SUGGESTIONS FOR TAKING A CHEMICAL INVENTORY IN THE SCHOOL SCIENCE DEPARTMENT

- **Have spill/breakage aids available**
- **Make sure the room is well lighted**
- **Plan before you start**
- **Alert school administrators about the inventory**
- **Use safe ladders**
- **Wear appropriate clothing**
- **Avoid involving students**
- **Work slowly**

We are sure that responsible science teachers and school administrators agree that it is necessary to know exactly what chemical substances are present on school premises and in what quantities. Such an inventory would serve many valuable purposes such as (but not limited to):

- To comply with regulatory requirements
- To make the school safer
- To efficiently use (and perhaps share) the existing inventory
- To rid the premises of excess/unused chemical substances
- To implement the storage of all remaining substances in compatible chemical families
- To isolate and safely store particularly hazardous substances
- To create and maintain a perpetual inventory of all chemical substances
- To identify substances (severe toxins, carcinogens, etc.) that should not be found on school premises and rid the premises of these materials
- To identify substances as a function of their specific hazardous character (flammables, acids, oxidizers, etc.) and provide dedicated and approved storage for them.

In our opinion, just plain old-fashioned "good sense" suggests that it is time for action! Action demands that you know what you have and how much of it you have. Once this inventory is accomplished a great many benefits will follow.

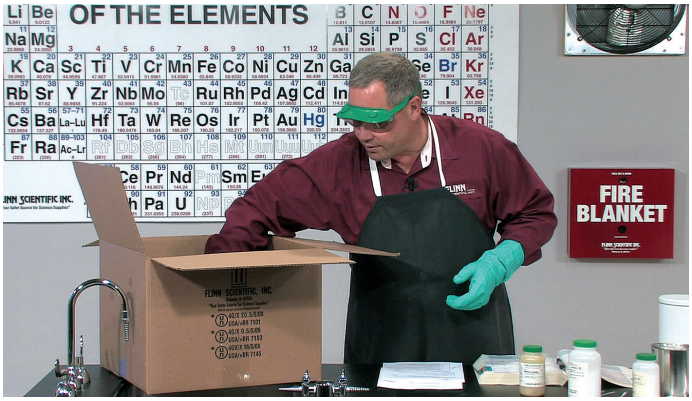
It is very important to point out that laboratory chemicals should ***no longer be purchased like other routine school supplies!*** The normal routine of most schools is to acquire a year's supply of needed chemicals at one time, along with other routine science supply needs. The result of this process is that dozens of chemical items, many in very large quantities, arrive at the school and are then stored in science storerooms never designed to handle such quantities and rarely equipped to meet even minimum standards of safe storage. We are sure your conventional wisdom says that the smaller the quantities of these materials found in schools at any given time, the smaller the problem.

We cannot emphasize strongly enough the need for science teachers, science department heads and, most particularly, school administrators and business managers to recognize the problems created by lumping hazardous chemicals into the buying routine. To continue to apply the same buying routine to hazards simply aggravates and perpetuates the problem. Those in the school with science backgrounds must educate the non-science-trained administrators about the severe problems created by continuing to buy hazardous chemicals in the same manner as they buy routine school supplies.

It can also accurately be stated that when a large school with many science teachers has no one in charge of managing the chemical storeroom, the problem is made more severe. When every science teacher or multiple science teachers are in charge of this matter—then, in fact, no one is in charge.

School districts with multiple school buildings should also give very serious consideration to establishing a central "chemical ordering committee." This committee could routinely see every chemical requisition. Their review would be aimed at completely eliminating or reducing the quantity of some substances purchased. No, we are not suggesting that science teachers be denied access to needed reagents. We are, however, suggesting that the matter be well managed. Who better to manage the problem than the knowledgeable users; i.e., the science teachers meeting as a committee.

It is common to find, among multiple school buildings, an excess of a chemical in Building A while the science teacher in Building B just placed an order for the very same chemical. Why can't inventories be shared with the goal of better systemwide chemical management? If the impediment to better, safer and more efficient substance management is the "established system" or the "established bureaucracy" then



the "system" or the "bureaucracy" must be educated and its methods changed. An efficient method of chemical management in a science department or in a multiple building school is to provide inventory level information to all users and allow all users access to excess inventories. One building or department should not be allowed to rob another's inventory. However, excesses should be identified and shared. The science teacher who is a good substance or inventory manager should not be penalized to serve the poor manager in another department or building. Conventional wisdom suggests that excess substances can be better managed by sharing knowledge of their existence. For more efficient management of chemical supplies, a good inventory and communication is critical.

CHEMICAL INVENTORY continued on next page.

Chemical Inventory, continued

You have now decided it is time to take an inventory. Plan for the event using the Inventory Planning Checklist below. A very effective means of taking and temporarily recording your inventory is by using your phone or tablet as a recording device.

It is an absolute that you ***never undertake an inventory alone***. You must always have a teammate. The teammate is there to help you, to hold a ladder, to go for help or just to be there but, in any case, you should never work alone. We urge against recruiting students. It is also an absolute that the right kind and type of fire extinguishers be in the room with you and immediately available for use.

Another absolute is that you are appropriately dressed and spill materials are present. In general, we assume you have done all the preplanning and all the plans have been implemented.

Record on paper or computer, the chemical name, bottle size, bottle type and approximate amount of chemical present. For example, a typical description might read, "one 5-lb bottle, glass, of acacia, about one-half full." You may opt to use Flinn Online Chemventory™, which is a cloud-based laboratory chemical inventory system that allows multiple users access to a single chemical inventory database from multiple locations and devices. The program comes fully-loaded with GHS pictograms, hazard codes, and signal word information for over 2,400 Flinn chemicals. You can build your inventory by selecting from a list of Flinn chemicals or add your own chemical information manually. You can build an inventory database for your school and invite other teachers, lab assistants, and administrators to join for free. The program also includes a label printing feature to print GHS-compliant labels for any of the 2,400+ Flinn chemicals listed in the program. You can also take advantage of the chemical solution label printing options to easily keep track of all the solutions you prepare in your lab.

CHEMICAL INVENTORY continued on next page.

Inventory Planning Checklist

- Who will be the team members to perform the inventory?
- How much time shall you allow to perform this task?
- As materials are taken from the shelf (if you elect to do this at this time) where and how will they then be housed?
- Do you have the requisite safety items to protect yourselves during the process?
- Will this be simply an inventory of what substances you have or will it be a major reorganization of the chemical stores facility?
- Are flashlights, ladders and other such devices available?
- Will the room be properly ventilated during the process?
- Will a means of communicating with the outside be available in case of a serious problem like spill, breakage or fire.
- How will you record the chemicals on a substance-by-substance basis?
- How will you handle unknowns or "mystery" substances as these are encountered?
- Will spill materials, such as sand, neutralizers, etc., be available and, if yes, which have you chosen?
- Will alternate containers (empty bottles, cans, bags, etc.) be available when a broken container is encountered?
- Is there a plastic broom, plastic dust pan and plastic receptacle available for cleanup?
- Have you made arrangements for the removal of unwanted substances or, if you want to isolate these materials, have you planned for temporary and safe storage methods while you examine your disposal options?
- Will a fume hood be available to very temporarily store a substance which, upon discovery, needs your immediate attention?
- Have you undertaken and completed as much storeroom housekeeping as possible prior to the inventory so you are not faced with obstacles that would lead to an accident?
- Have school authorities and maintenance people been alerted to this inventory undertaking?
- If you elect to do some disposal during the inventory process (we urge against this) are the reacting chemicals available?
- Have you arranged for the process to be free of interruptions that might distract you at a critical moment?
- Will the team members performing the inventory be wearing appropriate clothing?
- Will all sources of ignition be eliminated?
- Is it your plan to add some form of label or other kind of identification to each chemical container and, if so, have you decided how this is to be done and are the means to do it available?
- Will you have a supply of replacement caps available for containers with bad closures? If you expect to transfer some substances to alternate containers—are such available?
- What will be done with the many bottles of solutions that have been prepared and stored for lab use over the past years? Will you include these in your inventory? How?
- If you expect to rearrange your chemical shelves during the process are shelf labels available?
- Do you expect to identify substances by their hazardous character during the process? If yes, will you then house them (like flammables, acids, etc.) in dedicated and approved cabinets? Are the cabinets now available? Is there sufficient space in the existing cabinets?
- Will the method you select to record this inventory allow you, if you elect to do so, to perpetually maintain the inventory?
- Will you have tape or an adhesive of some kind available to affix loose labels? Will you have blank labels available to place on currently unlabeled materials which you can identify with accuracy?

Chemical Inventory, continued

To the extent you can, you should avoid actually touching or moving bottles to take this inventory. If your shelves are loaded you may have to remove some bottles in order to see the bottles at the rear of the shelf or cabinet. Try to avoid as much moving or transfer as possible.

It is unlikely that you will want to reorganize your shelves at this time since your primary goal is to determine what you have and how much of it you have. Once the inventory is complete and has been converted to hard copy then you can begin to think about the reorganization process. At this point focus on just discovering and recording what and how much you have. You really should not consider major reorganization until you know the "what and how much" since these facts may cause you to elect not to set shelf space aside for substances you wish to eliminate from your inventory. It is our experience that in an average school (if there is such a thing as an average school) four out of ten bottles on the shelves have not been used in the last five years and will not be used in the next five years. There is no need to dedicate shelf space to such excess substances.

If your shelves and cabinets are just loaded and a lot of movement of substances is required to inventory all the materials, then the task will require several hours. If however, most substances can be viewed and recorded with little bottle shifting or relocation then even a very large high school chemical stores facility will not require much more than about 2–2½ hours to record all of these substances and their pertinent information.

We recommend aquiring the Flinn online chemical inventory system called Chemventory™. This system can be used to track and describe chemical information and on-hand amounts, while also providing easy, electronic access to chemical information form on- and off-site locations.

Next assign compatible chemical family designations and hazard data to each listing. Our computer chemical inventory system has established 15 alpha designations to identify hazards. You may wish to use this same system to code your list. The designations are shown below.

Flinn Hazard Caution Codes

A — Flammable
B — Volatile
C — Toxic
D — Strong oxidizer or reducer
E — Carcinogenic
F — Produces Peroxides
G — Skin and/or eye irritant
H — Contains harmful impurities
I — Unpredictable explosive
J — Harmful dust or vapors
K — Avoid contact with water
L — Avoid contact with air
M — Corrosive
N — Allergen
O — Avoid contact with organic material

If you do not know either the hazardous character or compatible chemical family of a substance, you need look no further than the individual listings of any chemical in the *Flinn Scientific Catalog/Reference Manual*.

Your next step would be to decide what stays and what goes in this total inventory. We urge you to be ruthless in ridding your premises of these unused and unneeded chemicals. In fact, when you have made the decision about ridding yourself of many substances, then consider getting those items off your shelf first. No, do not simply acquire some cartons and pile bottle upon bottle into cartons and create a new problem. Rather, use your conventional wisdom and ask yourself if the item is hazardous and then investigate its hazardous character.

Be able to call for help in the event help is needed.

Should it be physically isolated? An example please. Let's assume you find a 500-gram bottle of aluminum chloride, anhydrous, and you wish to rid yourself of this substance. You do not know how to achieve this but you want it off the shelf and yet protected and safe for later disposition. Place the bottle in three thicknesses of Baggies®. You can get Baggies at your local grocery store. Flinn has heavy duty plastic bags called *Chem-Saf*™ Bags for this purpose. You will find *Chem-Saf*™ Bags listed on page 1178 in this Catalog/Reference Manual. Next, acquire some clean, never-used, one-quart and one-gallon paint cans. Flinn has such containers called *Saf-Stor*™ Cans. These are also listed on page 1178 in this Catalog/Reference Manual. You can acquire similar cans (less heavy duty) at a local paint store or store that might sell and mix paints to order.

Now, line the bottom of the can with just enough vermiculite or cat litter (cat litter is bentonite) to cushion the plastic bag-enclosed bottle. Place the plastic bag-enclosed bottle in the center of the can. Fill the remaining empty void of the can with vermiculite or cat litter. Place the friction lid on the can and label the outside of the can with the chemical formula of the substance contained therein. By using the chemical formula rather than the full name you can thwart the potential vandal intent upon securing or using a hazardous chemical. The vandal simply will not be able to read the formula.

CHEMICAL INVENTORY continued on next page.

FLINN COMPATIBLE CHEMICAL FAMILY CODES

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

Flinn Organic Compatible Family Codes

O1 – Acids, Amino Acids, Anhydrides, Peracids

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

O3 – Hydrocarbons, Esters, Aldehydes, Oils

O4 – Ethers, Ketones, Halogenated Hydrocarbons

O5 – Epoxy Compounds, Isocyanates

O6 – Peroxides, Hydroperoxides

O7 – Sulfides, Polysulfides, Sulfoxides, Nitriles

O8 – Phenols, Cresols

O9 – Dyes, Stains, Indicators

OM – Miscellaneous

Flinn Inorganic Compatible Family Codes

I1 – Metals, Hydrides

I2 – Acetates, Halides, Iodides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Oxalates, Phthalates, Oleates

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

I4 – Hydroxides, Oxides, Silicates, Carbonates, Carbon

I5 – Sulfides, Selenides, Phosphides, Carbides, Nitrides

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

I7 – Arsenates, Cyanides, Cyanates

I8 – Borates, Chromates, Manganates, Permanganates, Molybdates, Vanadates

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

I10 – Sulfur, Phosphorus, Arsenic, Phosphorous Pentoxide

IM – Miscellaneous

You have now provided a secure container for this unwanted substance. You may now assign an area in the storeroom where such hazards will be safe until you investigate and ultimately exercise your disposal or removal options. You will find that plastic bags and cans can be among your best friends for isolating and containing hazards during your investigation.

The cans will serve to protect against breakage and even act as a miniature fire cabinet to prevent these hazards from being directly involved in a conflagration.

Those substances which remain on your shelves can now be reorganized into their compatible chemical families. We urge that you review all the details of appropriate and safe storage in the section of this Catalog/Reference Manual dedicated to that subject.

Avoid distractions.

For the first time you know exactly the substances and their quantities in your chemical stores area. It is from this base of knowledge that you can begin to manage this matter of chemicals on school premises. You needed to take this first, important step. You may need further help and advice. If you do, call Flinn.

Here's the Last Acid Cabinet You'll Ever Need!

Flinn Acid Cabinets will not rust or corrode. Many companies promise corrosion resistance; we'll guarantee it. How? Simple—we don't use metal hardware or hinges. We use only wood and plastic in our construction; therefore, there is no rust or corrosion. Our unique design and unsurpassed quality will give you an outstanding cabinet both now and for many years to come.