Chemical Storage Guidelines

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DISCLAIMER

The information contained in this publication has been compiled from sources believed to be reliable and to represent the best opinions on the subject. This publication is intended to provide basic guidelines for the safe storage of chemicals and should serve as a starting point for good practices. Local, state, and federal laws and legal counsel should be consulted prior to initiating a chemical storage program. It

cannot be assumed that all necessary warning and precautionary measures are contained in this publication; additional information may be required.
Mention of the name of any company or organization does not constitute endorsement by the New York State Education Department.

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PREFACE

This publication is intended to provide school faculty and staff with guidelines pursuant to New York State Education Law, '305(19) Chapter 627 of the Laws of 1989:

> The commissioner is authorized and directed to require all elementary and secondary schools to store all chemicals present in their science facilities in locked and secure storage rooms and cabinets. The schools shall provide for the placement, spacing, arrangement, ventilation and fire protection of such stored chemicals in accordance with guidelines promulgated by the commissioner of education. The commissioner shall also require all elementary and secondary schools to prepare at least annually an inventory of such chemicals, including the chemical's name, the chemical abstracts service registry number, a hazard warning code, the generally accepted method or methods of disposal, a compatible storage code, the date received, the scheduled date of disposal, the quantity received, the quantity remaining and its location. The inventory must be kept in a secure location and be available for inspection by the commissioner.

This statute requires the New York State Education Department to develop guidelines in accordance with Federal, and New York State laws and regulations. The New York State Education Department recommends that school districts comply, where applicable, with these guidelines drawn from relevant State and Federal standards.

INTRODUCTION and OVERVIEW

As modern laboratory courses and programs emphasize a "hands-on" approach, a common problem for many school district personnel is the safe storage of chemicals in the school science laboratory. Often incompatible chemicals are found next to each other on shelves rather than locked in approved safety storage cabinets. The shelving may be inappropriate and unsafe. Aging chemicals may need to be replaced or discarded (disposal options must be approved and safe). Often chemical inventories are nonexistent or incomplete. Chemicals, when not in use, are found or stored in the classroom rather than in safety storage cabinets or other locked and ventilated storage areas. Chemicals are found stored on the floor or under a sink. Reagent bottles are unlabeled, or a warning or storage code is omitted from the label. These practices may result in serious injury to students and staff.

Regulations and guidelines promote safe practices for the *how* and *where* of the storage of hazardous chemicals. Federal and state laws, and regulating agencies give direction in how and where hazardous chemicals may be stored. These guidelines have been developed under the standards and regulations set forth by the Occupational Safety And Health Act of 1970, Title 29 of the Code of Federal Regulations (29CFR), the Uniform Fire Code (UFC) and the Resource Conservation and Recovery Act of 1976 (RCRA). Additional sources of information, such as consultations and publications from the American Chemical Society and the National Science Teachers Association, were used in the development of the guidelines.

The issue of safe storage involves factors such as placement and spacing (e.g., compatibility), security and arrangement (e.g., inventory), ventilation, and fire protection. Corrosive chemicals and flammable liquids present the greatest storage problem; they should never be stored together. Storage in separate, approved safety storage cabinets is highly recommended. Oxidizers, irritants, carcinogens, pyrophorics, and toxic chemicals pose additional storage problems. The incompatibility of certain chemicals may introduce unsuspected hazards into the school science laboratory, e.g., accidental production of a hypergolic mixture, such as magnesium powder and perchloric acid, will cause spontaneous ignition. The term " chemical inventory" may apply to both shelf arrangement and/or record keeping. Shelf arrangement of compatible chemical families should follow recommended patterns using appropriate compatible family codes. Record keeping should entail detailed accounts of date and quantities at receival, quantities remaining, shelf life, hazards, family codes, etc.

To assist school personnel in adhering to regulations, guidelines have been prepared in table format by classroom type and topic. Where appropriate each guideline is listed with a publication referring to a source of law, regulation, or mandate on chemical storage to assist in documentation of compliance. A section with answers to common questions is also provided.

STORING CHEMICALS IN CLASSROOMS AND STORAGE AREAS

When chemicals are not in use in the classroom they should be stored in accordance with the guidelines set forth by the Commissioner of Education. To assist in determining applicable regulations, the following designations of classroom types based on relevant standards have been assigned: **General Classrooms**; **Science Classrooms/ Laboratories**; **Storage/Prep Rooms**. These classification types have no other purpose than to assist in the limited or the long term storage of chemicals in school buildings.

Type I - General Classrooms

General classrooms shall be classified as any classrooms (K-12) that are not designated as a science room, but are being used for demonstrations or hands-on science. For example, these may be classrooms

that are used with kit-type programs at the elementary level, or they may be rooms at any level that are used for all or part of the day for teaching science, but have no built-in science facilities (storage, gas, water, etc.). Chemical storage in such rooms shall be limited to small quantities of low-hazard materials. These materials may be stored for short periods of time (example: for a two-week period of time during the teaching of a unit). There shall be no bulk or long-term storage in such rooms.

Type II - Science Classrooms/Laboratories

Science classrooms/laboratories shall be classified as any classrooms that are specifically designed for housing science classes. These rooms are generally equipped with cabinets and/or areas to be used for long-term storage of chemicals; these cabinets and/or areas are part of the area that students and teachers occupy. Such rooms shall not be used to store bulk quantities of chemicals, or large quantities of flammable, reactive, or highly toxic materials.

Type III - Storage/Prep Rooms

Storage/prep rooms shall be classified as rooms whose purpose is the storage of chemicals. These rooms are not to be used as classrooms, and shall not be occupied by classes of students. Such rooms shall be specifically designed for the long-term storage of a variety of materials. Bulk storage shall be permitted in such rooms.

Guidelines for Storing Chemicals in Classrooms and Storage Areas

TYPE I: GENERAL CLASSROOMS

Type I: General Classrooms: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. The following chemicals shall not be placed in long-term (permanent) storage in Type I rooms in bulk quantities: a) Concentrated acids and bases b) Flammable/combustible liquids c) Highly corrosive, explosive, reactive, or toxic chemicals d) Compressed gas cylinders These chemicals shall be stored in locked cabinets in chemical storage areas outside the classroom.			
2. In an instructional classroom, the maximum container size for each flammable/combustible chemical shall be no more than one gallon. Any amount of a single chemical greater than one gallon shall be stored outside the classroom in a locked storage area. When storing small containers of less than one gallon of flammable/combustible liquids in the classroom, follow the specifications for the maximum allowable capacity for each container type as outlined in NFPA 45: Table 7-2.	NFPA 45: Table 7-2 (91)		
3. Compressed/liquefied gases in cylinders shall be stored in a safe location outside the classroom.	NFPA 45: 8-2.2 (91)		
4. All gas cylinders placed in use in the classroom shall be secured to prevent accidental falling.	NFPA 45: 8-2.5 (91)		
5. Gas cylinders shall be placed away from localized heat, open flame/sparks, electrical sparks, and flammable substances.	NSTA SSC (81) NFPA 451.5.1 (96)		
6. Gas cylinders shall be placed away from corrosive chemicals.	NSTA SSC (81)		
7. When cylinders of incompatible gases are being used, they shall be segregated from each other by a distance.	NSTA SSC (81); NFPA 45: 7-2.3.4 (96)		
8. Chemicals shall not be stored in refrigerators in Type I classrooms.			

Type I: General Classrooms: Arrangement			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Chemicals that have been brought into the room must be arranged (on table or cart or in storage area) in temporary and permanent storage by their color codes and compatibility.	NFPA 45: 7-2.3.4 (96)		
2. If a teacher is using chemicals for a demonstration, the teacher must arrange the chemicals on the desk or table by their color codes and compatibility.	NFPA 45: 7-2.3.4 (96)		

Type I: General Classrooms: Ventilation			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Air exhausted from an exhaust system shall not be re-circulated.	NFPA 45: 6-4.1 (96)		
2. Exhaust fans shall be selected to meet fire, explosion, and corrosion requirements.	NFPA 45: 6-7.1 (96)		

Type I: General Classrooms: Ventilation			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
3. Means must be provided for the manual shutdown of any existing ventilation equipment at a location approved by the fire chief.	NYSUFPBC §1004.2(e) CRRSNY 1004.2(e)		

Type I: General Classrooms: Fire			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. In a classroom where chemicals are to be stored, a portable fire extinguisher with a minimum rating of 2A, 20BC shall be provided. Combinations of other extinguishers may be used, provided the ratings of these extinguishers meet or exceed the 2A, 20BC requirement.	NYSUFPBC §1163.13(f) CRRSNY 1163.13 NFPA 10: 2-2.1 (98) NFPA 10: 3-2.1 (98) NFPA 10: 3-3.1 (98) NFPA 10: 3-3.3 (98)		
2. Portable fire extinguishers shall be maintained in a fully charged and operable condition and kept in their designated place at all times when not in use.	NFPA:10: 1-6.2 (98)		
3. Portable fire extinguishers shall be conspicuously located where they are readily and immediately available in the event of a fire.	NFPA 10: 1-6.3 (98)		
4. Portable fire extinguishers shall not be obscured from view.	NFPA 10: 1-6.5 (98)		
5. Written procedures for fire emergencies shall be developed.	29 CFR 1910.38		
6. Employers shall provide training initially, and on an annual refresher basis, for all personnel who may be involved in firefighting activities.	29 CFR 1910.157(g)		
7. The employer shall be responsible for the inspection, maintenance, and testing of all portable fire extinguishers in the workplace.	29 CFR 1910.157(e)		

Note: Many fires are small at their beginning and may be extinguished by a portable extinguisher. However, the fire department shall be notified as soon as a fire is discovered. **SOUNDING THE ALARM MUST NOT BE DELAYED WHILE A PORTABLE EXTINGUISHER IS USED.**

TYPE II: SCIENCE CLASSROOMS/LABORATORIES

Type II: Science Classrooms/Laboratories: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Students shall not be allowed to store chemicals in their desk or in their lab drawers.	ACS-SACL p. 7 (85)		
2. When chemicals are not in use on a particular day, they shall be placed in their designated locked storage cabinets, locked closets, or locked storage rooms.	ACS-SACL p. 7 (85)		
3. Science kits that contain chemicals shall be stored in locked cabinets or locked storage areas.	Ed. Law §305 Sub. 19		
4. Containers of chemicals shall be placed in locked storage cabinets or closets, apart from areas where other equipment or supplies are stored.			

Type II: Science Classrooms/Laboratories: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
5. Chemical storage areas shall be located so as not to block exits, entrances, or aisles.	NYSUFPBC §1162.2(c), (d), (e), (f), (g) CRRSNY §1162.2(c), (d), (e), (f), (g)		
6. Chemical storage areas shall be located so that electrical receptacles, switches, and controls are not subject to spills.	NFPA 45: 3-6.1 (91)		
7. Chemical storage areas shall not be located adjacent to heat sources or heat vents.	NYSUFPBC §1171.1(c) CRRSNY §1171.1(c)		
8. Containers of chemicals shall not be stored on the floor of classrooms, laboratories, closets, or base cabinets.			
9. Containers of chemicals shall not be stacked on top of one another.			
10. Containers of chemicals shall not be stored in or under fume hoods.	NRC-PPHHCL p. 200 (91)		
11. Containers of chemicals shall be stored away from direct exposure to sunlight.	ACS-SACL p. 49 (90)		
12. Containers of chemicals shall be stored in cool, dry locations.	NSTA-SSC (81)		
13. In an instructional classroom, the maximum container size for each flammable/combustible chemical shall be no more than one gallon. Any amount of a single chemical greater than one gallon shall be stored outside the classroom in a locked storage area. When storing small containers of less than one gallon of flammable/combustible liquids in the classroom, follow the specifications for the maximum allowable capacity for each container type as outlined in NFPA 45: Table 7-2.	NFPA 45: Table 7-2 (96)		
14. Compressed/liquefied gases in cylinders shall be stored outside the classroom.	NFPA 45: 8-1.2 (96)		
15. All gas cylinders placed in use in the classroom shall be secured to prevent accidental falling.	NFPA 45: 8-1.5 (96)		
16. Gas cylinders shall be placed away from localized heat, open flames/sparks, electrical sparks, and highly flammable substances.	NSTA-SSC (81)		
17. Gas cylinders shall be placed away from corrosive chemicals.	NSTA-SSC (81)		
18. Empty gas cylinders shall be labeled "empty" and placed in a storage area that is separate from areas where full gas cylinders are stored.	NSTA-SSC (81)		
19. Gas cylinders of incompatible gases shall be segregated from each other by a distance and/or different cabinets.	NSTA-SSC (81) NFPA 45: 7-2.3.4 (96)		
20. Corrosive chemicals shall be stored on corrosive-proof surfaces in locked, corrosive-proof storage cabinets.			
21. Containers of corrosive chemicals shall be stored so that any spills or leaks will be contained and isolated from other chemicals.	NSTA-SSC (81) CBCRM (99), p. 958		
22. Acids shall be stored in dedicated cabinets segregated from the bases.	NSTA-SSC (81)		
23. Chemicals that become hazardous over a prolonged period of time or peroxide- forming chemical compounds shall be stored in airtight containers in dark, cool, and dry locations. Containers in which these compounds are found shall be labeled with the date received, date opened, and date of expected disposal, before they are placed in storage.	NFPA 45: 10-3.2 (96) NFPA 45: 7-2.3.5 (96)		
24. Toxic chemicals shall be stored in designated locked cabinets within the storage area, separated from other chemicals.			

Type II: Science Classrooms/Laboratories: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
25. Water-reactive chemicals shall be placed in a cool, dark location, and protected from exposure to water emanating from accidental spills, leaks, and automatic sprinkler systems.	NSTA-SSC (81) NFPA 45: 7-2.1.2 (96)		
26. Chemical wastes shall be placed in containers that are designated specifically for their storage, segregated from all other chemicals, and placed according to their compatibility.	NFPA 45: 7-2.1 (96)		
27. Flammable/combustible liquids which require cooling shall be stored in explosive-proof refrigerator units which meet NFPA 45: 9-2.2.2 specifications.	NFPA 45: 9-2.2.2 (96)		
28. Chemicals shall not be stored in the same refrigerator units used for the storage of food to be eaten by humans.	NRC-PPHHCL p. 24 (81)		

Type II: Science Classrooms/Laboratories: Arrangement			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Incompatible materials must be segregated to prevent accidental contact with one another. Chemicals shall be stored according to the patterns in "School Science Laboratories: A Guide to Some Hazardous Substances" or another similar storage scheme.	NFPA 45: 7-2.3.4 (96) CSSS-SSL: GHS		
2. Oxidizing acids shall be placed in dedicated storage cabinets, segregated from organic acids and flammable/combustible chemicals.	NSTA-SSC (81)		
3. Acids shall be stored in acid storage cabinets, so that they are segregated from active metals and chemicals which could produce toxic gases when exposed to acid spills.	NSTA-SSC (81)		
4. When storing oxidizing chemicals, they shall be segregated from organic materials, flammable/combustible liquids and solids, corrosive liquids, hazardous chemicals, and reducing agents.	NYSUFPBC § 1174.5 CRRSNY §1174.5 NSTA-SSC (81)		

Type II: Science Classrooms/Laboratories: Ventilation			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. The air for science classrooms/laboratories shall be changed six times per hour during every 24-hour period and be vented to the outside.	29 CFR 1910.106 (d) (4) (iv)		
2. Air exhausted from an exhaust system shall not be re-circulated.	NFPA 45: 6-4.1 (96)		
3. Air exhausted from an exhaust system shall be discharged above the roof at a location, height, and velocity sufficient to prevent the reentry of hazardous chemicals.	NFPA 45: 6-84.10 (96)		
4. Means must be provided for the manual shutdown of any existing ventilation equipment at a location approved by the fire chief.	NYSUFPBC §1004.2 (e) CRRSNY §1004.2 (e)		
5. Exhaust fans shall be selected to meet fire, explosion, and corrosion requirements.	NFPA 45: 6-7.1 (96)		
6. Air supply and exhaust fans, motors, and components shall be inspected at least annually.	NFPA 45: 6-13.5.1 (96)		

Type II: Science Classrooms/Laboratories: Fire

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ITEM	CONDITION		
	CITATION	EXISTS	LACKING
1. In a classroom where chemicals are to be stored, a portable fire extinguisher with a minimum rating of 2A, 20BC shall be provided. Combinations of other extinguishers may be used, provided the ratings of these extinguishers meet or exceed the 2A, 20BC requirement.	NYSUFPBC §1163.13(f) NFPA 10: 2-2.1 (88) NFPA 10: 3-2.1 (88) NFPA 10: 3-3.1 (88) NFPA 10: 3-5.1 (88)		
2. Portable fire extinguishers shall be maintained in a fully charged and operable condition and kept in their designated place at all times when not in use.	NFPA 10: 1-6.2 (98)		
3. Portable fire extinguishers shall be conspicuously located where they are readily and immediately available in the event of a fire.	NFPA 10: 1-6.3 (98)		
4. Portable fire extinguishers shall not be obscured from view.	NFPA 10: 1-6.5 (98)		
5. At least one (1) approved fire blanket must be provided for each room.	NYSMPSS 110-7		
6. Written procedures for fire emergencies shall be developed.	29 CFR 1910.38		
7. Employers shall provide training initially, and on an annual refresher basis, for all personnel who may be involved in firefighting activities.	29 CFR 1910.157 (g)		
8. The employer shall be responsible for the inspection, maintenance, and testing of all portable fire extinguishers in the workplace.	29 CFR 1910.157 (e) (1)		
9. Science classrooms and laboratories shall be separated from adjoining non-laboratory areas by a minimum one-hour, fire-rated construction.	NFPA 45: 3-1.3 (96)		
10. Penetrations of fire-rated floors, ceilings, or wall assemblies shall be protected so as to retain the required fire resistance rating.	NFPA 45: 3-1.8 (96)		
11. Automatic fire protection systems, when provided, shall comply with all NFPA standards.	NFPA 45: 6-10.2 (96)		
12. An automatic and manual fire alarm system shall be installed in case a fire, by itself, would not provide adequate warning to building occupants.	NFPA 45: 4-5.1 (96) NYSUFPBC §1060.3 (b), NYSUFPBC §1163.13(g)		
13. Methods for the storage and piping of gases shall comply with the requirements of applicable NFPA standards.	NFPA 45: 8-2.1 (96)		
14. In general, materials which present an explosion hazard shall not be stored in schools.	CRRSNY §1174.9(b)		
15. Materials that require refrigeration due to reactivity, etc. shall not be stored in areas that are used for classroom instruction.			

Type II: Science Classrooms/Laboratories: Fire			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
16. Sources of ignition shall be eliminated or controlled where flammable vapors are present.	NYSUFPBC §1171.1(c) CRRSNY §1170.1(c)		
17. Science classrooms/laboratories (laboratory units) for educational purposes shall be designated either NFPA Class B or Class C. Flammable liquid storage shall not exceed the following quantities: A) Class B - 5 gallons of Class I flammables; 10 gallons total of flammables (per 100 square feet of room space). B) Class C - 2 gallons of Class I flammables; 4 gallons total of flammables (per 100 square feet of room space).	NFPA 45: 2-2.1 (96) NFPA 45: Table 2-2 (96)		
18. Any quantities of flammable and combustible liquids must be stored in approved flammable liquid storage cabinets or flammable liquid storage rooms. Flammables are to be stored in a one-hour storage cabinet or a one-hour storage room.	NYSUFPBC§1171.3(b)(4) NYSUFPBC§1171.3(b)(5) NFPA 45: 7-2.1.2 (96)		
19. Class I flammable liquids may be stored in glass containers of not more than one gallon capacity, only if the required liquid purity would be affected by the storage in a metal container, or if the liquid would cause excessive corrosion of the metal container. Otherwise, Class IA liquids are restricted to glass containers not exceeding one pint capacity, and Class IB liquids are restricted to glass containers not exceeding one quart capacity. Class IC liquids may be stored in containers up to one gallon capacity.	NFPA 45: 7-2.3.2 (91)		
20. No container for Class I or II liquids in a lab shall exceed a capacity of one gallon, except for safety cans, which may be of two gallon capacity.	NFPA 45: 7-2.3.2 (91)		

Note: Many fires are small at their beginning and may be extinguished by a portable extinguisher. However, the fire department shall be notified as soon as a fire is discovered. **SOUNDING THE ALARM MUST NOT BE DELAYED WHILE A PORTABLE EXTINGUISHER IS USED.**

TYPE III: STORAGE/PREP ROOMS

Type III: Storage/Prep Rooms: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Containers of chemicals shall be placed in locked storage cabinets or locked closets, apart from areas where other equipment or supplies are being stored.			
2. Chemical storage shall be located so as not to block exits, entrances, and aisles.	NYSUFPBC Sec. 1162.2 (c), (d), (e), (f), (g)		
3. Chemical storage areas shall be located so that electrical receptacles, switches, and controls are not subject to spills.	NFPA 45: 3-6.1 (91)		

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Type III: Storage/Prep Rooms: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
4. Chemical storage areas shall not be located adjacent to heat sources or heat vents.	NYSUFPBC Sec. 1171.1 (c)		
5. Containers of chemicals shall not be placed on the floor.	Ed. Law Sec. 305, Sub. 19		
6. Containers of chemicals shall not be stacked on top of one another after they have been removed from their original shipping cartons.	Ed. Law Sec. 305, Sub. 19		
7. Containers of chemicals shall not be stored in or under fume hoods.	NRC-PPHHCL p. 200 (81)		
8. Containers of chemicals shall be stored away from direct exposure to sunlight.	ACS-SACL p. 6-7 (85)		
9. Containers of chemicals shall be stored in cool, dry locations.	NSTA-SSC (81)		
10. Flammable/combustible liquids shall be stored away from sources such as flames, heat, and electrical sparks.	NSTA-SSC (81)		
11. In an instructional classroom, the maximum container size for each flammable/combustible chemical shall be no more than one gallon. Any amount of a single chemical greater than one gallon shall be stored outside the classroom in a locked storage area. When storing small containers of less than one gallon of flammable/combustible liquids in the classroom, follow the specifications for the maximum allowable capacity for each container type as outlined in NFPA 45: Table 7-2.	NFPA 45: Table 7-2 (91)		
12. Compressed/liquefied gases in cylinders are to be stored in designated storage rooms, not in classrooms.	NFPA 45: 8-2.2 (91)		
13. All gas cylinders shall be secured to prevent accidental falling.	NFPA 45: 8-2.5 (91)		
14. Gas cylinders shall be placed away from localized heat, open flames/sparks, electrical sparks, and highly flammable substances.	NSTA-SSC (81)		
15. Gas cylinders shall be placed away from corrosive chemicals.	NSTA-SSC (81)		
16. Empty gas cylinders shall be labeled "empty" and placed in a storage area that is separate from areas where full gas cylinders are stored.	NSTA-SSC (81)		
17. Gas cylinders of incompatible gases shall be segregated from each other by a distance and/or different cabinets.	NSTA-SSC (81) NFPA 45: 7-2.3.4 (91)		
18. Corrosive chemicals shall be stored on corrosive-proof surfaces in locked, corrosive-proof storage cabinets.			
19. Containers of corrosive chemicals shall be stored so that any spills or leaks will be contained and isolated from other chemicals.	NSTA-SSC (81)		
20. Acids shall be placed in separate acid storage cabinets, segregated from the bases.	NSTA-SSC (81)		
21. Chemicals shall not be stored in the same refrigerator units used for the storage of food to be eaten by humans.	NRC-PPHHCL p. 24 (81)		
22. Chemicals that become hazardous over a prolonged period of time or peroxide forming chemical compounds shall be stored in airtight containers in dark, cool, and dry locations. Containers in which these compounds are found shall be labeled with the date received, date opened, and date of expected disposal before they are placed in storage.	NFPA 45: 10-3.2 (91) NFPA 45: 7-2.3.5 (91)		
23. Toxic chemicals shall be stored in designated locked cabinets within the storage area; toxic chemicals shall thereby be separated from other chemicals.			

Type III: Storage/Prep Rooms: Placement and Spacing of Chemicals			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
24. Water-reactive chemicals shall be placed in a cool, dark location, and protected against exposure to water emanating from accidental spills, leaks, and automatic sprinkler systems.	NSTA-SSC (81) NFPA 45: 7-2.1.2 (91)		
25. Chemical wastes shall be placed in containers that are designated specifically for their storage, segregated from all other chemicals, and placed according to their compatibility.	NFPA 45: 7-3.1 (91)		
26. Containers of chemicals shall be stored in cabinets or on shelves which have been secured to prevent falling or collapse.	NSTA-SSC (81)		
27. Containers of chemicals shall be stored in cabinets and/or shelves which are designed to prevent the accidental dislodging of the containers.	NRC-PPHHCL p. 219 (81)		
28. Containers of chemicals shall be placed in cabinets or on shelves so as to prevent overcrowding and to enable easy access.	NSTA-SSC (81)		
29. Containers of chemicals shall not be placed on shelves so they protrude over the shelf edge.	NSTA-SSC (81)		
30. Containers of hazardous chemicals shall not be placed on shelves above eye level.	NSTA-SSC (81)		
31. Flammable/combustible liquids shall not be stored in cabinets, closets, or shelves that are located near or adjacent to exits.	29 CFR 1910.106 (d) (5)		
32. Flammable/combustible liquids which require cooling shall be stored in explosive-proof refrigerator units which meet NFPA 45: 9-2.2.2 specifications.	NFPA 45: 9-2.2.2 (91)		
33. Containers of flammable/combustible liquids shall be placed only in refrigeration units which are prominently labeled to indicate that they are suitable for storage of flammable liquids.	NFPA 45: 9-2.2.1 (91)		
34. Only flammable/combustible liquids in closed containers may be placed in refrigerator units.	NFPA 45: 9-1.6.6 (91)		
35. Containers of chemicals shall not be stored on the floor of closets or base cabinets.			

Type III: Storage/Prep Rooms: Arrangement			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. Incompatible materials must be segregated to prevent accidental contact with one another. Chemicals shall be stored according to the patterns in "School Science Laboratories: A Guide to Some Hazardous Substances" or another similar storage scheme.	NFPA 45: 7-2.3.4 (91) CSSS-SSL: GHS		
2. Since some inorganic chemicals are NOT compatible, these chemicals are sorted by color into some pattern. Compatible chemical families may be arranged on the shelves or in dedicated cabinets in patterns using compatible family codes.			
3. Since some organic chemicals are NOT compatible, these chemicals are sorted by color into some pattern. Compatible chemical families may be arranged on the shelves or in dedicated cabinets with compatible family codes. Follow your system carefully.			
4. Oxidizing acids shall be placed in acid storage cabinets so they are segregated from organic acids and flammable/combustible chemicals.	NSTA-SSC (81)		

Type III: Storage/Prep Rooms: Arrangement			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
5. Acids shall be placed in acid storage cabinets so they are segregated from active metals and chemicals which could produce toxic gases when exposed to acid spills.	NSTA-SSC (81)		
6. When storing oxidizing chemicals, they shall be segregated from organic materials, flammable/combustible liquids and solids, corrosive liquids, hazardous chemicals, and reducing agents.	NYSUFPBC Sec. 1174.5 NSTA-SSC (81)		

Type III: Storage/Prep Rooms: Ventilation			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. The air for chemical storage rooms shall be changed six times per hour during every 24-hour period and shall be vented to the outside.	29 CFR 1910.106 (d) (4) (iv)		
2. Air exhausted from an exhaust system shall not be re-circulated.	NFPA 45: 6-5.1 (91)		
3. Air exhausted from exhaust systems shall be discharged above the roof at a location, height, and velocity sufficient to prevent reentry of hazardous chemicals.	NFPA 45: 6-8.7 (91)		
4. Means shall be provided for the manual shutdown of any existing ventilation equipment at a location approved by the fire chief.	NYSUFPBC Sec. 1004.2 (e)		
5. Exhaust fans shall be selected to meet fire, explosion, and corrosion requirements.	NFPA 45: 6-8.1 (91)		
6. Air supply and exhaust fans, motors, and components shall be inspected at least annually.	NFPA 45: 6-14.5.1 (91)		

Type III: Storage/Prep Rooms: Fire			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
1. In a classroom where chemicals are to be stored, a portable fire extinguisher with a minimum rating of 2A, 20BC shall be provided. Combinations of other extinguishers may be used, provided the ratings of these extinguishers meet or exceed the 2A, 20BC requirement.	NYSUFPBC Sec. 1163.13 (f) NFPA 10: 2-2.1 (88) NFPA 10: 3-2.1 (88) NFPA 10: 3-3.1 (88) NFPA 10: 3-5.1 (88)		
2. Portable fire extinguishers shall be maintained in a fully charged and operable condition and kept in their designated place at all times when not in use.	NFPA 10: 1-6.2 (88)		
3. Portable fire extinguishers shall be conspicuously located where they are readily and immediately available in the event of a fire.	NFPA 10: 1-6.3 (88)		
4. Portable fire extinguishers shall not be obscured from view.	NFPA 10: 1-6.5 (88)		
5. At least one (1) approved fire blanket must be provided for each room.	NYSMPS S 110-7		
6. Written procedures for fire emergencies shall be developed.	29 CFR 1910.38		

Type III: Storage/Prep Rooms: Fire			
ITEM	**CONDITION**		
	CITATION	**EXISTS**	**LACKING**
7. Employers shall provide training initially, and on an annual refresher basis, for all personnel who may be involved in firefighting activities.	29 CFR 1910.157 (g)		
8. The employer shall be responsible for the inspection, maintenance, and testing of all portable fire extinguishers in the workplace.	29 CFR 1910.157 (e) (1)		
9. Science classrooms and laboratories shall be separated from adjoining non-laboratory areas by a minimum one-hour, fire-rated construction.	NFPA 45: 3-1.3 (91)		
10. Penetrations of fire-rated floors, ceilings, or wall assemblies shall be protected so as to retain the required fire resistance rating.	NFPA 45: 3-1.6 (91)		
11. Automatic fire protection systems, when provided, shall comply with all NFPA standards.	NFPA 45: 6-11.2 (91)		
12. An automatic and manual fire alarm system shall be installed in case a fire, by itself, would not provide adequate warning to building occupants.	NFPA 45: 4-5.1 (91) NYSUFPBC Sec. 1060.3 (b) Sec. 1163.13 (g)		
13. Methods for the storage and piping of gases shall comply with the requirements of applicable NFPA standards.	NFPA 45: 8-1.1 (91)		
14. In general, materials that present an explosion hazard shall not be stored in schools.			
15. Materials that require refrigeration due to reactivity, etc. shall not be stored in areas that are used for classroom instruction.			
16. Sources of ignition shall be eliminated or controlled where flammable vapors are present.	NYSUFPBC Sec. 1171.1 (c)		
17. Science classrooms/laboratories (laboratory units) for educational purposes shall be either NFPA Class B or Class C. Flammable liquid storage shall not exceed the following quantities: A) Class B - 5 gallons of Class I flammables; 10 gallons total of flammables (per 100 square feet of room space). B) Class C - 2 gallons Class I flammables; 4 gallons total of flammables (per 100 square feet of room space).	NFPA 45: 2-2.2 (91) NFPA 45: Table 2-2 (91)		
18. Any quantities of flammable and combustible liquids must be stored in approved flammable liquid storage cabinets or flammable liquid storage rooms. Flammables are to be stored in a one-hour rated storage cabinet or one-hour rated storage room.	NYSUFPBC Sec. 1171.3 (b) (4) Sec. 1171.3 (b) (5) NFPA 45: 7-2.1.2 (91)		
19. Class I flammable liquids may be stored in glass containers of not more than one gallon capacity, only if required liquid purity would be affected by storage in a metal container, or if the liquid would cause excessive corrosion of the metal container. Otherwise, Class IA liquids are restricted to glass containers not exceeding one pint capacity, and Class IB liquids are restricted to glass containers not exceeding one quart capacity. Class IC liquids may be stored in containers up to one gallon capacity.	NFPA 45: 7-2.3.2 (91)		
20. No container for Class I or II liquids in a lab shall exceed a capacity of one gallon, except that safety cans may be of two gallon capacity.	NFPA 45: 7-2.3.2 (91)		

Note: Many fires are small at their beginning and may be extinguished by a portable extinguisher. However, the fire department shall be notified as soon as a fire is discovered. **SOUNDING THE ALARM MUST NOT BE DELAYED WHILE A PORTABLE EXTINGUISHER IS USED.**

Appendix

GLOSSARY OF ABBREVIATIONS USED AS RESOURCES

Abbreviation	Definition
ACS-SACL (85)	Safety in Academic Chemistry Laboratories. Fourth Edition, American Chemical Society, 1985
ACS-SACL (90)	Safety in Academic Chemistry Laboratories. Fourth Edition, American Chemical Society, 1990
CSSS-SSL:GHS (84)	School Science Laboratories: A Guide to Some Hazardous Substances, Council of State Science Supervisors. U.S. Consumer Product Safety Commission, 1984
29 CFR	Title 29, Code of Federal Regulations
NFPA 10 (98)	Portable Fire Extinguishers. National Fire Protection Association, 1998
NFPA 45 (96)	Fire Protection for Laboratories Using Chemicals. National Fire Protection Association, 1996
NRC-PPHHCL (81)	Prudent Practices for Handling Hazardous Chemicals in Laboratories. National Research Council, National Academy Press, 1981
NRC-PPHHCL (91)	Prudent Practices for Handling Hazardous Chemicals in Laboratories. National Research Council, National Academy Press, 1991
NSTA-SSC (81)	Safe Storage of Chemicals: A Check List for Teachers, The Science Teacher. February, 1981, National Science Teachers Association
NYCRR	Codes, Rules and Regulations of New York
NYSMPS	Manual of Planning Standards. New York State Education Department, 1998
NYSUFPBC	New York State Uniform Fire Prevention and Building Code
Ed. Law '305(19)	New York State Education Law '305(19), Chapter 627 of the Laws of 1989

COMMON QUESTIONS

A) APPLICATION OF EDUCATION LAW §305(19)

1) **Question: What is a chemical?**
   Answer: All substances (solids, liquids, and gases) purchased from supply companies and retail stores and used in science instruction, as well as chemicals used in cleaning, are considered to be chemicals according to this act. Animals and plants are not considered to be chemicals.
2) **Question: What chemicals in a biology or physics laboratory fall within the requirement of this law?**
   Answer: All chemicals as defined by the act.
3) **Question: Does the law apply to food grade chemicals that can be obtained in a grocery store?**
   Answer: Yes, all chemicals are hazardous when handled improperly. Even the ingestion of salt, if taken in large enough amounts, can endanger a student's life. In addition the accidental mixing of various chemicals can produce poisonous chlorine gas. The possibilities for unsupervised exploration, which could result in injury to a student, are greatly reduced when chemicals are locked in specific storage areas.
4) **Question: Does the law apply to chemicals in elementary science kits that are leased by a school district?**
   Answer: Yes.
5) **Question: Does the law apply to preserved biological specimens?**
   Answer: Yes, if the specimen contains chemicals that are considered toxic, flammable, or irritating, or if the chemicals pose physical and/or health hazards. Since most preserved specimens have more than 3% formaldehyde, all containers that hold such specimens shall be labeled "possible carcinogen."

6) **Question: Does the law apply to science equipment such as microscopes and oscilloscopes or supplies such as glassware and toothpicks?**
   Answer: No.
7) **Question: Does the law apply to rock and minerals?**
   Answer: In most cases the law does not apply, unless a specific substance is known to pose a physical and/or health hazard (e.g., asbestos and heavy metals).

B) PLACEMENT AND SPACING OF CHEMICALS

I) Shelves And Cabinets

1) **Question: What is the recommended way to store chemicals in cabinets and shelves?**
   Answer: Containers of chemicals should be stored no more than two deep on a shelf. When storing the small bottles that come in science kits, it may not be practical to store them this way, especially if your shelves are deep. When it is not practical to follow the above recommendation, the containers of chemicals should be placed according to size. Place large containers toward the back of the shelf and smaller containers in front.

Adequate space should be allowed between the containers so that a container can be easily grasped without dislodging the container on each side. A space of at least one-inch should exist between containers.

2) **Question: Do I have to replace metal shelves with wood shelves?**
Answer: No, but it is safer if you have placed rubber matting under your stored chemicals.

3) **Question: What are some ways that storage cabinets and shelves can be secured to prevent them from tipping or collapsing?**
Answer: Cabinets and freestanding shelf units can be bolted to the wall at the top and bottom or bolted to metal strapping which is then bolted to the wall. Shelving or cabinets must be secured into cinder block walls with special plugs or toggle bolts, or secured directly into the studs of stud walls. Ask your school custodian or local hardware dealer for information about these fasteners.

4) **Question: Do I have to use special corrosion-proof cabinets and shelving, or can I still use my preexisting units?**
Answer: You may purchase several corrosion-proof cabinets to store acids. These cabinets must be vented.

However, preexisting storage for corrosive chemicals can be used if modified in a certain way, that is, if you use corrosion-proof polypropylene shelf lining and storage trays, which you can obtain from your supply company. These cabinets must be vented. If your preexisting storage is constructed of metal cabinets and metal shelf brackets, etc., these items must be replaced since they corrode easily and may weaken and collapse as a result.

5) **Question: What precautions should be taken to prevent containers of chemicals from being accidentally dislodged from storage shelves?**
Answer: Shelves should be equipped with raised edges or rim guards. The recommended height for such guards is 1/2 inch for all open shelving. A shelf lip is not necessary for locked cabinets. In areas where heavy traffic exists or where there is a possibility of earthquakes or tremors, retaining shock cords should be used.

6) **Question: How high off the floor can the shelves be where I store large containers of chemicals?**
Answer: NSTA recommends that large containers not be located more than two feet off the floor.

7) **Question: How can corrosive chemicals be stored so that spills and leaks are prevented from spreading or making contact with other chemicals?**
Answer: These chemicals should be stored in polypropylene storage trays which have at least 1/2-inch or 3/4-inch sides.

II) Hazard Prevention

8) **Question: How do I store hazardous materials?**
Answer: Safe storage facilities must be provided for materials having unique hazardous properties, such as temperature sensitivity, water reactivity, or explosive potential

9) **Question: How should acids be stored?**
Concentrated acids in quantities of one pint or more are to be stored in special acid cabinets that are vented. Nitric acid is to be stored in a special cabinet.

10) **Question: How do I store flammable liquids?**
Answer: For classroom use, flammable liquids shall be in containers no larger than one gallon.

The allowed quantity of flammable liquid in an individual container depends on:
a. The flammability of the liquid
b. The material and construction of the container (see NFPA 45 for details).
The total quantity of flammable liquids that may be stored in laboratories or chemical storerooms (either inside or outside approved cabinets for the storage of flammables) depends on the flammable/combustible classification of the liquid (see NFPA 45 for quantities).

11) **Question: What procedures should be followed for the continued storage of hazardous chemicals?**
Answer: Containers of materials that may become hazardous upon prolonged storage shall be dated when first opened. At the end of six months, the material shall be evaluated or tested for continued safe use. Material found to be safe or material that can be treated to make it safe may be re-dated and retained for an additional six-month period. All other material shall be safely discarded.

12) **Question: Why is it hazardous to store chemicals where other equipment and supplies are located?**
Answer: There is a greater danger of fire that will produce life-threatening fumes. Many chemicals produce fumes that can attack other items stored in that area, such as connections for AV equipment or electrical wiring.

13) **Question: Why must chemicals be stored away from sunlight? Does that mean I can no longer store chemicals in cabinets that have glass door fronts?**
Answer: A number of chemicals decompose when exposed to ultraviolet rays. Check the Material Safety Data Sheet (MSDS), which should accompany any chemical you purchased, for this information. Direct exposure can also warm the containers of chemicals to dangerous levels, resulting in spontaneous combustion of some chemicals. For safety, store chemicals in the dark.

For cabinets that have glass fronts, place covering material on the inside or outside of the glass in order to shut out the light.

14) Question: What is the ideal temperature at which to store chemicals?
Answer: Ideally, chemicals should be stored in areas where the temperature range is between 55°F (18°C) and 80°F (27°C).

15) Question: How can I protect chemicals from dampness and humidity, especially during summer months?
Answer: Some chemicals are hygroscopic and absorb moisture immediately on exposure to air. For this type of chemical, place the container in a plastic bag and seal the bag with a twist tie before putting it on the shelf. The seal-type plastic bags designed specifically for this purpose can be obtained from your supply companies.

16) Question: How can I obtain a copy of the NFPA codes referred to in these guidelines?
Answer: A copy of the NFPA Series of Codes should be located in the building or engineering department of the town in which your school is situated. If you cannot access the codes in this way, you can order copies at cost directly from NFPA by calling 1-800-344-3555.

17) Question: What is the difference between a flammable and combustible liquid?
Answer: The NFPA identifies flammable liquids as those that have a flash point below 100°F (37.8°C) and have a vapor pressure of 40 psia (2.068 mm Hg) at 100°F (Class I liquids). Combustible liquids have a flash point of 100°F or above. Flash point information can be found on your MSDS sheets for all liquids.

III) Incompatibles

18) Question: How can incompatible chemicals stored in the same room be segregated from each other?
Answer: Some scientific supply companies can provide a system by which you can isolate your incompatible chemicals. Special corrosion-proof and flame-resistant cabinets may be needed. Special unbreakable storage cans containing an absorbent can also be purchased. The container of chemical is placed in the can, surrounded with the absorbent, and the can is then closed. This method isolates the chemical from others on the shelf. Dividers or plastic trays can also be used to separate chemicals. Use only products that can resist chemical damage.

19) Question: What is the color code for incompatible chemicals?
Answer: Chemicals are stored according to a color scheme, and those chemicals stored on shelves and/or cabinets are stored according to their chemical compatibility (see your chemical catalog).

20) Question: Why is it not advisable to store chemicals such as flammable liquids and compressed gases in basement storage rooms?
Answer: In case of fire, these storage areas are not easily accessible to firefighters and therefore pose a greater safety hazard for persons in the building.

21) Question: I thought acids neutralize bases, so why must they be separated in the storage area?

Answer: Acids and bases, especially concentrated ones, can react violently with each other. This reaction can generate intense heat and cause a great deal of spattering.

22) Question: Why must some acids be stored separately from one another?

Answer: It is important to isolate some acids from each other. Oxidizing acids such as nitric acid can react violently with some organic acids such as acetic acid.

23) Question: What are some of the active metals and other chemicals that should be segregated from acids?

Answer: Active metals such as sodium, potassium (these metals should NOT be found in schools any longer) and magnesium react violently with acids. Other chemicals such as sodium cyanide, iron sulfide, and calcium carbide react with acids to produce toxic or flammable gases.

24) Question: What are toxic chemicals, and what is the best way to store them?

Answer: Toxic chemicals include those which are highly poisonous, carcinogenic, or mutagenic. These chemicals are best stored in a specifically designated cabinet, away from other chemicals. Remember to take compatibility into account when placing these chemicals in storage. If it is not feasible to store toxic chemicals in a designated cabinet, segregate them by placing each container in a clearly labeled, unbreakable secondary container.

25) Question: What are some of the most common peroxide-forming chemicals found in schools?

Answer: Isopropyl ether, ethyl ether, p-dioxane, and potassium metal are the most common sources of peroxides found in schools. Potassium metal that is stored over a long period of time forms a crust that may contain peroxides, which can explode when small pieces of the metal are used for demonstration.

26) Question: Why must compressed gas cylinders be stored away from corrosive chemicals?

Answer: Corrosive chemicals like nitric acid can react with the metal cylinders and cylinder caps. This reaction can lead to a gas leak or possible explosion of the cylinder, due to weakening of the cylinder wall.

27) Question: Why must empty gas cylinders be stored separately from full gas cylinders?

Answer: Empty gas cylinders should be stored separately from full gas cylinders to prevent confusion; an accidental explosion could occur if a full cylinder were discarded by mistake.

C) SECURITY AND ARRANGEMENT

I) Secure Chemical Storage

1) Question: When are stored chemicals secured?

Answer: When they are in locked cabinets and/or locked storage areas.

2) **Question: Can chemicals be stored on open shelves in the classroom?**
Answer: No.

3) **Question: When must chemicals be stored securely?**
Answer: When chemicals are not being used, they must be stored and locked up.

4) **Question: How secure must stored chemicals be in our science facility?**
Answer: The answer depends on the facilities that the teacher has access to:
   a. *Situation I*: If you do not have storage cabinets with locks in your classroom, all chemicals must be stored in a locked storage room.
   b. *Situation II*: If you do not have a storage room in your facility, you must store your chemicals in locked cabinets. If your cabinets have glass doors, place posters on the glass so that the chemicals are out of sight. The chemicals stored in the classroom shall be locked at ALL times.
   c. Situation III: If you have a science storage room, the door to the storeroom must be locked at all times. Though it is not necessary that chemicals be in locked cabinets in a chemical storage room, it is advisable.

5) **Question: Is a student project room considered a science facility?**
Answer: Yes. If chemicals are used by students in the project room or any other room, such rooms shall comply with the guidelines. The chemicals shall be stored in cabinets that are locked.

6) **Question: We only have a few other chemicals in our elementary school classroom beside those which are received in kits. Must we build or purchase expensive storage rooms or cabinets?**
Answer: Select a place where chemicals, kits with chemicals, and household chemicals can be stored in a locked area. The chemicals and/or kits should be stored in cabinets or on shelves. Segregate the chemicals into compatible groups.

7) **Question: There are only a few bottles of concentrated acids in our elementary school classroom. Must we purchase a separate cabinet for each of these?**
Answer: If you have a well-ventilated closet or room that can be locked, you can store small quantities of these chemicals. You can isolate acids from other chemicals by storing them in polyfoam containers designed specifically for acid storage (some acids are shipped in these containers). By also placing these containers in acid-resistant trays, you can provide additional protection against spills and corrosion of shelf surfaces.

8) Question: Most of the chemicals, which come in elementary science kits such as vinegar or baking soda, are not hazardous. Why must they be kept in special storage and locked?

Answer: All chemicals are hazardous when handled improperly. Even the ingestion of salt, if taken in large enough amounts, can endanger a young child's life. In addition, the accidental mixing of various chemicals can produce poisonous chlorine gas. The possibilities for unsupervised exploration, which could result in injury to a child, are greatly reduced when chemicals are locked in specific storage areas.

II) Ratings, Numbers, And Codes

9. Question: What is the chemical abstract service (CAS) registry number, and who assigns this number to a chemical?

Answer: The CAS number is a number assigned by the American Chemical Society to each unique chemical element and compound. The CAS number ensures that the identity of a chemical can be determined, despite the fact that it may have several different common names.

10. Question: Where does one find the CAS number?

Answer: When you receive a new chemical you have ordered, you will find the CAS number on its MSDS sheet.

11. Question: Should I include the vendor used to determine our hazard color code, storage compatibility, and CAS numbers in the inventory?

Answer: Yes, to insure that all staff use this information consistently.

12. Question: Do the numeric ratings used by various suppliers all agree?

Answer: No. While they will usually be close, there may not be exact agreement. The variance is most often a matter of plus or minus one number. You must use one rating system and use it consistently for all your chemicals.

13) Question: What is the hazard warning code?

Answer: This code will indicate the physical or health hazard of the chemical and facilitate subsequent storage or disposal. The Material Safety Data Sheet (MSDS), chemical supply catalogs, and professional reference books provide information and/or color codes which may be assigned so long as the chosen code is used consistently and understood by everyone working in the laboratory.

14) Question: What colors are commonly associated with hazards in hazard warning codes?

Answer: Different vendors vary in the color they recommend. However, blue is often used to represent a health hazard, red a flammable hazard, yellow a reactivity hazard, and white a contact hazard. Some companies, such as J. T. Baker, use both solid and striped colors to designate hazards and give storage recommendations. Baker's system is described in "School Science Laboratories: A Guide to Some Hazardous Substances."

15) Question: Is the hazard warning code the same as the compatible storage code?
Answer: No. Chemicals sorted by physical and health hazards should be further sorted into organic and inorganic classes and grouped into compatible families. Vendors provide compatible storage codes. A popular scheme has been developed by Flinn Scientific, Inc., and is described in "School Science Laboratories: A Guide to Some Hazardous Substances."

16) Question: What is meant by a compatible storage code?
Answer: Compatible storage codes are typically based upon numerical or color designations. Chemical supply companies recommend various compatible storage codes. It is essential that the code selected be applied consistently in the storage of chemicals.

17) Question: May I use the NFPA hazard coding system in describing chemical hazards?
Answer: No. These numbers relate to health hazards under fire conditions and do not relate to other conditions.

18) Question: What is the meaning of the Health Hazard Rating assigned to compressed and liquefied gases?
Answer: The NFPA has assigned numerical grades to designate the severity of the health hazards posed by chemicals. The numbers range from 4 to 0 denoting the most severe hazard (4) to no hazard (0). The complete NFPA Hazard Identification System can be found in NFPA 704. Gas cylinders are usually labeled with this information. Or, see your MSDS sheet, which you received from your supplier.

19) Question: When a flammable liquid is classified IA, what does it mean? (Flammability/Number Code [NFPA 704 System]).
Answer: It means the material is the most dangerous material in this category, due to its high volatility.

20) Question: When a flammable liquid is classified IB and/or IC, what does it mean?
Answer: It means the material may ignite under normal temperature conditions.

21) Question: When a flammable liquid is classified 0, what does it mean?
Answer: It means the material will not burn.

22) Question: When a flammable liquid is classified II B, what does it mean?
Answer: It means the material must be preheated before ignition will occur.

23) Question: When a flammable liquid is classified II and/or II A, what does it mean?
Answer: It means the material must be moderately heated before ignition will occur.

24) Question: What are some examples of OSHA definitions for flammable and combustible liquids?
Answer:

Examples Of OSHA Definitions For Flammable And Combustible Liquids

Class	Criteria	Fire Hazard Rating	Examples	Class
IA	Boiling point - 100°F (flash point below 73°F	below 4	ether, n-pentane	IA
IB	Boiling point at or above 100°F	3	acetone, benzene, methyl alcohol	IB
IC	Boiling point not considered (flash point between 73 and 100°F	3	n-butyl alcohol, xylene	IC
II	Flash point between 100 and 140°F	2	acetic acid, n-pentanol	II

25) Question: What is the OSHA maximum allowance container for storage of flammable and combustible liquids?

Answer:

OSHA Requirements For Storage Of Flammable And Combustible Liquids				
Class	**Fire Hazard Rating**	**Glass**	**Metal**	**Safety Can**
IA	4	1 pint	1 gallon	2 gallon
IB	3	2 pint	5 gallon	5 gallon
IC	3	1 gallon	5 gallon	5 gallon
II, IIA	2	1 gallon	5 gallon	5 gallon

26) Question: What is the glossary of Codes?

Answer:

Code Glossary	
Code	**Definition**
ANSI	American National Standard Institute
CFR	Code of Federal Regulation
NFPA	National Fire Protection Association
UBC	Uniform Building Code
UFC	Uniform Fire Code

III) Inventory

27) Question: How can one determine the shelf life of a chemical?

Answer: Each designation indicates the anticipated shelf life expectancy of a laboratory chemical in a school setting. You should be cognizant of the shelf life of all of your chemicals. The shelf life of a chemical is indicated in some chemical catalogs. The following are some shelf life designations:

Determination Of The Shelf Life Of A Chemical	
Designation	**Shelf Life**
Very Good	Fair

Determination Of The Shelf Life Of A Chemical	
Designation	**Shelf Life**
Good	Fair if kept moisture free
Good when stored properly	Fair if stored properly
Good if kept tightly closed	Fair if kept dry
Good if kept sealed	Poor, decomposes gradually with time (abide by label's expiration date)
Good if kept dry	

28) Question: How should I keep the record of a chemical's quantity in the inventory?
Answer: When you receive a chemical bottle, record its mass or volume and mark the bottle at the full level. This will make it easier for you to estimate the quantity remaining when you do your annual inventory.

29) How often does one indicate the quantity remaining on the inventory?
Answer: You should indicate the quantity remaining each year when you prepare the inventory. Make sure the date of the inventory is recorded.

30) Question: How should one indicate the chemical's location?
Answer: The location should designate both the room location and the cabinet location.

31) Question: How are several bottles or containers holding the same chemical to be handled in the inventory?
Answer: The information pertaining to EACH bottle or container is to be recorded on the inventory.

32) Question: What date of receival do I use in the inventory for chemicals that I have in stock?
Answer: If you have recorded a date for chemicals already in stock, that date should be entered into the inventory. All chemicals received after December 31, 1991, must have their dates of receival recorded in the inventory. Chemicals in stock prior to December 31, 1991, for which the dates of receival are unknown, are to be designated "pre-1992."

33) Question: Can my inventory be only on a computer disk?
Answer: No. There must be a hard copy of the inventory that is in a secure location, where it is available for inspection by the Commissioner of Education. An additional hard copy of the inventory should be placed in a second secure location (principal or superintendent's office).

IV) Chemical Disposal

34) Question: I have been told that I can dispose of chemical waste down the drains. Is this accurate information?
Answer: Municipalities have strict rules governing the nature of the chemicals which can be disposed of down a drain. For example, some rules forbid the disposal of alcohol down the drain or specify the pH of the solution which can be disposed

of in this manner. Many wastes should never be flushed down the drain. For each chemical you use or produce, you must identify its proper method of disposal. You can purchase plastic coated-containers for storing chemical wastes until you can properly dispose of them. All containers must be labeled with the type of waste present. Remember not to put incompatible chemicals in the same waste container.

35) **Question: Where do I find the method or methods of disposal?**
Answer: Various chemical companies have developed number or letter systems to designate the methods of disposal. New chemicals that you buy may have the method of disposal on the label, and the method must be on the MSDS sheet. The New York State Right to Know Law requires that you have MSDS sheets for all chemicals. This is one way to establish your code for the method of disposal.

36) **Question: How do I designate the scheduled date of disposal?**
Answer: Some compounds must be disposed of after specific periods of time determined by the chemical's shelf lives. For those chemicals with longer shelf lives, it is still wise to order smaller quantities that can be used up within one or two semesters.

D) VENTILATION

1) **Question: When is an auxiliary ventilation system required in a room where chemicals are stored?**
Answer: Such a system is required when its presence is needed to meet the guideline of having the air changed six times per hour during a 24-hour period.

2) **Question: What measurements can be taken to determine the volume of the air change in a room?**
Answer: Using a velometer to measure the linear airflow into or out of a room, one can determine the volume of air exhausted from that room each hour.

3) **Question: What can be done if I do not have the knowledge to determine the airflow in a room?**
Answer: Ask the local BOCES HVAC (heating, ventilation, and air conditioning) class or a local HVAC company to conduct an air flow study. The air measured must not be re-circulated air.

4) **Question: What specifications are required for the ventilation system in case of fire?**
Answer: In the event of fire, the ventilation system shall automatically shut down. There shall also be a switch located outside the storage area that allows for the manual shutdown of the ventilation system.

E) FIRE

I) Fire Safety

1) **Question: What is a laboratory unit?**
Answer: A laboratory unit is any enclosed space used for experiments or tests. It may include one or more separate work areas.

2) **Question: How are laboratory units classified?**
Answer: Laboratory units are classified as Class A, B, or C. Classification is based on the type of construction and the amounts of flammable and/or combustible material present in the rooms. Class A is the highest level of hazard, and Class C is the lowest level. Class A laboratories may not be used for instruction.

3) **Question: In the classroom where students' activities and demonstrations take place, where should the fire extinguisher be located?**
Answer: A portable fire extinguisher must be conspicuously located where it is readily and immediately available in the event of a fire.

4) **Question: In the classroom where student activities and demonstrations take place, where should the fire blanket be located?**
Answer: A portable fire blanket must be conspicuously located where it is readily and immediately available in the event of a fire.

5) **Question: How frequently should the fire equipment be inspected?**
Answer: Annually.

6) **Question: How frequently should the school district train employees on fire safety?**
Answer: Each year the school district shall have a workshop for its employees on safety. If possible, this workshop should be given in conjunction with the district's chemical safety workshop.

7) **Where should the written fire emergency procedures be kept, and how often should they be reviewed?**
Answer: The fire emergency written procedures shall be part of the employee's handbook. The procedures shall be reviewed yearly.

8) **Question: What type rooms must have an approved fire blanket?**
Answer: Type II and Type III rooms.

9) **Question: Should explosive hazards be stored in schools?**
Answer: No.

10) **Question: Should materials that are reactive be stored in refrigerators in storage rooms?**
Answer: No.

II) Fire Extinguishers

11) **Question: What do the ratings A, B, C, D and the numbers mean when applied to portable fire extinguishers?**
Answer: The letters A, B, C, D refer to the type of fire that an extinguisher is effective in putting out. The meanings are as follows:

Ratings for Fire Extinguishers

Rating	Fire Extinguisher Uses
Class A	Use on fires in ordinary combustible materials such as wood, paper, cloth, plastic, rubber, cardboard (Class A fire extinguishers use water as the fire fighting agent.)
Class B	Use on fires fueled by flammable or combustible liquids or gases such as alcohol and acetone (Class B fire extinguishers use carbon dioxide.)
Class C	Use on fires in electrical wiring such as motors, panel boxes, and hot plates (Class C fire extinguishers use carbon dioxide.)
Class D	Use on fires fueled by combustible metals such as magnesium, lithium, and sodium

12) Question: What do the numbers on fire extinguishers mean?
Answer: The numbers on a fire extinguisher refer to the volume of fire that a particular extinguisher will be effective against. The larger the number, the greater a volume of fire that can be effectively extinguished. An extinguisher with a rating of 10 will extinguish 5 times more fire than one with a 2 rating.

13) Question: Can one use a Class B or Class C fire extinguisher on a Class A fire?
Answer: No. Carbon dioxide fire extinguishers are not effective on Class A fires and usually spread the fire rather than extinguishing it.

14) Question: What is a 2A fire extinguisher?
Answer: A 50-gallon pressurized water extinguisher.

15) Question: What is a 20B fire extinguisher?
Answer: Two 20-pound carbon dioxide extinguishers.

16) Question: What is a 2A, 20BC fire extinguisher?
Answer: One 20-pound dry chemical extinguisher.

17) Question: What is a multi-use unit fire extinguisher?
Answer: A fire extinguisher that uses dry chemicals such as sodium bicarbonate.

18) Question: What is the minimum rating for a fire extinguisher?
Answer: The chemicals stored in each area should determine ratings. Local fire departments using NFPA 10 or MSDS sheets may be used in determining the rating for each classroom storage type, e.g., for Class A hazards a minimum of a 2A extinguisher is recommended. Other hazards requiring B-C agents will require protection relevant to the type and quantity of the given substance. One consideration may be a minimum of 10 BC for the elementary classroom (Type I), 30 BC or greater for Type II or III classrooms.

19) Question: Must a district have a fire extinguisher in areas where flammable liquids are stored?
Answer: Yes.