

Appendix 5.2. Chemical Safety

SCIENCE SAFETY IN OUR SCHOOLS

Managing Your Chemical Inventory, Part 1

What is chemical management?

A chemical management plan identifies, manages, and prevents hazards through all stages of chemical purchasing, storage, use, and disposal.

Who is responsible for managing the chemical inventory?

There are many individuals involved in managing the chemical inventory; all have an important role.

- **Teachers** are responsible for storing, using, evaluating, disposing, and purchasing of chemicals.
- **School boards** establish as policy a chemical hygiene plan developed by the science teachers.
- **Superintendents** create a budget line item for safety and ensure science safety is a priority.
- **Business managers** establish procedures that allow for the purchase of chemicals throughout the year (no budget freezes).
- **Facilities managers** dispose of waste by a licensed waste hauler and provide a facility for the safe storage of the chemical inventory.
- **Principals** serve as safety advocates for the school, provide time for teachers to manage the chemical inventory, and say, “Science safety is a priority in our school.”

How do I assess the current condition of the chemical inventory?

Before you can manage your chemical inventory effectively, you need to assess the current status of your chemical inventory and your chemical bunker.

How should the chemicals be organized?

Before organizing your chemicals, your shelving needs to be inspected. Check that your shelving is solid, sturdy, and attached securely to the wall. Inspect shelving and shelving supports for corrosion, sagging, and cracking. Each shelf should have a front lip to prevent a chemical from sliding off the shelf.

All of your chemicals need to be placed in compatibility groups. A suggested arrangement for storing your chemicals is the NIOSH system, also known as the Flinn system. The system allows chemicals to be placed into safe compatibility groups. (Refer to www.flinnsci.com/Sections/Safety/safety.asp.)

Yes, you need an MSDS for each chemical in your inventory.

A Material Safety Data Sheet (MSDS) is the standard document available for every hazardous chemical manufactured or sold in the United States. It contains information in a specific format so science teachers, emergency personnel, and other users can find needed information. Every chemical in your inventory must have an MSDS.

When chemicals are ordered, an MSDS needs to accompany the order. The shipment must have an MSDS to be accepted. Everyday items such as baking soda, vinegar, and ammonia water—if part of your inventory—require an MSDS.

Some local regulations require that you provide your local fire department with copies of your MSDS and inventory.

A safety prescreening will identify imminent hazards such as sagging or damaged shelves, sources of ignition, obstructed aisles, inaccessible shelves, corroded or unstable containers, incompatible grouping of chemicals, availability of MSDS and an inventory, and the condition of the storage area.

Just a reminder that textbooks, laboratory manuals, and other instructional materials generally designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Teachers need to first consult the MSDS and other references before undertaking an unfamiliar or familiar activity.

How do I assess the current condition of the chemical inventory?

Conducting a chemical inventory will always produce many surprises:

- Chemicals you never thought you had
- Chemicals in damaged containers
- Chemicals in poorly labeled containers
- Chemicals in containers without labels
- Hazardous or unstable chemicals
- Chemicals that are toxic
- Chemicals in need of special handling
- Chemicals that are never used
- Chemicals that are seldom used
- Chemicals in excessive quantities
- Chemicals in large containers

If the prescreening determines that it will be unsafe to conduct a chemical inventory due to existing hazards, a trained professional should be contacted to remove any hazardous chemicals and correct any unsafe conditions.

Once it is established that it is safe to conduct the inventory, the process can begin. Your team should establish a plan for conducting the inventory.

How do I create an accurate chemical inventory?

After the inventory protocol and systems assessment have been reviewed, the inventory can begin. Your team will need to record the following information for each chemical; the list should be modified according to your needs.

- Name of the chemical
- Type of container
- Concentration and molarity
- Estimated quantity
- Location of container
- Whether the chemical will remain in the inventory
- Whether the chemical will be disposed

You should also develop a list of chemicals for disposal after recording the required information. Once the inventory is complete, the information should be entered into your inventory program. The chemicals can then be reviewed for health ratings, flammable ratings, toxicity, corrosiveness, and special hazards.

You will need to select an inventory system (a database or spreadsheet that contains a wealth of information on each one of your chemicals; inventory systems are available from your vendor). If you need a copy of a chemical inventory system, please send an e-mail to bwazlaw@sau16.org. The inventory contains a wealth of information. The format is an Excel spreadsheet.

For additional information, please feel free to contact:

Brian Wazlaw, Ed.D.
Laboratory Safety Officer
Exeter Region Cooperative School District
Exeter, NH 03833
Bwazlaw@sau16.org

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Managing Your Chemical Inventory, Part 2

The Three Rs of Chemical Management

Besides creating an accurate inventory of the chemicals that will remain in your inventory and identifying the chemicals in your inventory for disposal, you need to consider the three Rs of chemical management: reduce, reduce, reduce.

Maintaining small and limited quantities of chemicals will promote the prudent and effective management of your inventory.

How do I develop a plan to maintain small and limited quantities of chemicals?

Purchasing Chemicals

Your district needs to consider a purchasing plan. The plan needs to include two essential components. The first component is to only purchase chemicals in quantities that will be consumed during the current school year, with any remaining quantities (hopefully a minimal amount) to be consumed the following year.

The second component is the method to accomplish this: “Just-in-Time Purchasing.” Chemicals are purchased at various times during the year when needed and in quantities needed for the particular activities. This method limits the quantities in storage and prevents the school from having excessive quantities of chemicals. The following is a plan for chemical procurement:

Determining Chemicals Needed By Program

- From your program, review the list of student activities.
 - What activities will require the use of chemicals?
 - What chemicals will be required for the activities?
 - Is the chemical appropriate for students? (Assess the hazards.)

Determining the Quantities Needed

1. By discipline (chemistry, biology, physical science, technology) and grade level, review the quantity of the required chemicals that are currently in the inventory.
2. By discipline (chemistry, biology, physical science, technology) and grade level, determine the chemicals needed for the school year based on the quantities required and the quantities available in the current inventory.
3. Chemicals should be purchased using “Just-in-Time” procedures. At times, based on a particular need, some chemicals may be purchased quarterly.
4. Generally, attempt to restrict the quantity (solids) to a container of 500 g. If larger-quantity containers are requested, a reason should be provided.
5. Restrict the quantity of a solution to a 500 ml or 1 L container.

6. All concentrated acids should not exceed 1 L containers. All acids should be purchased “just in time” as needed throughout the year.
7. Concentrated ammonium hydroxide should not exceed a 500 ml container.
8. Flammables should be purchased “just in time” throughout the year.

Processing Requests

1. Chemicals on the Acceptable Chemical List are the only chemicals that can be purchased. (All districts should develop an Acceptable Chemical List.)
2. All chemicals need to be assessed for hazards (e.g., TLV, PEL, hazard level, toxicity, LD 50, LC 50, possible carcinogen).

Introducing New Laboratory Activities

Introducing new laboratory activities to your science curriculum needs to be a prudent and thoughtful process, particularly when chemicals will be used. Any chemicals that are not part of your Acceptable Chemical List need to be reviewed. This will hopefully prevent purchasing chemicals that are hazardous or seldom or never used.

A list of acceptable chemicals should be developed for use in the classroom. The decision to use a new chemical will be based on the best available knowledge of the hazards of the substance and the availability of proper handling facilities and equipment.

Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Teachers should consult additional references, including Material Safety Data Sheets (MSDS), before undertaking an unfamiliar activity.

The following questions should be considered:

- Is use of the chemical pedagogically sound?
- Is use of the substance an effective method to illustrate an important process, property, or concept?
- Are adequate safeguards in place to assure proper use of the substance?
- For how long will employees and students be exposed to the substance?
- Are the permissible exposure limit and threshold limit value of the substance acceptable?
- Have the chemical and physical hazards been reviewed?

How do I manage and control the chemical storage bunker?

For effective management and control of your chemical inventory, you need a plan for accessing and accounting for the chemicals in your chemical storage bunker. Your plan should address the following issues:

- A. Establishing who has access to the bunker: Deciding who will have access to the chemical bunker is always a dilemma. Knowledge of the chemicals, shelf patterns, compatibility groups, spill procedures, safety equipment, acid and base storage, flammable storage, location of MSDS, the return of reagents, and the recording of the usage and consumption of the chemicals should be considered prerequisites for “accessing chemicals” in the bunker.
- Lack of knowledge and procedures will result in the inability to locate chemicals, account for chemicals, and determine the consumption and rate of use of the chemicals.
- B. Maintaining a safe, clean, and organized bunker: The bunker needs to be monitored weekly. For example, can I account for the chemicals? Has the consumption of the chemicals been recorded? Are chemicals returned to the shelves? Are the chemicals located in the correct compatibility groups? Are the aisles clear? Are copies of the MSDS and the chemical inventory sheets available? Did I inspect the spill kit and eyewash/deluge shower?
- C. Preventing chemicals from being removed from the bunker to the classroom: You need to avoid the “Chemical Quiz Game”—Where is the chemical? Who has the chemical? What quantity remains? Reagent containers should remain in the bunker and never in the classroom. Student bottles and demo bottles should be prepared in the bunker prep room or another designated area. Upon completing the preparation of the student and demo bottles, the reagent containers need to be returned to the chemical storage bunker. Student bottles and demo bottles need to be returned to the chemical storage bunker after the laboratory activity is completed.

How Do I Track the Chemicals?

The first objective is to control the reagent containers; as stated above, they are to remain in the bunker, *not* in the classroom. The second objective is to determine the consumption of the chemical. This can be accomplished by recording the quantities consumed on a clipboard in the bunker or on a spreadsheet. As the need for additional quantities of chemicals is determined by the activities, ordering chemicals should follow “Just-in-Time” purchasing procedures.

For additional information, please feel free to contact:

Brian Wazlaw, Ed.D.
Laboratory Safety Officer
Exeter Region Cooperative School District
Linden St.
Exeter, NH 03833
bwazlaw@sau16.org