sulfoxides, Nitriles

O8 – Phenols, Cresols

O9 – Dyes, Stains, Indicators

OM – Miscellaneous

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SUGGESTED SHELF STORAGE PATTERN—INORGANIC

INORGANIC #10
Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide

INORGANIC #2
Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Acetates, Oxalates, Phthalates, Oleates

INORGANIC #3
Amides, Nitrates (not Ammonium Nitrate), Nitrites, Azides
(Store Ammonium Nitrate away from all other substances—*ISOLATE IT!*)

INORGANIC #1
Metals & Hydrides
(Store away from any water.)
(Store flammable solids in flammables cabinet.)

INORGANIC #4
Hydroxides, Oxides, Silicates, Carbonates, Carbon

If possible avoid using the floor.

INORGANIC #7
Arsenates, Cyanides, Cyanates
(Store away from any water.)

INORGANIC #5
Sulfides, Selenides, Phosphides, Carbides, Nitrides

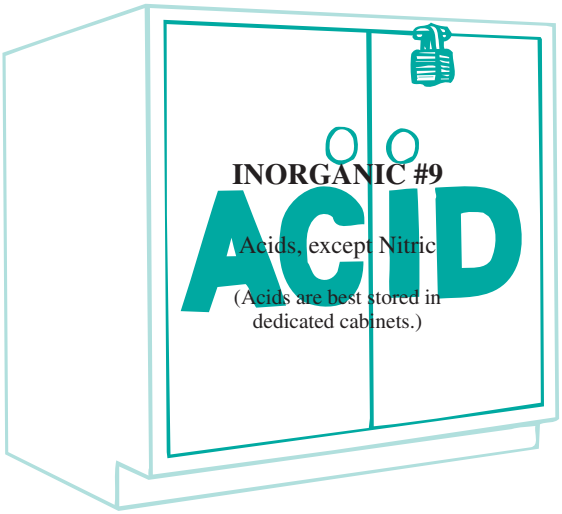
INORGANIC #8
Borates, Chromates, Manganates, Permanganates, Molybdates, Vanadates

INORGANIC #6
Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide

MISCELLANEOUS

Storage Suggestions

1. Avoid storing chemicals on the floor (even temporarily).
2. No top shelf chemical storage.
3. No chemicals stored above eye level.
4. Shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
5. Provide anti-roll-off lips on all shelves.
6. Ideally, shelving assemblies would be of wood construction.
7. Avoid adjustable metal shelf supports and clips. Better to use fixed, wooden supports.
8. Store acids in a dedicated acid cabinet. Store nitric acid in the same cabinet **only** if isolated from other acids. Store both inorganic and some organic acids in the acid cabinet.
9. Store flammables in a dedicated flammables cabinet.
10. Store severe poisons in a dedicated poisons cabinet.
11. Maximize Storage Space. If shelf space is a problem, you are permitted to place more than one compatible chemical family on a shelf. Make sure you either have a physical divider or leave a 3" space between each family. This will maximize your tight shelf space while keeping each compatible chemical family separate from one another.



Store nitric acid away from other acids unless your acid cabinet provides a separate compartment for nitric acid.

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SUGGESTED SHELF STORAGE PATTERN—ORGANIC

ORGANIC #2
Alcohols, Glycols, Sugars, Amines, Amides, Imines, Imides
(Store flammables in a dedicated cabinet.)

ORGANIC #3
Hydrocarbons, Oils, Esters, Aldehydes
(Store flammables in a dedicated cabinet.)

ORGANIC #4
Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide
(Store flammables in a dedicated cabinet.)

ORGANIC #5
Epoxy Compounds, Isocyanates

ORGANIC #7
Sulfides, Polysulfides, etc.

ORGANIC #8
Phenols, Cresols

ORGANIC #6
Peroxides, Azides, Hydroperoxides

ORGANIC #1
Acids, Amino Acids, Anhydrides, Peracids
(Store **certain** organic acids in acid cabinet.)

ORGANIC #9
Dyes, Stains, Indicators
(Store alcohol-based solutions in flammables cabinet.)

MISCELLANEOUS

If possible avoid using the floor.

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Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group 1 **Flammables and Combustibles (Includes organic acids)** AKA: organics, solvents	Flammable liquids have a flashpoint (FP) below 100^{0}F (38^{0}C). Combustible liquids have a flashpoint above 100^{0}F and below 140^{0}F Flashpoint is the lowest temperature at which a liquid gives off enough vapor to ignite.	The MSDS provides the flashpoint for flammable and combustible liquids. Ignition sources include spark from electrical outlet, vacuum pumps, and static electricity.	FP $\leq$ 140^{0}F (60 ^{0}C) store in a metal flammable cabinet that is completely enclosed. If vented, the vent must have a flash arrestor. NO cardboard shipping boxes in the cabinet. Never store in cold rooms or refrigerators (unless the refrigerator is explosion-proof). Do not store with oxidizers or inorganic acids.	All alcohols: butanol, ethanol, methanol, isopropanol, etc. Acetone, acetaldehyde, acetonitrile, amyl acetate, benzene, cyclohexane, dimethyldichlorosilane, dioxane, ether, ethyl acetate, hexane, hydrazine, methyl butane, picolene, pyridine, all silanes, tetrahydrofuran, toluene, triethylamine, xylene, etc. Combustibles: dimethylformamide, formaldehyde
Peroxide-formers Generally, Group I	Highly flammable. May form low-power explosives that are very sensitive to shock, sparks, light, strong oxidizing and reducing agents, friction, and high temperatures.	Read Peroxide-Forming Chemicals SOP Distillation, evaporation, or other concentration can present a high risk of explosion. Test for peroxide formation monthly.	Store with flammables. Date when received and when opened. Dispose of as hazardous waste after 12 months.	Ether (diethyl and isopropyl), tetrahydrofuran, acetaldehyde, etc.
Group II (volatile) and VII (non-volatile) Toxics AKA: poisons, organics, halogenated solvents, carcinogens, mutagens, reproductive toxins	Chronic exposure is a health hazard. Avoid inhalation, skin contact. Many toxic solvents are highly volatile. Non-flammable (some are combustible).	Commonly mistaken for a flammable liquid.	OK to store with flammables in flammable cabinet. Alternative: Any enclosed cabinet or shelf to protect from accidental breakage. Store containers larger than 1 liter below bench level. Do not store with bases.	Volatile toxics: carbon tetrachloride, chloroform, dimethyl sulfate, halothane, mercaptoethanol, methylene chloride (dichlormethane), phenol Non-volatile toxics: acrylamide solutions, ethidium bromide, triethanolamine

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group III (oxidizing acids)	**Oxidizing acids are highly reactive, and may react with each other. Corrosive, burns skin and eyes.**	**Concentrated (> 70%) perchloric acid reacts with wood and paper and may ignite. Never store concentrated perchloric acid directly on wood shelves without a plastic tub. Also, see Group IV.**	**Oxidizing acids should be separated from each other by use of a plastic tub. Oxidizing acids can be stored with mineral acids but not organic acids.**	**Oxidizing inorganic acids: nitric, sulfuric, perchloric, chromic**
Group IV Mineral Acids and Organic Acids	Corrosive, burns skin and eyes. Organic acids are combustible (FP >100^{0}F<140^{0}F)	Acid mist escapes from closed bottles and builds up inside un-vented cabinets causing corrosion of labels, metal cabinets, etc.	Store in the vented cabinet under fume hood or in a vented stand alone cabinet. Do not store with bases. Store below eye level. It is a good idea to keep hydrofluoric acid in a separate tub or tray to avoid contamination of surfaces.	Mineral acids: hydrochloric, phosphoric, hydrofluoric Organic acids: acetic, acrylic, acetic anhydride, butyric, formic, glacial acetic, isobutyric, mercaptopropionic, trifluoroacetic, etc.
Group V **Liquid Inorganic Bases** **AKA: alkaline**	Corrosive burns skin and eyes.	Avoid contact with acids and volatile toxics.	Store in a separate cabinet. Alternative: store with other chemicals and keep in a separate tub or tray. Can be stored with flammables if no volatile toxic (halogenated organics) are present. Store below eye level.	Sodium hydroxide, ammonium hydroxide, calcium hydroxide, potassium hydroxide, aqueous ammonia

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group VI Oxidizing Liquids **(Excluding Oxidizing acids)** **AKA: reactives**	**Provides oxygen that feeds fires and makes fires very difficult to extinguish.** **Oxidizing liquids react with many things potentially causing explosions or corrosion of surfaces.**	**The oxidizer symbol (a burning O) may be mistaken for a flammable symbol (a flame).** **Oxidizers are considered ignitable for hazardous waste management purposes.**	**Store on a separate shelf. Do not store directly on wood shelf or paper.** **If stored near other chemicals, including other oxidizers keep in a separate tub or tray.** **Do not store with flammables.**	**Ammonium persulfate, hydrogen peroxide ≥ 30%**
Group VIII **Pyrophorics and Water Reactives**	**Ignite spontaneously in air. Water reactives can react with moisture in the air to produce a flammable gas.** **Metal hydrides react violently with water, some ignite spontaneously in air.**	**Read Pyrophoric and Water Reactives SOP**	**Waterproof double containment (the shipping container may be an appropriate second container).** **Isolate from other chemicals. OK to store with dry chemicals.** **Do not store with liquid chemicals (oxidizers, flammables, acids, bases, toxics etc.)**	**Metal hydrides: sodium borohydride, calcium hydride, lithium aluminum hydride, etc.** **Pyrophorics: borane, diborane, dichloroborane, lithium, phosphorous, 2-furaldehyde, diethyl aluminum chloride, trimethyl aluminum, etc.** **Water Reactives: aluminum chloride anhydrous, calcium carbide, acetyl chloride, chlorosulonic acid, sodium, potassium, phosphorous pentachloride calcium, aluminum tribromide, calcium oxide, acid anhydrides etc.**

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

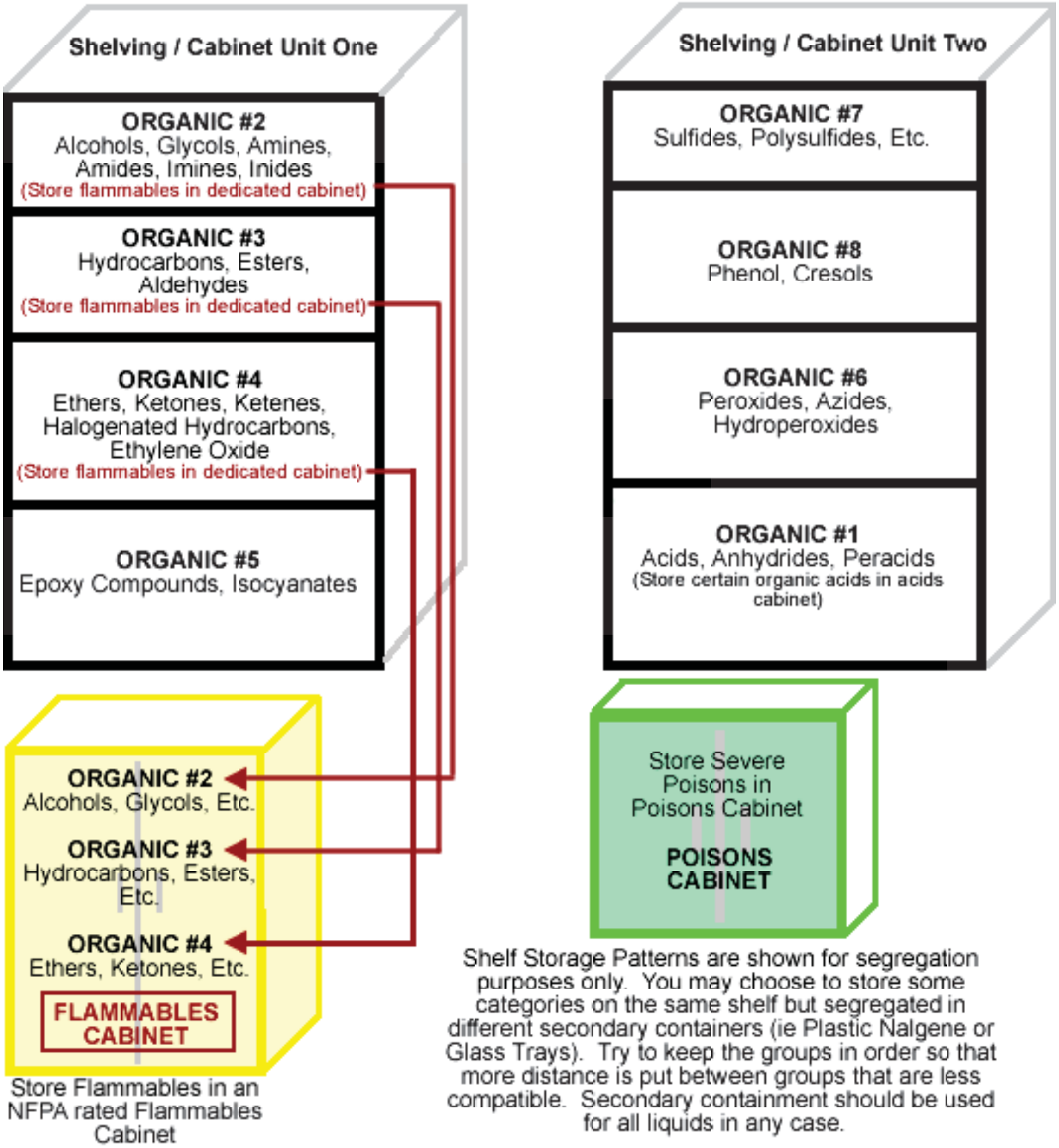
Group	Properties	Important Notes	Storage	Examples
Group IX Dry Solids	Varies. They are dry, but when wet, may have different properties, depending on the material.	Keep Dry. Indicate where the more toxic materials are located. (See SOP)	Cabinets are suggested, but shelves are O.K. Store above liquids and separate from liquids.	Benzidine, cyanogens, bromide, oxalic acid, potassium hydroxide.
Chemicals with no great storage options, e.g. anhydrides	These materials react with many things.	Keep isolated in some way by using secondary containment. Minimize quantities on hand.	Will depend on specific chemical. Call EHS for guidance.	Acetic anhydride, trichloro acetic anhydride

For more information see the Chemical Storage SOP and App A – Storage Scheme One of the SOP. Go to: http://web.mit.edu/environment/ehs/chemical_storage.html

Basic Rules	Common Problems
▪ Store in compatible groups. Consult above referenced SOP, manufacturer's recommendations and MSDS. (To obtain MSDS, Google search: chemical name MSDS, or type MSDS on MIT Home page search to see link to MIT MSDS link page.) ▪ Minimize chemicals purchased, especially flammables and reactives. ▪ Label storage areas, and label all chemicals being stored. ▪ Store hazardous liquids below eye level. ▪ Make sure chemical containers are in good condition and are compatible with contents. ▪ Lids should be tightly closed. ▪ Secondary containment for floor storage. ▪ Do not store solids with liquids ▪ Do not store items in working space of fume hoods. ▪ Do not store hazardous chemicals in cold rooms ▪ Annually discard unused, unwanted, and expired chemical	▪ Oxidizing acids stored with organic acids, e.g. Nitric acid and acetic acid. ▪ Oxidizers stored with flammables. ▪ Acids stored with bases. ▪ Flammables stored in non-flammable refrigerator. ▪ Large quantities of flammables stored outside flammable cabinets. ▪ Corrosives (acids and bases) or other liquids stored above eye level. ▪ Stock chemicals stored in fume hood. ▪ Reactives stored with incompatible chemicals. ▪ Liquids stored with solids that are incompatible with liquids, e.g. cyanides. ▪ Anhydrides not stored with secondary containment.

Note: The compatibility groups are guidelines. There are other options for chemical storage. There are some options for combining chemical groups, as well. Chemtracker uses a different storage system, referred to as Storage Scheme Two, also shown in the Chemical Storage SOP. If you have a specific problem or question regarding chemical storage, please contact EHS at 2-3477, and let them know you have a chemical storage question.

SUGGESTED SHELF STORAGE PATTERN - ORGANIC



Store Flammables in an NFPA rated Flammables Cabinet

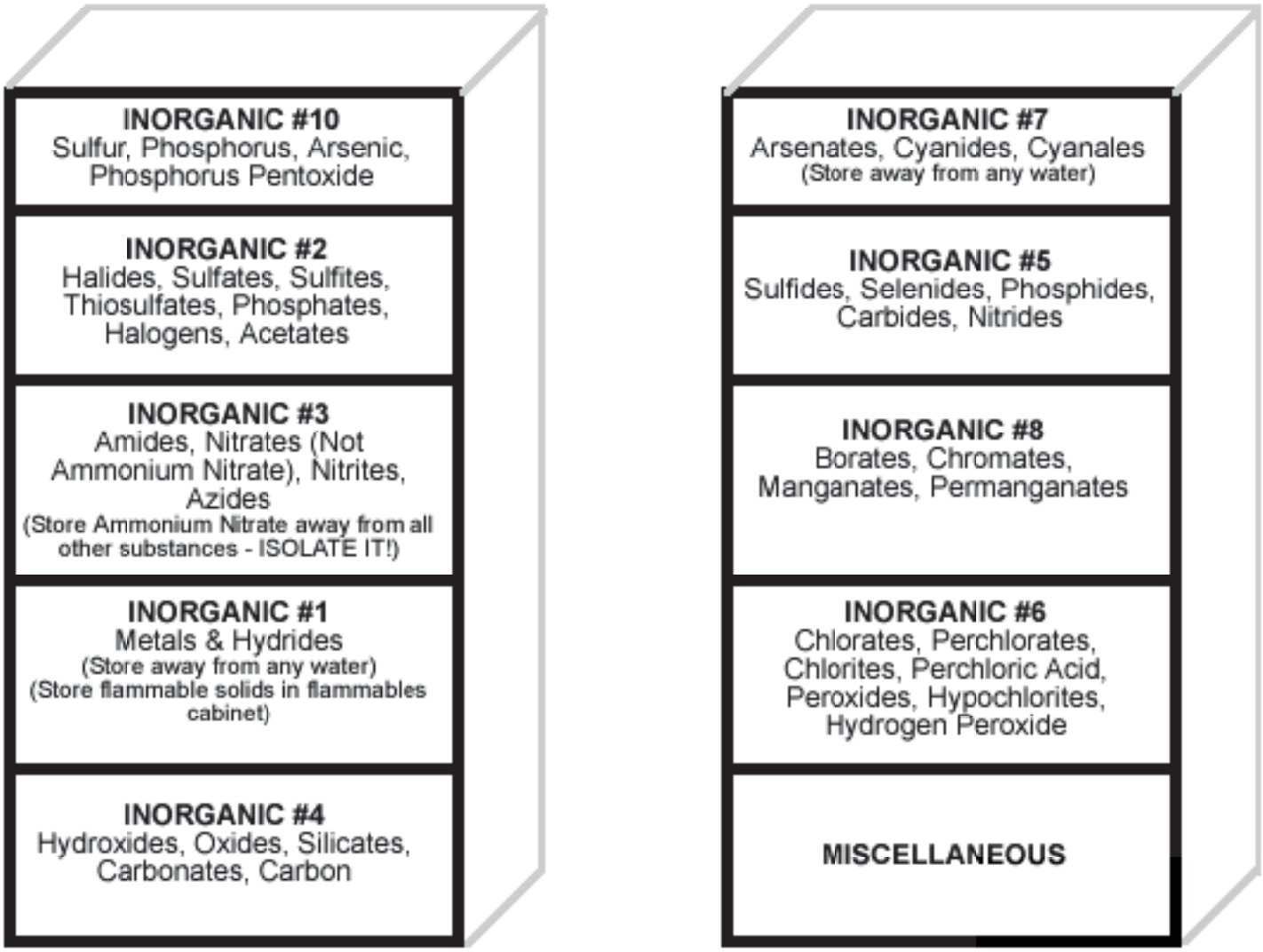
Shelf Storage Patterns are shown for segregation purposes only. You may choose to store some categories on the same shelf but segregated in different secondary containers (ie Plastic Nalgene or Glass Trays). Try to keep the groups in order so that more distance is put between groups that are less compatible. Secondary containment should be used for all liquids in any case.

ORGANIC KEY

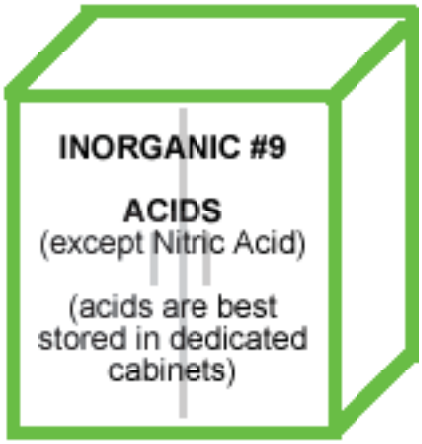
1 - Acids, Anhydrides, Peracids
2 - Alcohols, glycols, amines, amides, imines, imides
3 - Hydrocarbons, esters, aldehydes
4 - Ethers**, Ketones, Ketenes, Halogenated hydrocarbons, Ethylene Oxide
5 - Epoxy compounds, Isocyanantes
6 - Peroxides, hydroperoxides, azides**
7 - Sulfides, Polysulfides, sulfoxides, nitriles
8 - Phenols, Cresols

**** These Chemicals deserve special attention due to their potential instability.**

SUGGESTED SHELF STORAGE PATTERN - INORGANIC



Shelf Storage Patterns are shown for segregation purposes only. You may choose to store some categories on the same shelf but segregated in different secondary containers (ie Plastic Nalgene or Glass Trays). Try to keep the groups in order so that more distance is put between groups that are less compatible. Secondary containment should be used for all liquids in any case.



Store Nitric Acid away from other acids unless your acid cabinet provides a seperate compartment or secondary containment for Nitric Acid.

INORGANIC KEY

1 - Metals, hydrides
2 - Halides, sulfates, sulfites, thiosulfates, phosphates, halogens.
3 - Amides, nitrates** (except ammonium nitrate), nitrites**, azides**, nitric acid.
4 - Hydroxides, oxides, silicates, carbonates, carbon.
5 - Sulfides, selenides, phosphides, carbides, nitrides.
6 - Chlorates, perchlorates**, perchloirc acid**, chlorites, hypochlorites, peroxides**, hydrogen peroxide.
7 - Arsenates, cyanides, cyanates.
8 - Borates, chromates, manganates, permanganates.
9 - Acids (except nitric)
10 - Sulfur, phosphorus**, arsenic, phosphorus pentoxide**.

**** These Chemicals deserve special attention due to their potential instability.**

Appendix C – Example SOPS (including CCC Incident Report form)

Standard Operating Procedures (SOPs)

City Colleges of Chicago

SOP Name:

Prepared by: Revision Date:

Activity

Hazard Analysis

Engineering Controls/ PPE

Notes:

Standard Operating Procedures (SOPs)

City Colleges of Chicago

SOP Name: Handling and Storage of Chemicals

Prepared by: Revision Date:

Activity: For handling and storage of chemicals, be aware of the chemical and properties you are working with and refer to MSDS for chemical information.

In General:

1. Limit exposure to chemicals by using PPE, fume hoods for volatile chemicals, and other engineering controls.
2. When flammable materials are in use, make sure there are no sources of ignition.
3. Never leave open chemicals unattended.
4. Dispose of broken glassware in box labeled “broken glass disposal”.
5. Wash hands before and after handling chemicals.
6. When working with acids, add acid to water, DO NOT add water to acid.
7. Do not eat, drink, or chew gum while working with chemicals.
8. Do not store food in chemical storage areas, refrigerators for laboratory work should be labeled for “No FOOD”.
9. Secure all hazardous chemicals.
10. Store chemicals by hazard and compatibility.
11. Label hazard areas.
12. Be aware of safety equipment available and use.

Hazard Analysis

The handling of chemicals could result in spills or exposure. Exposure should be minimized. Beware of exposure risk: ingestion, inhalation, skin risk.

Engineering Controls/ PPE: Review the Hazard Analysis on the MSDS and follow the recommendations. PPE may include glasses or goggles, gloves, lab coat and/or fume hood.

Notes: Special Cautions may be needed for Compressed Gas, Flammables, Corrosives, Highly Hazardous Chemicals.

Standard Operating Procedures (SOPs)

City Colleges of Chicago

SOP Name: Emergency Procedure

Prepared by: Revision Date:

Activity: In the event of an uncontrolled release, determine the hazard concern.

1. For a small release, use appropriate safety equipment (spill kit or other) to clean up the spill and notify the laboratory supervisor (Department Chair). Secure the spill area and be sure to know the chemical spilled, refer to MSDS. Turn off possible ignition sources. Follow safe cleanup procedures. Complete the release form.

2. For a major release (beyond your control), stabilize and stay safe, contact emergency personnel for assistance (911 – or local safety). Secure the area (evacuate as needed) and notify personnel. Turn off all sources of ignition. Complete incident report form.

Hazard Analysis

The handling of chemicals could result in spills or exposure. Exposure should be minimized. Beware of exposure risk: ingestion, inhalation, skin risk.

Engineering Controls/ PPE: Review the Hazard Analysis on the MSDS and follow the recommendations.

Notes:

Assigned Codes.....A/C
Administration..... ..1
Faculty.....2
Staff.....3
Student.....4
Non-Student.....5

DEPARTMENT OF SECURITY AND SAFETY

2. Name of College/Facility

3. Date/Time Incident Report Prepared
Day Mo Yr Time

4. Incident	5. Location of Incident	6. Date of Incident Day Mo Yr Time

7. Victims Name	8. A/C	9. sex	10. Race	11. Date of Birth	12. Address/Room Number	13. Telephone Number
14. Person Reporting Incident	15. A/C	15. sex	16. Race	17. Date of Birth	18. Address/Room Number	19. Telephone Number
20. Witness Name	21. A/C	22. sex	23. Race	24. Date of Birth	25. Address/Room Number	26. Telephone Number

27. Offender's Name	28. A/C	29. sex	30.. Race	31. Date of Birth	32. Age	33. Height	34. Weight	35. Hair	36. eyes	37. complexion

38. Offender's Address	39. Telephone Number	40. Clothing Description

41. Charges, if in custody	42. Court date/Time	43. Court Branch/Location	44. Name of Administrator notified	45. Time notified

46. Narrative: Give description of entire incident, if personal injury, ensure a check of the area is made and report by Security.
(Answer questions—who, what, when, where, why, and how. List additional victims and offenders in narrative.)

	47. Chicago Police Officer Assigned	48. Beat Number

49. Routing System	50. Signature/ Reporting Officer	51. Approval/Supervisor	54. R.D. Number	Yes / No
☐ President ☐ Engineer ☐ Business Manager ☐ Attorney ☐ Central Office ☐ Dean/Students ☐ Storekeeper ☐ Other (Specify)	Print/Type			
	52. Day investigation completed Day Mo Yr Time	53. Review/Director	Office Use Only	

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Standard Operating Procedures (SOPs)

City Colleges of Chicago

SOP Name: Routine check of Safety Equipment

Prepared by: Revision Date:

Activity: Safety Equipment should be checked once every quarter.

Eye Wash – turn on to check water flow.

Safety Shower – turn on to check water flow.

Fire Extinguisher – do NOT operate, review for rust and review operation procedures.

Spill Kit – review contents and how to use.

Complete checklist and place in file.

Hazard Analysis: No apparent hazard.

Engineering Controls/ PPE: No Engineer controls

Notes:

Standard Operating Procedures (SOPs)

City Colleges of Chicago

SOP Name: General Rules for Safe Laboratory Practices

Prepared by: Revision Date:

Activity: Laboratory classroom and experiments.

CCC is committed to establishing a safe and hazard controlled environment for all staff, students, and professionals. It is the policy of CCC to take every reasonable precaution to provide a safe learning environment.

General Safety Practices:

1. Conduct yourself in a responsible manner at all times in the laboratory. Follow directions from the instructor (written and verbal) for activities, experiments, and handling of chemicals in the laboratory. Directions will include safety and safety equipment. Only instructed experiments and activities are allowed. Unauthorized experiments are prohibited.
2. No eating, drinking, gum chewing, or smoking in the laboratory. Do not use laboratory glassware for food or beverages.
3. Never taste or directly smell a chemical. Keep chemical experiments a safe distance from your face and use safety equipment as directed. Respect your classmates.
4. Wear or apply safety procedures as directed, follow all safety practices. (i.e. Wear safety glasses and/or gloves when instructed).
5. Wash hands before and after handling chemicals.
6. Keep work surfaces clear of materials not related to the experiment, activity or subject material.
7. Use caution when heating or mixing chemicals. When working with acids, add acid to water, DO NOT add water to acid.
8. Notify the instructor of any spill or exposure and follow directions for safety and containment. Emergency safety equipment is available near each laboratory.
9. Follow directions for disposal of waste chemicals, do not mix waste chemicals. Do not mix solids and liquids. Follow directions for disposal in a container versus down a sink drain. Chemicals may not be re-used.
10. Clean work equipment and area as directed.

11. Dress appropriately for class; closed toe shoes, tied hair, no loose clothing or dangling jewelry, safe dress as instructed.
12. All students have a right to know of any hazardous chemicals being used in the classroom for an activity or experiment. Listen and follow directions for safe use of hazardous chemicals. Alert the instructor to any health issues or allergies that could be triggered by any laboratory activity.
13. Broken glass should be disposed in designated containers.

Hazard Analysis

The handling of chemicals could result in spills or exposure. Exposure should be minimized by general safety practices. Each experiment and activity will have specific safety practices.

Engineering Controls/ PPE: PPE may include glasses or goggles, gloves, lab coat and/or fume hood.

Notes: Special Cautions may be needed for specific experiments that may use Compressed Gas, Flammables, Corrosives, or other Hazardous Chemicals.

Distribute to each student as an agreement:

I, _____ (student name) have read and agree to follow all of the safety practices set forth in the Safety Agreement. I realize I must obey these safety practices for my safety and for the safety of my fellow students, instructors, and laboratory staff. I will cooperate, follow directions, and maintain a safe lab environment. If I violate this safety agreement, I may be subject to disciplinary action that could impact my class work or grades.

_____

Name (printed): _____

Signature: _____

Date: _____

Class: _____

Instructor: _____

SOP Name: General Rules for Safe Laboratory Practices

Instructors to collect this page from each student and retain with class records.

Distribute to each student as an agreement:

I, _____ (student name) have read and agree to follow all of the safety practices set forth in the Safety Agreement. I realize I must obey these safety practices for my safety and for the safety of my fellow students, instructors, and laboratory staff. I will cooperate, follow directions, and maintain a safe lab environment. If I violate this safety agreement, I may be subject to disciplinary action that could impact my class work or grades.

_____

Name (printed): _____

Signature: _____

Date: _____

Class: _____

Instructor: _____

Appendix D – Example Training Record

Training Record

City Colleges of Chicago

Training: Chemical Hygiene Plan Training

Given by: Environmental Design International inc. Date:

Patricia Feeley

Training Attendees:

Activity: Chemical Hygiene Training Plan

Topics:

1. Defining a Hazard (physical and chemical, acute and chronic)and Reading an MSDS.
2. Health Hazard Types: Irritants, asphyxiants, toxics (to liver, to kidney, to CNS), carcinogens, mutagens, teratogens.
3. Chemical classifications: flammables, corrosives, reactives, and non-compatibles.
4. Signage, Labeling (containers and shelves), and the chemical inventory (posting and updating).
5. General Safe Work Practices, SOPs and College Specific CHP.
6. Laboratory facility and PPE.
7. Environmental Monitoring and medical monitoring.
8. Training and documentation (annual review).
9. Waste Disposal Program.

Notes: