Massachusetts
School Chemical Management Program

Working Draft
November 2006

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This is a living document, which is currently being used as part of several school pilot projects, and will continue to undergo review and revision. Please contact the Hazardous Waste Program Manager at the MassDEP at 617-292-5704 with any comments.

Overview

Challenges Schools Face in Managing their Chemicals

Unmanaged chemical stockpiles

Most schools have hundreds of chemicals in the science labs, art rooms, shop classes, and maintenance areas, but few know which chemicals they have and where they are located. Hazardous chemicals accumulate when there is no tracking system and no disposal plan, especially when there are changes in staff and/or changes in curriculum. Industry donations of chemicals can compound the problem.

Quantities and hazard level of chemicals

Many of the chemicals in schools are the same ones used in industrial and commercial facilities such as factories and research labs. These include:

- chlorinated solvents
- heavy metals
- strong corrosives
- explosives
- toxics such as cyanides, mercury and lead compounds

Some of the chemicals found in schools are fatal at an exposure of less than 0.1 gram, and some will explode just by having the cap removed from the jar.

Challenges Schools Face in Managing their Chemicals

Serious health and safety risks

Even though schools use many of the same chemicals as industry, they do not have environmental, health and safety staff or any protective systems in place, such as:

- inventory control systems
- personal protective equipment for employees and students
- employee safety and hazardous chemicals management training
- medical monitoring of employees
- chemical emergency response systems
- control mechanisms for hazardous material releases to air and wastewater

Lack of such systems can lead to serious risks such as chemical exposures, accidents, spills, explosions, fires, or releases of hazardous chemicals to the environment. Few schools have the resources or expertise needed to manage highly toxic or otherwise hazardous chemicals.

Roots of the problem

School administrators and staff are often unaware of the quantity and toxicity of hazardous chemicals accumulating in their school buildings, or of the proper use and storage procedures necessary to maintain product stability and occupant safety. Most staff are not trained to recognize and manage the risks of hazardous chemicals. Few schools have a budget for proper chemical storage space and equipment, staff time for chemical management activities, or even hazardous waste disposal.

Overview of a School Chemical Management Program

The purpose of a chemical management program

To avoid the problems outlined above, a school or a school district can establish a *School Chemical Management Program*, which identifies, manages, and prevents hazards through all stages of chemical purchasing, storage, use, and disposal. This program can also help to reduce the quantity and toxicity of chemicals used in a school's curriculum and in cleaning and maintenance of the school's physical plant, and to prevent the buildup of a surplus chemical inventory.

Program goals

A School Chemical Management Program should:

- Minimize the volume, types, and toxicity of hazardous chemicals purchased, used and stored;
- Develop systems for staff to safely purchase, use, manage and dispose of hazardous products;
- Identify, prevent, and manage chemical hazards;
- Develop systems for responding appropriately to chemical emergencies;
- Ensure that the school (or school district) complies with environmental, health, and safety regulations, as well as "best management practices"; and
- Model and promote responsible chemical management.

Organization of this manual

Designed primarily for maintenance of secondary schools, this manual provides a framework and tools for developing a comprehensive School Chemical Management Program that can be tailored to the needs of individual schools. The remainder of this manual is organized into a description of how to develop a school chemical management program and appendices that describe further each part of the process:

Manual: Describes the five–step process for developing a School Chemical Management Program

Appendix 1: Administrative Information - describes how to develop a Team and provides information on regulations that pertain hazardous chemicals in schools

Appendix 2: Assessing Current Conditions - describes how to assess the current conditions of your hazardous chemicals practices and systems, and to perform an chemical inventory

Appendix 3: Chemical Emergency Response Plan - describes how to develop a plan for responding to chemical emergencies

Appendix 4: Chemical Purchasing Policy – describes how to develop a system for managing chemical purchases (to ensure that stockpiles of unneeded chemicals do not build up)

Appendix 5: Chemical Management and Storage - describes how to ensure that chemicals are tracked, managed and stored safely

Appendix 6: Hazardous Waste Management - describes how to store and dispose of hazardous chemicals

Appendix 7: Other Resources

Developing a School Chemical Management Program

A five step approach

A School Chemical Management Program is a long-term commitment to improving environmental health and safety conditions in a school or school district. This manual advocates the use of a team approach that will develop and implement a Program in five steps. The initial steps are designed to remove imminent hazards and stockpiles of hazardous chemicals. Once you reduce the quantity and toxicity of your inventory, you will be in a position to develop management systems for the remaining products. The five steps involve:

Step 1: Form a school environmental team
Step 2: Assess the school's current chemical management practices, storage conditions and written policies/procedures
Step 3: Dispose of unnecessary chemicals
Step 4: Develop a long term program to improve chemical management and to adopt practices that will result in better environmental health and safety
Step 5: Periodically evaluate your progress, and update your program as needed.

Cost to develop and implement the program

Initial costs may involve hiring a chemical expert and the disposal of stockpiles of hazardous chemicals. The cost to develop and implement the longer-term program will primarily be the staff time necessary to develop and maintain systems and procedures. Program implementation may also require the purchase of special equipment and supplies, annual hazardous chemical disposal and staff training.

However, once a Program is underway, it can save the school a considerable amount of money, reduce liability for chemical spills, and improve the safety of students and staff.

Step 1: Getting Started - Form a Team

The value of the team approach

A team approach to chemical management in schools has been found to be the most effective strategy for long term planning and implementation. A team creates institutional memory, and the success of the team's work continues even if one member leaves the school. Also, a team representing all aspects of chemical use in the school will develop a program that represents the entire school, and helps to coordinate common responsibilities across departments.

The purpose of the team

The Team will coordinate the development and implementation of your school's Chemical Management Program. It will:

- Conduct initial investigation.
- Identify and prioritize systems to be developed.
- Recommend assignment of roles and responsibilities.
- Conduct research and exchange information.
- Develop long and short-term recommendations and plans.
- Identify and solicit resources necessary to develop the program.
- Develop and maintain an information and record keeping system.
- Provide long-term program oversight including a reporting mechanism and auditing process.

The Team should solicit involvement throughout the school and its community, identify and coordinate all department activities related to chemical management, provide technical assistance or referral to outside experts for school departments, and serve as a liaison to the school community.

Step 1: Getting Started - Form a Team

Get buy-in from the top

- Individual School Program - The principal's support for the development of a School Chemical Management Program is key to enlisting staff to participate on the team, and to implement the group's recommendations.
- District Program - If the Program will cover multiple schools, the superintendent and operations department are key to ensuring that efforts from both the academic and operations aspects of the district are involved and coordinated.

Appendix 1- Administrative Information provides a full description of how to develop a School Chemical Management team.

Step 2: Assess Current Chemical Management Systems and Conditions

Overview

Before you can effectively develop a chemical management program, you should assess your current systems and conditions so you can make decisions about what needs to be corrected. This step has four parts together that provide a complete picture of how chemicals are currently managed at the school. These steps will provide the information necessary to decide how to reduce the quantity and hazard of chemicals in the school.

Part A: Gather information on current practices

Before assessing the state of the school's chemicals, it is good to gather some basic information about the school's on-going practices, including:

- Who currently uses or is responsible for staff that uses hazardous chemicals?
- Has the school performed a chemical cleanout in the past?
- Is there an inventory of any chemicals in the school?
- Does the school keep Material Safety Data Sheets anywhere in the building?
- Has any school staff received any training related to chemical safety such as Right-to-Know training?

Appendix 2 – Assessing Current Conditions provides a questionnaire that can help you establish this basic information

Part B: Conduct safety prescreen

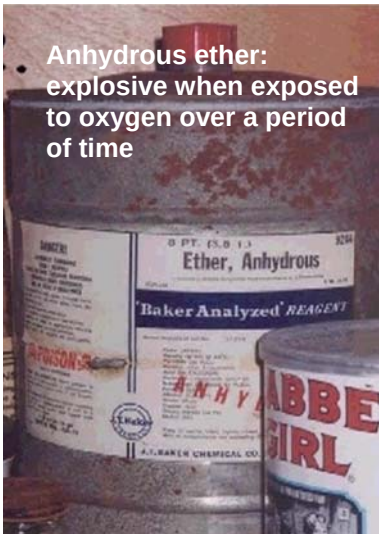
A safety prescreen will identify and resolve "imminent hazards." Dangerous situations are often found when schools start exploring the conditions of their chemicals. Obtain or hire a technical expert who can walk through all areas of the school where chemicals may be stored with the team and identify the types of imminent hazards listed below. Identify areas to evaluate, but do not limit your evaluation to known storage and use areas, as chemicals are often used, left and forgotten in non–storage areas. Take notes for each location visited, and map the locations where chemicals are currently used and stored.

Step 2: Assess Current Chemical Management Conditions (continued)

Part B: Conduct safety prescreen (continued)

Look for these imminent hazards:

- Incompatible groupings of chemicals
- Unstable and compromised chemicals
- Corroded or unstable containers
- Sagging cabinets, corroded shelving and/or shelving supports housing chemicals
- Sources of ignition, water, and heat that pose a dangerous situation in the chemical storeroom, etc.



Appendix 2 – Assessing Current Conditions provides a safety pre-screen description and inspection checklist.

Step 2: Assess Current Chemical Management Conditions (continued)

Part C: Conduct a walk-through inspection

Conduct a full assessment of the school facility with respect to its storage of chemicals with your Team. Many of these items can be identified during the safety prescreen, although a second walk-through is often necessary
Collect the following information:

- The types, conditions, quantities, and storage locations of chemicals and hazardous waste throughout the school.
- The staff responsible for each of these locations.
- The condition and appropriateness of the chemical storage area, equipment and environmental controls, such as ventilation systems.


Acids stored in metal cabinet


Chemicals in front of heater

- Any chemical inventories for these storage areas, the status of these inventories, and who maintains them.
- The location, condition, amount and appropriateness of personnel protective equipment.
- The location, condition, amount and appropriateness of the emergency response supplies and equipment for the amount and type of chemicals stored. See Safety and Emergency Response Equipment and Supplies Inventory Form in Appendix 2 – Assessing Current Conditions.
- Is there an effective system in place for chemical emergency response?
- The location, completeness and availability of Material Safety Data Sheets (MSDS) in each department using chemicals.

Meet with the team who performed the walk-through inspection to review notes and develop a list of action items to address chemical management problems.

Step 2: Assess Current Chemical Management Conditions (continued)

Part D: Conduct a chemical inventory

There are several options for conducting an inventory, depending on your goals:

- Short Term, inventory for disposal purposes
  - You can work with your staff to collect information on only products you need to price for disposal, or
  - You can have staff collect information on all products to enable you or a vendor or specialist to screen and flag items that are overstocked or particularly hazardous for disposal.
- Long Term Inventory System
  - Select an electronic inventory system (your school chemical vendor may have one available or you may develop your own data base or spreadsheet) or printed form that can be used and maintained for long-term tracking.
  - Inventory all of the chemicals in the school to identify the name of the chemical, hazard class, container size and percent full, locations of containers, and dates on which solutions were prepared or expiration date, if applicable.

A full description of how to perform an inventory is found in Appendix 2 – Assessing Current Conditions.

Step 3: Dispose of Unnecessary Chemicals

Rationale for reducing toxicity and volume

Many schools have substantial quantities of chemicals they no longer need. Once these chemicals are removed, it is much easier to set up and maintain systems to purchase, track and store the remaining chemicals. The necessary storage facilities and personal protective and emergency response equipment and supplies are much easier to determine after the school has reduced the volume and toxicity of the chemical inventory to the amount and types required for safely running the school facility and its programs.

How to determine what to dispose of

Each person responsible for using and storing chemicals should review their stock of chemicals. For each chemical found, the following questions should be asked:

- Why do we need this chemical?
- Do we have more than we will use of this chemical in the next few years?
- Is a less hazardous process or product available?
- Does this chemical have special safety requirements? If so, does the teacher/staff person have the appropriate training to use it?
- Does the chemical have special storage or disposal requirements?
- Is the chemical on the "High Risk Chemical List" list of highly hazardous chemicals in Appendix 4?

Chemicals no longer needed should be marked for disposal.

Clean out all unnecessary chemicals

Arrange for disposal of unneeded chemicals at a time when students will not be around.

- Secure funding for this "one-time" comprehensive clean-out.
- Schedule disposal with a licensed hazardous waste management firm. (State Contract # FAC36)
- Find out whether the school has a registered hazardous waste generator identification number, and if not, get one from the MassDEP (required by state regulation), http://www.mass.gov/dep/recycle/approvals/genreg.doc
- Keep records of hazardous waste disposal (manifest) for 3 years.

For full description, see Appendix 6 – Hazardous Waste Management.

Step 4: Develop a Long Term Chemical Management Program

Overview

After you have assessed your current chemical management system and removed unnecessary chemicals, you will be in a good position to set up a sustainable system to purchase, track, use, store, and dispose of your chemicals. Proper use and management of chemicals requires appropriate storage facilities, staff and student training, personal protective and emergency response equipment and supplies, and a budget for waste disposal. As the hazard level of your chemicals increase, their management requirements also increase in complexity.

Components of a sustainable program

An effective chemical management system should include the five following elements:

A. Administrative Systems
B. Chemical Emergency Response
C. Chemical Purchasing Controls
D. Chemical Management and Storage
E. Hazardous Waste Management

These components are described below, with more detail in the appendices.

Component A: Administrative Systems

Support your program with the necessary staff time and budget

The school should develop the administrative framework to implement a Chemical Management Program. The Team is an integral part of this framework, and should be given the time and authority to develop the Program. Establishing the Teams authority and sustainability may be enhanced by formal recognition of the school committee. The framework also includes:

- identifying and assigning administrative and staff responsibilities
- providing staff with resources, including time and training to fulfill their responsibilities
- identifying and addressing relevant environmental health and safety regulations
- developing a budget for chemical management and disposal

Appendix 1 - Administrative Information provides a description of applicable state and federal regulations.

Component B: Chemical Emergency Response

Prepare your school for the possible chemical emergency

Wherever there are chemicals, there is the possibility of an accident. Provisions should be made for the worst-case scenario, as well as for minor spills and releases. Training must be provided for all staff and students who work with chemicals on how to respond in the event of a chemical spill or accident. An effective emergency response plan can reduce liability for the school. Be sure to coordinate with other school and municipal emergency policies and protocols.

Appendix 3- Chemical Emergency Response Plan provides an overview of the criteria to consider when developing a chemical emergency response plan.

Step 4: Develop a Long-Term Chemical Management Program (continued)

Component C: Chemical Purchasing Controls

Why a school needs purchasing controls

Most schools do not evaluate the health and safety criteria, or storage requirements before purchasing a chemical product. Thus, schools often end up with chemicals that are very toxic, reactive and even explosive that they are not adequately prepared to use and store. Schools often purchase more chemicals than they need to obtain lower bulk pricing. Surplus stock also results from changes in staff and curricula, as well as the availability of better substitutes. Also, chemicals received as free donations often end up not used, and incur costs for disposal. The unanticipated cost of disposal can be 5 to 10 times more than the purchase price.

To prevent over-purchase and purchase of extremely hazardous chemicals, schools should put a system in place to screen purchases of hazardous chemicals.

Appendix 4 – Chemical Purchasing Policy provides criteria to consider when developing a policy to limit purchases.

Component D: Chemical Management and Storage

Properly store and manage chemicals

Once the school has pared down to the necessary chemicals, these chemicals must be stored properly. A reduced stock provides an opportunity to consolidate and organize your products into compatible categories, and to locate them in appropriate equipment in a safe secured location. For example,

- Acids must be stored in an acid compatible cabinet and not on metal shelving.
- All hazardous chemicals should be stored in a locked area.
- Flammable products should never be stored near a source of ignition.
- All chemicals should be stored and used in an area with adequate ventilation.

Another part of your management system is to continually update your inventory to make purchasing decisions and ordering of emergency response and safety supplies. There are many such issues that should be considered when managing and storing chemicals.

Appendix 5 – Chemical Management and Safe Storage provides an overview of the design and maintenance requirements for safe storage of all types of chemicals.

Step 4: Develop a Long-Term Chemical Management Program (continued)

Component E: Hazardous Waste Management

Manage hazardous waste according to regulation

There will be hazardous waste generated periodically and it must be managed according to state and federal regulation. These rules require that hazardous waste be stored separately from hazardous products. These rules also limit the quantity of waste you can store, and the length of time that you can store it.

You will need to identify which departments generate what types and amounts of waste. This information will help you to determine the size of your storage area, a good location (either near where the chemical is used or in a central location), and the necessary storage and emergency response equipment.

You must dispose of your hazardous waste at least annually, or when it reaches specific storage time limits. This will involve the identification, collection and disposal of your waste, either through a hazardous waste contractor or through your local municipality. Either way, the hazardous waste contractor can help you set up a system for storing your waste and provide you with the proper containers.

Appendix 6 - Hazardous Waste Management reviews the requirements for management of hazardous waste and provides an overview of the steps involved in the clean-out process.

Step 5: Evaluate and Update Your Program

How to evaluate your program

Conduct an audit to evaluate and monitor the implementation of the School Chemical Management Program. The audit system includes audit procedures, a trained audit team, and a process to correct imminent hazards and program deficiencies.

Types of Audits

"Internal audits" are conducted by a school class and/or safety team.

- Involve and train staff on system requirements.
- Identify issues in non-confrontational ways.
- Maintain systems.

"External audits" are conducted by third party such as an industry mentor, Fire Department, Local Emergency Planning Committee, MassDEP, Accreditation Team, Health Agent, Division of Occupational Safety, and Department of Public Health. They will:

- Verify systems.
- Obtain addition technical assistance, models, and lines of authority.

Design your "Internal Audit" Program

Set scope and objectives of audit protocols.

- Appoint department representatives to the audit team.
- Establish audit schedule, including time of year and frequency of audit.
- Conduct training for both the staff conducting the audit and the administrators overseeing the audit process.

Design your "External Audit" Program

- Identify municipal, state, and private consultants to serve as the audit team.
- Work with audit team to set scope and objectives of audit protocols.
- Establish audit schedule, including time of year and frequency of audit.

Conduct Audits

- Implement your audit policies and procedures.
- Develop corrective actions for identified problems.

Appendix 1: Administrative Information

How to Form a Team

Administrative responsibilities

It is the administrations responsibility to ensure that chemicals are managed safely and that the school is in compliance with all regulations. Experience has shown that the best way to meet this responsibility in an on-going way is to form a team.

Form a team

A school chemical management team should ideally be formed for the long term, so that it can monitor the chemical management system set up over time. Then, the team could branch out to work on a variety of different issues around environmental health and safety in the school. Ideally, there would be a coordinator for the team that would have a stipend or other incentive for taking on this responsibility.

Team Structure

You can have a team at the district level and at individual school levels, or you can have a team at the school level only. The advantage of having a district level team in addition to individual schools is the efforts across the district are streamlined and coordinated. Possible roles of a District Team:

- Develops tools that can be customized and implemented in each school.
- Coordinates team activities (building assessments, hazardous waste clean-outs, training, etc.) throughout the district.
- Provides technical assistance to individual schools.
- Coordinates assistance from municipal and state agencies.
- Develops and allocates resources for program development and implementation.
- Addresses union issues.

Who should be on the team

Staff from the school are key to developing a successful chemical management program. The team will build relationships across departments to understand the variety of issues and to identify common responsibilities. Select team members from representatives of departments that use hazardous products, and from administrators who oversee those staff. Representatives can provide input on their specific issues, as well as on solutions and systems that will work for their staff. It will be helpful (if not critical) to involve school administrative staff, including the business official and/or purchasing agent.

How to Form a Team

Selecting team members

Select a team of effective size and representation from the following list:

- Principal, Assistant Principal or designee
- Business Official or Purchasing Agent
- Science Department Head or Science Teacher
- Art Department Head or Art Teacher
- Shop Teacher
- Facilities Manager and/or Head Custodian
- Parent organization representative
- Union representative

Other municipal staff members

Local municipal agencies can provide invaluable assistance to this effort as team members. They can provide expertise that may not be available from school staff, and can assist in program planning, policy development, assessments of existing conditions, and training. Your team should include a member of one or more of the following department or agencies:

- Fire Department
- Local Emergency Planning Committee
- Board of Health
- Department of Public Works or Solid Waste District – Recycling or Hazardous Waste Coordinator

How to Form a Team

Additional assistance

Other local organizations may also be able to provide specific expertise to the Team, such as an Environmental Health and Safety Officer employed by a local industry. Team members may be sought from:

- A local industry;
- A local university or college; or
- A local business.

Organization of the team

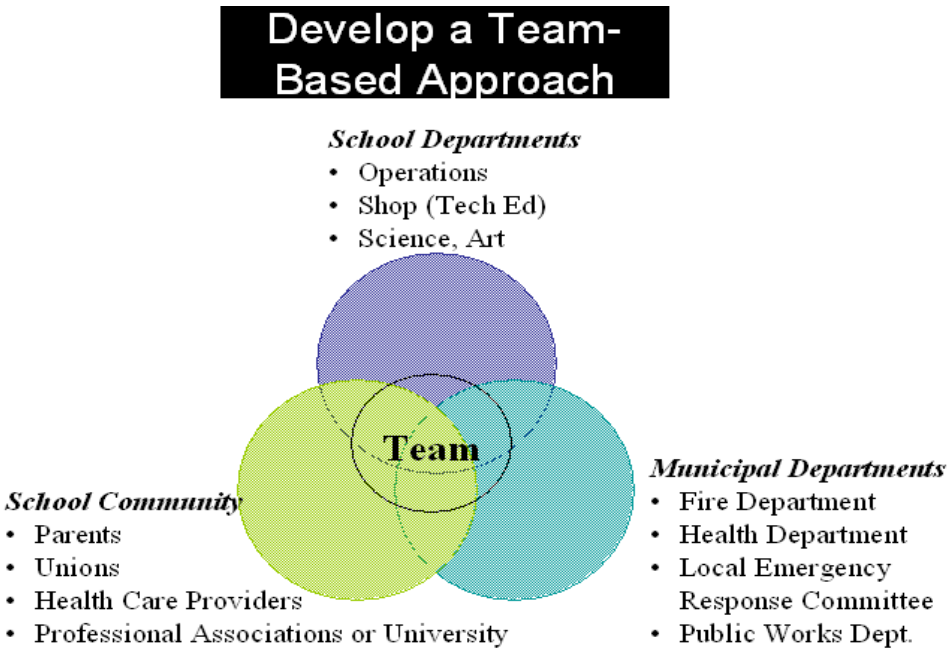
The team will need to appoint a coordinator who has the time and authority to:

- Serve as liaison between team members, and between the team and other entities;
- Schedule and coordinate follow up from meetings; and
- Ensure that information is distributed to team members, and from the team to other stakeholders.

Team meetings

The team should meet on a regular basis, with all members attending whenever possible. Team members need to make time for meetings and for follow-up work. Some schools have made it easier for staff to participate in a team by:

- Relieving team members of certain duties
- Providing a stipend for overtime work
- Providing a designated amount of time per month or semester
- Providing professional development credits, or
- Providing substitutes to free up time.



State Regulations Governing the Management of Hazardous Materials in Schools

Hazardous Waste Regulations, *310 CMR 30.000*	Regulated by Massachusetts Department of Environmental Protection (MassDEP). Requires hazardous waste generators to register their hazardous waste activities with MassDEP. The regulations guide hazardous waste identification and storage including: storage procedures, signage and container labeling, the length of time waste can be stored, the quantities that can be stored, inspection, transportation, disposal, emergency response, and record keeping.
Universal Waste Rule, *310 CMR 30.1000*	Regulated by MassDEP. A recently enacted section of the hazardous waste rules that governs the management of fluorescent lamps, mercury containing devices, hazardous batteries, and hazardous waste pesticides including collection, storage, transportation and disposal.
Right–To–Know Law, *310 CMR 33.00, Chapter 33 M.G.L c.111F*	Regulated by Dept of Labor and Workforce Development, Division of Occupational Safety. Governs the provision of chemical information (Material Safety Data Sheets - MSDS) to staff handling or exposed to hazardous materials, annual training of workers and new hires handling or exposed to hazardous materials to understand the hazards of these materials, worker recourse, and the record keeping of MSDSs.
Fire Prevention Regulations, *527 CMR 10.00*	State Fire Marshal Fire Prevention Regulations, enforced by Local Fire Departments. Governs flammable products and waste, including; the amount of flammables that can be stored; the way that flammable materials can be stored, dispensed, and used; the types of flammable storage equipment; and emergency response systems including equipment and supplies, signage, communication systems, etc. Also governs the storage of corrosive and oxidizing materials.
Massachusetts Building Code *780 CMR*	Written by Department of Public Safety, enforced by local Building Inspector. Governs ventilation, air exchange, temperature and humidity for the different types of indoor environments, exits for chemical storage rooms and emergency sprinkler systems.
Children's and Families Protection Act, *Chapter 85 of the Acts of 2000*	Governs the use and application of pesticides in school buildings and on school grounds.

Appendix 2: Assessing Current Conditions

Collect information on your schools systems	Use the following questionnaire to establish as much of the basic information as possible about the school's chemical management systems.
Planning a Safety prescreen and walk-through inspection	Schedule the assessment when school is minimally occupied. Inform the administration and other relevant parties of the assessment schedule. Obtain or hire a technical expert who can walk through all areas of the school where chemicals may be stored with the team and identify imminent hazards. Often, a chemist from a hazardous waste management company will do this for free if the school contracts with the company for removal of excess chemicals, or you can purchase these services from a hazardous waste contractor on state contract # FAC 36. (See Appendix 6 – Hazardous Waste Management for information on the state contract). Ensure that a member of the fire department and/or Local Emergency Planning Committee accompany the team on the prescreen to assist with any imminent hazards, should any be found. Those performing the safety prescreen should be prepared to arrange for emergency disposal of compromised chemicals posing an imminent risk (such as "shock-sensitive" chemicals) and to evacuate the school or area of the school if there is an incident. Check with your hazardous waste disposal company for cost and procedures should a "shock-sensitive" chemical be found.
Plan areas to assess	Before starting any assessment of physical conditions, it is best to get a floor plan of the school, including all external sheds, garages and storage areas that belong to the school. Identify areas to evaluate, but do not limit your evaluation to known storage and use areas, as chemicals are often used, left and forgotten in non–storage areas. Sometimes chemicals are found in closets, cabinets, file cabinets, fume hoods, under sinks, refrigerators, under stairwells, attics, basements, along hallways, sheds where power equipment is stored, etc. Think about what the area was used for in the past. Notify those responsible for areas where chemicals are likely to be found that the team will be performing an assessment at the chosen time. Take notes for each location visited, and map the locations where chemicals are currently used and stored.
What to bring	Bring clipboards, note pads, pens and at least enough copies of the Safety Prescreen Inspection Sheet so everyone on the team has one and knows what to look for. The professional should have disposable chemical resistant gloves to be able to examine containers. Others should not touch chemical containers unless the professional deems it safe.

School Chemical Management Systems Assessment Questionnaire

1. Does your school have a Chemical Management Plan or program?

2. Does your school have an individual or team responsible for chemical management or environmental health and safety? If so who? Do these individuals do this work on their own time or are they compensated for these efforts?

3. Does the school have a chemical emergency response plan? Is the staff trained in chemical emergency response?

4. Does the school have an inventory of the hazardous materials used in the school? If so is it on computer or paper? Where is it kept? How often is it updated and by whom?

5. When was the last time the school had a comprehensive school wide hazardous materials clean-out to rid the school of old unwanted chemicals?

6. What kind of storage system does the school use for its chemicals? Are chemicals stored separated by hazard class and compatibility?

7. Does the school have enough proper chemical storage area and cabinets? What unmet storage needs are you aware of?

8. Does the school have Material Safety Data Sheets (MSDS) for the hazardous materials used in the school? Where are they kept?

9. What kind of chemical management or safety training has the staff received? Do you do annual Right-To-Know training for all staff handling hazardous materials?

10. Does the school have a chemical purchasing policy? Who is responsible for chemical purchasing?

11. Is the school registered as a very small quantity generator (VSQG) of hazardous waste with the MassDEP?

Safety Prescreen Planning Worksheet

What would be a good date for the school to schedule the Prescreen?

Who will coordinate with the Chemist from a reputable hazardous waste disposal company to set the Prescreen date?

Who will notify staff about the Prescreen date? (Both those participating and those whose rooms might be screened.)

Who will take notes at Prescreen?

Who will compile notes?

Who will coordinate with contractor on any emergency response?

Who should participate in the Prescreen Walk-through?
Science Facilities Art Shops Other
_____
_____
_____
_____

What areas, rooms, closets, outbuildings, sheds should we prescreen?
Science Facilities Art Shops Other
_____
_____
_____
_____
_____
_____
_____
_____
_____

Who has the keys to these areas?
Science Facilities Art Shops Other
_____
_____
_____

Safety Prescreen: Planning Worksheet
Questions for Contractor

Will the contractor review an inventory list for disposal suggestions? Who will provide the list to the contractor?

Science department storage/disposal questions.

Custodial department storage/disposal questions.

Art department storage/disposal questions.

Shop department storage/disposal questions.

Other area's storage/disposal questions.

Safety Prescreen Inspection Sheet

Room #: Date: Evaluated by:

GENERAL STORAGE CONDITIONS	**COMMENTS**
Are storerooms too crowded? __Y __N __shelves packed with chemicals __trip hazards __other_____	
Are shelves or shelf supports attached to the walls or in cabinets corroded or at risk of collapsing? __Y __N	
Are there sources of ignition or heat that pose a risk? __Y __N __Appliances __Exposed wires __ Light Sensor __Electrical Panel __Fan on a timer __ other_____	
Are chemicals stored: overhead on high shelves __Y __N where they cannot be observed __Y __N, stacked on the floor __Y __N	
CONTAINER CONDITIONS	
Are there any "shock-sensitives" __Y __N	
Is there evidence or signs of spilled materials or of vapors __Y __N	
Are there any containers: __ leaking ___corroded __weak __ broken	
Do any chemicals have crystals or other material on container? __Y __N	
Are the elemental metals submerged in sufficient liquid __Y __N	
Are there chemicals stored in on incompatible shelving __Y __N __ acids on metal shelves __oxidizers on wooden shelves	
Are there any chemicals stored in dangerous combinations __Y __N __nitric acid with other acids __ flammables and oxidizers __alphabetical order __acids and bases __other	
Are water-reactives stored where there is a sprinkler system, water source, or under sink? __Y __N	
Due to the presence of Moisture, is there: __corroded pipes __corroded shelving __compromised chemicals	
Have container lids: __come loose __bulging __collapsed	
Are any container labels: __missing __unreadable __have insufficient information __other	
Do the storage rooms have two locking exit doors?	
Is there adequate ventilation in the room?	

Conducting a School Chemical Inventory

Preparing for the Inventory

Identify areas to be inventoried	Consult school map developed during the Safety Prescreen or subsequent walk-through. Create a list of all areas to be inventoried, including those not designated as official storage areas, that were identified in the assessment.
Prepare staff	• Contact staff in those departments who will either be involved in conducting the inventory or will be having their chemicals inventoried such as custodial, art, shops, home economics, and science. • Notify the following people in advance when the inventory will be conducted: Principal, custodial staff, Emergency Response Coordinator, nurse, and the teacher whose storage area will be inventoried. • Provide an orientation on the inventory process to staff participating in the inventory process. • Ensure staff knows what constitutes an emergency and how to handle it, especially if a pre-screen by a qualified chemist has not been performed. (See *Emergency Response Protocol* in Appendix 3 – Emergency Response Plan..*)*
Schedule inventories and allocate staff time	• Ensure that the person conducting the inventories schedules time with your teachers to prepare for the inventory, and to conduct the inventory at a time that works for the teacher. • Schedule the inventory before or after school at a time when students would not be at risk, staff won't be interrupted, and when staff can pair-up to work together. There should always be someone else in the building while the inventory is being conducted.

Obtain inventory supplies

Decide if you will do an inventory on paper or computer. In either case, you will need:

- Personal Protective Equipment: Nitrile Gloves or other chemically resistant gloves, chemical resistant apron or suit, and Chemical Splash Goggles
- General supplies such as: a ladder, flashlight, alternative containers (empty cans – Saf-Stor, bags – Chem-Saf, bottles) for overpacking a broken container, blank replacement labels, adhesive for adhering loose labels, Teflon tape for sealing seldom used containers, replacement caps, a permanent marker, dish tubs to contain leaking materials or provide secondary containment, etc.
- Emergency response supplies such as spill control materials (absorbents, sand, and neutralizers) specific to the types and quantities stored. You may also need specialty spill kits for acid or mercury. Flinn Scientific, Inc. rule of thumb is to have twice the amount of absorbents, sand and neutralizer as your largest container.
- Some reference material such as a chemical dictionary, NIOSH Pocket Guide to Chemical Hazards, MSDS sheets or the Flinn Catalogue, in case chemical questions arise.
- Lists of chemicals of concern including; peroxidable compounds, explosives, reactives, in case they were missed in the pre-screen.
- Data entry form for recording information listed on the next page at "Record the Following Information."
- Color-coded sticky dots. Purchase special coding dots that don't fall off, or purchase clear tape to secure the dots with.
- Data entry forms to record list of information on next page.

Prepare areas to be inventoried

- Ventilate storeroom - try to achieve the best ventilation during the inventory. If there is no ventilation or an operable window in the area, check to see if an adjacent room could be opened and a fan used to circulate the air.
- Ventilate compromised containers - locate the closest fume hood and check to see if it is operable.
- Sources of Ignition - identify and shut-off sources of ignition where possible – Bunsen Burners, appliances, etc. See Appendix 5 – Chemical Management and Safe Storage, *Environmental Controls, Ignition Sources* for guidance.
- Create Access to Chemicals - clear debris out of storage rooms to make some work space, to create access to the containers on the shelves, and to avoid tripping or knocking something over.
- Ensure Emergency Response equipment such as a Fire Extinguisher (type designed for the chemicals stored), and an Eyewash Station and Emergency Shower are available nearby, accessible, operable, and placarded.

Conducting the Inventory

What to wear

- Personal Protective Equipment - Nitrile Gloves, Chemical Splash Goggles, chemical resistant apron
- Protective clothing - closed toed low heeled shoes, long sleeves, and pants
- No jewelry that could get caught on containers.
- No contact lenses as chemicals and chemical vapors can get trapped behind.

Inventory the Following Items

- Mercury containing instruments
- Radioactive samples – some may be marked and others may not
- All solutions
- All chemicals and chemical compounds
- Gas cylinders (see attached *Chemical Storage Guidelines, Chemical Storage equipment, Gas Cylinders* for information on proper storage)
- All unlabeled containers with chemicals in them

Record the Following Information

This list can be modified based on the system you use.

- Name of chemical or product – no abbreviation or formula name
- Container size and % full – container size does not indicate how much is in the container
- Number of containers
- Location of containers
- Concentration, strength or molarity and date solutions were prepared
- NFPA or HMIS information
- Product expiration dates
- How often it gets used, e.g. heavy, moderate, light or minimal usage
- Note whether it needs to be disposed of

One person should read the information from the container while the other records it on the data entry form.

Develop a color-coding system

Identify items for disposal, for keeping, and for special handling. Provide guidance to all departments to ensure everyone uses the same system. Check with your chemical supplier to see if there is a color-coding system that they recommend

What to do with unlabeled containers

If you encounter just a few unlabeled containers, take the time to label them with:

- Name of chemical or product – no abbreviation or formula name
- Concentration, strength or molarity and date solutions were prepared
- NFPA or HMIS information
- Product expiration dates

If you find many unlabeled containers, schedule a time when they can be labeled.

Mark the following items for disposal

Strongly consider marking the following items for disposal with sticky dots based on your color-coding system:

- Any container that is an unknown or has unreadable label
- Expired, outdated materials
- Materials that are so old that you do not have health and safety information
- Unused or overstocked
- Compromised containers and products
- Health ratings of 4 and most 3s
- Flammable rating of 4
- Reactivity rating 3 or 4
- Special hazards – radioactive
- Require use of respirator
- Require special storage that is not available to the school.

General Inventory Instructions

Do not remove chemicals for disposal unless there has been an area designated and prepared for hazardous waste storage. Mark with color-coded dots for disposal.
Do not allow students to handle the chemicals; they can input data into inventory forms away from the area being inventoried.
Move containers as little as possible during the inventory.
Do not reorganize containers on the shelves at this time unless you find the following situations which should be **separated immediately**:

- Water reactives stored under the sink where they are exposed to water
- Flammables and oxidizers
- Acids and bases

Please relock and secure all storage rooms and cabinets when you are done

---

Instructions for Potentially Dangerous Situations

- Unlabeled containers or unreadable labels:
  - **Do not** open to see what is inside or to smell, do not move or shake, etc.
  - Mark with color coded dots for disposal
- Compromised containers - broken, leaking, pitted, bulging, cracked, dented, broken, seam separating, or corroded containers. If the material is not dangerous to move - encase in a compatible container with new label. Do not move if it is a dangerous substance or unknown substance, or if you have a question about the safety of handling the substance – **contact emergency assistance.**
- Spills on the floor or in a cabinet - **stop inventory** (unless it is a tiny manageable spill, you have materials to clean it up with, and a way to safely dispose of the spill waste). If there is a large amount of unknown or unsafe leaked materials – **stop inventory and get emergency assistance.**
- Chemicals currently reacting such as smoking, bubbling, hot to the touch, crystallized or there are overpowering fumes in the chemical storage room – **do not go in room, contact emergency assistance.**
- Evaporation of protective fluids that can destabilize the chemical as with white phosphorus-**contact emergency assistance.**
- Unsafe shelving that might give way when conducting the inventory – **stop inventory and get emergency assistance.**
- Dangerous materials - expired materials (peroxide formers) or shock sensitive materials that can explode when moved - do not move, **contact Emergency Assistance.**
- *See your Chemical Emergency Response Plan for information on how to handle an emergency.*

Appendix 3: Chemical Emergency Response Plan

Overview

The Chemical Emergency Response Plan should address:

- Preparation for, and identification and handling of chemical related accidents.
- Management of leaking or otherwise compromised containers, and compromised chemicals.
- Emergency disposal of shock-sensitives, other dangerous chemicals, and chemical spill materials.
- Gas leaks, plumbing leaks, electrical shorts or other utility emergencies.
- To evacuate if there is an incident.

Designate an emergency response coordinator

Assign responsibilities of the Coordinator and other staff during an emergency. MassDEP regulations require that Small Quantity Generators designate the coordinator who:

- Must be available 24 hours a day.
- Will serve as liaison between the school and the Emergency Responders to provide information on: the location and details of the incident; name of Emergency Hazardous Waste Contractor; location and contents of chemical storage areas; school layout; location and diagrams of shut-off valves for utilities; locations of MSDSs; etc.

Develop emergency response protocols

- Call 911 FIRST. The 911 Dispatcher will notify: the Fire Department to come to evaluate the problem; the Emergency Medical System if someone is hurt; and the Police if there is a need for security. The Fire Department will contact the District Haz Mat Team if necessary.
- Contact School Emergency Response Coordinator.
- Consult with the Fire Department to determine if you need to also call MassDEP if reportable quantities of spill material have been exceeded.
- Call an emergency hazardous waste contractor if their help is needed, or if the Fire Department or MassDEP requires you to. Check with them early on to provide an effective timeframe for the contractor to come. It is helpful to have a relationship with a hazardous waste contractor, through HHW events or regular waste pickups.

Provide chemical emergency response training

- Train the Emergency Response Coordinator, staff and administrators who use and/or responsible for chemicals, on the procedures outlined in the Emergency Response Plan.
- Define roles and responsibilities of staff.
- Provide examples on what constitutes an emergency.
- Provide information on the potential chemical hazards, how to identify an emergency, worst-case scenarios, evacuation plans, alarm systems, emergency shutdown procedures, location and use of common emergency equipment, proper emergency response, and any special chemical hazards in your school.

Emergency Response Plan (continued)

Diagrams of facility grounds

Emergency Response plan should include:

- Location of Chemicals - chemical use, prep and storage areas, and hazardous waste storage areas
- Types and general quantity of chemicals – corrosives, oxidizers, water reactives, flammables and poisons
- Master utility shut-off controls – identify and indicate utility shutoffs locations for electric, gas jets in lab, water sources, sprinkler control valves, and ventilation and/or exhaust systems. Also identify the room numbers the master utility serves.
- Entrances and emergency exits
- Emergency Response supplies and equipment - spill control equipment and supplies, emergency wash stations, first aid stations, fire extinguishers, and fire alarm systems, bells, sirens

Develop an evacuation and accountability plan

- Identify staff to facilitate an evacuation. All other staff should know which staff members are authorized to facilitate the evacuation.
- Include a diagram of evacuation route on floor plans and workplace maps.
- Post Evacuation Route throughout the school. Determine if you can use the same route as designated for fires.
- Identify safe distances and places of refuge.
- Develop a way to account for all building occupants during and after the incident, such as an assembly location where you can take a head count.

Develop communication systems

- Locate phones or two-way communication in or near chemical use and storage areas.
- Post emergency response information by communication devices in chemical use and storage areas.
- Develop a site security and control system to keep unauthorized people from entering the incident area.
- Develop a way to alert all building occupants about the incident, such as an alarm, public address system, etc.

Emergency Response Plan (continued)

Identify location, inventory and condition of emergency response equipment and supplies

Equipment – See Appendix 5- Chemical Management and Safe Storage, section *Chemical Emergency Response in the Chemical Storage Room* for information on the requirements for the types, locations, and signage of emergency response equipment.

- Emergency Deluge Showers
- Eyewash Stations
- Fire Extinguishers designed for use on the materials stored
- Wool Fire Blanket

Types of General Spill Management Supplies (Flinn, Inc., rule of thumb is to have twice as much of the following three items as the largest container of chemical that you store[1]):

- Absorbents such as kitty litter – absorbs and contains spilled liquids and some of the vapors
- Sand – contains spill, provides traction, and prevents spill from migrating
- Neutralizers – Bases are used to neutralize inorganic acid spills and must be calculated in moles. Citric acid is used to neutralize strong bases.[2]
- Specialty Spill Kits – e.g., Mercury Spill Kit, Acid Spill Kit
- Personal Protective Equipment – e.g., chemical splash goggles, chemical resistant aprons and gloves
- First Aid Kit

Identify management of emergency response systems

- Location of Chemical Emergency Response Equipment and Supplies – locate wherever chemicals are prepped, used, and stored.
- Signage - post signs identifying the emergency response and first aid supplies, and keep the signs unobstructed.

Floor drain management

Manage drains to prevent chemical spills from entering. Some of the options include; permanent capping, using a temporary drain sealing material that is laid over the drain, or placing a berm[3] around the drain by using a bead of silicon caulk around the rim (which could pose a trip hazard, depending on its location).

[1] Flinn,Inc. *Laboratory Safety Inspection Report*, page 22, #72
[2] Flinn,Inc. *Laboratory Safety Inspection Report*, page 22, #72
[3] Step By Step Guide to Better Laboratory Management Practices, Washington State Department of Ecology Hazardous Waste and Toxics use Reduction Program, 1999

Emergency Responders

Fire department role

- They have total command authority during a chemical incident.
- They stop chemical reactions but don't clean up the spill.
- They conduct life safety rescue.
- They are notified when you call 911.

Call fire department immediately when you have

- A fire, explosion, or threat of one (e.g. smell of gas)
- An uncontrolled chemical reaction, or fumes that cause or pose a health risk, or someone is injured.
- A sizeable spill that involves acids, bases, reactives or toxics with a 3 or 4 rating.
- A spill that cannot be contained (through the floor, out the door, under tiles, or down drain).
- Insufficient spill materials or personal protective equipment to deal with spill

Massachusetts Department of Environmental Protection (MassDEP) role

Consultation on how to manage small spills:

- They may require you to call in a hazardous waste contractor to remove spill materials.
- They may require you to call the fire department to respond to the incident, if you have not already done so.

Emergency response services for reportable spills:

- Once MassDEP determines the severity of the incident, they may be able to provide on site assistance.
- They are not able to provide life safety rescue.
- They can provide regulatory oversight for reportable quantities of spills.

Call MassDEP Emergency Response line 888-304-1133

Call MassDEP's Emergency Response line when you:

- Need to determine if the amount spilled is considered a "reportable quantity,"
- Have technical questions regarding chemicals.

Chemical Emergency Response Phone Numbers

Call in the following order:

School Emergency Coordinator ***If you cannot reach, call 911 immediately***	
911 Dispatcher * **	**911**
Fire Department, Police, Ambulance	**911**
Poison Control Center	**(800) 682-9211**

Consult with the Fire Department whether you should contact:

Emergency Response Contractor	
MassDEP Emergency Response	**(888) 304-1133**

Location of Emergency Equipment and Supplies:

Eye Wash Station	
Emergency Shower	
First Aid Kit	
Spill Materials	
ABC Fire Extinguisher	

(*Complete and post near a phone*)

Safety and Emergency Response Equipment and Supplies Inventory Sheet

Regulations - Routine Safety Inspection of Safety Equipment: Local Fire Departments are required to conduct inspections of Massachusetts's public high schools. The MA Board of Fire Prevention Regulations, Chapter 527 CMR 10.02(2), requires schools laboratories that handle corrosives or flammables, to provide portable fire extinguishers, emergency eye wash stations, deluge showers, hand held body face washers, and deck mounted drench hoses. The specifications and locations of this equipment can be found in the American National Standard Institute Standard Z-3581.1, 1991.[4]

Teacher: **Classroom:** **Date:**

Equipment	Inventory	Condition	Need
Safety showers (see reverse)			
Eye wash stations (see reverse)			
Fire extinguishers (see reverse)			
Fire blankets			
Chemically resistant gloves Types Sizes			
Chemical resistant aprons or suits			
Goggles - splash, safety, laser			
Face shields			
Respirators: used only if fit tested Types Cartridges			
First aid materials			
Spill management materials: Absorbents Specialty spill kits Secondary container for leaky container Biomedical waste receptacle Other			

[4] Capstone Report, page 3-3

Requirements for safety showers:

- There should be one shower per lab, located within 50 feet of where chemicals are stored or used, with a sign “Emergency Shower.”
- Water flow should be 30 gallons per minute. Water temperature should be tepid (70-90 degrees F). Cold water is permitted if tempered water is unavailable, or if permitted by the head of the Fire Department. (Remember that someone in an emergency must be able to use the water for 15 minutes, which is difficult if the water is too hot or too cold).
- Showers should be tested twice a year (every 6 months) for operation, flow, clarity and temperature. Keep test records to provide upon request to the Fire Department, including but not limited to: date of test, station operation, system malfunctions, and the name of the person performing the test.

Requirements for eye wash station:

- There should be one per lab, within 50 feet of where chemicals are stored or used, with a sign “Emergency Eye Wash”. (Consider that a person will have compromised vision, so it is essential to keep the path to the equipment unobstructed).
- Eye wash must provide a continuous flow of 0.4 gallons per minute for 15 minutes. It should have a mechanism to stay on, to enable the user to keep hands free for cleaning off chemicals. It should be able to treat both eyes at the same time.
- If portable, eyewash must have fluid replaced every 6 months.
- Eyewash should be tested twice per year.

Requirements for fire extinguishers:

- Make sure extinguisher is the appropriate type for the chemicals used. It should be within 50 feet of where chemicals are stored or used.
- Maintain dated inspection tags to ensure that it is adequately charged.

Student Training:

Schools are required to train students on the location and proper use of emergency equipment prior to their use of hazardous materials. Schools must also provide training to them twice during their course on how to extinguish clothing fires.

Appendix 4: Chemical Purchasing Policy

Goals of the Purchasing Policy	To reduce the risk, liability and cost to students and staff through eliminating the purchase of unnecessary hazardous products.
Objectives of the Chemical Purchasing Policy	• Define the quantities and types of chemicals that can be purchased or accepted as donations. • Promote the use of less toxic alternatives. • Create a tracking system for the purchase and management of hazardous materials. • Compliance with Mercury in Products legislation
Hidden Costs of Chemical Management	• The school's liability (property damage, environmental contamination, personal injury, etc.) is greater relative to the quantity and toxicity of materials. • Expenses for the personal protective equipment, special storage equipment, special ventilation systems, emergency response supplies, and personnel and student training required for the use and management of hazardous materials. • Purchase of a relatively inexpensive chemical with unexpected huge disposal costs such as radioactives, or chemicals, that become "shock sensitive" over time. • Increased administrative costs.

Steps to Developing a Chemical Purchasing Policy

Identify a Purchasing Coordinator	Ideally this should be someone from the business office or another designated administrator who can oversee budget issues and approve purchases across all departments and has an understanding of the chemical issues.
Identify Department Representatives to Participate in Review Process	This group will participate in the development and implementation of the Purchasing Policy and purchase review criteria. Identify a representative from each department where chemicals are purchased (see Attachment # 1 *Departments that Use Hazardous Products)* who has the skills and authority to review their department's purchase requests.
Review Current Purchasing Procedures	Identify how chemical purchasing is currently done within each department, the individual school buildings, and within the district. Explore how to integrate the review of chemical purchase requests with the existing purchasing system. Please note: The *Massachusetts Mercury Management Act* prohibits schools from purchasing products that contain mercury for use in classrooms as of October 1, 2006. This provision is part of a larger law signed by Governor Romney on July 28, 2006 (Chapter 190 of the Acts of 2006, amending MGL c. 21H). The specific provision that applies to schools (Section 6G) states: *"No school in the commonwealth shall purchase for use in a primary or secondary classroom elemental mercury, mercury compounds or mercury-added instructional equipment and materials, except measuring devices and thermometers for which no adequate non-mercury substitute exists that are used in school laboratories. This section shall not apply to the sale of mercury-added lamps or those products whose only mercury-added component is a mercury-added lamp or lamps."*
Assess Chemical Inventory System	Determine if there is an existing chemical inventory system in the school. If not, initiate the development of a school wide or district wide chemical inventory system. This will enable departments to screen purchase orders against what already is in stock at the school. (*See Appendix 2: Assessing Current Conditions, Conducting a Chemical Inventory* for how to conduct a chemical inventory safely.) If products are requested that are already in the school system, you may need to develop guidelines on how to share them. See Attachment # 6 - *Chemical Swap System.*

Developing Guidelines on Chemical Purchases

Create *Standard Use Chemical Lists,* by Department

The *Standard Use Chemical Lists* are used as a guide for selecting acceptable chemical purchases. It will also eliminate the need for screening hundreds of other chemicals in your school for hazards.

Have staff members from the relevant departments (Attachment # 1 - *Departments that Use Hazardous Products*) create a list of the types and amounts of chemicals they use for one school year. Ask them to confirm wherever possible, with written laboratory lesson plans, art projects, and maintenance plans. These *Standard Chemical Use Lists* must be screened for highly hazardous chemicals.

Develop a process to consider exceptions to *Standard Use Chemical List*

Develop a protocol and criteria for evaluating exceptions to the *Standard Use Chemical List*. Consider the extra requirements necessary for proper management including; training, storage facilities, personal protective equipment, emergency response supplies, and disposal costs. Determine how the exception would be evaluated (e.g., funding available for special storage, necessity of products, etc.), and how it would be approved (e.g., points scoring, voting, etc.).

Develop a *Chemical Health and Safety Cap*

Identify specific chemicals or chemical characteristics that are considered too hazardous for use in the school due to their high health and safety risk. See Attachment # 2 C*hemical Health and Safety Cap Criteria* or the High Risk Chemical List from King County, Washington.

Explore toxics use reduction opportunities

Assist departments to research potential alternatives to using hazardous products, including: substituting a less toxic product, changing a certain process to eliminate the need for a product, or using a demonstration or video instead of an entire class experiment. A curriculum review committee should be formed to periodically do this review. Staff time must be allocated for such product and curriculum review.

Determine allowable quantities

If highly hazardous chemicals are required, such as sodium metal, instruct staff to purchase only what is needed for the next school year, or at most, for two years. For all other chemicals, use a reasonable time period. Discourage purchasing chemicals just to use up end-of-the-year budget surplus.

Develop receiving protocol

Assign someone to be responsible for receiving products. Use a log such as the Sample Central Receiving and Distribution Log to ensure all the relevant information is recorded. Discourage acceptance of donations. See Attachment # 3 *Donation Evaluation Criteria* to use for screening donations.

Developing a Chemical Purchase Review

Form review committee

Identify Departments that must follow the review process and designate members of a review committee. See Attachment #1 - *Departments that Use Hazardous Products*.

Coordinate Staff Purchase Review

Provide Attachment # 4 *Purchase Evaluation Criteria for Staff* to staff to screen their purchase requests before submission for review. Ask staff to complete and submit Attachment # 5 *Information to be Submitted with Purchase Request of a Hazardous Material* with an MSDS for any new hazardous chemical or any chemicals that are not on the standard use list.

Develop a Review Schedule

Coordinate the chemical purchase review with the regular purchase schedule. Consider the timeframe in which staff need to provide information to the reviewer, the reviewer's schedule, and when staff can appeal a purchase decision. Consider scheduling the review process after the completion of the annual chemical inventory to eliminate the purchase of items already in stock.

Provide an Orientation to Relevant Staff

Staff should also be instructed on the new chemical purchasing strategy for the school. This will include the following elements:

The purpose of the *Chemical Purchasing Policy*.

- The development, personnel, and role of the reviewer.
- How the *Chemical Purchase Review* Process works, including the role of the staff, and the information that the staff must provide the reviewer.
- The development and use of the *Standard Use List,* and how staff can request an exception to the *Standard Use List.*
- The new *Chemical Health and Safety Cap "Red Flag Criteria"* and how it will be used.
- How staff can appeal a decision made by the reviewer.
- Any administrative changes to the purchasing process, such as budget modifications.
- The Purchase Review Schedule including: the timeframe in which staff need to provide information to the reviewer, the review schedule, and when staff can appeal a purchase decision.

Attachment 1: School Departments that Use Hazardous Products

1. Academic departments
   - Science - laboratory chemicals, preserved specimens, and compressed gas cylinders from chemistry, biology, physics, etc.
   - Art – project supplies from painting, photography, graphic arts, ceramics, etc.
   - Home Economics – cleaning supplies, etc.

2. Shop Classes
   - Automotive – engine repair and auto body products petroleum and solvent based products, etc.
   - Wood Shop – wood finishes, adhesives, etc.
   - Metal Fabrication – metal working fluids, metal solders, gas cylinders, etc.
   - Cosmetology – solvent-based nail products, acids and bases used for hair treatments, hair dyes, disinfectants for equipment, etc.

3. Facilities
   - Maintenance – mercury containing devices* (thermostats, fluorescent lamps etc.), building maintenance products and finishes, etc.
   - Custodial – cleaning products, disinfectants, floor finishes, pool chemicals, etc.
   - Grounds – products for maintaining athletic fields and school grounds, petroleum products for power equipment, etc.

4. Nurse's Office
   - Mercury-containing thermometers and blood pressure cuffs*
   - Disinfectants, etc.

5. Food Services
   - Cleaning products - bleaches, ammonia, oven cleaner, degreasers, automatic dishwashing detergent, etc.
   - Disinfectants.
   - Mercury Cooking Thermometers*

*For a list of mercury-containing products that are commonly found in schools along with suggested non-mercury substitutes, visit: http://www.mass.gov/dep/service/hgschfax.pdf

Attachment 2: Health and Safety Cap Criteria

It is recommended that the following chemicals or types of chemicals should NOT BE ALLOWED for purchase or use in your school **(note that many chemicals will fall into more than one of these categories)**:

Chemicals with a flammability or reactivity rating of 4

Ratings are based on the MSDS, or the HMIS or NFPA rating system.

Chemicals that are explosive or that become unstable ("shock sensitive") as they age.

This includes peroxidizable compounds (such as ethyl ether and picric acid).

Chemicals with a health rating of 4

Ratings are based on the MSDS, or the HMIS or NFPA rating system. Chemicals with a health rating of 4 are generally fatal at very low exposure levels. All mercury and mercury compounds are strong neurotoxins. Most salts of mercury are fatal at less than one gram.

Chemicals with a health rating of 3

These should be carefully reviewed before purchase. It may not be possible to totally eliminate use of these chemicals because some common laboratory acids are in this category, but many cancer-causing and other highly toxic materials have a rating of 3. Examples include lead and lead compounds which are strongly neurotoxic, and most, such as lead acetate, are suspected cancer-causing agents.

Chemicals that require use of a respirator

Respirator use requires a formal respirator program including medical monitoring and fit testing. This is not going to reasonably occur in the school environment for staff and students. Also, if the respirator fails, the student or teacher receives an exposure.

Chemicals with special storage requirements

Examples include elemental sodium and phosphorus, which must be stored under mineral oil; some chemicals must be stored in an explosion-proof refrigerator, etc. These storage requirements are usually not met due to financial and time constraints.

Gas Cylinders

Cylinders can be dangerous for two reasons: the compressed nature of the gas creates a handling hazard as well as an "explosive" hazard in storage, and the gas itself can be hazardous.

Chemicals with a regulatory designation of "Acutely Hazardous Substances". If your school has any amount "Acutely Hazardous Substance", your hazardous waste generator status is automatically classified at a minimum as a "Small Quantity Generator"(even if the total amount of your hazardous waste would normally classify you as a "Very Small Generator"). Thus, you invoke the more stringent level of regulations.

Attachment 3: Evaluation for Donation Acceptance

Criteria	**Answer**	**Comments**
Do you need it?	yes ❑ no	
Do you need the quantity that they are offering?	yes ❑ no	
Is it what they say it is?	yes ❑ no	
Is it open?	yes ❑ no	
Is it contaminated?	yes ❑ no	
Is it in the original container?	yes ❑ no	
Is it in a used or new container relabeled properly?	yes ❑ no	
Is it in a intact container that is compatible with the product inside?	yes ❑ no	
What are the disposal costs?		
Do you have the storage facilities, staff training, safety and emergency response systems, and disposal program to manage it safely (hidden costs)?	yes ❑ no	
Have you checked the MSDS?	yes ❑ no	

Attachment 4: Evaluation of Staff Chemical Requests

Create a Curriculum Review Committee to

1. Evaluate your curriculum or procedure:

- Can the procedure requiring the chemical be done safely or should the chemical be eliminated?
- Is there a substitute procedure that will not require the use of a hazardous chemical such as a video or computer simulation?
- Could you use a less hazardous chemical?
- If the chemical is truly needed, could you use a smaller quantity of the chemical, such as in a demonstration instead of a whole class experiment?

2. Evaluate the storage requirements for this chemical:

- Do you have the type of cabinet, compatible shelving, etc, required or would you have to purchase them?
- Does this chemical react violently to air, water or other chemicals? Does it become unstable as it ages? Will it create toxic fumes if there is a fire?

3. Evaluate the health and safety issues for this chemical:

- What are the health effects of this chemical?
- Do you have the proper training to use it?
- Does your local hospital and Emergency Response Team have the training and equipment to deal an accident using this chemical? You cannot assume that you will have emergency aid if you are using a highly toxic or reactive chemical.
- Do you have the Personal Protective Equipment and emergency response equipment and supplies to use it or the budget to purchase them?

Attachment 5: Purchase Request Form for High Hazard Chemicals and/or Products Not On the Standard Use List

Staff Requesting Chemical: **Date Submitted:**
Reviewed by: **Review Date:**
Chemical Requested: **Synonym:**

Criteria	Answer	Comments
Why do you need this chemical?		
Is there a video, or computer simulation, or less hazardous alternative?	yes ❑ no	Alternatives:
Chemical will be used by:		__instructor only, __entire class
Product be used up in the following:		__1 year, __ 2 years, ___other_____
Is there a less hazardous alternative available?	yes ❑ no	Alternatives:
Can this be done in Microscale?	yes ❑ no	
Is this chemical already available within the school (your department or elsewhere)?	yes ❑ no	Location:
What are the hazard characteristics of this chemical and what is the NFPA rating?		Corrosive ❑ Reactive Flammable ❑ Carcinogen Oxidizer ❑ Explosive Poison ❑ Other_____
Do I have the training to use it?	yes ❑ no	Training:
Does this chemical require special safety requirements? If so, what are they?	yes ❑ no	Gloves ❑ Fume Hood Goggles ❑ Respirator Apron ❑ Other
Does this chemical require special emergency response supplies? If so, what are they?	yes ❑ no	Special Fire Extinguisher Specialty Spill Kits Other_____
Does this chemical have special storage requirements? If so, what are they?	yes ❑ no	Explosion proof refrigerator _____ Type shelving_____ Type cabinet_____ Temperature_____ Moisture_____ Other_____
What type and quantity of waste products are produced? What is the cost to dispose of it?	$_____	
Is the product on the *Red Flag List?* In what category?	yes ❑ no	
Are there any special handling requirements upon receipt of the product? If so, what?	yes ❑ no	

Attachment 6: Chemical Swap System

Consider developing a system for sharing inventory that is available in another department or school building. Issues to be addressed include:

Transporting the chemicals within a building and between buildings.

Transport of chemicals between buildings involves risks that need to be taken seriously. Consider the health and safety issues and related liability issues of having staff transport hazardous products. It involves;

- understanding how to pack chemicals safely in compatible groupings,
- having staff trained in chemical management and emergency response, and
- having proper receiving and storage of the materials on the receiving end.

Value of traded materials.

Some staff may want compensation for the materials that they are swapping. This could be done as a credit system. It could also be thought of as a reduction in disposal fees, thus saving the department money.

Tracking the swap on the inventory system.

A major problem with the inventory systems is keeping them updated. Be sure to track any changes in inventory.

Sample Point of Use Receiving Log for Hazardous Products - *Compliance with RCRA*

Product Name & Company	Product Quantity and Strength	Date Received	Final Destination Receiver	Ordered By	Compare to Purchase Order	Verify & Date MSDS	Short Term Storage	Long-term storage

Sample Central Receiving and Distribution Log for Hazardous Products -
Compliance with RCRA

Product Name & Company	Product Quantity and Strength	Date Received	Initial Location Delivered	Receiver	Ordered By	Transporter to final destination	Final Destination Receiver	Verify & Date MSDS

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Acetaldehyde	3	O-3 Flam Cabinet	75-07-0	Suspect carcinogen. Highly flammable. Peroxide former. Severe irritant to eyes	3	4	2	
Acetic Acid, >6M	2	O-1 Organic Acid	64-19-7	Corrosive.	3	2	0	
Acetic Acid, Glacial	1	O-1 Flam Cabinet	64-19-7	Corrosive. Combustible	3	2	0	
Acetic Anhydride	2	O-1 Flam Cabinet	108-25-7	Corrosive, flammable	3	2	1	
Acetone	2	O-4 Flam Cabinet	67-64-1	Highly flammable.	1	3	0	
Acetonitrile	2	O-7 Flam Cabinet	75-05-8	Flammable. Toxic by skin absorption, inhalation & ingestion.	2	3	0	
Acetyl Chloride	3	O-4 Acid Cabinet	75-36-5	Corrosive. Reacts with water & alcohol	3	3	2	W
Acrolein (acrylaldehyde)	3	O-3 Flam Cabinet	107-02-8	Flammable. Inhalation toxin. Severe irritant. Many incompatibilities. P-listed	4	3	3	
Acrylamide	3	O-3	79-06-1	Toxic by absorption, suspected carcinogen	2	2	2	
Acrylic Acid	3	O-8 Organic Acid	79-10-7	Corrosive. Poison by inhalation & skin absorption. Flammable	3	2	2	
Acrylonitrile	3	O-7 Flam Cabinet	107-13-1	Flammable. Poison by inhalation, skin absorption. Carcinogen	4	3	2	
Adipoyl Chloride	2	O-1 Organic Acid	111-50-2	Corrosive; absorbs through skin, lachrymator	2	2	0	
Adrenaline (Epinephrine)	3	O-2	51-43-4	Toxic. Theft risk. Drug Precursor.	3	0	0	
Aluminum Chloride, anhydrous	2	I-9	7446-70-0	Water reactive. Corrosive	3	0	2	W
Aluminum Nitrate	1	I-3	7784-27-2	Oxidizer	1	0	0	OX
Aluminum, powder	1	I-1	7429-90-5	Highly flammable as dust.	0	3	1	
Ammonia, gas cylinders	3	Poison Gas	7664-41-7	Corrosive lachrymator, intense irritant, theft risk	3	1	0	
Ammonium Bichromate	3	I-8	7789-09-5	Powerful oxidizer, toxic, carcinogen	2	1	1	OX
Ammonium Bifluoride	3	I-2	1341-49-7	Caustic, poison, severe irritant. Reacts with water, forms hydrofluoric acid	3	0	2	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Ammonium Chromate	3	I-8	7788-98-9	Oxidizer, toxic, carcinogen	1	1	1	OX
Ammonium Dichromate	3	I-8	7789-09-5	Powerful oxidizer, toxic, carcinogen	2	1	1	OX
Ammonium Fluoride	2	I-2	12125-01-8	Caustic. Toxic.	3	0	0	
Ammonium Hydroxide (>3 Molar)	1	I-4 Base Cabinet	1336-21-6	Corrosive. Lachrymator.	3	1	0	
Ammonium Metavanadate	1	I-8	7803-55-6	Highly toxic. Emits ammonia gas if heated.	3	0	0	
Ammonium Molybdate	1	I-8	12027-67-7	Irritant. Toxic by ingestion.	1	0	0	
Ammonium Nitrate	2	I-8 Separate	6484-52-2	Powerful oxidizer, reactive with organic compounds.	0	0	3	OX
Ammonium Oxalate	2	I-2	6009-70-7	Toxic via ingestion & inhalation. Corrosive.	2	0	0	
Ammonium Perchlorate	3	I-6	7790-98-9	Explosive; highly reactive	1	0	4	OX
Ammonium Persulfate	1	I-6	7727-54-0	Oxidizer. Moderately toxic. Strong irritant.	1	3	0	OX
Ammonium Sulfide	2	I-5	12124-99-1	Poison, reacts with acids to form poisonous H2S gas	3	2	1	
Amyl Acetate	1	O-3 Flam Cabinet	628-63-7	Flammable.	1	3	0	
Amyl Alcohol	1	O-2 Flam Cabinet	71-41-0	Flammable. Severe irritant.	1	3	0	
Aniline	3	O-2	62-53-3	Carcinogen, toxic, absorbs through skin	3	2	0	
Aniline Hydrochloride	3	O-2	142-04-1	Poison	3	1	0	
Antimony Trichloride	3	I-2	10025-91-9	Corrosive; emits hydrogen chloride gas if moistened	3	0	2	
Arsenic Oxide	3	I-4	7440-38-2	All are deadly poisons & carcinogens. Oxides are P-listed	3	0	0	
Arsenic Trioxide	3	I-7	1327-53-3	Arsenic & its salts are deadly poisons & carcinogens. P-listed	3	0	0	
Ascarite	1	I-4	1310-73-2	Sodium hydroxide coated silica. Corrosive	3	0	2	
Barium Chloride	2	I-2	10361-37-2	Deadly poison.	2	0	0	
Barium Chromate	3	I-8	10294-40-3	Toxic, oxidizer, carcinogen	2	0	1	OX
Barium Nitrate	2	I-3	10022-31-8	All are toxic. Barium nitrate is oxidizer	1	0	0	OX
Barium Peroxide	2	I-6	1304-29-6	Toxic by ingestion. Oxidizer. Corrosive.	1	0	0	OX
Benzaldehyde	2	O-3 Flam Cabinet	100-52-7	Combustible. Ingestion of small amount can cause convulsions	2	2	0	
Benzene	3	O-3 Flam Cabinet	71-43-2	Flammable. Carcinogen. Toxic.	2	3	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Benzidine	3	O-2	97-87-5	Carcinogen. Absorbs thru skin. Avoid contact! Poison. Use is banned in many countries.	1	0	0	
Benzonitrile	3	O-7 Flam Cabinet	100-47-0	Toxic. Organic cyanide, reacts with acids to produce poison gas. Combustible.	2	2	1	
Benzoyl Chloride	3	O-3 Flam Cabinet	98-88-4	Corrosive. Combustible. Inhalation hazard.	3	2	2	W
Benzoyl Peroxide	3	O-6	94-36-0	Organic peroxide, flammable, oxidizer	1	0	3	
Beryllium	3	I-1	7440-41-7	Poison. Dust is P-listed & highly toxic. Carcinogen	3	1	0	
Bismuth Trichloride	1	I-2	7787-60-2	Corrosive. Toxic.	0	0	0	
Biuret Test Solution	1	I-4 Base Cabinet	Mixture	Copper sulfate + sodium hydroxide. Corrosive. Toxic.	3	0	1	
Bouin's Solution	3	O-8 Organic Acid	Mixture	Diluted picric acid. Explosive when dry.	2	1	0	
Bromine Water	1	I-2 Acid Cabinet	7726-95-6	Corrosive. Irritating fumes.	3	0	0	OX
Bromine, concentrated	3	I-2 Acid Cabinet	7726-95-6	Corrosive, oxidizer, volatile liquid, poison fumes	3	0	0	OX
Bromobenzene	3	O-4 Flam Cabinet	108-86-1	Flammable. Toxic. Bioaccumulative pollutant.	2	2	0	
Bromobutane	2	O-4 Flam Cabinet	109-65-9	Flammable. Bioaccumulative pollutant.	2	3	0	
Bromoform	2	O-4	75-25-2	Toxic. Lachrymator. Bioaccumulative pollutant.	3	0	1	
Butanol, 1- (n-butyl alcohol)	1	O-2 Flam Cabinet	71-36-3	Flammable. Moderately toxic.	1	3	0	
Butanol, 2- (sec-butyl alcohol)	2	O-2 Flam Cabinet	89-92-2	Flammable. Can form explosive peroxides on concentration.	1	3	0	
Butoxyethanol	2	O-2 Flam Cabinet	111-76-2	Toxic by skin absorption. Combustible.	0	0	0	
Butyraldehyde	1	O-3 Flam Cabinet	123-72-8	Flammable. Toxic via skin absorption.	3	3	2	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Butyric Acid	2	O-1 Acid Cabinet	107-92-6	Corrosive; intense stench. Combustible. Theft risk.	3	2	0	
Cadmium Chloride	3	I-2	10108-64-2	Toxic heavy metal, carcinogen	4	0	0	
Cadmium Nitrate	3	I-3	10022-68-1	Toxic heavy metal, carcinogen. Oxidizer.	2	0	0	OX
Cadmium, powder	3	I-1	7440-43-9	Carcinogen. Poison.	3	0	0	
Caffeine	2	O-2	58-08-2	Poison.	0	0	0	
Calcium Carbide	2	I-5	75-20-7	Reacts with water to produce flammable acetylene gas.	3	3	2	W
Calcium Fluoride (Fluorspar)	1	I-2	7789-75-5	Poison by ingestion. Emits toxic fumes when heated.	0	0	0	
Calcium Hypochlorite	1	I-6	7778-54-3	Toxic. Strong oxidizer. Body tissue irritant.	3	0	1	OX
Calcium Nitrate	1	I-3	13477-34-4	Oxidizer	1	0	0	OX
Calcium Oxide	2	I-4	1305-78-8	Corrosive. Reacts with water.	3	0	1	
Calcium Phosphide	3	I-5	1305-99-3	Emits poisonous, flammable phosphine gas when wet.	4	3	3	W
Calcium Sulfide	2	I-5	1344-81-6	Poison, reacts with acids to form poisonous H2S gas	0	1	0	
Calcium, metal	1	I-1	7440-70-2	Water reactive.	3	1	2	W
Calomel (Mercurous Chloride)	3	I-2	10112-91-1	Extreme poison.	3	0	0	
Carbol Fuchsin Solution	2	O-8 Flam Cabinet	Mixture	Phenol + Ethanol. Toxic & flammable.	2	1	0	
Carbon Disulfide	3	I-5 Flam Cabinet	75-15-0	Flammable, poison, P-Listed, reacts with acids to form poisonous H2S gas	3	4	0	
Carbon Tetrachloride	3	O-4	56-23-5	Toxic, carcinogen. Bioacuumulative pollutant	3	0	0	
Carnoy's Fixative Solution	3	O-4 Flam Cabinet	Mixture	Chloroform + acetic acid + ethanol. Flammable. Corrosive. Carcinogen.	2	4	0	
Catechol	2	O-8	120-80-9	Highly toxic. Powerful allergen.	3	1	0	
Chloral Hydrate	3	O-2	302-17-0	Hypnotic drug. Controlled substance	2	0	0	
Chloretone	3	O-4	57-15-8	Poison. Narcotic. Controlled substance.	3	1	0	
Chlorine water	1	I-2 Acid Cabinet	7782-50-5	Corrosive. Irritating fumes.	3	0	0	
Chlorine, gas cylinders	3	Poison Gas	7782-50-5	Poison gas. Corrosive.	4	0	0	OX
Chlorobenzene	3	O-4 Flam Cabinet	108-90-7	Flammable, toxic via inhalation & contact. Bioacuumulative pollutant	2	3	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Chloroethanol	3	O-4 Flam Cabinet	107-07-3	Poison by skin absorption. Can produce acid gas. Flammable. Bioaccumulative	4	2	0	
Chloroform	3	O-4	67-66-3	Carcinogen. If old forms deadly Phosgene gas. Bioacuumulative pollutant	2	0	0	
Chlorophenol, p-	3	O-4	106-48-9	Poison by ingestion. Severe irritant. Bioaccumulative pollutant.	2	0	0	
Chloroprene	3	O-4 Flam Cabinet	126-99-8	Flammable. Poison. Bioaccumulative pollutant. Affects central nervous system	3	3	0	
Chlorosulfonic Acid	3	O-1 Acid Cabinet	7790-94-5	Toxic inhalation hazard. Highly corrosive. Bioacuumulative pollutant	4	0	2	W, OX
Chromic Acid	3	I-8 Acid Cabinet	1333-82-0	Strong oxidizer. Poison. Carcinogen. Corrosive.	3	0	1	OX
Chromium Nitrate	2	I-3	7789-02-8	Oxidizer. Toxic.	1	0	0	OX
Chromium Trioxide	3	I-4	1333-82-0	Oxidizer. Poison. Carcinogen.	3	0	2	
Cobalt Chloride	1	I-2	7646-79-9	Toxic. Possible carcinogen.	0	0	0	
Cobalt Nitrate	1	I-3	10026-22-9	Oxidizer. Suspect carcinogen. Toxic.	1	0	0	OX
Colchicine	3	O-2	64-86-8	Deadly poison. Affects cell division. Severe eye irritant.	3	1	0	
Collodion	3	O-4 Flam Cabinet	9004-70-0	Flammable. Explosive when dry. Ether/Nitrocellulose compound.	1	4	0	
Copper Chloride	1	I-2	10125-13-0	Toxic by ingestion & inhalation.	2	0	0	
Copper Cyanide	3	I-7	544-92-3	Severe poison. P-Listed. Releases poison gas when acidified even slightly.	3	0	0	
Copper Nitrate	2	I-3	19004-19-4	Oxidizer. Toxic.	1	0	0	OX
Copper Sulfide	2	I-5	22205-45-4	Poison, reacts with acids to form poisonous H2S gas	3	1	1	
Creosote	3	O-8 Flam Cabinet	8001-58-9	Carcinogen. Combustible.	2	2	0	
Cresol	3	O-8 Organic Acid	1319-77-3	Corrosive to skin & eyes. Toxic via ingestion, skin absorption.	3	2	0	
Cumene	3	O-4 Flam Cabinet	98-82-8	Flammable. Central nervous system depressant. Peroxide former. Explosion risk.	2	3	1	
Cyanogen Bromide	3	O-4	506-68-3	Poison. Corrosive. Reacts with acids to form poison gas.	4	0	1	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Cyclohexane	1	O-3 Flam Cabinet	110-82-7	Highly flammable.	1	3	0	
Cyclohexanol	1	O-2 Flam Cabinet	108-93-0	Combustible. Peroxidizable. Toxic by inhalation.	1	2	0	
Cyclohexene	3	O-3 Flam Cabinet	110-83-8	Flammable, peroxide former	1	3	0	
Denatured Alcohol	1	O-2 Flam Cabinet	Mixture	Flammable. Toxic via ingestion. Source of many lab fires. Methanol + Ethanol	2	4	0	
Dichlorobenzene, p-	2	O-4	106-46-7	Toxic. Severe irritant.	2	2	0	
Dichloroethane, 1,2- (ethylene dichloride)	3	O-4 Flam Cabinet	1300-21-6	Flammable. Toxic. Bioacuumulative pollutant	1	4	0	
Diethylamine	3	O-2 Flam Cabinet	109-89-7	Flammable. Corrosive to skin & eyes.	3	3	0	
Dimethyl Aniline	3	O-2 Flam Cabinet	121-69-7	Combustible. Poison by ingestion. Irritant. Central nervous system depressant.	3	2	0	
Dinitrophenol, 2,4-	3	O-4	51-28-5	Poison by inhalation, skin absorption. Explosive. "Bomb Squad"	3	3	1	
Dinitrophenyl Hydrazine, 2,4-	3	O-4	119-26-6	Explosion risk	1	2	2	
Dioxane, 1,4-	3	O-4 Flam Cabinet	123-91-1	Flammable. Peroxide former. Explosion risk.	2	3	1	
Estrone	3	O-2	53-16-7	Steroid. Carcinogen. Theft Risk.	0	0	0	
Ethanol (ethyl alcohol)	1	O-2 Flam Cabinet	64-17-5	Flammable.	0	4	0	
Ethidium Bromide	2	O-2	1239-45-8	Potent Mutagen	3	0	0	
Ethyl Acetate	1	O-3 Flam Cabinet	141-78-6	Flammable.	1	3	0	
Ethyl Carbamate (urethane)	2	O-2 Flam Cabinet	51-79-6	Toxic. Combustible. Possible carcinogen.	2	2	0	
Ethyl Chloride	3	O-4 Flam Cabinet	75-00-3	Extremely flammable. Contact w/ water produces corrosive, toxic fumes.	2	4	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Ethyl Ether (diethyl ether or anhydrous ether)	3	O-4 Flam Cabinet	60-29-7	Flammable. Peroxide former. Explosion risk.	1	4	1	
Ethyl Iodide	3	O-2 Flam Cabinet	75-03-6	Combustible. Contact w/ water produces corrosive, toxic fumes.	3	1	1	
Ethyl Nitrate	3	O-4 Explosive	625-58-1	Explosive. "Bomb squad"	3	4	4	
Ethylenediamine	3	O-2 Flam Cabinet	107-15-3	Flammable. Toxic by inhalation. Corrosive base.	3	2	0	
Ethyleneimine	3	O-2 Flam Cabinet	151-56-4	Flammable. Toxic. P –listed	4	3	3	
Ferrous Sulfide	1	I-5	69012-73-3	Reacts with acids to form poisonous hydrogen sulfide gas	0	0	1	
Formaldehyde (37% Solution)	3	O-3	50-00-0	Toxic. Carcinogen. Severe sensitizer	3	2	0	
Formalin, buffered, (<10% solution)	2	O-3	50-00-0	Toxic. Carcinogen. Severe allergen.	2	2	0	
Formic Acid, very old	1	O-1 Organic Acid	64-18-6	Corrosive. May degrade & pressurize sealed container.	3	2	0	
Furfural	3	O-3 Flam Cabinet	98-01-I	Combustible. Toxic via inhalation & ingestion. Dangerous to eyes.	3	2	0	
Glutaraldehyde (>10%)	1	O-3	111-30-8	Toxic via inhalation & skin absorption. Strong irritant.	3	0	1	
Gunpowder	3	I-4 Flam Cabinet	Mixture	Explosive, theft risk	0	4	3	
Hayem Diluting Fluid	3	I-2	Mixture	Contains mercuric chloride. Severe poison.	3	0	0	
Heptane	1	O-3 Flam Cabinet	142-82-5	Flammable	1	3	0	
Hexamethylenediamine (1,6-hexanediamine)	2	O-2 Base Cabinet	124-09-4	Corrosive if in typical solution with sodium hydroxide. Absorbs through skin, lachrymator	2	0	0	
Hexane	1	O-3 Flam Cabinet	110-54-3	Flammable.	1	3	0	
Hydrazine	3	O-2 Flam Cabinet	302-01-2	Flammable. Poison by inhalation & skin absorption. Carcinogen. Corrosive to skin.	3	3	3	
Hydrazine Sulfate	3	O-2	10034-93-2	Poison. Absorbs through skin. Carcinogen.	3	0	1	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Hydriodic Acid	3	I-9 Acid Cabinet	10034-85-2	Corrosive. Toxic by inhalation	3	0	0	
Hydrobromic Acid	2	I-9 Acid Cabinet	10035-10-6	Corrosive. Toxic fumes	3	0	0	
Hydrochloric Acid (>5 molar)	1	I-9 Acid Cabinet	7647-01-0	Highly corrosive. Toxic via inhalation & ingestion.	3	0	0	
Hydrofluoric Acid	3	I-9 Acid Cabinet	7664-39-3	Corrosive. Poison. Absorbs readily through skin,	4	0	0	
Hydrogen Peroxide, >29%	2	I-6	7722-84-1	Powerful oxidizer. Corrosive to skin	3	0	1	OX
Hydrogen Sulfide, gas cylinders	3	Poison Gas	7783-06-4	Poison. Inhalation hazard. Stench	4	4	0	
Hydrogen, gas cylinders	2	Flam Gas	1333-74-0	Flammable	0	4	0	
Hydroquinone	3	O-2	123-31-9	Toxic by ingestion & inhalation. Corrosive to eyes & skin.	2	0	0	
Immersion Oil (very old)	1	O-2	Mixture	May have 10-30% PCBs such as Arochlor 1260.	0	0	0	
Iodine	1	I-2	7553-56-2	Corrosive. Toxic via inhalation of vapors & dusts.	3	0	0	
Iron Chloride (ferric chloride)	1	I-2	10025-77-1	Corrosive. Toxic by ingestion.	2	0	0	
Iron Nitrate (ferric nitrate)	1	I-3	7782-61-8	Oxidizer	1	0	0	OX
Isopentyl Alcohol (isoamyl alcohol)	2	O-2 Flam Cabinet	78-83-1	Flammable. Can form explosive peroxides when concentrated	1	2	0	
Isopropanol (isopropyl alcohol)	1	O-2 Flam Cabinet	67-63-0	Flammable. Can form explosive peroxides when concentrated	1	3	0	
Isopropyl Ether	3	O-4 Flam Cabinet	108-20-3	Flammable, Highest-risk peroxide former. Explosive. Bomb squad.	2	3	1	
Lactic Acid	1	O-1 Organic Acid	79-33-4	Corrosive. Toxic.	3	0	0	OX
Lanthanum Nitrate	1	I-3	15878-72-5	Oxidizer.	1	0	0	
Lauroyl Peroxide	2	O-6	105-74-8	Severe irritant. Powerful oxidizer.	1	2	3	
Lead Acetate	2	I-2	301-04-2	Highly toxic	3	1	0	
Lead Carbonate	2	I-4	1319-46-6	Highly toxic	3	0	0	
Lead Chloride	2	I-2	7439-92-1	Highly toxic	3	0	0	
Lead Nitrate	2	I-3	10099-74-8	Highly toxic. Oxidizer	3	0	0	OX

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Lead Sulfate	2	I-2	7446-14-2	Highly toxic.	3	0	0	
Lead, powder	3	I-1	7439-92-1	Highly poisonous. Possible carcinogen.	2	1	0	
Lithium Aluminum Hydride	3	I-1	16853-85-3	Flammable solid. Reacts with air, water & organics	3	2	2	W
Lithium Fluoride	1	I-2	7789-24-4	Poison by ingestion. Emits toxic fumes when heated.	1	0	0	
Lithium Hydroxide	1	I-4	1310-65-2	Corrosive.	1	0	0	
Lithium Nitrate	1	I-3	7790-69-4	Oxidizer	1	0	0	OX
Lithium, Metal	2	I-1	7439-93-2	Reacts with water & nitrogen in air. Flammable solid.	3	2	2	W
Magnesium Nitrate	1	I-3	13446-18-9	Oxidizer.	1	0	0	OX
Magnesium Perchlorate (Anhydrone)	3	I-6	10034-81-8	Powerful oxidizer. Explosive reaction with alcohols.	1	0	0	OX
Magnesium, powder	2	I-1	7439-95-4	Highly flammable. May spontaneously ignite when wet or if friction is applied.	0	1	1	W
Malonic Acid	1	O-1 Organic Acid	39520-24-6	Corrosive in solution. Strong irritant. Drug precursor.	1	1	1	
Manganese Dioxide	1	I-4	1313-13-9	Oxidizer.	1	0	1	
Mercaptoethanol	3	O-2 Flam Cabinet	60-24-2	Flammable. Corrosive. Intense stench	3	2	1	
Mercuric Chloride	3	I-2	7487-97-7	Poison via all routes.	3	0	0	
Mercuric Iodide	3	I-2	7774-29-0	Poison.	2	0	0	
Mercuric Nitrate	3	I-3	7783-34-8	Poison. Oxidizer	3	0	0	OX
Mercuric Sulfate	3	I-2	7783-35-9	Poison via all routes.	3	0	0	
Mercurochrome	2	O-2	129-16-8	Toxic. Mercury compound	3	0	0	
Mercurous Chloride	3	I-2	10112-91-1	Poison	2	0	0	
Mercurous Nitrate	3	I-3	7782-86-7	Poison. Oxidizer.	3	0	0	OX
Mercurous Sulfate	3	I-2	7783-36-0	Poison.	3	0	0	
Mercury Thermometers	2	I-1 Separate	7439-97-6	Toxic heavy metal. Carcinogen. Volatile liquid. Corrosive.	2	0	0	
Mercury, liquid	2	I-1	7439-97-6	Toxic heavy metal. Carcinogen. Volatile liquid. Corrosive.	2	0	0	
Methanol (methyl alcohol)	1	O-2 Flam Cabinet	67-56-1	Flammable. Toxic via ingestion. Source of many lab fires.	2	4	0	
Methyl Ethyl Ketone	2	O-4 Flam Cabinet	78-93-3	Flammable. Dangerous fire risk. Toxic	1	3	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Methyl Iodide (Iodomethane)	3	O-4 Flam Cabinet	74-88-4	May be a narcotic; Carcinogen. Lachrymator.	3	0	1	
Methyl Isobutyl Ketone	2	O-4 Flam Cabinet	108-10-1	Flammable. Peroxidizable. Toxic.	2	3	1	
Methyl Isocyanate	3	O-5 Flam Cabinet	624-83-9	Flammable, dangerous fire risk, toxic	4	3	1	W
Methyl Isopropyl Ketone	2	O-4 Flam Cabinet	563-80-4	Flammable. Toxic by ingestion. Skin irritant.	1	3	0	
Methyl Methacrylate	2	O-3 Flam Cabinet	80-62-6	Flammable. Toxic via inhalation. Can polymerize violently.	2	3	2	
Methyl Orange	1	O-9	547-58-0	Highly toxic via ingestion.	2	0	0	
Methylamine	3	O-2 Flam Cabinet	74-89-5	Flammable. Corrosive. Intense stench. Inhalation toxin.	3	4	0	
Methylene Chloride	2	O-4	75-09-2	Suspected carcinogen. Bioaccumulative pollutant. Toxic.	2	1	0	
Millon's Reagent	3	I-9 Acid Cabinet	10045-94-0	Mercury nitrate + nitric acid. Deadly poison. Highly corrosive.	3	0	0	OX
Molisch Reagent	1	O-2 Flam Cabinet	Mixture	Napthol + ethanol. Toxic & flammable.	1	3	0	
Naphthalene	1	O-3	91-20-3	Toxic by ingestion, inhalation & skin absorption.	2	2	0	
Naphthylamine, a-	3	O-2 Flam Cabinet	134-32-7	Combustible, Toxic. Carcinogen. Absorbs through skin or lungs	2	1	0	
Nessler's Reagent	3	I-4	Mixture	Mercury iodide + sodium hydroxide. Deadly poison. Corrosive.	3	0	0	
Nickel Chloride	1	I-2	7440-02-0	All nickel dusts are carcinogenic. Toxic.	3	0	0	
Nickel Nitrate	2	I-3	13478-00-7	Strong oxidizer. Carcinogen as dust.	1	0	0	OX
Nickel Oxide	2	I-4	1313-99-1	Flammable as dust. Toxic. Carcinogen.	1	0	0	
Nickel, dust	2	I-1	7440-02-0	All nickel dusts are carcinogenic. Toxic.	1	0	0	
Nicotine	3	O-2	54-11-5	Poison. P-Listed Extremely hazardous	4	1	0	
Ninhydrin	2	O-2	485-47-2	Toxic. Strong irritant.	3	0	2	
Nitric acid (>1 molar & <10 molar)	1	I-9 Acid Cabinet	7697-37-2	Oxidizer. Toxic. Corrosive.	3	0	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Nitric Acid, concentrated	2	I-9 Acid Cabinet	7697-37-2	Poison. Highly corrosive. Powerful oxidizer.	4	0	0	OX
Nitrilotriacetic Acid	3	O-1 Organic Acid	139-13-9	Confirmed carcinogen. Toxic via ingestion.	3	1	1	
Nitrobenzene	3	O-3 Flam Cabinet	98-95-3	Toxic. Combustible. Oxidizer. Absorbs through skin.	3	2	1	
Nitrogen Triiodide	3	O-4 Explosive	13444-85-4	Explosive. Highly unstable! "Bomb Squad"	2	0	4	
Nitroglycerin	3	O-4 Explosive	55-63-0	Explosive. "Bomb Squad"	3	1	2	
Nitrophenol, 3-	2	O-8	554-84-7	Toxic via ingestion, inhalation.	3	0	0	
Nitrophenol, 4-	2	O-8	100-02-7	Poison via inhalation, ingestion, skin contact.	3	0	0	
Octanol, 2-	2	O-2 Flam Cabinet	4128-31-8	Combustible. Can form explosive peroxides if concentrated.	1	2	0	
Osmium Tetraoxide (Osmic Acid)	3	I-4	20816-12-0	Highly toxic. P-Listed Extremely Hazardous.	3	0	0	
Oxalic Acid	1	I-1	6153-56-6	Toxic. Irritant.	3	1	0	
Paraformaldehyde	3	O-3	30525-89-4	Releases poisonous formaldehyde gas when heated	3	1	0	
Paraldehyde	3	O-3 Flam Cabinet	123-63-7	Flammable. Controlled substance. Poison. Theft risk.	2	3	1	
Pentachlorophenol	3	O-4	87-86-5	Extremely toxic. Bioaccumulative pollutant.	3	0	0	
Pentane	1	O-3 Flam Cabinet	109-66-0	Flammable. Narcotic at high concentrations.	1	4	0	
Perchloric Acid	3	I-9 Acid Cabinet	7601-90-3	Powerful oxidizer. Highly corrosive. Potential explosive in contact w/ metals	3	0	3	OX
Perchloroethylene	2	O-4	127-18-4	Toxic. Bioaccumulative pollutant.	2	0	0	
Petroleum Ether	1	O-3 Flam Cabinet	8032-32-4	Flammable.	1	4	0	
Phenanthroline	2	O-2	66-71-7	Toxic by ingestion.	2	1	0	
Phenol	2	O-8	108-95-2	Poison. Corrosive. Readily absorbed through skin.	4	2	0	
Phenylthiocarbamide	2	O-2	103-85-5	Deadly poison.	2	0	0	
Phosphoric Acid	1	I-9 Acid Cabinet	7664-38-2	Corrosive. Toxic.	3	0	0	
Phosphorus Pentasulfide	3	I-5	1314-80-3	Water Reactive. Toxic. Incompatible with air & moisture	2	1	2	W

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Phosphorus Pentoxide	3	I-10	1314-56-3	Oxidizer. Corrosive. Toxic.	3	0	2	W
Phosphorus, Red	2	I-10 Flam Cabinet	7723-14-0	Flammable solid. Poison	1	1	1	
Phosphorus, Yellow or White	3	I-10 Flam Cabinet	7723-14-0	Spontaneously ignites in air. Poison.	4	4	2	
Physostigmine	3	O-2	57-47-6	P-listed. Toxic	0	0	0	
Picric Acid, Trinitrophenol	3	O-8 Organic Acid	88-89-1	Explosive when dry. Explosive crystals form in contact with metals.	3	4	4	
Polyurethane Foam – Part B	2	O-5	26471-62-5	Can contain toxic isocyanates. Use in hood.	2	1	1	
Potassium Bromate	2	I-6	7758-01-2	Strong oxidizer. Toxic.	1	0	0	OX
Potassium Chlorate	2	I-6	3811-04-9	Powerful oxidizer. Theft risk. May explode if heated.	2	0	0	OX
Potassium Chromate	2	I-8	11073-34-0	Powerful oxidizer. Toxic. Carcinogen	3	0	1	OX
Potassium Cyanide	3	I-7	151-50-8	Severe poison. P-Listed. Releases poison gas when acidified even slightly.	3	0	0	
Potassium Dichromate	2	I-8	7778-50-9	Powerful oxidizer. Toxic. Carcinogen	3	0	0	OX
Potassium Ferricyanide	1	I-7	13746-66-2	Releases cyanide gas if heated or acidified. Toxic	3	0	0	
Potassium Ferrocyanide	1	I-7	14459-95-1	Releases cyanide gas if heated or acidified. Toxic	1	0	0	
Potassium Fluoride (potassium bifluoride)	2	I-2	7789-29-9	Highly toxic by ingestion or inhalation. Severe skin irritant.	1	0	0	
Potassium Hydroxide (>3 molar)	1	I-4 Base Cabinet	1310-58-3	Corrosive. Blisters skin on contact.	3	0	1	
Potassium Iodate	1	I-6	7758-05-6	Oxidizer. Toxic.	1	0	0	OX
Potassium Nitrate	1	I-3	7757-79-1	Oxidizer	1	0	0	OX
Potassium Nitrite	1	I-3	7758-09-0	Oxidizer. Toxic by ingestion.	1	0	0	OX
Potassium Perchlorate	3	I-6	7778-74-7	Powerful oxidizer. Reactivity hazard. Severe irritant.	1	0	2	OX
Potassium Periodate	1	I-6	14691-87-3	Oxidizer. Severe skin irritant.	1	0	2	OX
Potassium Permanganate	1	I-8	7722-64-7	Strong oxidizer. Strong irritant. Can explode if quickly heated.	1	0	0	OX
Potassium Peroxide	3	I-6	17014-71-0	Water reactive. Strong oxidizer.	3	0	1	OX
Potassium Persulfate	1	I-6	7727-21-1	Strong oxidizer. Strong irritant.	1	0	0	OX
Potassium Sulfide	3	I-5	37199-66-9	Flammable. Unstable, may ignite spontaneously.	3	1	0	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Potassium Thiocyanate	1	I-7	333-20-0	Toxic by ingestion. Reacts with acids to release cyanide gas.	1	0	0	
Potassium, metal	3	I-1	7440-09-7	Water reactive, peroxide former (orange fog/crystals)	3	3	2	W
Propanol, n-	1	O-2 Flam Cabinet	71-23-8	Flammable.	2	3	2	
Propionic Acid	2	O-1 Organic Acid	79-09-4	Corrosive. Flammable.	3	2	0	
Pyridine	3	O-2 Flam Cabinet	110-86-1	Flammable. Toxic by ingestion, inhalation, skin contact Vapor forms explosive mix with air	3	3	0	
Pyrogallol	2	O-8	87-66-1	Toxic. Readily absorbed through skin.	3	0	0	
Resorcinol	2	O-8	108-46-3	Toxic. Easily absorbed through skin.	3	1	0	
Sebacoyl Chloride	2	O-1 Organic Acid	111-19-3	Corrosive fumes. Lachrymator	3	1	1	
Sebacoyl Chloride/Hexane Solution	2	O-3 Flam Cabinet	Mixture	Flammable. Corrosive.	3	3	1	
Selenium	2	I-1	7782-49-2	Acute poison by inhalation of powder or ingestion.	1	0	0	
Silver Acetate	2	I-2	563-63-3	Toxic	1	0	0	
Silver Cyanide	3	I-7	506-64-9	Severe poison. P-Listed. Releases poison gas when acidified even slightly.	3	0	0	
Silver Nitrate	2	I-3	7761-88-8	Oxidizer. Poison. Corrosive.	2	0	0	OX
Silver Oxide	2	I-4	1301-96-8	Oxidizer. Toxic.	1	0	0	
Soda Lime	1	I-4 Base Cabinet	Mixture	Calcium oxide + sodium hydroxide. Corrosive solid. Generates heat in contact w/ water.	3	0	1	W
Sodium Arsenate	3	I-7	15120-17-9	Deadly poison. Carcinogen.	3	0	0	
Sodium Arsenite	3	I-7	7784-46-5	Deadly poison. Carcinogen.	3	0	0	
Sodium Azide	3	I-3	26628-22-8	Poison, explosive reaction with metals. P-Listed Extremely hazardous	3	0	3	
Sodium Bismuthate	1	I-7	12232-99-4	Oxidizer.	2	0	0	
Sodium Bisulfite (sodium hydrogen sulfite)	1	I-2	7631-90-5	Severe skin irritant when moist. Toxic.	1	0	1	
Sodium Borohydride	3	I-1	16940-66-2	Flammable solid. Water reactive	3	0	2	W

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Sodium Bromate	2	I-6	7789-38-0	Oxidizer. Toxic by ingestion.	1	1	1	
Sodium Chlorate	2	I-6	7775-09-9	Powerful oxidizer. Theft risk. May explode if heated.	1	0	2	OX
Sodium Chromate	2	I-8	7775-11-3	Powerful oxidizer. Toxic. Carcinogen	3	0	0	OX
Sodium Cyanide	3	I-7	143-33-9	Severe poison. P-Listed. Releases poison gas when acidified even slightly.	3	0	0	
Sodium Dichromate	2	I-8	10588-01-9	Powerful oxidizer. Toxic. Carcinogen	3	0	0	OX
Sodium Ferrocyanide	1	I-7	13601-19-9	Can release cyanide gas if heated or acidified.	2	0	0	
Sodium Fluoride (Bifluoride)	2	I-2	1333-83-1	Highly toxic by ingestion or inhalation. Strong skin irritant.	3	0	0	
Sodium Hydrosulfite (sodium dithionite)	3	I-2	7775-14-6	Water reactive. Toxic by ingestion & inhalation. An allergen. Powerful reducing agent.	2	1	2	
Sodium Hydroxide (>3 molar)	1	I-4 Base Cabinet	8012-01-9	Corrosive. Blisters skin on contact.	3	0	1	
Sodium Hypochlorite (>4 % solution)	1	I-6	7681-52-9	Toxic by ingestion & inhalation. Oxidizer. Reacts with acid to form chlorine gas.	2	0	0	
Sodium Nitrate	1	I-3	7631-99-4	Oxidizer.	1	0	0	OX
Sodium Nitrite	1	I-3	7632-00-0	Oxidizer. Toxic by ingestion.	1	0	0	OX
Sodium Nitroferricyanide	2	I-7	14402-89-2	Inhalation & ingestion toxic. Reacts with acids to form cyanide gas.	3	0	0	
Sodium Perborate	2	I-8	10486-00-7	Oxidizer. Toxic by ingestion.	1	0	0	OX
Sodium Perchlorate	3	I-6	7601-89-0	Powerful oxidizer. Reactivity hazard. Severe irritant.	2	0	2	OX
Sodium Peroxide	3	I-6	1313-60-6	Water reactive. Strong oxidizer.	3	0	1	OX
Sodium Sulfide	2	I-5	1313-82-2	Poison. Reacts with acids to form poisonous hydrogen sulfide gas	3	1	1	
Sodium Thiocyanate	1	I-7	540-72-7	Toxic by ingestion. Reacts with acids to form poisonous cyanide gas.	1	0	1	
Sodium, metal lump	2	I-1	7440-23-5	Water reactive. Ignites spontaneously in dry hot air. Corrosive	3	3	2	W
Sodium, metal, small chips	1	I-1	7440-23-5	Water reactive. Corrosive	3	3	2	W
Stannic Chloride	2	I-2	7646-78-8	Corrosive. Can produce hydrochloric acid fumes. Toxic by inhalation.	3	0	1	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Stannous Chloride	1	I-2	7772-99-8	Corrosive. Toxic. Skin irritant.	3	0	1	
Strontium	3	I-1	7440-24-6	Flammable. Store under naphtha. Water reactive.	2	2	2	W
Strontium Hydroxide Solution	2	I-4 Base Cabinet	1311-10-0	Corrosive.	2	0	1	
Strontium Nitrate	1	I-3	10042-76-9	Oxidizer.	1	0	0	
Styrene, monomer	2	O-3 Flam Cabinet	100-42-5	Flammable. Suspect carcinogen.	2	3	0	
Sulfamic Acid	1	I-9 Acid Cabinet	5329-14-6	Corrosive.	1	0	0	
Sulfur Dioxide, gas cylinder	3	Poison Gas	7446-09-5	Poison gas at high levels. Corrosive irritant to eyes & skin.	3	0	0	
Sulfuric Acid	1	I-9 Acid Cabinet	7664-93-9	Corrosive. Oxidizer.	3	0	2	W
Testosterone	3	O-2	58-22-0	Controlled substance. Steroid. Theft risk.	0	0	0	
Testosterone Proprionate	3	O-2	57-85-2	Controlled substance. Steroid. Theft risk.	0	0	0	
Tetrahydrofuran	3	O-4 Flam Cabinet	109-99-9	Flammable. Peroxide former. Explosion risk.	2	3	1	
Thallium	3	I-1	7440-28-0	Extremely poisonous.	2	0	0	
Thermite Igniting Mixture	2	I-1 Flam Cabinet	Mixture	Flammable solid.	0	1	0	
Thimerosal (merthiolate, mercurochrome)	2	O-2	54-64-8	Poison. Organic mercury compound.	1	0	0	
Thioacetamide	3	O-2 Flam Cabinet	62-55-5	Toxic. Carcinogen. Combustible.	3	1	1	
Thionyl Chloride	3	I-6 Acid Cabinet	7719-09-7	Corrosive. Violent reaction w/ water forms acid gas.	4	0	2	W
Thiourea	3	O-2	62-56-6	Carcinogen. Highly toxic.	1	0	0	
Thorium Nitrate	2	I-3 Radioactive	13823-29-5	Radioactive. Toxic. Oxidizer	1	0	0	RAD
Titanium Tetrachloride	3	I-2	7550-45-0	Toxic inhalation hazard. Highly corrosive.	3	0	2	W
Titanium Trichloride	3	I-2	7705-07-9	Corrosive. Reacts with water & heat to produce corrosive, toxic fumes.	3	0	1	

High Risk Chemical List (King County, Washington)

Chemical Name	Risk	Storage Category	CAS #	Hazards	Health (Blue)	Flamma-bility (Red)	Reactivity (Yellow)	Special Hazard (White)
Toluene	2	O-3 Flam Cabinet	108-88-3	Flammable. Toxic	2	3	0	
Trichloroacetic Acid	2	O-1 Organic Acid	76-03-9	Corrosive. Toxic fumes. Bioaccumulative pollutant. Degrades to form chloroform.	3	0	0	
Trichloroethane	3	O-4	71-55-6	Toxic. Ozone depleting chemical. Bioaccumulative pollutant.	2	1	1	
Trichloroethylene	3	O-4	79-01-6	Toxic via skin, inhalation. Ozone depleter. Bioaccumulative pollutant. Carcinogen.	2	1	0	
Triethyl Phosphate	2	O-5	78-40-0	Pesticide. Moderate cholinesterase inhibitor.	0	1	1	
Triethylamine	3	O-2 Flam Cabinet	121-44-8	Flammable. Toxic. Irritant.	3	3	0	
Trinitrobenzene	3	O-3 Explosive	99-35-4	Explosive. "Bomb Squad"	2	4	4	
Trinitrotoluene (TNT)	3	O-3 Explosive	118-96-7	Explosive. "Bomb Squad"	2	4	4	
Turpentine	1	O-3 Flam Cabinet	8006-64-2	Flammable.	1	3	0	
Uranium	2	I-1 Radioactive	1344-59-8	Radioactive. Toxic by ingestion.	1	4	3	RAD
Uranyl Acetate	2	I-2 Radioactive	541-09-3	Radioactive. Toxic by ingestion.	1	0	0	RAD
Uranyl Nitrate	3	I-3 Radioactive	36478-76-9	Radioactive. Toxic by ingestion. Oxidizer. Corrosive to skin.	1	0	0	RAD, OX
Vanadium Pentoxide	3	I-4	1314-62-1	Poison via inhalation & ingestion.	3	0	1	
Wood's Metal	2	I-1	76093-98-6	Poison. Contains cadmium & lead.	0	0	0	
Wright’s Staining Solution	1	O-9 Flam Cabinet	68988-92-1	Mixed with methanol. Flammable. Toxic by ingestion.	1	0	0	
Xylene	2	O-3 Flam Cabinet	1330-20-7	Flammable. Toxic	2	3	0	
Zinc Chloride	1	I-2	7646-85-7	Corrosive to skin. Toxic by ingestion.	1	0	0	
Zinc Nitrate	1	I-3	10196-18-6	Oxidizer. Toxic by ingestion.	1	0	0	OX
Zinc Sulfide	1	I-5	1314-98-3	Reacts with acids to form poisonous hydrogen sulfide gas.	2	0	1	
Zinc, dust	1	I-1	7440-66-6	Flammable solid. If gets damp, can generate heat & pressurize container.	0	1	1	

Risk Levels:

3: **Highest Risk Chemicals -** Not Recommended for Use in Schools. Pose Very Serious Risks to Health and Environment.

2: **High Risk Chemicals -** Use with extreme care. Purchase in smallest available amounts. If possible:Buy prediluted, limit storage to <250 g or 500 ml, use as demos.

1: Other Chemicals of Concern - Stock smallest practical amount. Limit student use unless low concentration.

Hazards Rating:

W: Materials that react violently or explosively with water (i.e., water reactivity rating 2 or 3).

OX: Materials possess oxidizing properties (promote ignition and rate of burning of organic materials)

RAD: Materials that are radioactive.

Health Hazards Rating:

0: Materials that offer no hazard beyond that of ordinary combustible materials.

1: Materials that, under emergency conditions, can cause significant irritation.

2: Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.

3: Materials that, under emergency conditions, can cause serious or permanent injury.

4: Materials that, under emergency conditions, can be lethal.

Flammability Hazards Rating:

0: Materials are not ignitable.

1: Materials that require considerable preheating before ignition and combustion can occur.

2: Materials that, under high ambient temperatures or under moderate heating could ignite or release hazardous vapors.

3: Materials can be readily ignited and produce hazardous vapors under almost all ambient temperatures.

4: Materials that rapidly or completely vaporize and disperse at normal ambient temperatures and will burn readily.

Reactivity Rating:

0: Materials are normally stable even under fire conditions.

1: Materials are normally stable but can become unstable at elevated temperatures and pressures.

2: Materials readily undergo violent chemical change at elevated temperatures and pressures.

3: Materials are capable of detonation but require an initiating source or heating under confinement first.

4: Materials are readily capable of detonation or explosive decomposition at normal temperatures and pressures.

Appendix 5: Chemical Management and Safe Storage

Hazardous Product Storage Area, Design and Maintenance

Table of Contents of this Appendix

Please note: End Notes for this Appendix can be found at the end of this document.

Introduction

Overview

This appendix provides criteria for either designing a new storage room, or retrofitting your existing storage room for the storage of hazardous *products*, not *waste*. Hazardous waste has a separate set of regulatory guidelines. See the Attachment, MassDEP Fact Sheet on *Hazardous Waste Accumulation Area Guidance.*

Each section of this guide provides both the design elements and the related maintenance activities for your chemical storage room to enable you to maintain the integrity of the system.

Disclaimer

The information is based on state and federal laws, industry standards, and best management practices. Although the guide integrates information from a number of relevant state regulations, it does not represent any regulation in its entirety, and it is not a replacement for consulting local, state and federal regulations. The *Massachusetts School Chemical Management Program* was designed to be implemented with the active participation of municipal, state and federal agencies.

Regulatory References

Referenced state regulations include (See Appendix 1: State Regulations)

- Fire Prevention Regulations
- Right-To-Know Law
- Hazardous Waste Regulations
- Universal Waste Rule

For Building Code references, please contact your Building Inspector since the codes that apply to your school are determined by the specific parameters of your building, such as age and use.

Terminology

The use of the word **chemical** throughout this guide refers to **hazardous products** used throughout the school for curriculum, cleaning and building maintenance, and for **chemicals** used in science labs. It does *not* refer to hazardous waste. A hazardous product becomes waste when the user designates it as a waste. Reasons for designating it a waste include when it expires, becomes contaminated, has deteriorated, is no longer being used, or is leftover from a process or project. Please see Appendix 6: Hazardous Waste Management for storage of hazardous waste.

Introduction (continued)

Common Chemical Storage Problems

The most common problems of improper chemical storage found in schools result from the lack of management policies and protocols:

- Staff are not assigned responsibility for managing hazardous materials.
- Lack of staff and student training in safe chemical management, emergency response and Right-To-Know.
- Lack of chemical management policy and protocols.
- Lack of inventory control, resulting in stockpiles of unmanaged chemicals. School personnel are usually unaware of the location, quantity, toxicity, and condition of these stockpiles.
- Chemicals stored in incompatible groupings, on incompatible shelving, or in incompatible containers. Incompatible storage can cause chemicals to react to each other and result in explosions, fires, release of vapors, or deterioration of equipment.
- Flammable products stored improperly with ignition sources.
- Chemicals stored in workspace, with food or supplies.
- Lack of a central storage area with proper equipment and a controlled environment, often resulting in hazardous products stored in classrooms, prep rooms, desks, and supply closets under dangerous conditions.
- Lack of emergency response systems including; inspection, equipment, supplies, and signage for type and quantities of chemicals stored, increasing health and safety risks to students.
- Poor housekeeping including; crowded storerooms and shelves, containers stored overhead and on the floor, trip hazards, and deteriorated products.
- Lack of separation of hazardous products and hazardous waste.
- Lack of identifying information including; MSDSs, container labels, room placards and shelf signage.
- Lack of proper ventilation, which compounds many of the other problems.

Roles and Responsibilities

Evaluate Existing Chemical Management Responsibilities

- Identify departments, staff and students who use chemicals, including but not limited to; art, shops, custodial, sciences, the nurse, and food service.
- Identify who is currently responsible for the transport, receipt, storage, use, inventory, inspection, maintenance, and the disposal in each department.
- Identify who in each department orders the equipment and supplies for chemical storage and chemical emergency response.
- Identify who maintains the Material Safety Data Sheets (MSDS) for chemicals in each department. Check on the status and completeness of the current MSDS system, its location and accessibility.
- Review the current staff's job descriptions, qualifications, experience, and training related to chemical management.

Assign Chemical Management Responsibilities

- Determine who should and shouldn't be handling chemicals, and to what extent they should be participating in the management of these chemicals.
- Identify who should be assigned management oversight for the storeroom.
- Determine what training staff requires to do this work.

Provide Chemical Storage Supplies and Equipment

Provide supplies for storage including:

- Chemically compatible cabinets, shelving, and containers.
- Safety containers and secondary containment for compromised containers.
- Labels that are blank or have the HMIS system on them, clear tape and permanent markers (and any coding markers if you have a coding system).
- Chemical emergency response supplies (spill control) and equipment (emergency wash stations and firefighting equipment), see Attachment *Chemical Emergency Response.*
- Carts for chemical transport through building.
- Personal protective equipment for the type of chemicals used.

Plan Training

Plan training based on the needs identified above. Training should cover:

- The Right-To-Know law and how to read an MSDS sheet.
- Proper transport, receipt, storage, use, inventory, inspection, maintenance, and disposal of chemicals.
- Safety, Hazard Mapping and Chemical Emergency Response.

Location and Signage of Chemical Storage Room

Design:

Location

Identify where the chemicals are used and:

- Plan for safety when locating a storage area in relationship to the transport route to the point of use. Consider the current transport pattern of chemicals from the point of use to the current storage area. Are they transported through places where chemicals can get jostled or harm the carrier while in transport, such as through busy corridors, down the central staircase, or outside?
- Locate in a separate room in a location central to the departments using it. It should be near points of use, but *not* within classrooms, prep rooms, hallways, or under stairways.

Design:

Room Specifications

- Locate away from rooms with ignition sources, e.g., the boiler, major appliances, and ignition sources (see section on *Environmental Controls, Ignition Sources*).
- Locate where floors are in good repair (seamless, uncracked) to prevent spills from accumulating in floor, and leaking to a room or the ground below.
- Locate where there are no floor drains if possible. If this is not possible, see the section on *Emergency Response, Spill Control, Floor Drains* in this document for management of floor drains.
- The room must be enclosed and lockable.
- It is best to locate in a room that has two exits. The Massachusetts Building Code governs the number of exits that are required in chemical storage rooms. These requirements are school building specific, and you should check with your local Building Inspector.

Design:

Signage

- Clearly label the storage door “CHEMICAL STORAGE”.
- Consult with your Fire Department about whether they would like you to placard the door with the NFPA Diamond, with the most potential hazardous reactions noted on the diamond. Although this is a Department of Transportation marking system, it helps the Fire Department to know what chemicals are stored in the room to help them accurately decide what types of firefighting materials to use. For example, some chemicals are water reactive, and could seriously injure a Fireman if they used water on it.
- Post signs inside to identify the exits.
- Post a map of the location and storage pattern of the stored chemicals.

Location and Signage of Chemical Storage Room
(continued)

Maintenance:

Signage

- If used, maintain the number on the NFPA Placard Diamond designating the most hazardous product in the storeroom when the inventory changes.
- Update map of chemical locations.
- Keep all exit signs unobstructed.

Environmental Controls: Ventilation

Introduction
Types of Ventilation Systems

There are two types of ventilation systems:

- *General Dilution Ventilation Systems* – are designed to mix in a percentage of fresh air with the air that is currently in the building, and to recirculate it throughout the building. This type of system is not appropriate for chemical storage rooms since it does not remove the chemical vapors, it just *dilutes* them.
- *Dedicated Direct Ventilation Systems* – are separate ventilation systems that operate independently from the general ventilation system. They are used to completely capture and exhaust 100% of air from room or attached equipment directly to the outside, *not* into the general school ventilation system. Chemical storage rooms should use this system.[i] Direct ventilation systems are used for appliance exhaust systems such as a Laboratory Fume Hood, or for a room exhaust system such as a bathroom or chemical storage room.

Design

- Air Pressure – a direct exhaust system should "depressurize" (more air leaves the room then comes in) the room to ensure that evaporating chemicals are directed out of the building. This will prevent the migration of chemical vapors into adjacent spaces.
- Air Supply – the storage room should not have its own fresh air supply. An adequate source of transfer air (air from one building space to another) needs to be provided for the exhaust to work.
- Air Changes Per Hour – a whole room exhaust system should provide 6 air changes per hour at a minimum, operating continuously on a 24-hour basis.
- System Design – the system should ventilate from the floor level up to capture vapors from flammables that are heavier than air, and settle on the floor.
- Equipment Specifications – If the ventilation is wall mounted, it should be equipped with a fan guard. Also, consult with your Fire Department to determine if the ventilation equipment requires special explosion or spark proof equipment where there is flammable storage such as; non-sparking or nonferrous blades in your fans, motor and controls, or to specify if the fan needs to be located outside the path of possible vapor release.
- Location of Direct Ventilation Exhaust Pipes – locate the exhaust pipes a minimum of 8 feet[ii] above the roofline, and a minimum of 2 feet[iii] above fresh air intakes.

Environmental Controls: Ventilation (continued)

Maintenance

Inspect on an annual basis:

- Check that all of the ducting for the system is intact, continuous and free of corrosion.
- Check that the fan is connected to the ductwork.
- Check that the outside exhaust vent is not clogged with bird nests or other debris.
- Ensure that the system is running continuously, *not* on a timer or occupancy schedule.
- Check to ensure that it is being vented directly to the outside and not into the general ventilation system.
- Conduct annual maintenance.

Environmental Controls: Heat, Temperature, Lighting

Design: **Temp and Heat Sources**	Heat Sources – select heat sources in the storage room appropriate for the types of chemicals stored (see section on *Environmental Controls, Ignition Sources*).
Maintenance: **Temperature and Heat Sources**	Temperature and Conditions – keep the air cool and dry, with a temperature maintained at 50 – 80 degrees F. Store chemicals away from heat sources, and out of direct sunlight. Stable temperatures[iv] will maintain chemical quality and stability.
Design and Maintenance: **Lighting**	Quantity – lighting should be sufficient (50 – 100 candles per square foot)[v] to provide good visibility and prevent accidents. Bulb Replacement – replace any flickering or nonworking bulbs. As an Ignition Source – check with your Fire Department to determine if this is a problem.

Environmental Controls: Ignition Sources

Design:

Ignition Sources

Identify Ignition Sources – the MA Fire Prevention Regulations[vi] require you to eliminate or control ignition sources where flammable vapors are present. Thus, you must identify all potential sources of ignition when designating or designing rooms for storage of flammables:

Electrical

- Automatic and manual switches for lights and fans including motion detectors, thermostat sensors and timers
- Electrical panels, outlets, fixtures, exposed wires, and control panels for the classroom appliances
- Electrical appliances if plugged in - e.g., microwaves, coffee pots, refrigerators. Also remember that compressors are in appliances such as soda machines, some kitchen equipment, refrigerators, and air conditioners.

Sparks

- Static – from pouring flammable liquids into ungrounded containers, and from movement across a static surface such as a rug
- Mechanical and electrical

Spontaneous Combustion

- Rags soaked in flammable liquid

Hot Surfaces and Radiant Heat

- Radiators
- Stoves

Heat Producing Chemical Reactions

- Oxidizers and flammables mixed together
- Reactive metals exposed to air

Special Equipment – Although the ignition of flammable vapors can be more of a hazard where flammables are dispensed versus where they are stored, you should check with your Fire Department as to whether your flammable storage requires the use of special equipment such as; explosion-proof lighting, spark-proof fans, explosion-proof refrigerators, flammable storage refrigerators (see section on *Chemical Storage Equipment, Refrigerators)*, and non-arcing electrical outlets in storage rooms to prevent fires.

Environmental Controls: Ignition Sources (continued)

Maintenance:

Ignition Sources

Management of Ignition Sources – due to the fact that most existing secondary schools do not have special spark proof or explosion proof equipment, the following management techniques are provided to help manage the problem, but cannot completely alleviate the risk of fire. For flammable storage located near uncontrolled ignition sources such as an electrical panel, you may have to relocate your flammables. Check with your local Fire Department.

To manage these ignition sources, you need to have control over when and how they are activated. An example would be not turning on a light switch or fan if you smell vapors upon entering the storeroom. To create this option, you must replace motion sensors that automatically turn on lights when you enter the room with manual switches, and remove automatic timers from room exhaust fans to enable continuous operation. Also, do not unplug an appliance that is running when there are vapors present as it will arc.

Elimination of Ignition Sources – do not use electrical appliances such as microwaves, refrigerator, and coffee pots, in areas where flammable chemicals are stored.

Chemical Storage Equipment and Management

Introduction

There are many different types of shelving specifically designed for chemical storage. It is important to review relevant features before selecting the equipment to ensure compatibility of the chemicals stored. Also, check with your chemical supplier about the types of shelving and equipment that would be appropriate for your needs.

Shelf Type and Chemical Compatibility

Overview for all types of shelving:

- Depth - should be a maximum of 12 inches deep.
- Material types - non-porous surfaces are the best. Match compatibility of chemical to be stored with the type of shelf.
- Shelf fastener material - all shelf fasteners should be made of corrosion resistant materials, not steel or iron nails or brackets that can rust. Supports should also be strong enough to withstand load.

Wood Shelving

- Use for corrosives and other chemicals (non-oxidizers and non-flammables).
- Do not use for oxidizers and flammables, which could ignite the shelves. If wood is all you have, then place the oxidizers in a plastic tub and then shelve the tub.
- Use plywood (not particleboard or veneer).

Metal Shelving

- Use for flammables.
- Do not use for corrosives unless it has an epoxy or chemical resistant finish.

Composite or Plastic Shelving (not Formica)

- Check with chemical product suppliers what the shelving is compatible with.

Design:

Shelving

Location and Installation:

- Installation - secure firmly to cabinet, walls and floor.
- Location - avoid locating shelving over sinks to eliminate risk of spills or breakage releasing chemicals to the septic system or sewer.[vii]

Chemical Storage Equipment and Management (continued)

Anti – Roll Lips

One safety feature available for chemical shelving is an anti-roll mechanism such as a lip, trough, or guardrail. Note that a shelf lip could also pose a safety hazard such as causing a container to catch when removed.

- New Shelving - if you are ordering shelves, they can be purchased with a trough or lip.
- Shelf Renovation - if you are renovating shelves, you can purchase a chemically resistant 2" shelf lip from some chemical suppliers, or 1 ½ x ¼ wood firring strips, wood molding or plexiglass strips from the hardware store (do not use for oxidizers or flammables). They can be nailed on, although the nails need to be periodically inspected for corrosion from chemicals. Do not adhere with an adhesive as the adhesive can react with other chemicals. The renovated shelves can help prevent containers from rolling off of the shelf, but will not completely prevent spilled liquid from dripping over the edge.

Ensure containment of liquids by encasing containers with liquids in a plastic tub or put into safety bottles, which can then be placed on shelf.

Maintenance:

Shelving

Label Shelves

- Label with the hazard class and type of chemicals stored.
- Protect label with clear tape.

Inspection

- Inspect shelving and shelving supports for corrosion, sagging, and cracking.
- Inspect for signs of chemical spills and leaking containers, and how that has affected the shelves, surrounding containers and storage area.

Chemical Storage Equipment and Management (continued)

Design and Maintenance:

Gas Cylinders

Storage Procedure

- Store cylinders with valves in the off position, with the regulator removed, and the safety cap on.
- Secure cylinders larger than 12" high to the wall. They should be secured vertically at the center point of the cylinder using a chain or other strong, fire resistant material.
- Label each cylinder with the name of the gas contained

Location

- Locate away from localized heat, open flame/sparks, electrical sparks, and flammable substances.[viii]
- Locate away from corrosives[ix] and other incompatible gases.
- Store extra compressed oxygen and acetylene gas tanks at least 20 feet apart. One set can be stored together securely in an up-right position on a welding cart.
- When stored outdoors, keep in a dry location not less than 50 ft. from any building.[x]

Inspection

- Check the integrity of the valve guard.
- Check the expiration date. If it has expired, the cylinder must be hydrostatically tested before use.

Design:

Refrigerators

- Types - use an "*explosion proof refrigerator*" for storage of explosive materials, or when the refrigerator is located in a hazardous atmosphere with flammable vapors that is not recommended. They require special hazardous location wiring in a hazardous atmosphere with flammable vapors. **This program strongly recommends discontinuing the use of any material that poses this safety hazard!**
- Types - use *"lab safe"* or flammable storage refrigerators for storage of flammable materials.
- Rating - the refrigerator should be rated by a recognized safety organization such as UL, ANSI, or NFPA. Removing the light bulb from a kitchen refrigerator is not sufficient to prevent an explosion. It still has thermostat housing that is not spark proof, and a compressor.
- Location – do not locate where flammables are stored

Chemical Storage Equipment and Management (continued)

Maintenance:

Refrigerators

- Do not store food in any refrigerator designated for chemical storage.
- Post the refrigerator with a sign “Chemical Storage Only,” and list the types and names of the chemicals stored within.
- Inventory contents once a month.
- Lock refrigerators that contain chemicals.

Organization of Storage Categories in the Science Department

Chemicals should be stored according to hazard class and chemical compatibility, not in alphabetical order! Check the MSDS sheet for chemical incompatibilities.

The following Chemical Storage Pattern is recommended by Flinn Scientific, Inc. The numbers are specific to their products, and other suppliers may not use these reference numbers. The storage categories are still applicable, and are in order of the chart from top shelf to bottom shelf:

Organic

# 2 Alcohols, Glycols, Amines, Amides, Imines, Inides	# 8 Phenol, Cresols
# 3 Hydrocarbons, Esters, Aldehydes	# 6 Peroxides, Azides, Hydroperoxides
# 4 Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide	# 1 Acids, Anhydrides, Peracids (Store in an Acid Cabinet)
# 5 Epoxy Compounds, Isocyanates	Miscellaneous
# 7 Sulfides, Polysulfides, etc.	Miscellaneous

Inorganic Acids

# 9 Acids – except Nitric (Store in an Acid Cabinet)	Nitric Acid (Store in a separate acid cabinet)

Inorganic

# 10 Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide	# 7 Arsenates, Cyanides, Cyanates (store away from water)
# 2 Halides, Sulfates, Sulfites, Thosulfates, Phosphates, Halogens, Acetates	# 5 Sulfides, Selenides, Phosphides, Carbides, Nitrides
# 3 Amides, Nitrates (not Ammonium Nitrate), Nitrites, Azides	# 8 Borate, Chlorates, Manganates, Permanganates
# 1 Metals and Hydrides (store away from water)	# 6 Chlorates, Perchlorates, Chlorites, Perchloric Acid, Peroxides, Hypochorites, Hydrogen Peroxide
# 4 Hydroxides, Oxides, Silicates, Carbonates, Carbon	Miscellaneous

Organization of Chemical Storage Categories in non-Science Departments

(Art, Custodial, Food Service and Vocational Departments)

Separate and store products in compatible categories in compatible equipment and on compatible shelving designed for:

Corrosive Acids (pH < 2.5) – examples:

- Custodial - Hydrochloric Acid and Phosphoric Acid in toilet cleaners
- Shop – battery acid
- Kitchen – sulfuric acid in drain cleaner
- Art – nitric acid for etching, acetic acid for photography stop bath

Corrosive Bases (pH >12.5)

- Custodial and Shop - ammonia
- Kitchen – sodium hydroxide (lye) in oven cleaner, some automatic dishwashing products
- Art – photography developer

Oxidizers - Strong oxidizing agents include concentrated nitric acid, concentrated sulfuric acid, chlorates, nitrates, nitrites, perchlorates, peroxides, and sodium hypochlorite.

- Custodial and Shop - bleach (sodium hypochlorite), pool chemicals
- Kitchen – bleach (sodium hypochlorite)
- Art – ammonium persulfate in photography reducing solutions

Flammables

- Custodial and Shop – non-chlorinated solvents and solvent based products
- Kitchen – alcohol and solvent based cleaning products
- Art – non-chlorinated solvents and solvent based products

Poisons

- Custodial – butoxyethanol in all purpose cleaners, carpet spotter and glass cleaner
- Shop – carburetor cleaner
- Kitchen - disinfectants
- Art – paints and glazes with heavy metals

Storage Requirements for Specific Chemical Hazards

Hazardous waste

Location: Store hazardous products separate from hazardous waste. See Attachment MassDEP Fact Sheet – *Hazardous Waste Accumulation Areas.*

Poisons

Location: Store Poisons separately in a secured, labeled cabinet.

Water Reactives

Conditions:

- Store in a cool dry location.
- Store Sodium, Lithium, and Potassium Metals (water reactives) under mineral oil in a container that will prevent the oil from leaking and evaporating. **This program recommends discontinuing their use or purchasing only what will be used in a 1-2 year period.**

Location and Compatibility:

- Store water reactive chemicals (and all chemicals) away from water sources[xi] including; sinks, plumbing pipes, sprinkler systems, emergency eyewashes, deluge showers, windows, etc. If water reactive chemicals come into contact with water, they can cause a dangerous reaction and form flammable or toxic gases.
- Store away from acids.
- Store in a *separate* room from flammable or combustible liquids.[xii]

Emergency Response Equipment:

- Requires the use of a Class D Fire Extinguisher.
- Check to see if they also require the use of dry sand.

Oxidizers

Conditions

- Store in a cool dry location, out of direct sunlight. Protect from extreme temperatures and rapid temperature changes.

Location and Compatibility

- Store away from organic materials, flammables, combustible materials, and corrosives.

Specific Storage Requirements for Corrosives

Corrosives

Location and Compatibility

- Separate acids and bases as they can cause violent reactions and generate heat when mixed.
- Corrosive chemicals and flammable liquids present the greatest storage problem; they should never be stored together.[xiii]
- Do not store acids and bases over each other, or on top of each other.
- Locate large containers on lower shelves.

Equipment and Management

- Small Quantities of Acids and Bases – if you have a very small quantity of acids and bases whose total quantity does not warrant a cabinet, you can store them separately in small plastic tubs to ensure containment if there is a spill. Ideally, acids and bases should be stored in the following cabinets, which do not need to be vented (if they are vented, the vent pipes must be corrosion proof).
- *Acids* should be stored in a Corrosive Cabinet, labeled on the outside of the door as "Acids". Cabinet should be nonmetal or have a corrosion resistant finish.
- There are three types of acids that need to be stored separately in a separate cabinet, or if it has to be in the same cabinet, it must be in a separate compartment or in secondary containment:
    - Organic acid - e.g., acetic acid
    - Inorganic acid – e.g., hydrochloric acid
    - Oxidizing – e.g., nitric acid
- Also separate oxidizing acids (nitric) from flammables and combustible materials.
- To prevent off-gassing of acid fumes, acids can be placed into a polyethylene bag, and then placed into a sealed secondary container in the Acid Cabinet.[xiv]
- Purchase all concentrated acids in PVC coated bottles.[xv]
- *Bases* should be stored in a Corrosive Cabinet, labeled on the outside of the door as "Corrosives".

Specific Storage Guidelines for Flammables

Definitions

- Combustible Liquid: Any liquid having a flash point at or above 100°F. Combustible liquids are divided into the following classifications:

  Example - fuel oil

- Flammable Liquid: Any liquid having a flash point below 100°F and having a vapor pressure not exceeding 40 psi at 100°F. Flammable liquids Class 1 and are divided into the following classifications:

  Examples – gasoline, lacquer thinner

- Flammable Solid: A solid substance that is liable to cause fires through friction, through absorption of moisture, through spontaneous chemical changes, or as a result of retained heat from manufacturing or processing.

  Examples - Solidified Alcohol (STERNO)

Regulatory Requirements

- You must have a ***permit*** from your local Fire Department to store ***any*** amount of flammable products.[xvi] 793 gallons is the maximum amount that schools can store in one building. Once you exceed that limit, you are required to obtain a license in addition to the permit.[xvii]
- Your flammable storage areas must be approved by your local Fire Department.[xviii]

Location and Compatibility

- Store away from heat and ignition sources.
- Store in separate room from water reactive materials.
- Store away from oxidizing materials, they can start and/or increase a fire.
- You can locate up to three cabinets in one room.[xix]
- Locate the cabinets away from exits.
- Locate Class I flammables above basement areas, *not in basement.* Most flammables are lighter than air, which could get trapped in the basement and then rise to reach an ignition source[xx]

Specific Storage Guidelines for Flammables (continued)

Flammable Materials Storage Cabinet

- Flammables Cabinet - store all flammable and combustible products in an NFPA rated, Flammables Cabinet.
- Quantity Allowed in a Flammable Cabinet - check the UL listing of the Flammable Cabinet to determine the quantity of flammables that it is rated for. Check with your Fire Department about whether the type and quantity of flammables you are storing requires use of a Flammables Cabinet, and how much it is acceptable to store. The Fire Department may limit the quantity of flammable or combustible liquids, flammable solids or flammable gases that may be kept and stored under the authority of a permit.[xxi]
- Quantity - if you only have a small amount of flammable material, check to see if there are other departments that could share their Flammables Cabinet.
- Cabinet Venting - if you do not vent the cabinet, seal the vent holes with bungs supplied with the cabinet or as specified by the manufacturer. Some local fire regulations may require you to vent the flammables cabinet. If you do vent the cabinet, it must be vented directly to the outside, in a manner that does not compromise the functioning of the cabinet. The equipment and set-up must be approved by your local Fire Department.
- Cabinet Condition – ensure that the cabinet completely closes to prevent vapors from escaping, and that it is not rusted.

Requirements of Flammables Storage Outside of Storage Cabinet

Flammables must be stored in a flammable liquid storage cabinet or inside a designated flammable storage area:[xxii], unless they are stored in the following quantities:

- Limits Class I to 1 or 2 gallons in a safety cans outside of a cabinet
- Limits ClassI/II to 10 gallons in safety cans outside a cabinet
- Limits ClassI/II to 25 gallons in safety cans outside cabinets
- Limits Class IIIA to 60 gallons in safety cans.

Storage Guidelines for Specific Chemical Hazards: Flammables (continued)

Allowable Quantities

Containers and Equipment

- Quantity – Allowable for Container Types and sizes:[xxiii]

Type of Product	Glass Container	Metal/Plastic
Class IA	1 pint	1 gallon
Class IB	1 quart	5 gallons
Class IC	1 gallon	5 gallons
Class II	1 gallon	5 gallons
Class III A	5 gallons	5 gallons

- Safety Can - store quantities larger than a gallon in an approved safety can.
- Containment of flammable soaked materials - store oil and solvent-soaked rags in approved self-closing oily waste metal cans, and empty daily into drums that are located outside, and kept closed. This containment prevents the release of vapors that can self-ignite. Do not mix with other waste or combustible materials.
- Outside flammable storage - should be no more than 20’ in height, and not less than 25’ from any other buildings on site or lot line. There must be road access for a fire apparatus and adequate water supply. The area must be kept free of combustible materials and exposure hazards. Tarpaulins used to cover the flammables must be flame-proofed.[xxiv]

Dispensing Container

- For dispensing small amounts of flammables, store them in spring loaded dispensers.

Chemical Information, Location and Housekeeping

Material Safety Data Sheets (MSDS)

- Under the Massachusetts Right-To Know Law, schools are required to obtain MSDSs from their suppliers for all hazardous chemicals.[xxv] MSDSs provide information on manufacturer contact, proper storage, chemical incompatibility, physical characteristics, hazards, routes of exposure, first aid, emergency response, pH, etc. Sometimes they include the NFPA diamond rating for identifying the product hazards.
- MSDSs are required to be available upon request within a specified amount of time.[xxvi] Ideally, they should be stored at the point of use to be immediately accessible for use during routine work and emergencies. All relevant staff, administrators, and emergency personnel should be informed of their location.
- Train the staff and supervisors who use hazardous materials on how to read MSDSs for the products that they are using.[xxvii] Massachusetts Division of Occupational Safety has great fact sheet on all Right-To-Know and related MSDS requirements.
- Post a workplace notice about the school's MSDS system for relevant staff and supervisors.[xxviii]

Storage Guidelines

- Return of chemicals to storage - remove chemicals from counters, desktops, prep areas, and Chemical Fume Hoods, and return to a secured storeroom. Chemicals stored in fume hoods reduce the airflow, clutter workspace, and could potentially spill into cup drains.[xxix]
- Density of container storage - keep shelves uncluttered to eliminate the need to move chemicals to see or obtain items. Keep container depth to a maximum of a two-container depth, with the larger size in the back where you can see it without moving it. 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.[xxx]
- Location - store containers on shelf only, do not stack on top of each other.
- Location - store chemicals at or below eye level.[xxxi] Locate the heavier containers on lower shelves. Locate chemicals off of the floor for temperature control, and to prevent corrosion, trip hazards, and contact with chemical spills.
- Location – store solids on shelves above liquids.
- Location and compatibility - store all chemicals away from water (never under, over, or near a sink).

Chemical Information, Location and Housekeeping
(continued)

Housekeeping Safety

- Remove trip hazards such as wiring, clutter, carts, etc.
- Protect chemicals from physical harm that can result events such as poor traffic patterns, doors hitting, or containers falling.
- Remove food and food vessels from chemical storage room.
- Purchase and store chemicals in unbreakable plastic or plastic coated bottles when possible to reduce risk of breakage.[xxxii]
- Rotate stock through a first in, first out system. Check expiration dates on chemicals to identify and remove items for disposal.
- Check containers and chemicals for signs of deterioration.
- Maintain inventory system when chemicals are purchased or disposed of.
- Put Teflon tape around the lids of chemical containers to prevent vapors from escaping.[xxxiii]

Labeling

- Label all chemicals and solutions with at least the chemical name (spelled out, not the formula), concentration, molarity or strength, date received or made-up; and the NFPA or HMIS symbol and information.
- You can purchase software to make the labels from chemical supply companies such as Flinn, Scientific, Inc., or purchase blank HMIS labels that provide prompts for the correct information.
- Use labels and marking pens that are colorfast and permanent. Cover with clear packing tape.

Chemical Emergency Response - Chemical Storeroom

Design: **Emergency Communication and Evacuation**	• Communication – provide emergency communication by locating a phone, intercom, two-way radio, or communication mechanism in the storeroom. • Emergency Numbers – post emergency telephone numbers by the phone. • Evacuation Route – develop and post Evacuation Procedures and Routes.
Maintenance: **Communication and Evacuation**	• Access - keep exits, signs and emergency information unobstructed. • Locate keys in an area where staff and emergency personnel can access them. Notify them of this location.
Design: **Master Utility Shut-Off Controls**	• Identify and Indicate Locations – identify utility shutoffs locations for electric, gas jets in lab, water sources, sprinkler control valves, and ventilation and/or exhaust systems. Label shutoff with the type of utility and the room numbers that it serves. • Signage – if your school was built in 1997 to the present, and has sprinkler control system that is located in a separate room, it must have a sign with four inch letters on the door, indicating the presence of the system.[xxxiv] • Map Locations - map utility shutoffs for your prep room, classroom, and chemical storeroom on a layout of your school.
Maintenance: **Master Utility Shut-Off Controls**	• Train Staff - ensure that staff and emergency response personnel know where the map of utility shutoffs is located, and know how to operate the shutoffs. • Maintain Access - keep pathways to controls clear. • Restrictions - do *not* store chemicals in the control room.
Design : **Spill Control**	• Location – store spill supplies and equipment wherever chemicals are stored and used. • Signage - post signs identifying the supplies, and keep the signs unobstructed. • Floor Drain Management - manage drains to prevent chemical spills from entering. Some of the options include; permanent capping, using a temporary drain sealing material that is laid over the drain, or placing a berm[xxxv] around the drain by using a bead of silicon caulk around the rim (which could pose a trip hazard, depending on its location).

Chemical Emergency Response - Chemical Storeroom
(continued)

Maintenance: **Spill Control**	• Supplies - select the spill response supplies and equipment to match the quantity and type of chemical hazard. Have specific chemical spill kits such as Acid Spill Kits, Mercury Spill Kits, etc. in addition to the general supplies. (See Attachment *Chemical Emergency Response Criteria* for information on supplies.)

Fire Safety

Design

Smoke Detectors and Fire Alarms

- Alarm - design and install alarms to be heard outside of the chemical storage room. They should be hardwired and should send a signal to the master control panel.
- Sprinkler Location - do not locate a sprinkler system in the chemical storage room unless mandated by local Fire Code.

Maintenance

Smoke Detectors and Fire Alarms

- Inspection – Test electrical smoke detectors and battery back-ups - Check with Fire Department for frequency of testing.
- Battery Replacement – back-up batteries need to be inspected.

Design

Fire Extinguisher

- Type – select the appropriate type for the chemicals used. The following types of extinguishers deal with the various types of fires:[xxxvi]

  A – ordinary combustibles (paper or wood)

  B – organic solvents (alcohol or acetone)

  C – electrical wiring

  D – reactive metals (sodium, lithium, potassium metals)
- Location –outside of storage area, not more than 6 feet from door.[xxxvii]
- Signage – post sign indicating location.

Maintenance:

Fire Extinguisher

- Inspection – Professionally test annually, and recharge when necessary. Self-inspect monthly. Maintain dated inspection tags to ensure that they are adequately charged.
- Accessibility – keep them unobstructed for quick identification and access.

Design and Maintenance:

Fire Blanket

- Amount and Location – Chemical use areas not equipped with emergency wash stations must have at least one approved fire blanket.[xxxviii] Locate on a wall, at eye level, and within 30 feet (Flinn, Scientific, Inc.) of where chemicals are stored or used.
- Signage – post sign “Fire Blanket” indicating location of blanket, that reads;

  “In case of clothing fire – STOP, DROP, and ROLL”
- Accessibility – keep the blanket and sign unobstructed.
- Inspection – check regularly to see if the blanket is still in the cabinet!

Safety Equipment - Emergency Wash Systems

Design Requirements

Deluge Shower and Eyewash Station

- Location – locate equipment wherever corrosives and flammables are used[xxxix]. Suggested for all other types of hazardous materials.
- Signage – post equipment with a sign at least 70 square inches indicating each type of equipment, "Emergency Shower", "Emergency Eye Wash". It should be in contrasting color – red and white, or green and white[xl]. The intent of this regulation is to make equipment easy to locate in the event of an emergency.
- Water Temperature – provide tepid (70 – 90 degrees F) water. Cold potable water is permitted if tempered water is unavailable, or if permitted by the head of the Fire Department[xli]. Remember that someone in an emergency must be able to use the water for 15 minutes, which is difficult if the water is too hot or too cold.
- Status of Equipment Prior to Use – emergency equipment must be in place and operating before materials are stored, and prior to staff and students use of hazardous materials[xlii].
- Floor Drains – locate a floor drain under the equipment but not near chemical storage. Some plugs can be installed to open automatically when shower is turned on. A drain can be constructed with a sump with a standpipe to prevent spilled materials from going down the drain while allowing the shower water to drain. Check with your local building inspector and code to determine whether this is allowed and whether the sumps must be double contained.[xliii]
- Alarm – where possible, have the emergency wash system trigger an alarm when activated, to alert other people that there is an emergency.

Maintenance Requirements

Deluge Shower and Eyewash Station

- Testing – test twice a year (every 6 months) for operation, flow, clarity and temperature[xliv]. Keep test records to provide upon request to the Fire Department, including but not limited to): date of test, station operation, system malfunctions, and the name of the person performing the test.
- Student Training – you are required to train students on the location and proper use of emergency equipment prior to their use of hazardous materials. Also provide training to them twice during their course on how to extinguish clothing fires[xlv].
- Accessibility – keep all signs and safety equipment unobstructed.
- Maintain floor drain – pour a pint of water down the floor drain weekly to prevent the back-up of sewer gases into the room. Consider covering or plugging the grain when not in use.

Safety Equipment - Emergency Wash Systems (continued)

Eyewash Stations

Additional Specifications

- Location – locate at the same level of hazard, within 50 feet or 10 seconds of hazard[xlvi]. Consider that a person can walk 50 feet in 10 seconds, and that they will have compromised vision, so it is essential to keep the path to the equipment unobstructed.

Eyewash Stations

System Requirements

- Should treat both eyes at the same time.
- Must provide a continuous flow of 0.4 gallons a minute for 15 minutes[xlvii]. You may be required to have a plumbed system since portable or handheld Eyewash Stations may not have the amount of flow for the required length of time. Also, the water in them can become contaminated and needs to be replaced. They can be used to minimize damage while accessing a plumbed eyewash.[xlviii] You can obtain attachments for converting existing faucets. Check with your Fire Department for local requirements.
- Should have a mechanism to stay on, to enable you to keep hands free for cleaning off chemicals.

Deluge Shower

Additional Specifications

- Location – locate within 50 feet of where chemicals are stored or used[xlix]. Can attach a drench hose to extend shower to locations a little further away.
- Requirements – should have a flow of 30 gallons of water per minute[l]. Should have a mechanism to stay on, to enable you to keep hands free.
- Accessibility – shower should be available at all times with the pull chain easily accessible.

References for Appendix 5

- NFPA, 2000, Flammable and Combustible Liquid Code, National Fire Prevention Association, Quincy, MA
- Flinn Scientific, 1998, Flinn Laboratory Chemical Safety, Flinn Scientific, Inc., Batavia, IL, www.flinnsci.com.
- M.G.L. c.111f, Hazardous Substance Disclosure by Employers
- BFA, 1997, Flammable and Combustible Liquids, Flammable Solids, or Flammable Gases, Board of Fire Prevention, Boston, MA, http://www.mass.gov/Eeops/docs/dfs/osfm/cmr/527014.doc
- SBBRS, 1997, Mechanical Ventilation, State Board of Building Regulations and Standards, Boston, MA, Code of Massachusetts Regulations, 780 CMR 1209.0 (Incorporate BOCA 1993 by reference)
- BOCA, 1993, the BOCA National Mechanical Code/1993, 8th edition, Building Officials and Code Administrators International Inc., Country Club Hills, Illinois
- Laboratory Waste Management Guide, 1999, Dave Waddell, King County Local Hazardous Waste Management Program
- School Laboratory Safety for Teachers and Laboratory Supervisors, 9/21/01, MA Division of Occupational Safety, IAQ Program
- Step By Step Guide to Better Laboratory Management Practices, Washington State Department of Ecology Hazardous Waste and Toxics use Reduction Program, 1999
- 527 CMR, sections 10.00, 12.00, and 14.00, MA Fire Prevention Regulations

Endnotes for this Appendix appear at the end of the entire document.

Appendix 6: Hazardous Waste Management

Policy

The School District should establish procedures to identify hazardous waste, develop facilities and methods of storing hazardous waste and removing hazardous waste when it reaches its quantity and/or time limits under the hazardous waste regulations. The School District should also develop a policy to train staff on hazardous waste storage and disposal procedures.

Identify Your Hazardous Waste

Check all of your departments for the following waste products:
Characteristic Wastes (D List) – corrosives, ignitables, reactives, and oxidizers.
Universal Wastes – hazardous batteries, spent fluorescent lamps, pesticides, and mercury–containing instruments. See the attached MassDEP fact sheet *Universal Waste Rule in Massachusetts for Small Quantity Generators*. They are regulated differently that characteristic wastes.

Identify your *Hazardous Waste Generator Status*

You should either be a *Small Quantity Generator (SQG)* or a *Very Small Quantity Generator (VSQG).* This status is a measure of the types and quantities of waste you generate on a monthly basis. MassDEP and EPA use this measure to determine which state and federal regulations apply to your school.

Most schools will have VSQG status once they clean-out their stockpiles of hazardous waste. VSQGs only have to register with MassDEP. SQGs must register with both MassDEP and EPA. Both of the SQG registrations are done through MassDEP.

To identify and obtain your school's *Hazardous Waste Generator Status Identification Number:*

- Obtain a MassDEP hazardous waste generator application (see Hazardous Waste Generator Registration Form under the hazardous waste section of the applications and forms page of MassDEP's website: http://www.mass.gov/dep/recycle/approvals/hwforms.htm#gen
- Determine the types and quantities of hazardous waste that you generate throughout the school on a monthly basis.
- Register this information with MassDEP on a Hazardous Waste Generator Application.
- Identification Numbers are assigned to a specific location where the hazardous waste is generated. Each school building with a different address must register for a separate Hazardous Waste Generator Status based how much waste is generated at that address. It is used nationally to track hazardous waste from "cradle-to-grave", from the point of generation to the final point of disposal.
- You will use your Identification Number on shipping manifests and paperwork. A hazardous waste transporter and/or treatment, storage, and disposal facility (TSDF) must have your Identification Number to accept your waste. Do not allow anyone other than MassDEP to assign you a number.

Hazardous Waste Management (continued)

Accumulation and Storage

There are special requirements that govern the storage of hazardous *waste*, which must be stored separately from hazardous *products*. These storage areas are called *Accumulation Areas* and there are two types:

- *Central Accumulation Area* – one storage area for the entire school to use.
- *Satellite Accumulation Areas* – smaller additional storage areas, located at the point of use. See attached working document Hazardous Waste Accumulation Areas, for guidelines for setting up and inspecting these areas.

Frequency of Disposal

You are required to dispose of your hazardous waste when you reach a certain quantity and/or length of storage time. Your Hazardous Waste Generator Status determines these quantity and time limits. See the attached MassDEP fact sheet *Summary of Requirements for VSQGs* for this information.

- *At a minimum, your hazardous waste should be disposed of annually.*
- *Your school could possibly time your disposal with the frequency of town hazardous waste collections, if you use this disposal option, and it does not exceed your time and quantity limits*

Record Keeping

The Shipping Manifest: An administrator who has been designated as legally responsible for the waste must sign the shipping manifests that list your hazardous waste for transport to disposal or recycling facility.

Keep records and copies of shipping manifests of the hazardous waste that you dispose of. The manifest is a multiple copy shipping form designed to track your hazardous waste from "Cradle To Grave". It must accompany your hazardous waste when it is being transported by a licensed hazardous waste transporter, disposed, recycled, or otherwise treated. Most licensed hazardous waste transporters will provide a complete manifest as part of their paid service.

Your legal responsibility includes:

- Completing the generator portion of the manifest form, or if the transporter completes it, verify that the information is correct.
- Obtaining a copy of page 8 of the Massachusetts Manifest Form before the transporter leaves. If page 8 is illegible, make a copy of page 1.
- Maintaining a copy of all manifests and any records of testing or analysis of your waste for at least 3 years.

Hazardous Waste Management (continued)

Record Keeping (continued)

- Receiving a copy 3 of the manifest back from the destination facility within 35 days of the time they receive your waste. If you do not receive it, contact the hazardous waste transporter or operator of the disposal facility to determine the disposition of the waste.
- Filing an *Exception Report* with MassDEP if after 45 days your school has still not received copy 3 of the manifest that explains the efforts you have taken. Send the Exception Report to the MassDEP Manifest Section and to the state enforcement agency of the state where the facility is located.
- You do not need a manifest if your school is a VSQG and is self-transporting the waste to a hazardous waste collection site.

Roles and Responsibilities

District Office:

- Coordinates multi–building clean–outs. Hires Hazardous Waste Contractor for multi–building hazardous waste collection.
- Maintains School District hazardous waste paperwork.

Individual Schools:

- Obtain and maintain individual Hazardous Waste Generator Status for their address. This involves monitoring the amount and type of waste accumulated for disposal.
- Possibly hire hazardous waste contractor for individual school collection or participates in district–wide collection.
- Schedule and oversees hazardous waste collection for their school building.
- Budget funds for their disposal costs.
- Maintain Central and Satellite Hazardous Waste Accumulation (storage) Areas for hazardous waste generated in their building.
- Maintain records for all hazardous waste stored and shipped out from their building.

Departments and Staff:

- Participate in identifying and preparing waste for removal.
- Conduct self–inspection of hazardous waste storage.

Hazardous Waste Management (continued)

Disposal

Alternative Options

- Recycling – e.g.) fluorescent lamps, hazardous batteries, waste oil or used anti–freeze
- Alternate users – e.g.) other schools, businesses, or industry for unopened materials

Hazardous Waste Collection Options

- *Municipal One Day Collection* - participate in periodically scheduled Municipal Household Hazardous Waste (HHW) Days if allowed by your local municipality. They are usually held once or twice a year. Contact your local Department of PublicWorks or Solid Waste District to determine if you can participate. The benefit of this option is that your town has already hired and screened the contractor. This option limits the school control over the schedule
- *Municipal Permanent Hazardous Waste Collection Site* - participate in collections at your town's Municipal Permanent Hazardous Waste Depot. They may be scheduled more frequently than the HHW Days, such as monthly or quarterly. The benefit of this option is that your town has already hired and screened the contractor. Although, there is a scheduling limitation with this option, the Depots are often open often enough to find a suitable time.
- *Vendor from the State Hazardous Waste Vendor List* - hire a vendor off of the MassDEP Hazardous Waste Contractor Vendor List. The benefit of using this option is that MassDEP has already gone out to bid and screened the vendor. Check the state procurement web site at www.comm-pass.com for the *Hazardous Materials Collection Services, Contract #FAC 36.* If you have a problem finding this information on the web site, you can also contact OSD Dmitriy Nikolayev at 617-720-3351.
- *School District Goes Out to Bid* - the school conducts an independent bid process to select a contractor, and schedules regular or episodic pickup. This option involves having to screen and verify vendors. Remember that you are responsible for the waste even after it leaves your school. You must verify that the vendor is licensed, qualified and in compliance with state and federal laws

Self-transport

Self-transport of waste is an option for *Very Small Quantity Generators of Hazardous Waste.* Transporting hazardous waste should only be done by staff trained in chemical management and emergency response for the type of waste that is being transported. Use only vehicles insured by the municipality for insurance to cover in case of an accident. See the attached MassDEP fact sheet – *The Very Small Quantity Generator of Hazardous Waste* for special self-transport requirements

Hazardous Waste Management (continued)

Training

- Provide training to staff and administrators on requirements for the storage, inspection, disposal, and transportation of hazardous waste.
- Provide an orientation and supplies to staff participating in clean–outs on how to select and prepare items for disposal, what to expect during the collection process and how to participate in the collection.

Requirements for Hazardous Waste Accumulation Areas
Central Accumulation Area

A central hazardous waste accumulation area is a single storage location for hazardous waste generated throughout the school. The following guidance is based on requirements for both Small Quantity Generators (SQG) and Very Small Quantity Generators (VSQG).

SQG	VSQG	Regulatory Requirement
X	X	Secure hazardous waste storage area against unauthorized entry.
X	X	Store containers on impervious surface (no cracks or gaps), away from floor drains or doors to the outside. If this is not possible, make sure hazardous wastes containers are stored inside other vessels that can contain the entire contents of the largest container, in case of leakage.
X	X	Post a sign with the words HAZARDOUS WASTE with letters at least one inch high, on the door of the storage area or inside.
X	X	Clearly delineate the area containing hazardous waste in an open room with a rope, chain, or boundary painted on the floor.
X	X	Ensure that hazardous waste containers are in good condition, compatible with the waste stored within.
X	X	Store waste by hazard category, e.g. corrosives, ignitables/flammables, etc.
X	X	Separate containers of incompatible waste with berms, walls, or other devices.
X	X	Keep containers closed unless waste is being added.
X	X	Clearly label every container accumulating hazardous waste with: the words Hazardous Waste the name of the waste, e.g. waste solvents the hazard category, e.g. corrosives
X		Clearly label every container accumulating hazardous waste with: • the date accumulation began
X		Accumulate no more than 500 gallons at any one time, and do not store waste for more than six months.
	X	Accumulate no more than 165 gallons at any one time.
X		Ship hazardous waste using a licensed transporter when time or volume limit has been reached.
	X	**For VSQGs only:** Transport hazardous waste to community collection or other hazardous waste generator where prior approval has been given. Carry MassDEP VSQG form in the vehicle when transporting.
X	X	Keep records of shipment, either manifest or hazardous waste receipt for VSQG, available for inspection on site for three years.
X		Have a telephone or method of two-way communication immediately accessible.
X		Post telephone numbers of local responders, such as fire department, as well as the number for notifying MassDEP, in case of large spill.
X		Keep spill clean up materials easily accessible.
X		Keep fire suppression equipment easily accessible.
X		Train employees in emergency procedures, prevention and response.

Satellite Accumulation Area

You can create satellite accumulation areas in addition to your central hazardous waste accumulation area to store small amounts of hazardous waste created at different locations around the school. Satellite accumulation areas provide flexibility in meeting accumulation time limits. You do not have to count the amount of waste stored in your satellite accumulation area towards generator status until it is moved to the central accumulation area.

The same requirements for hazardous waste accumulation apply as stated above, with the addition of the following:

- Satellite accumulation area must be located at the point of waste generation.
- The area must be managed by the key staff person responsible for the area, who must be trained in proper handling and disposal practices relative to the chemicals managed.
- Note the accumulation date on each container, and move container to the central accumulation area within three days of becoming full.
- Use only one container for each waste stream.

MassDEP Fact Sheet: The Very Small Quantity Generator of Hazardous Waste

Many essential services, including printers, drycleaners, painters, and institutions such as schools and hospitals, produce hazardous waste. If you use cleaning solvents, oil, inks, paints, acids or alkalines, for example, you may be generating hazardous waste. These wastes may be:

Ignitable (catches fire easily, with a flash point lower than 140 degrees F)
Corrosive (very acidic or basic, with a pH less than 2.0 or more than 12.5)
Reactive (unstable, reacts violently with water, potentially explosive)
Toxic (causes cancer and other health effects), or
Listed specifically as "hazardous" in the MassDEP's regulations.

MassDEP regulates all hazardous wastes generated by businesses. Only hazardous wastes generated by households are not regulated. The regulations are published in 310 CMR 30.000 (see below information about obtaining a copy).

The regulations establish requirements for businesses that generate large and small quantities of hazardous waste, which ensure that the wastes are identified, safely managed, and tracked from the point where they are generated to their ultimate disposal. The regulations allow more flexibility for those who only generate "very small quantities" of hazardous waste, but also require that they be safely managed, to avoid releases to the environment.

You can minimize the amount of hazardous waste you produce (and take advantage of the flexible requirements for "Very Small Quantity Generators) by substituting non-hazardous products for hazardous ones, by reusing or recycling hazardous wastes wherever possible, and by not mixing non-hazardous with hazardous wastes.

Qualifying as a Very Small Quantity Generator (VSQG)
If in every calendar month you produce less than 220 lbs. (approximately 27 gallons) of hazardous waste and you produce less than 220 lbs (approximately 27 gallons) of waste oil, you can register as a VSQG. If your waste includes more than one pound of material classified as "acutely hazardous", you have to manage your waste as a Large Quantity Generator ("Acutely hazardous" wastes are listed in 310 CMR 30.136, as "P" wastes).

What are the requirements for VSQGs?

Register with MassDEP
Never accumulate more than 1,320 lbs. (approximately 165 gallons) at any one time
Store your hazardous wastes on an impervious surface in a separate secured area identified as "HAZARDOUS WASTE" (if outdoors, liquid wastes must have secondary containment)
Label your hazardous waste containers "HAZARDOUS WASTE," with the name of the waste and the hazard associated with it (e.g. corrosive, toxic, ignitable)
Obtain a receipt for your waste, or retain in your files a copy of the manifest
Retain records of the type and quantity, date and method of treatment or disposal of your waste

Registration

To qualify you must notify MassDEP on a registration form that lists the types of hazardous waste you generate, the amount of each in gallons per month, and the disposal, treatment, and/or recycling destination of the waste. If you plan to ship your waste with a licensed transporter, and have not previously registered with MassDEP, you should use the prefix **MV** with your **10-digit** telephone number as your site-specific generator ID number. **Be sure to include your area code.** (If you have already notified and have an ID, it may begin with the letters **MAD, MAR, MA5** or **MAV.**) The VSQG form is available on MassDEP's Web site: http://www.mass.gov/dep/recycle/approvals/genreg.doc. Remember to keep a copy of the completed form for your records.

Transfer, treatment and disposal options for VSQG's

You may recycle or treat your waste, provided the process you describe in your registration is acceptable to MassDEP.

You may use a licensed transporter and manifest (requires ID #).

You may transport your waste to another generator who is in compliance with the regulations and who will count your waste as part of his waste.

You may transport your waste to a licensed treatment, storage or disposal facility, community hazardous waste collection center, or permitted recycling facility (with the center or facility's permission).

Special self-transport requirements

As a registered VSQG you may transport *your own* hazardous waste when:

You do not transport more than 55 gallons at one time.

A copy of your registration as a VSQG is in the vehicle.

You do not transport incompatible waste in the same shipment. (example: alkaline cleaner with battery acid)

Your waste must be in containers that are tightly sealed, labeled as "Hazardous Waste" with the name and the type of the hazard, and are tightly secured to the vehicle.

Note: Some types of waste will also require a shipping paper, placards or labels as specified by the federal Department of Transportation (DOT). For more information contact the Federal Motor Carrier Safety Administration: (617) 494-2770.

You are in compliance with all DOT and Massachusetts Department of Public Safety (DPS) requirements. For example, liquids with a flashpoint of less than 100° F, without a permit from the Fire Marshall [(978) 567-3300], must be transported in DPS-approved containers up to 7 gallons in volume, in total quantities of no greater than 21 gallons.

In the event of a spill or a leak of hazardous waste that may threaten human health or the environment, notify MassDEP's 24-hour toll-free line: (888) 304-1133.

Note: Some VSQG's are also Small Quantity Generators of waste oil. In this case the waste oil may not be self-transported.

Further Information:

The complete regulatory requirements for VSQG are found in the Massachusetts Hazardous Waste Regulations section 310 CMR 30.353, or for SQG of Waste Oil at 310 CMR 30.253 (6). Copies of these regulations are available at: http://www.mass.gov/dep/recycle/laws/regulati.htm#hw or from the State House Book Store.

For further assistance contact the **MassDEP Business Compliance Assistance Line at (617) 292-5898**.

You will need your business' Standard Industrial Classification (SIC) Code. A list of SIC codes commonly used for VSQG is attached. More information can be found at: http://www.osha.gov/oshstats/sicser.html . The SIC Codes may be changing in the future as state and federal government offices adopt a new system of industrial classifications called the North American Industrial Classification System (NAICS). This fact sheet will be updated at that time.

MassDEP Fact Sheet: Fluorescent Lamp Management for Businesses and Institutions

Using fluorescent lamps makes business and environmental sense because they consume one quarter as much electricity as incandescent lighting. At the same time, spent and broken fluorescent lamps need to be handled very carefully because the phosphor powder inside them contains mercury. Standard linear fluorescents, lamps with green end caps or green marking, compact fluorescents, germicidal lamps, and high intensity discharge (HID) and high-pressure sodium lamps used in outdoor lighting all contain mercury.

When broken, burned in waste-to-energy plants or buried in landfills, fluorescent lamps release mercury. Since not even the best pollution control devices can completely prevent mercury from entering the environment, the Massachusetts Department of Environmental Protection (MassDEP) recommends recycling all fluorescent lamps. Fluorescents that do not have green end caps must be recycled as universal waste or managed as hazardous waste. It is against the law to throw them in the trash.

Why is mercury a problem?

Mercury is toxic to the human nervous system, kidneys, liver and immune system. When inhaled or ingested, it can cause a range of physical symptoms. Mercury that is released to the environment "bioaccumulates" in fish – that is, it builds up in their tissue over time – making them less healthful or even dangerous to eat. The Massachusetts Department of Public Health (DPH) has advised pregnant women, nursing mothers, women of child bearing age and children under 12 to avoid eating freshwater fish from lakes, rivers and streams that are not replenished by government stocking programs. DPH has also recommended that all Massachusetts residents avoid certain fish from those bodies of water where sampling has revealed a significant mercury problem.

What are the risks of mercury exposure from handling lamps?

Only broken lamps pose a hazard. When they are handled properly to minimize breakage, there is little chance of mercury exposure. In fact, an active lamp recycling program can reduce the likelihood of an accidental mercury release by stressing the importance of handling lamps carefully.

Are there specific rules for handling spent and broken lamps?

MassDEP regulates the accumulation, storage, transportation and disposal of hazardous wastes, including fluorescent lamps, under the *Massachusetts Hazardous Waste Management Act* and the federal *Resource Conservation and Recovery Act (RCRA)*.

Fluorescent lamps may be recycled under the streamlined provisions of the *Universal Waste Rule* (found at 310 CMR 30.1000), which MassDEP adopted to encourage the recycling of consumer products with specific toxic or hazardous constituents. If you choose to recycle fluorescent lamps, you must:

Store unbroken lamps in a box or fiber drum to prevent breakage, and keep that container in a secure, protected area.

Label the container *Universal Waste – Spent Fluorescent Lamps* and mark it with the date on which you first began storing the lamps.

Have these lamps collected by or deliver them to an authorized lamp recycler, hazardous waste transporter or another universal waste handler within one year of the date marked on the container.

What do I do if a lamp breaks?

If it happens indoors, close off the room to other parts of the building, open a window and leave the area for at least 15 minutes to allow the mercury vapor to dissipate. When you return, scoop up the glass and powder debris with a stiff paper and place the material in a sealed container labeled *Broken Fluorescent Lamps*. Never use a vacuum cleaner, which will only disperse the mercury over a wider area, then itself need to be handled as a hazardous waste. All mercury-contaminated debris, including cleanup materials, must be disposed as hazardous waste.

How can I dispose of spent or broken fluorescent lamps?

A number of companies recycle fluorescent lighting fixtures, several of which are listed below. You may wish to contact several to obtain price quotes.

Fluorescent Lamp Recycling Facilities

Advanced Environmental Recycling Corp.
2591 Mitchell Avenue
Allentown, PA 18103
(800) 554-2372

Superior Special Services
218 Canton Street
Stoughton, MA 02072
(781) 341-6080

Bethlehem Apparatus
890 Front Street
Hellertown, PA 10855
(610) 838-7034

Full Circle Inc.
509 Manida Street
Bronx, NY 10474
(800) 775-1516

American Lamp Recycling
22 Stage Door Road
Fishkill, NY 12524
(800) 315-6262

Northeast Lamp Recycling
250 Main Street
East Windsor, CT 06088
(860) 292-1992

Mercury Waste Solutions
26 Railroad Avenue
Albany, NY 12154
(518) 489-6347

Complete Recycling Solutions, LLC
One Father DeValles Blvd
Fall River, MA 02723
866-CRS-9797

Sources of Information and Assistance

General Information about Mercury: http://www.mass.gov/dep/toxics/stypes/hgres.htm

Health Effects of Mercury: DPH at (617) 624-5757 or http://mass.gov/dph/beha

Universal/Hazardous Waste Regulation: MassDEP Business Compliance Assistance Line at at (617) 292-5898 or http://mass.gov/dep/bwp/dhm/dhmpubs.htm#regs

On-Site Pollution Prevention Assistance: Office of Technical Assistance for Toxics Use Reduction (OTA) at (617) 626-1060 or http://www.mass.gov/envir/ota/

National Electrical Manufacturers Association
http://www.lamprecycle.org/

Association of Lighting and Mercury Recyclers
http://www.almr.org/

MassDEP Fact Sheet: Mercury Collection Checklist for Municipal Programs

This checklist is intended to assist employees and managers of municipal collection programs for mercury-bearing products and components. These may include spent fluorescent lamps, switches, thermostats, thermometers, manometers and gauges.
Under the Universal Waste rule these items are regulated less stringently than hazardous waste, as long as they are recycled and not disposed of in regular trash.

Note: Elemental, or liquid, mercury must be managed separately as hazardous waste.

Maintaining your mercury collection and storage area:

Instruct employees/volunteers in proper handling of mercury bearing products, emergency procedures, prevention and response.

Store items in structurally sound containers so as to minimize breakage and prevent release of mercury.

Mark containers with the name of the waste, e.g. UNIVERSAL WASTE - WASTE FLUORESCENT LAMPS, or WASTE MERCURY-CONTAINING DEVICES, with the earliest date that the waste was put in the container.

Store any lamps and other devices that are broken during handling separately in an intact vapor-tight container and label UNIVERSAL WASTE – BROKEN MERCURY DEVICES.

- Ampoules can be removed from thermostats by trained employees, in a well-ventilated area, but only over or in a container with mercury clean-up materials at hand. Cleanup residues are regulated as hazardous waste.

Do not store your mercury wastes longer than one year. You may contract with a recycling facility or you may transport your universal waste in a municipal vehicle to another universal waste handler or a state-approved recycling facility.

For information about state contract services, training for mercury collection operators, or equipment grants for mercury collection programs, contact MassDEP at 617-292-5861.

Revised March 2003

Appendix 7: Other Resources

Useful websites:

Healthy Schools Network, Inc.
http://www.healthyschools.org/internet_resources.html

Massachusetts Coalition for Occupational Safety and Health
http://www.masscosh.org/Building_Healthy_Schoools.htm

Massachusetts Department of Public Health - Environmental Health & Safety Issues in Massachusetts' Schools
http://www.mass.gov/dph/beha/iaq/schools/schools.htm

Massachusetts State Contracts

Recycled and Environmentally Preferrable Products and Services Guide, published by the Operational Services Division is available on line: http://mass.gov/Aosd/docs/EPP/VOL_23_SEC_2.pdf including:

- Mercury and lamp collection -- FAC26 Category A
- Hazardous Material Collection Services -- FAC36
- Computer and Misc Electronics Recycling -- FAC26 Category B
- Asbestos and Lead Paint Abatement Services -- FAC32

A number of state and federal agencies can help school districts plan ahead for prevention and respond to emergencies. The MassDEP has compiled this resource list to help you connect with them when you need their assistance. We encourage school administrators and facilities staff in your schools to post copies of this list in prominent locations. We also encourage you to consult the Healthy Schools Checklist that contains all federal and state laws and regulations that pertain to school health and safety in Massachusetts at: http://www.mass.gov/dph/beha/iaq/schools/schools.htm

School Environmental Health and Safety Resources

Topic	Agency	Telephone	Web Site
Asbestos	MassDEP	617-292-5638	http://www.mass.gov/dep/air/asbhom01.htm
Asbestos Abatement	Division of Occupational Safety	617-969-7177	http://www.mass.gov/dos/pages/asbestos.htm
Asbestos Project Notifications	MassDEP	617-292- 5638	http://www.mass.gov/dep/air/approvals/anf001.pdf
Asthma Information	Dept. of Public Health	617-624-5632	http://www.mass.gov/dph/topics/asthma.htm
Chemical Cleanout Grant	MassDEP	617-292-5704	http://www.mass.gov/dep/service/compliance/schlchem.htm
Chemical Emergencies/Spills	MassDEP	617-556-1133 or 888-304-1133	http://www.mass.gov/dep/about/callnow.htm
Chemical Management	MassDEP	617-292-5704	http://www.mass.gov/dep/service/schools.htm
	U.S. Environmental Protection Agency	617-918-1847	http://www.epa.gov/schools/
Energy Conservation	Division of Energy Resources	617-727-4732	http://www.mass.gov/doer/
Floor Drains, UIC	MassDEP	617-348-4014	http://www.mass.gov/dep/water/laws/uicqa.htm
Indoor Air Quality	Dept. of Public Health	617-624-5757	http://www.mass.gov/dph/beha/iaq/iaqhome.htm
	Div. of Occupational Safety	617-969-7177	http://www.mass.gov/dos/iaq/index.htm
	U.S. Environmental Protection Agency	617-918-1639	http://www.epa.gov/iaq/schools/
Laboratory Safety	Division of Occupational Safety	617-969-7177	http://www.mass.gov/dos/iaqdocs/iaq-403.htm
Lead in Drinking Water	MassDEP	617-348-4014	http://www.epa.gov/safewater/lead/schoolanddccs.htm
Lead Paint Program	Division of Occupational Safety	617-969-7177	http://www.mass.gov/dos/pages/lead.htm
Mentor Program	Office of Technical Assistance	617-626-1060	http://www.mass.gov/envir/ota/programs/school_mentoring.htm
Occupational Safety/Health	Division of Occupational Safety	617-969-7177	http://www.mass.gov/dos/
Outdoor Air Quality	MassDEP	617-556-1097	http://www.mass.gov/dep/air/index.htm
Pesticides, Integrated Pest Mgmt.	Dept. of Agricultural Resources	617-626-1781	http://www.mass.gov/dfa/cpa/index.htm
Procurement, State Contracts	Operational Services Division	617-720-3351	http://www.mass.gov/osd
Public Water Supplies	MassDEP	617-556-1106	http://www.mass.gov/dep/water/drinking.htm
Right-to-Know Law	Division of Occupational Safety	617-969-7177	http://www.mass.gov/dos/rtk/index.htm
Septic Systems, Title 5	MassDEP	617-292-5790	http://www.mass.gov/dep/water/wastewater/septicsy.htm
Toxics Use Reduction	Toxics Use Reduction Institute	978-934-4343	http://www.turi.org/community/schools.shtml
Underground Storage Tanks	Dept. of Fire Services	978-567-3300	http://www.mass.gov/dfs/osfm/fireprevention/ust/

Endnotes for Appendix 5: Chemical Management and Safe Storage

[ii] Flinn, 2002
[iii] BOCA
[iv] Flinn, 2002
[v] Flinn, 2000
[vi] 527 CMR 14.04 (8)
[vii] Laboratory Waste Management Guide, Dave Waddell, 1999, King County Local Hazardous Waste Management Program
[viii] NFPA 451.5.1 (1996)
[ix] The University of the State of NY, Regents of The University, Chemical Storage Guidelines for Secondary Schools
[x] 527 CMR 14.03(12)
[xi] 527 CMR 14.07 (5)
[xii] 527 CMR 14.07 (5)
[xiii] The University of the State of NY, Regents of The University, Chemical Storage Guidelines for Secondary Schools
[xiv] School Laboratory Safety for Teachers and Laboratory Supervisors, MA Division of Occupational Safety, IAQ Program, 9/21/01
[xv] Flinn, Preventing Chemical Spills, Safety Demonstration
[xvi] 527 CMR 14.03 and MGL c 148.13
[xvii] 527 CMR 14.03 and MGL c 148.13
[xviii] 527 CMR 14.03 (5)
[xix] NFPA 4.3.2. version 2000
[xx] 527 CMR 14
[xxi] 527 CMR 14.03(5)
[xxii] 527 CMR 14
[xxiii] NFPA 30 Section 4.2.3
[xxiv] 527 CMR 10.03 (5d), 10.05 (2), 10.05 (4)
[xxv] MGL C.111F
[xxvi] MGL C.111F
[xxvii] MGL C.111F
[xxviii] MGL C.111F
[xxix] Laboratory Waste Management Guide, Dave Waddell, 1999, King County Local Hazardous Waste Management Program
[xxx] The University of the State of NY, Regents of The University, Chemical Storage Guidelines for Secondary Schools
[xxxi] Flinn, Preventing Chemical Spills, Safety Demonstration
[xxxii] Flinn, Preventing Chemical Spills, Safety Demonstration
[xxxiii] School Environmental Issues, Hilary Eustace, formerly of OTA and DEP
[xxxiv] 780 CMR 906.8
[xxxv] Step By Step Guide to Better Laboratory Management Practices, Washington State Department of Ecology Hazardous Waste and Toxics use Reduction Program, 1999
[xxxvi] 527 CMR 14.07 (2)
[xxxvii] 527 CMR 14.07 (2)
[xxxviii] 527 CMR 10.02 (2)
[xxxix] 527 CMR 10.02 (2)
[xl] 527 CMR 10.02 (2)
[xli] 527 CMR 10.02 (2)
[xlii] 527 CMR 10.02 (2)
[xliii] Laboratory Waste Management Guide, Dave Waddell, 1999, King County Local Hazardous Waste Management Program
[xliv] 527 CMR 10.02 (2)
[xlv] 527 CMR 10.02 (2)
[xlvi] 527 CMR 10.02 (2) and ANSI Z358.1 – 1998 Eyewash requirements
[xlvii] 527 CMR 10.02 (2)
[xlviii] School Laboratory Safety for Teachers and Laboratory Supervisors, MA Division of Occupational Safety, IAQ Program, 9/21/01
[xlix] 527 CMR 10.02 (2)
[l] 527 CMR 10.02 (2)