

STORAGE SPACE: ANY THING BUT *EMPTY?*

SAFE SCIENCE: BE PROTECTED

By Dr. Ken Roy*

STORAGE SPACE VIEWS –

PART II – *Continued*

According to the many national science teachers associations' standards, adequate storage space for equipment and supplies, including a separate storage area for potentially dangerous materials should be provided. Although this statement is reflective of a professional standard, storage space is always an issue. In new middle/high school science laboratory construction and/or renovation projects, storage areas tend to be one of the places that architects look at as a way to reduce square footage. This strategy saves costs in effort to meet budget constraints. In some instances, there is the perception that storage is not important or needed. Yet, from a safety and environmental regulation standpoint, proper storage is a critical issue.

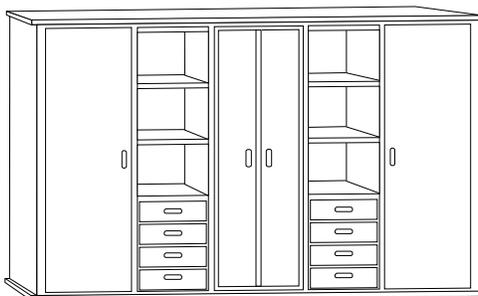
It is amazing that you will never hear a science teacher or supervisor say that they had planned for too much storage! In fact, it is always the opposite situation, so plan accordingly and be prepared to aggressively support it. The following information may be helpful in securing appropriate storage spaces during renovations and/or new construction projects for your science facility.

Why dedicated space for storage?

Dedicated space is required for the storage of labware, equipment, the safe and controlled storage of both hazardous and flammable/combustible chemicals, the temporary storage of students' projects, and/or other incomplete laboratory activities, etc. dedicated
HAZARDOUS MATERIAL STORAGE

Twenty years ago, finding a chemical in the storeroom was easy if you knew your alphabet. Easy but very dangerous! A bottle of nitric acid fumes placed on a shelf near 'hostile' flammables spells DANGER! Hazardous material storage depends on the nature of the hazard (flammable and combustible materials), gas cylinders, toxic materials and highly reactive substances, the quantity and the type of operations that are used.

Special considerations for storage are a must for a safe laboratory operation. Chemicals have different needs ñ some like it hot, some like it cold. Some like light, some like darkness. The point is, teachers must know the chemical nature of each product used and/or stored and accommodate for that need. As a result, chemicals are found stored in general storerooms, refrigerators, and flammable liquid cabinets, to name a few. One specific note about fume hoods and



storage – don't do it!

Make sure that the chemical inventories are current and updated at least semiannually as well as after receiving new products. Material Safety Data Sheets (MSDS) shall be on hand and readily accessible for all products used and/or stored. Store the minimum levels of inventory consistent with the lesson plans and dispense limited amounts as needed, being attentive to compatibilities.

In addition, OSHA's Hazard Communication Standard specifies the following chemical information on all containers: name of chemical, hazard warnings and name/address of the manufacturer or importer, as well as the date of receipt and, the initial opening date of container indicated on container label. However, it may be more useful to have a decision date on a container than its expiration date. When the decision date has been reached, the chemicals/products are removed from the shelf and the controller either overrides the decision date or sends the product back, with a new decision date or the product is properly disposed of.

Consider the following guidelines for chemical storage rooms:

- Appropriate ventilation as required by

NFPA-45 is to be provided with 6 to 10 room air exchanges per hour on a unidirectional/non-recycling forced air system during operation of laboratory work;

- Store only the smallest amounts of products that can be consumed in a school year, but do not exceed the amounts permitted to be stored by OSHA 29 CFR 1910.106 and NFPA 45, as well as maximums set by any other state/local building and fire codes; amounts of flammables as mandated by OSHA 29CFR 1910.106 and NFPA 45;
- Use caution in dealing with peroxides in peroxide-forming chemicals. They are accelerated in the presence of UV light and higher temperatures. Common chemicals in this group found in high school labs include diethyl ether and cyclohexane;
- Always isolate dissimilar reactive materials; e.g., strong acid-base groups, strong reducing agents and oxidizers;
- Shelf units must be firm, stable and secured to the walls to prevent sliding, collapsing or falling over;
- Lips or shelf-edge restraints should be placed on every shelf;
- Trays are needed under large volumes of bottles containing liquids to prevent spread of leaks;
- Floors are required to have curbs, scuppers, special drains, or other suitable means to contain spills and prevent the flow of liquids into adjacent building spaces. If a drainage system is used, it shall have sufficient capacity to carry the expected discharge of water from fire protection systems and/or hose streams, except if the containers stored do not exceed 10 gal. (38 L), then the storage area need not meet the requirements stated above;
- Nothing should be stored on the floor;
- Automatic fire suppression system i.e. — water sprinklers;
- Doors with self or auto close hardware;

- Doors to chemical storage areas must be secured with lockable hardware and the access limited to persons trained for the proper handling and operating procedures (science teachers, administrators);
- In spaces dealing with Class 1 liquids/explosive vapors, the light fixtures, switches, electrical equipment and wiring shall be classified electrically with respect to Article 500 of NFPA 70, National Electrical Code as Class 1, Division 2. The electrical wiring and equipment in storage rooms for Class 11 and Class 111 liquids are permitted to be suitable for general purpose use by NFPA 70, National Electrical Code;
- One or more fire extinguishers (A-B-C type);
- Appropriate signage advising of the need for splash goggles, etc.;
- Electrical receptacles located on workstations should be installed 6 inches above the work surface;
- Wall assemblies are required to be constructed to prescribed fire resistance ratings;
- Class I flammable liquids can not be stored at basement level;
- Containers should not be stacked on top of each other;
- Larger storage rooms (greater than 500 sq. ft.) should have at least two remount exits;
- Fans that could produce a spark, both the rotating element and the casing shall be constructed of nonferrous material or of other suitable spark-resistant materials;

Depending on the hazardous materials inventory, additional type of storage may be necessary such as flammable liquid cabinets, glass bottles, safety cans, approved plastic containers and laboratory refrigerators.

Storage cabinets for flammable and combustible materials should be mechanically ventilated in accordance with the manufactures listed recommendations and as required by any other local requirements. These cabinets usually have vent ports which can be connected to ducts. The vapors can then be exhausted to outside air. These cabinets can be placed in almost

any location providing proper ventilation is available. Safety cans and other approved containers can be stored in these cabinets. Again, proper signage is required: e.g., Caution: Flammable Liquids.

Some chemicals decompose quickly if not kept refrigerated. Even in refrigeration, chemicals eventually form products which can be flammable and explosive. Refrigerators, freezers, and other cooling equipment used to store or cool flammable liquids shall be designed or modified for such use. Household refrigerators may be modified to store flammable liquids. These modifications shall include that electrical equipment located within the outer shell or within the storage compartment, in or on the door, door frame shall meet the requirements for Class 1, Division 1 locations, as described in Article 501 of NFPA 70, National Electrical Code or NFPA-45.

Consider the following guidelines for storing chemicals in refrigerators:

- Use only refrigerators designed for chemical storage;
- Never store food and chemicals in the same refrigerator;
- Only store quantities needed;
- Remove chemicals and dispose of properly at drop dead dates;
- Use proper signage on the refrigerator noting storage items; e.g., "For Edible Food and Drink Only;" "For Hazardous Chemical Storage Only."
- Use good housekeeping techniques when storing in refrigerator to keep the contents neat and orderly; e.g., do not overload shelves.
- Any unattended electrical heating equipment shall be equipped with a manual reset over-temperature shutoff switch, in addition to normal temperature controls.

STORING BY SAFETY!

Appropriate storage for science laboratories is not only necessary but is also critical for the safety of all occupants in the building. Accidents can happen quickly and often where there is risk resulting from poor housekeeping and improper storage. Keeping it clean and orderly makes it safer for all.

LIVE LONG AND PROSPER SAFELY!

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Resources:

Occupational Safety and Health Administration: [HYPERLINK "http://www.osha.gov"](http://www.osha.gov) <http://www.osha.gov>
National Fire Protection Association: [HYPERLINK "http://www.nfpa.org"](http://www.nfpa.org) <http://www.nfpa.org>
Safety in Academic Chemistry Laboratories: American Chemical Society, 1155 Sixteenth St., Washington, D.C. ([HYPERLINK "http://www.acs.org"](http://www.acs.org) <http://www.acs.org>)
The International Building Code and International Fire Code: International Code Council, Inc., 4051 West Flossmoor Rd, Country Club Hills, IL ([HYPERLINK "http://www.iccsafe.org"](http://www.iccsafe.org) <http://www.iccsafe.org>)

Author's Note: Special thanks for his technical assistance in the writing of this article goes to John Dembishack. Mr. Dembishack has practiced architecture for more than 18 years, before entering his current position as a state fire marshal with the State of Connecticut, United States of America.

† *Storage Space: Any Thing But Empty, PART I*, appeared on pages 4-5 of the March 2004 issue of CSTA Newsletter.

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