

# Chemical Compatibility and Storage SOP

## SCOPE/PURPOSE:

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*Scope:* Biology, Chemistry, Physics, Health Science and Art Departments

*Purpose:* Hazardous chemical reactions can occur when incompatible materials mix because of accidental breakage, container failure, fires, natural disasters, or mixing from poorly closed containers. Hazardous reaction products can include: heat or fire generation, evolution of toxic or flammable gases, pressurization of containers, violent dispersion of material and polymerization. This plan contains the guidelines necessary to ensure that chemicals are stored properly in order to avoid incompatibility issues and to maintain compliance with storage quantity limits. Accurate inventory information also allows the university to fulfill its obligations to inform emergency response agencies of the potential risks within our facilities.

## GENERAL INVENTORY AND STORAGE GUIDELINES:

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1. Keep chemical inventory to a minimum and do not store excess quantities of any hazardous materials. Maintain an accurate chemical inventory, updating it as chemicals are received, used up or disposed of. The inventory should include the amount of chemical, storage class and designated storage location for each container in addition to other useful information the department may wish to maintain.
2. Separate all chemicals according to the chemical compatibility storage guidelines (below) and store them in labeled storage areas or cabinets. Some general guidelines are:
  - Separate acids from bases. Corrosive cabinets are preferable, but do not store acids and bases together.
  - Store cyanides on upper shelves so that any accidental acid spills cannot drip onto them.
  - Keep oxidizers away from flammables and reducing agents. It is best to keep them separate from every other hazard category, if possible.
  - Store flammable and combustible materials in flammables cabinets and in appropriate quantities. NFPA Class III-B combustibles may be stored on open shelving. (See below for flammability classes and quantity limitations.)
  - Store materials that are highly water-reactive in an area separate from all other chemicals.
3. Keep all chemical storage areas secured and prevent unauthorized access.

4. Containers must be in good condition and compatible with their contents. Degraded, spilled or leaking containers must be packed into a non-leaking larger container, labeled as waste and handled accordingly.
5. All containers must be legibly labeled with chemical name and GHS compliant hazard warnings, as described in section IV(b)(ii) of the Academic Chemical Safety and Management program. Abbreviations and chemical formulae should be avoided, unless necessary, and then only if definitions are provided in the lab or other rooms where the container may be used or stored.
  - 5.1. Extra labeling is required for highly hazardous materials requiring specific storage conditions, for example: peroxide formers and chemicals that react with either air or water.
6. According to department specific procedures, containers should be dated when received. Peroxide formers and other chemicals that degrade over time must be dated when opened and should not be stored longer than their published shelf life. See the Peroxide Former and Other Potential Explosives SOP for more detailed information.
7. Whenever possible, unstable chemicals, such as peroxide formers, should be purchased with a stabilizer or inhibitor additive.
8. Do not keep flammable materials in a 'domestic' or 'household' refrigerator; use a flammable storage refrigerator that is labeled as such. Refrigerators used for food storage should be labeled accordingly and that chemicals are prohibited. Refrigerators used for chemical storage should be labeled accordingly and that food storage is prohibited. See below for more information.
9. Secure gas cylinders to walls, tank racks or benchtops with chains or straps. Store cylinders with valve covers securely screwed on.
  - 9.1. Small lecture bottles may be stored in regular chemical storage separated from all other storage categories.
  - 9.2. Full sized gas cylinders are stored in one of the three gas cylinder storage rooms (Robinson 143 A, B and C). There are separate rooms for oxygen, flammable gases and inert gases.
10. As much as possible, store chemicals at eye level and below. Avoid using higher shelves unless absolutely necessary. Chemical storage shelves must have a 1inch lip on all sides.
11. In general, do not store chemicals on floors, in fume hoods, or in ways that would block access to an emergency exit, eyewash or safety shower. Large containers such as 5gal buckets can be stored on the floor out of the way.

## CHEMICAL COMPATIBILITY STORAGE GUIDELINES:

The primary template for our compatibility storage guidelines comes from the Department of Transportation regulations: 49CFR. Additional categories and designations have been added by the Chemical Hygiene Officer as necessary to comply with other regulations, to make storage of certain chemicals safer, and to make finding chemicals easier.

Separate each of the following classes of chemicals from each other by storing in separate cabinets or on separate areas of shelving. Tubs and similar containers can also be used to provide separation. All containers should be clearly labeled and all storage locations should be labeled according to compatibility group. Within each storage category organize chemicals alphabetically, or grouped by type or lab as agreed upon with the CHO.

### 1) Storage Categories

- General Organic – Hazards range from innocuous to very toxic, including slightly flammable, weak oxidizers, and carcinogens.
- General Inorganic -- Hazards range from innocuous to very toxic, including slightly flammable, weak oxidizers, and carcinogens.
- Flammable Liquids – See specific NFPA classifications below
- Flammable Solids and water reactive solids
- Corrosive oxidizers
- Oxidizers
- Acids: Inorganic separate from Organic
- Bases: Inorganic separate from Organic
- Toxic by Inhalation – This includes lachrymators, chemicals with a pungent odor, and some are also flammable.
- Gas cylinders
- Refrigerated items of various hazards
- Highly toxic (as defined by the NFPA)
- Mercury compounds (most of these are also very toxic)
- Radioactive substances
- “Controlled substances”
- Gas Cylinders

## 2) Quantity Limits on Chemical Storage:

Local fire and building codes limit the amount of hazardous chemicals that can be stored in buildings, depending on what the building is used for and the fire separation provisions in it. For the Robinson and Johnston Science Buildings, the following limits apply. Questions about application of these limits should be directed to the Chemical Hygiene Officer (777-4339) or Spokane County Fire District 9, Fire Prevention Office (466-4602) if the CHO is unavailable.

There are six Hazard Control Areas (HCA) in the Robinson Science Building and one in the Johnston Science Building.

### Robinson:

HCA1: room 145 – Waste Accumulation

HCA2: rooms 143A, B & C – gas cylinder storage

HCA3: room 129B – Biology chemical storage

HCA4: rooms 237, 241, 243 – General chemistry labs and Minor Instrument Room

HCA5: room 330 – Chemistry chemical storage

HCA6: A- 1<sup>st</sup> floor general, B- 2<sup>nd</sup> floor general, C- 3<sup>rd</sup> floor general

### Johnston:

Entire building – most chemical storage is in room 333.

### Robinson Maximum Quantities Allowed Per Control Area (per Article 80 of the Uniform Fire Code)

Hazard Class	Maximum Allowable Quantity
<i>Flammable Liquids</i>	
Class I-A	60 gallons
Class I-B	240 gallons
Class I-C	240 gallons
Total I-A, B & C	240 gallons
<i>Combustible liquids</i>	
Class II	240 gallons
Class III-A	660 gallons
Class III-B	13,200 gallons

<i>Flammable gas</i>	2000 cubic feet @ NTP (28,300 liters)
<i>Flammable solid</i>	250 pounds
<i>Organic Peroxides</i>	
Class I	10 pounds
Classes II, III, IV	250 pounds
<i>Oxidizers</i>	
Class I	4,000 pounds
Class II	500 pounds
Class III	20 pounds
<i>Oxidizing gas</i>	3,000 cubic feet @ NTP (42,450 liters)
<i>Pyrophoric</i>	4 pounds
<i>Water reactive</i>	
Class I	Not limited
Class II	100 pounds
<i>Toxic</i>	100 gallons, 1,000 pounds
<i>Highly toxic</i>	2 gallons, 20 pounds
<i>Corrosive</i>	970 gallons, 9750 pounds

**Johnston Maximum Quantities Allowed Per Control Area (per Article 80 of the Uniform Fire Code)**

<b>Hazard Class</b>	<b>Maximum Allowable Quantity</b>
<i>Flammable Liquids</i>	
Class I-A	30 gallons
Class I-B	120 gallons
Class I-C	120 gallons
Total I-A, B & C	120 gallons
<i>Combustible liquids</i>	
Class II	120 gallons

Class III-A	330 gallons
Class III-B	13,200 gallons
<i>Flammable gas</i>	1000 cubic feet @ NTP
<i>Flammable solid</i>	125 pounds
<i>Organic Peroxides</i>	
Class I	5 pounds
Class II	50
Class III	125
Class IV	Unlimited
<i>Oxidizers</i>	
Class I	4,000 pounds
Class II	500 pounds
Class III	10 pounds
<i>Oxidizing gas</i>	1,500 cubic feet @ NTP
<i>Pyrophoric</i>	Not allowed
<i>Water reactive</i>	
Class I	Not limited
Class II	50 pounds
<i>Toxic</i>	500 pounds
<i>Highly toxic</i>	10 pounds
<i>Corrosive</i>	5,000 pounds

### 3) Flammable and Combustible Specifics

NFPA Class definitions:

Class I-A: Flash point < 73 °F (22.78 °C) & boiling point < 100 °F (37.78 °C)

Class I-B: Flash point < 73 °F (22.78 °C) & boiling point ≥ 100 °F (37.78 °C)

Class I-C: Flash point ≥ 73 °F (22.78 °C) and < 100 °F (37.78 °C)

Class II: Flash point ≥ 100 °F (37.8 °C) and < 140 °F (60 °C)

Class III-A: Flash point ≥ 140 °F (60 °C) and < 200 °F (93.3 °C)

Class III-B: Flash point  $\geq 200$  °F (93.3 °C)

Some examples:

Class I-A -- Acetaldehyde, ethyl ether, pentane, petroleum ether.

Class I-B -- Acetone, reagent alcohol, benzene, carbon disulfide, cyclohexane, 1,4-dioxane, ethanol, hexane, ligroine, methanol, propanol, tetrahydrofuran, toluene.

Approved Containers:

When ordering large quantities of a flammable liquid, ensure it is shipped in an approved storage container. Metal safety cans are the safest way to store flammable liquids. They have spring-loaded lids and an internal screen, which prevents combustion of the contents. Large polypropylene (“Nalgene”) containers with stopcocks or valves at the bottom should never be used to store flammable liquids. These valves frequently leak and are unsafe in a fire.

Flammable Storage Refrigerators and Environmental Rooms:

Never store flammable liquids in a standard or domestic refrigerator.

If flammable liquids must be refrigerated or cooled, they must be kept in an approved “flammable storage” refrigerator or freezer. Flammable storage refrigerators are in the following locations: Robinson rooms 330, 321, 325 and 335.

Household refrigerators have a variety of ignition sources inside the cabinet, such as lights, switches, defrost coils, etc. that could ignite vapors. Flammable storage refrigerators have no ignition sources inside the cabinet. On extremely rare occasions, it may be necessary to use an explosion-proof refrigerator or freezer (i.e., one with no interior or exterior ignition sources). At present we do not have such a unit.

Environmental rooms (cold/warm rooms) have many ignition sources and little or no air circulation from outside. They should never be used for storage of flammable or other hazardous materials. Small quantities of hazardous materials (e.g. 500 ml) may be used in these spaces, but they should not be stored there.

## REVIEW

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Dean, College of Arts and Sciences:	Noelle Wiersma	Nov 7, 2016
Chemical Hygiene Officer:	Joy Diaz	Nov 1, 2016
Biology Department Chair:	Craig Tsuchida	Nov 7, 2016
Chemistry Department Chair:	Deanna Ojennus	Nov 11, 2016
Physics Department Chair:	John Larkin	Nov 16, 2016

Art Department Chair:	Gordon Wilson	Nov 16, 2016
Health Science Department Chair:	Mike Ediger	Nov 7, 2016