PROGRAM:	Schools
EFFECTIVE REGULATION:	Rules and Regulations Governing Schools in the State of Colorado
GUIDANCE NO.:	**G16-01**
DATE:	March 1, 2016
SUBJECT:	Chemical Hygiene Plan Template

Toxic and hazardous substances in schools have caused serious injuries to students and faculty in many states, including Colorado. These materials are a necessary part of curriculum and the maintenance of the school and grounds. The risks associated with the use of these materials is greatly reduced or eliminated when effective precautions and safety practices are implemented through the development of a Chemical Hygiene Plan (CHP). A CHP should act as the foundation of an effective chemical safety program at the school and is designed to aid faculty, staff, and students in maintaining a safe environment in the school.

Because of the importance of a CHP, the *Rules and Regulations Governing Schools in the State of Colorado (regulations), Section 6.12.1 (E),* requires each school to establish a CHP which addresses all areas of the school where toxic or hazardous substances are used or stored. The CHP requirement in the regulation applies to all areas of the school where toxic or hazardous substances are used, stored, or handled by faculty, staff, or students.

This document has been created to provide a template to assist schools with the development of a CHP and should be customized and completed with information specific to the chemicals used and procedures conducted within an individual classroom, laboratory, or area of the school using hazardous materials.

CHEMICAL HYGIENE PLAN (CHP)

CHP Template and Guidance Document for School Chemical Safety

Chemical Hygiene Plan (CHP)

Laboratory, Classroom, or Shop Specific Plan

Please read the instructions starting on page 12 before completing tables 1-8 below.

Table 1. School information		
School Name:	**School Address:**	**School Phone Number:**

Table 2. Classrooms, laboratories, shops, or areas of school addressed by this Chemical Hygiene Plan (CHP) *Please indicate which specific classroom(s) or areas of the school this CHP template has been completed for (e.g. chemistry classroom 123, art room 123, advanced chemistry classrooms, wood shop, etc.).*		
Classroom(s) and room number(s):	**Instructor Names:**	**Department:**

Table 3. Documentation of CHP training and annual CHP refresher training for faculty *Name and signature of all CHP users is required.*				
I have read and understand the content of this CHP:				
Name:	**Signature:**	**Date:**	**Refresher Completed by:** (Staff initials)	**Date of annual refresher**

Table 4. CHP Annual Review and Update				
Dates of completion for annual review and update of this CHP:				
Signature of person(s) reviewing and updating the CHP on dates above:				

Table 5. Important Phone Numbers and Contact Information *Please include contacts such as the school health and safety specialist, facilities manager, hazardous waste removal vendor, etc.*	
1. All Emergencies: 911 or Alternative Phone Number, if applicable:	
2. Poison Control Phone Number:	
3. Contact:	**Phone:**
4. Contact:	**Phone:**
5. Contact:	**Phone:**
6. Contact:	**Phone:**

Table 6. Locations of Important Safety Items	
A copy of this CHP will be located in the following area away from the toxic or hazardous substances addressed by the CHP (e.g. school front office):	
Locations of First Aid Kits:	
Locations of Emergency Chemical Spill and Cleanup Kits:	
Locations of Safety Data Sheets (SDS/MSDS):	

Table 7. Chemical Procurement *The following individual(s) are designated as having primary responsibility for approving, ordering and accepting chemicals for this classroom(s) or laboratory:*		
Name (Print or Type):	**Signature:**	**Date:**

Table 8. Student Safety Contract *Please provide the course name/title, the faculty member distributing the Student Safety Contract (contract), and the dates when the contracts were distributed.*			
Course Name/Title:	**Name of faculty member distributing contracts:**	**Dates when contracts were distributed**	**Faculty initials:**

D*isclaimer: No representation, warranty, or guarantee is made by CDPHE as to the accuracy or completeness of our suggestions or information, and CDPHE assumes no responsibility in connection therewith. This Chemical Hygiene Plan Template for schools is intended to provide basic guidelines and procedures to develop and implement a chemical hygiene plan as well as how to comply with related sections of the Rules and Regulations Governing Schools in the State of Colorado. It cannot be assumed that all necessary warnings and precautionary measures are contained in this document. Local conditions or circumstances unique to your particular situation (applicable federal, state, or local law) must also be considered. Users of this Chemical Hygiene Plan Template for Schools should consult local, state, and federal laws and regulations and their legal counsel prior to initiating any safety activity.*

Contents

SECTION 1: INTRODUCTION

Toxic and hazardous substances in schools have caused serious injuries to students and faculty in many states, including Colorado. These materials are a necessary part of curriculum and the maintenance of the school and grounds. The risks associated with the use of these materials is greatly reduced or eliminated when effective precautions and safety practices are implemented. To better manage and mitigate these risks, this document has been created to provide a template to assist schools with the development of a Chemical Hygiene Plan (CHP). A CHP should act as the foundation of an effective chemical safety program at the school and is designed to aid faculty, staff, and students in maintaining a safe environment in the school.

1.1 PURPOSE AND SCOPE

A CHP provides the framework to establish a formal program for protecting faculty, students and other school staff against health and safety hazards associated with exposure to toxic and hazardous substances that are used in a school. Because of the importance of a CHP, and to assure the safe use of these materials, the *Rules and Regulations Governing Schools in the State of Colorado (regulations), Section 6.12.1 (E),* requires each school to establish a CHP which addresses all areas of the school where toxic or hazardous substances are used or stored.

As defined by the regulations, a CHP is a written program that promotes the safe management of chemicals for students, faculty and staff and promotes a culture of safety within the school. The CHP describes all the following:

- Procedures for general laboratory safety
- Chemical management (including procurement, storage, handling, and disposal)
- Safety equipment testing
- Spill response, and
- Procedures for the operation and testing of laboratory chemical hoods and other emergency and safety equipment

In addition, chemicals that are listed as “Restricted” in the regulations that are used in the classroom or laboratory must be addressed individually in the CHP. Restricted chemicals are listed in Appendix B of the regulation and are defined as those substances with a hazardous nature, but that may have potential educational utility. Due to their hazardous nature, measures to mitigate the associated health and safety hazards must be provided in the CHP for each individual restricted chemical that is used. Ideally, the associated hazards and mitigation measures for restricted chemicals should be addressed by developing written standard operating procedures (SOPs) for the use of the restricted chemical. The completed SOPs should then be included with the CHP.

The CHP requirement in the regulation applies to all areas of the school where toxic or hazardous substances are used, stored, or handled by faculty, staff, or students. This includes a number of different areas of a school that are not commonly thought of as areas that need to address their

chemical safety practices such as an art studio or even a technology laboratory. To assure that a CHP is available for all areas of a school that require one, the following areas should be evaluated individually for the possible implementation of a CHP:

- **Science**: Chemistry, Biology, Physical Sciences, etc;
- **Art and Specialty Arts**[1]: Ceramics, Painting, Drawing, Jewelry Making, Glass Blowing, etc;
- **Drama/Stage Production**[1] **shops**;
- **Vocational Arts**[1]: Wood shop, Auto Shop, Welding Shop, Agricultural/4-H Shop, Technology Laboratory, etc; and
- **Cleaning, custodial, and maintenance chemical storage areas**[2].

[1]Non-toxic paints and other art related materials labeled with an ASTM – AP, NON-TOXIC, or otherwise labeled as non-toxic do not need to be addressed on your CHP. Art classrooms using only these materials do not need a CHP.

[2] Cleaning, custodial, and maintenance chemicals must be addressed by a separate CHP in those schools that also have other areas requiring a CHP (e.g. science and vocational art classrooms). A chemical hygiene plan is strongly recommended but not required for cleaning, custodial, and maintenance chemicals used and stored in elementary schools and other schools that do not otherwise have areas that use toxic or hazardous substances (e.g. science and vocational art classrooms).

1.2 CHEMICAL HYGIENE PLAN (CHP) TEMPLATE INSTRUCTIONS

This CHP template is based on best practices and safe work procedures required for the safe operation of laboratories, classrooms, shops and other areas of the school that utilize chemicals. This document can be customized and completed with information specific to the chemicals used and procedures conducted within an individual classroom, laboratory, or area of the school using hazardous materials.

Each area of the school with distinct, separate chemical use must develop and maintain an individual CHP specific to that area. For example, a separate CHP must be developed and maintained for a science classroom or laboratory and a separate CHP must be developed and maintained for an art classroom because each area utilizes different chemicals and procedures.

In areas of the school where the same chemicals and practices are shared, such as in a science area with several science classrooms, only one template will need to be completed for that area. In these areas, classrooms engaging in work with chemical practices that differ slightly, such as experiments conducted in a chemistry laboratory and those conducted in a biology laboratory, a CHP can be shared by the area but must be further customized by the addition of laboratory specific information. This may include specific standard operating procedures (SOPs), hazard assessments, and any other written (or referenced) lab-specific operating procedures or protocols that address the individual hazards and how to mitigate the risks.

The following instructions detail how this CHP template should be used and customized by each classroom, laboratory, or shop:

1. Review this template CHP.
2. Evaluate the chemical practices in your classroom to determine if a separate or shared CHP is required. If a shared CHP will be used, coordinate with other faculty to complete the CHP for your area(s).
3. Complete Tables 2-8 with information specific to your laboratory, classroom(s), shop(s), etc.
    - Ensure that information for all classrooms and laboratories sharing a CHP are indicated.
4. Review, and update (if necessary), the contents of the CHP at least annually. Record the date of the annual CHP review and any updates that are made to the CHP in Table 4.
5. Train all staff that use the CHP on the contents of the CHP before any work with hazardous chemicals occurs. Retrain all faculty and staff at least annually. Document and record the date of the initial and annual refresher trainings on Table 3. Guidance on CHP training and annual refresher training can be found in Section 8.1.
6. *Optional:* Insert standard operating procedures (SOPs) for the use of Restricted Chemicals under Tab 1. Guidance on the development of SOPs for Restricted Chemicals can be found in Section 4.4.2. Templates for Restricted Chemical SOPs can be accessed here: https://www.colorado.gov/pacific/cdphe/schools
7. *Optional:* Insert any additional SOPs for other chemicals and experiments or procedures under Tab 2. Guidance on the development of SOPs can be found in Section 4.4.1.
8. *Optional:* Insert all other additional documented safety rules, equipment protocols, procedures, etc., under Tab 2.
    - Tab 2 may also be used to insert user guides/manuals or operating instructions for equipment and safety equipment items (e.g., eyewash fountains, safety showers).
9. *Optional:* Insert completed student safety contracts in Tab 3. Guidance on student safety contracts and training can be found in Section 8.2.
10. *Optional:* Insert any miscellaneous correspondence from your local public health or fire agency such as approved regulation variances (see *Section 6.6.4, Variance Procedures* in the regulations), copies of inspection reports, enforcement letters, compliance agreements, plans of action, etc., under Tab 4.
11. Ensure that a copy of the CHP is maintained in 2 separate locations: near where the chemicals are stored and on file in a location away from the areas where chemicals are stored (e.g., front office of school).
12. Provide a copy of the CHP to the local fire department and local emergency planning committee upon request.

SECTION 2: CHEMICAL SAFETY GUIDELINES

2.1 TEACHING STAFF RESPONSIBILITIES

The teacher is ultimately responsible for the overall safe operation of the classroom or laboratory and the implementation of the CHP. The teacher must:

- Review, understand, and follow the requirements of the CHP;
- Ensure that the requirements of the CHP are followed by all staff members and students that work in your laboratory, shop, or classroom;
- Identify hazardous conditions or operations in your laboratory, shop, or classroom;
- Review and understand the hazards of materials and processes in the classroom prior to using them;
- Review and understand SOPs for each chemical class and restricted chemical
- Review, understand, and follow chemical product labeling and/or specific manufacturer's instructions for safe use;
- Ensure that all students working with hazardous chemicals and substances receive appropriate safety training (refer to Section 8 student safety training requirements);
- Develop and distribute student safety contracts at the start of each semester;
- Maintain written records of student safety training;
- Instruct students on all safety precautions and potential hazards for all procedures that will be conducted;
- Instruct students on the location and use of emergency and safety equipment prior to any activity;
- Instruct students on the location and use of SDS for the chemicals being used;
- Ensure that appropriate PPE (e.g., eye protection, gloves, smocks, etc.,) and engineering control equipment (e.g., chemical fume hoods) are made available as necessary, in good working order, being used properly, and tested as required;
- Understand the capabilities and limitations of PPE;
- Practice good chemical hygiene habits such as keeping chemical preparation and storage areas clean and uncluttered;
- Conduct periodic safety inspections and immediately take steps to abate hazards that may pose a risk to life or safety upon discovery of hazards;
- Never allow students to take chemicals out of the laboratory or classroom where chemicals are used;
- Never allow food or drink, open or closed, in areas where toxic or hazardous substances are being used. A personal water bottle is allowed only in areas where these substances are not being used;
- Immediately address and document all accidents, near misses, and unsafe conditions; and
- Actively enforce all applicable safety rules and procedures, including having a progressive disciplinary process for students that do not comply with the safety rules.

2.2 STUDENT RESPONSIBILITIES

All students in classrooms and laboratories that use, handle, or store hazardous chemicals and substances must:

- Follow all verbal and written laboratory and chemical safety rules, regulations, and SOPs required for the tasks assigned;
- Develop and practice good personal chemical hygiene habits such as keeping work areas clean and uncluttered;
- Plan, review, and understand the hazards of materials and processes in the classroom prior to conducting work;
- Utilize appropriate measures to control hazards, including consistent and proper use of engineering controls, administrative controls and PPE;
- Understand the capabilities and limitations of PPE;
- Immediately report all accidents, near misses, and unsafe conditions to the teacher; and
- Complete all required safety training including student safety contracts and routine safety orientations.

2.3 CHEMICAL SAFETY CONSIDERATIONS

All staff and students must have a good understanding of the hazards associated with the chemicals being used in the laboratory, shop, or classroom. There are many factors to consider when evaluating the use of chemicals and if effective safety controls are in place. Reviewing the following questions will help to ensure that the most important factors have been addressed prior to working with a chemical:

- Is the material flammable, explosive, corrosive, reactive, or toxic?
- If the material is toxic, what are the likely routes of exposure (e.g., inhalation, skin or eye contact)?
- What kind of ventilation is necessary to protect myself and students?
- What kind of PPE (e.g., chemical-resistant gloves, goggles) do I need to protect myself and students?
- Will the process generate other toxic compounds, or could it result in a fire, explosion, or other violent chemical reaction?
- What are the proper procedures for disposal of the chemicals?
- Do I have the proper training to handle the chemicals and carry out the process?
- Are my storage facilities appropriate for the type of materials I will be using?
- Can I properly segregate incompatible chemicals?
- What possible accidents can occur and what steps can I take to minimize the likelihood and impact of an accident? What is the worst incident that could result from my work?

2.4 GENERAL CHEMICAL SAFETY RULES

In order to promote a culture of chemical safety within the laboratory and classroom, it is extremely important that safety rules are followed by all staff and students. The following general safety rules must be followed at all times:

- Prior to beginning work, be prepared for hazardous materials emergencies and know what actions to take in the event of an emergency. Plan for the worst-case scenario. Be sure that the necessary supplies and equipment are available for small chemical spills. Know the location of and the proper way to use safety equipment such as the nearest safety shower and eyewash station, fire extinguisher, spill kit, and fire alarm pull station.
- Limit access to areas where chemicals are used or stored by posting signs and/or locking doors when areas are unattended.
- Ensure that adequate storage facilities (e.g., chemical storage rooms, flammable storage cabinets) and container are provided for hazardous materials. Ensure that hazardous materials are segregated by chemical compatibility.
- Ensure that ventilation is adequate for the chemicals being used. Understand how to properly use chemical fume hoods and local exhaust ventilation systems, and be able to determine if the hood is not functioning properly.
- Use good personal hygiene practices. Keep hands clean at all times; wash thoroughly with soap and water after handling any chemical. Do not handle your cell phone while wearing protective gloves.
- Drinking, eating, and the application of cosmetics are not allowed in areas where hazardous chemicals are in use. Confine loose hair and clothing.
- Never smell or taste chemicals. Never use mouth suction to fill a pipette.
- Inspect all equipment/apparatus before use.
- Ensure that you follow the manufacturer's guidelines and instructions when using equipment.
- If equipment requires routine maintenance or testing (e.g., HEPA filters need to be changed, fume hood need to be tested), ensure maintenance is provided by a qualified individual.
- Use required PPE as instructed by the PPE Policy detailed in Section 5.

2.4.1 GENERAL RULES FOR HANDLING CHEMICALS SAFELY

- Check the label on chemical bottles twice to verify that it is the correct substance before using it.
- Take only as much chemical as you need. Weigh out or remove on the amount of chemical you need. Never return unused chemicals to their original containers. Dispose of excess in the appropriate waste container designated by your teacher.
- Never use mouth suction to fill a pipet. Use a use a rubber bulb or pipet pump.
- Hold chemicals away from the body when transferring a chemical from one container to another.

- Always use a spatula or approved scoop to remove a solid reagent from a chemical container.
- Never use a metal spatula when working with peroxides. Metals will decompose explosively with peroxides.
- Acids must be handled with extreme care. Always add concentrated acid to water slowly. Never add water to a concentrated acid.
- Handle flammable liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.
- Take great care when transporting acids and other chemicals from one part of the laboratory to another. Hold them securely and walk carefully.
- When transporting chemicals (especially 250 mL or more), place the immediate container in a secondary container or bucket (rubber, metal or plastic) designed to be carried and large enough to hold the entire contents of the chemical.
- Never handle bottles or containers that are too heavy for you.
- Use a hot water bath to heat flammable liquids. Never heat directly with a flame.
- Do not immerse hot glassware in cold water; it may shatter.
- Never look into a container that is being heated.
- Do not place hot apparatus directly on the work bench or table. Always use an insulating pad. Allow plenty of time for the equipment to cool before touching it.
- Never store chemicals over, under, or near a sink.
- Always work in a well ventilated area. Use the laboratory chemical fume hood, or other local exhaust ventilation as required by your teacher if you are working with chemicals that can release vapor, gases, or dust.

SECTION 3: CHEMICAL MANAGEMENT PLAN

An effective chemical management plan is essential for safety in the laboratory or classroom. Requirements on topics including housekeeping, equipment safety, chemical inventories, proper handling, storage, and segregation must be established and implemented. This section details how chemicals should be safely managed.

3.1 HOUSEKEEPING

A clean, well-maintained laboratory or classroom improves safety by helping to prevent accidents. The following housekeeping guidelines should be followed:

- All doorways and hallways must be free of obstructions to allow clear visibility and exit. The laboratory or classroom should be uncluttered without excessive storage of materials that could cause or support a fire (e.g., paper, cardboard, flammable liquids, etc.).
- Fire protection sprinklers must be unobstructed; a minimum of 18 inches of clearance is required below the sprinkler head.
- Do not store items that block fire extinguishers or eyewash and safety shower stations.

- Do not store items in front of electrical boxes/panels.
- A routine cleaning schedule should be established. All work surfaces should be kept as clean as possible. All potentially contaminated work area surfaces (e.g., chemical fume hood deck, countertops) should be cleaned routinely (e.g., daily, weekly).
- For operations where spills and contamination are likely, cover work spaces with a bench paper or liner. The soiled liner should be changed on a routine basis or as needed.
- All chemical spills must be cleaned up immediately. Refer to Section 7 of the CHP for detailed chemical spill cleanup procedures.
- Do not allow materials to accumulate in chemical fume hoods or local exhaust ventilation systems and remove used tissues, foil, gloves, or other unnecessary objects immediately after use. The safety of the workspace and the hood ventilation may be compromised when excessive chemicals and equipment are kept under hoods. Do not keep chemical container under fume hoods for long-term storage.
- Ensure that all waste (e.g., trash, chemically contaminated debris, waste, etc.) is placed in the appropriate containers. Do not overfill waste containers.
- All equipment should be cleaned and returned to storage after each use.
- Equipment should be stored in a safe and orderly manner that prevents it from falling.
- Chemical containers must be clean, properly labeled, and returned to storage upon completion or usage. Avoid storing liquids above eye level.
- Do not store heavy or frequently used items on top shelves. Locate items used daily close to the work area.

3.2 CHEMICAL INVENTORIES

Taking a routine chemical inventory can reduce the number of unknown chemicals and the tendency to stockpile chemicals. All chemicals, solvents, and hazardous substances including chemical products typically found in art rooms and shops such as paints must be inventoried a minimum of once a year as required by the regulations. When inventorying chemicals, identify prohibited or restricted chemicals, assess which chemicals are not used and should be disposed of, and ensure that chemicals have not deteriorated.

A formal process for conducting the inventory must be implemented. This includes planning before the start of the inventory and not working alone. Do not involve students unless they are fully supervised and their actions structured and controlled. Always wear appropriate personal protective equipment.

Old chemicals may be unstable, some chemicals form explosive compounds as they age. If in doubt, call for help.

Prior to starting the chemical inventory please review the guidelines: **Recommended Procedures for Conducting a Chemical Inventory Safely** located in Appendix A.

At a minimum, ensure that the following safety practices are ALWAYS implemented during the inventory process:

- Wear appropriate PPE (chemical splash goggles, gloves, aprons). Have extra gloves available.
- Use a chemical cart.
- Use a step stool when needed.
- Have a fully stocked emergency spill kit at the ready.
- Review and be familiar with the emergency evacuation action plan.
- Never work alone.

The inventory should include all chemicals, compounds, products as well as all wastes that are stored in the area. The inventory must include the following elements:

- Name of the chemical or compound
- Amount
- Year the material entered the school
- Identification of restricted and prohibited chemicals (if present)

Other useful and recommended information includes:

- The materials CAS number
- The manufacturer's name
- The size and type of container
- Characterization of the contents (e.g., percent solid/liquid, presence of crystals, etc.)
- Shelf life
- Storage location
- Compatible family designations

A hard copy of the inventory should be kept in the storeroom or area where chemicals are being stored, available for reference. A hard copy must also be kept on file in a location away from the areas where the materials are stored (the front office, for example). This remote copy allows the emergency response team access to the inventory in case of a fire, explosion, or release at the storeroom.

3.3 SAFETY DATA SHEETS (SDS)

The SDS provides comprehensive information that is imperative for the safe handling of hazardous chemicals. Carefully read the label and the SDS for each chemical product and make sure that you understand the information before using the chemical. Ensure that all required safety controls as outlined in the SDS such as using mechanical ventilation and PPE are available and implemented before using the chemical. Information regarding chemical safety measures can be found primarily in Section 8, "Exposure Controls, Personal Protection". **Do not use a hazardous chemical unless all safety measures as directed by the SDS can be followed.**

In some cases, additional research may be required to ensure that all safety precautions outlined in the SDS are being followed. For example, a SDS may require that adequate ventilation be provided when using the product, without listing a specific type of engineering control such as a fume hood. In this case, additional research is required to determine what methods can be used to provide the required ventilation. Be sure to include any additional information collected alongside the SDS or insert it into Tab1.

The collection of SDS for all chemicals used in the classroom should be provided in an organized and easily searchable format (e.g., alphabetically filed). Using alphabetical index tabs is recommended as a convenient way to ensure that SDS can be found quickly in the event of an emergency.

Printed copies of SDS should also be kept on file in a location away from chemical storage (the front office, for example). Digital or electronic versions of SDS may be approved only at the discretion of the local fire authority. Documentation evidencing approval for electronic maintenance of SDS must also be kept on file for review.

To obtain a copy of a SDS, contact the chemical manufacturer or visit their website. Many SDS can also be found online at websites such as Siri MSDS Index. Links to online resources are included below:

- Siri MSDS Index (http://hazard.com/msds/)
- MSDS.COM (http://msds.com)

3.4 CHEMICAL LABELING REQUIREMENTS

Whenever feasible, store chemicals in the containers in which they were received and retain the vendor's labels. Containers of chemicals, poisons, corrosive substances and flammable liquids must be clearly labeled with:

- The chemical name
- Original quantity of the material
- The date the material entered the school
- Restricted chemicals should be labeled "restricted" or marked appropriately

Prepared solutions and secondary containers of chemicals intended for storage should have labels that include:

- Chemical name and if applicable, the formula (including solvent)
- Concentration
- Date of preparation
- Disposal date or expiration date

Other label information should include:

- Necessary handling and hazard information (such as poison, causes burns, flammable, harmful vapors, explosive, toxic, or corrosive)
- Shelf life (or expiration date)

3.5 CHEMICAL PROCUREMENT

Controlling what chemicals are used within the school is critical to ensuring that only products that have been reviewed and approved for use are brought into the school environment. This section establishes the protocol for evaluating, approving, and ordering school chemicals.

Prior to purchasing, each chemical must be evaluated using the following criteria:

- Assess all the health and safety hazards and physical properties of the chemical using the SDS; evaluate both short and long term risks.
- Prior to purchasing, all laboratory grade chemicals must be reviewed against the list of prohibited and restricted chemicals located in Appendices A and B in the regulations.
- Consider the worst case scenario(s) in the event that the substance is mismanaged, spilled, or causes personal injury.
- Make sure the hazardous properties of the chemical do not exceed the educational utility of the experiment.
- Determine whether a safer, less hazardous chemical can be used instead.
- Consider any potential environmental concerns that may result from the use of the product or in the management of its waste products.
- Determine whether the appropriate facilities are available for the proper storage of the chemical and the ventilation and fume hood(s) are sufficient.
- Determine whether the proper personal protective equipment and safety equipment is on hand for using the chemical.
- Establish whether the chemical or its end product will require disposal as a hazardous waste.
- Ensure that the budget will allow for the appropriate and legal disposal of the chemical and/or its end product.
- Have a mechanism in place to dispose of the chemical and its end product legally and safely.
- Determine whether lesser amounts of a chemical can be used to conduct the experiment.
- Purchasing chemicals in bulk should be avoided.
- Only order the amount that can be fully consumed under planned use within the shelf life of the product.
- Consider implementing small-scale chemistry where each student performs their own microscale experiments.
- If possible, order reagents in polyethylene bottles or plastic coated glass bottles to minimize breakage, corrosion, and rust.

- Consider using pre-weighed or premeasured chemical packets such as chemcapsules that reduce bulk chemical disposal problems (no excess chemicals remain).

3.5.1 APPROVAL AND ORDERING OF CHEMICALS

A centralized purchasing program should be implemented in which one person or department, who is knowledgeable of all the chemicals on hand, does all the purchasing, or links purchasing requests into an inventory tracking system so that excess chemicals in stock can be used before buying more. This type of ordering system allows for more control over the chemicals entering the school and is an important method of minimizing potentially hazardous and unneeded chemicals from accumulating.

Additionally, staff involved with chemical procurement in the receiving room, storeroom, and stockroom personnel should be trained in the proper methods of receiving and handling of hazardous substances.

3.5.2 RESTRICTED CHEMICAL INVENTORY CONTROL

All laboratory grade chemicals must be reviewed against the list of prohibited and restricted chemicals located in Appendices A and B in the regulations prior to purchase. An additional review of chemicals against the prohibited and restricted list should also be conducted at the time the chemical is received into the school as a secondary measure of inventory control.

The quantity of a restricted chemical must be limited to an amount that can be used within one school year. Safer and less hazardous alternatives should be purchased and used in place of restricted chemicals whenever feasible. Additionally, several restricted chemicals are limited to specific quantities as indicated next to the chemical name on the list. If a chemical is not on the restricted chemical list, consider purchasing only what can be used during the current school year, especially if the chemical has a poor shelf life.

A mechanism to monitor the amount of restricted chemicals on inventory should be developed. This should be implemented in addition to and alongside the routine chemical inventory process.

FIGURE 1. Provides an example of a method for ensuring that quantities of restricted chemicals are not exceeded:

Figure 1. Restricted Chemical Inventory Tracking				
Name of Restricted Chemical	**Amount that can be reasonably used within one year or less (approx.)**	**Amount restricted by quantity as indicated in Appendix B (if applicable)**	**Current amount on inventory**	**Amount that can be ordered (if any)**
Example: Calcium	*100 g*	*100 g*	*50 g*	*50 g*
Example: Acetic Acid	*200 mL*	*N/A*	*100 mL*	*100 mL*

3.6 CHEMICAL STORAGE REQUIREMENTS

Proper storage of chemicals is an essential component to a chemical safety program. Improper chemical storage practices can cause undesired chemical reactions, which may form hazardous products that can lead to dangerous chemical exposure, or possibly fires and property damage. Carefully review each chemical label and SDS to determine how to properly store a chemical. Information regarding chemical storage and compatibility can be found in the SDS, primarily in Section 7, "Handling and Storage" and Section 10, "Stability and Reactivity".

All chemicals must be stored according to chemical compatibility. Once segregated by chemical compatibility, they can then be stored alphabetically. Chemical segregation can be achieved by either isolation (e.g., organic solvents stored in a flammable cabinet), physical distance (e.g., acids and bases stored on opposite sides of chemical storage shelves), or secondary containment (e.g., placing oxidizing acids such as nitric acid into a secondary containment to segregate from organic acids such as acetic acid). In the most general terms, proper segregation can be achieved by:

- Storing acids away from bases and toxics;
- Storing oxidizers away from organic chemicals; and
- Storing reactive and acutely toxic materials away from all other chemicals.

FIGURE 2. Illustrates a more detailed chemical compatibility logic that can be used for storage of laboratory grade chemicals. Hazard classes marked by an **X** need to be segregated from each other (e.g., Acid, inorganic must be segregated from Base, inorganic).

Figure 2. Chemical Compatibility Chart

	Acid, inorganic	Acid, organic	Acid, oxidizer	Base, inorganic	Base, organic	Oxidizer	Toxic, inorganic	Toxic, organic	Reactive	Organic solvent
Acid, inorganic				X	X		X	X	X	
Acid, organic			X	X	X	X	X	X	X	
Acid, oxidizer		X		X	X		X	X	X	X
Base, inorganic	X	X	X						X	
Base, organic	X	X	X			X			X	
Oxidizer		X			X			X	X	X
Toxic, inorganic	X	X	X						X	
Toxic, organic	X	X	X			X			X	
Reactive	X	X	X	X	X	X	X	X		X
Organic solvent			X			X			X	

3.6.1 GENERAL CHEMICAL STORAGE AND CHEMICAL SEGREGATION

The following general chemical storage guidelines must be followed at all times:

- Each chemical must be stored in a specific location and returned there after each use. Acceptable chemical storage locations may include flammable cabinets, corrosive cabinets, ventilated chemical storage cabinets, secure laboratory or chemical storage shelves, or appropriate laboratory refrigerators or freezers.
- Chemical containers must be in good condition and appropriate for the chemical that they contain and be free from exterior contamination.
- Chemical fume hoods should not be used for permanent chemical storage areas. Not only does this create potentially unsafe conditions by having extraneous chemicals stored near chemical reactions and processes, excess chemical bottles in the hood may

also seriously impair the ventilating capacity of the fume hood. Only chemicals used in the process or experiment being conducted in the fume hood are allowed to be stored in the fume hood and should be removed when the process or experiment in complete.

- Chemicals should not be permanently stored on bench tops, tables, or at work stations. Avoid storing any chemical containers on the floor. Under no circumstance should chemical containers, or anything else, be stored in aisle ways, corridors, or in front of doors.
- Hazardous liquids should not be stored on shelves above eye-level unless there is a SOP detailing safe handling procedures.
- Chemicals should be stored at an appropriate temperature and humidity levels at all times including during school holidays and breaks. Work with the school administrator to ensure that temperature is controlled during these periods or make the necessary arrangements to provide for safe storage. Never be stored in direct sunlight.
- Periodic cleanouts of expired or unneeded chemicals should be conducted in addition to the required annual chemical inventory to minimize the volume of hazardous chemicals stored in the classroom or laboratory.
- Always follow the chemical manufacturer's storage instructions.

3.6.2 FLAMMABLE LIQUIDS STORAGE

Flammable liquids include any liquid with a flash point no greater than 93°C (200°F). The following guidelines for storing flammable liquids must be followed in all laboratories:

- Flammable and combustible liquids should be stored in flammable storage cabinets whenever possible. No more than 10 gallons of flammable liquid is permitted to be stored outside of a flammable storage cabinet.
- Domestic refrigerators or freezers must never be used to store flammable liquids. Flammable liquids can only be stored in refrigerators or freezers that are designed for flammable materials. (Note: most refrigerators and freezers and not intended for flammable storage).
- Flammable liquids must be stored in well-ventilated areas free from ignition sources such as Bunsen burners or art ceramic kilns.

3.6.3 COMPRESSED GASES STORAGE

Compressed gas cylinders are used in several locations within a school including art and vocational art rooms such as welding and automotive shops. Art studios that make jewelry will often times use compressed butane cylinders during soldering. The following guidelines for storing compressed gases must be followed:

- Compressed gas cylinders (cylinders) must be stored in a secure, well ventilated location, and in an upright position at all times. Small cylinders such as lecture bottles are not required to be stored in the upright position; they can be safely laid down in a chemical cabinet when not in use.
- All cylinders should be handled as if they are full.
- Cylinders that not in use must be stored securely and with the safety cap on. Multiple cylinders may be secured together as long as they are capped.
- Cylinders that are in use, meaning there is a regulator attached, must be individually secured by a chain or strap. Cylinder valves and regulators should be protected from impact or damage.
- Gas cylinder connections and fittings must be inspected frequently for deterioration.
- Never use a leaking, corroded, or damaged cylinder and never refill a compressed gas cylinder.
- When stopping a leak between the cylinder and regulator, always close the valve before tightening the union nut.
- The regulator must be replaced with a safety cap when the cylinder is not in use.
- The safety cap must be in place when a gas cylinder is moved. For large gas cylinders (>27 inches), an approved gas cylinder cart should be used to move it.
- The cylinder must be strapped to the cart and the protective cap must be in place before moving the cylinder. A cylinder should never be moved or transported without the protective cap.
- Never dispense from a cylinder if it is on a gas cylinder cart.

3.6.4 REACTIVE MATERIALS STORAGE

Reactive materials include explosives, pyrophorics, self-heating and self-reacting compounds, and water reactives. Many reactive materials are also toxic, corrosive, teratogenic, or can form organic peroxides. The following guidelines for storing reactive materials must be followed at all times:

- The amount of reactive materials stored must be kept to a minimum. Most reactive materials are listed on the restricted chemical list on Appendix B of the regulations and are limited to an amount that can be used within one year or may be additionally limited to specific amounts noted next to the chemical name on the list.
- Any expired or unwanted reactive materials must be removed from the school as soon as possible and must be disposed of as a hazardous waste.

- All reactive materials should be placed into secondary containment as a best management practice.
- Suitable locations for reactive materials include flammable storage cabinets that do not contain aqueous or other incompatible chemicals, or intrinsically safe refrigerators or freezers that also do not contain aqueous or other incompatible chemicals. If possible, store all reactive chemicals in a small flammable cabinet (such as flammable cabinet underneath a fume hood) dedicated only for reactives. Storage locations for reactive chemicals should be posted with signs indicate their presence and unique hazards.
- Many reactive materials are water and/or air reactive and can spontaneously ignite on contact with air and/or water. Therefore, reactives must be handled under atmosphere and in such a way that rigorously excludes air or moisture.
- If reactive materials are received in a specially designed shipping, storage, or dispensing container (such as the Aldrich Sure-Seal packaging system), ensure that the integrity of that container is maintained. Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while reactive materials are stored.

3.6.5 CORROSIVE MATERIALS STORAGE

The best storage method for corrosive materials is inside of a corrosive storage cabinet or lab cabinet where acids and bases are segregated at all timed. Acids must also be segregated from chemicals where a toxic gas would be generated upon contact with an acid (e.g., sulfide compounds). Organic acids (e.g., acetic acid, formic acid) must be stored away from oxidizing acids (e.g., nitric acid), as these types of acids are incompatible with each other. Segregation can be achieved either by physical distance (preferred method) or by secondary containment (e.g., placing the original chemical container into an empty container).

3.6.6 OXIDIZER STORAGE

The following guidelines for storing oxidizers and organic peroxides must be followed:

- Oxidizers (e.g., hydrogen peroxide, sodium nitrate) and organic peroxides (e.g., methyl ethyl ketone peroxide) must be stored in a cool, dry location and kept away from combustible materials such as wood, pressboard, paper, and organic chemicals (e.g., organic solvents and organic acids).
- If possible, store all strong oxidizing agents in a chemical cabinet dedicated only for oxidizers.
- The amount of oxidizers stored must be kept to a minimum. Most oxidizers are listed on the restricted chemical list on Appendix B of the regulations and are limited to an amount that can be used within one year or may be additionally limited to specific amounts noted next to the chemical name on the list.

3.6.7 REFRIGERATORS AND FREEZERS CHEMICAL STORAGE

A number of general precautions need to be taken when storing chemicals or specimens (e.g., dissection animals) in refrigerators or freezers. The following procedures must be followed:

- Domestic refrigerators or freezers must never be used to store flammable liquids. Flammable liquids are only allowed to be stored in refrigerators or freezers that are designed for flammable materials (note: most refrigerators and freezers and not intended for flammable storage).
- Refrigerators and freezers used for flammable compounds need to be prominently marked to indicate they contain flammable materials and that they meet the appropriate design requirements for the safe storage of flammable liquids.
- An inventory should be posted on the refrigerator door.
- Lab refrigerators or freezers must never be used to store food or beverages for consumption. Lab refrigerators or freezers should be posted with a sign that states “No Food or Drink”.
- All chemicals stored in a refrigerator or freezer must be labeled.
- Ensure that the chemicals stored in a refrigerator or freezer are compatible with each other. For example, do not store an oxidizer such as hydrogen peroxide in a refrigerator with organic chemicals.
- All chemical containers stored in a refrigerator must be completely sealed or capped and safely stored.
- Chemicals should be allowed to warm to room temperature before sealing to prevent pressure buildup.
- Liquid chemicals should be placed in suitable plastic trays or other containers for secondary containment.
- Remember that power outages and technology failures can cause internal temperatures to rise, which can impact chemical contents. Be aware of unusual odors, vapors, etc., when opening the refrigerator or freezer.
- Chemical refrigerators or freezers should be located away from laboratory exists.
- Refrigerators and freezers should be cleaned-out and manually defrosted as necessary. When defrosting a freezer, consideration should be taken regarding potential chemical contamination of the water.

3.7 EQUIPMENT AND INSTRUMENT SAFETY

3.7.1 HEATING DEVICES

Science laboratories commonly use heating devices such as ovens, hot plates, heating mantles, and Bunsen burners. Steam heated devices are generally preferred whenever temperatures of 100°C or less are required because they do not present shock or spark risks and can be left unattended with assurance that their temperature will never exceed 100°C. Ensure the supply

of water for steam generation is sufficient prior to leaving the reaction for any extended period of time.

Art and vocational classrooms also utilize a number of different heating devices including ceramic kilns (electric or fuel fired).

A number of general precautions need to be taken when working with heating devices in the laboratory. When working with heating devices, consider the following:

- The actual heating element in a heating device should be enclosed in such as to prevent accidental touching of the wire. If a heating device becomes so worn or damaged that its heating element is exposed, the device should be discarded or discontinued from service until it can repaired.
- To avoid electrocution while working with electrical equipment, ensure that ground fault interrupter (GFCI) protected electrical outlets are used.
- Ensure that appropriate ventilation is provided and appropriate protective clothing, gloves, and eyewear are available when using a heating device.
- Kilns require mechanical ventilation to the outdoors to prevent exposure to the many inhalation hazards including chlorine, fluorine, carbon monoxide, and metallic vapor emissions.
- Ensure that no flammable materials are stored near the heating devices.

3.7.2 LABORATORY GLASSWARE

Broken laboratory glassware is dangerous. In order to reduce the risk of accidents, the following guidelines should be followed:

- Temperature changes can shatter any laboratory glassware. Never flash-cool glassware with cold water, especially after autoclaving or exposure to any high temperatures.
- Carefully inspect glassware for any small imperfections before using. Sometimes a hairline crack may be present. Tap the glassware with a pen and listen to the tone to tell if there is a defect. A ringing tone indicates the glassware is fine, while a dull “thud” indicates there is a flaw present.
- Do not keep cracked glassware and properly dispose of it.
- Always wear appropriate PPE when working with glassware and varying temperatures. Always wear safety glasses.

3.8 ART, SPECIALTY ART, AND VOCATIONAL SHOP SPECIFIC CHEMICAL MANAGEMENT

Art and vocational shop areas of the school utilize a number of different materials and processes that pose additional risks. This section provides an overview of several specific art and craft disciplines, associated materials, and the appropriate safety considerations that should be employed in addition to those covered throughout this document.

3.8.1 CERAMICS

Both clay and glazes often contain hazardous components that pose potential health effects from chronic long-term exposure including lung diseases/infections, cancer, and skin irritation. Hazardous components in clay dust may include crystalline silica and asbestos while hazardous components in certain glazes include arsenic, uranium, and lead, among others. All of these components may be toxic by inhalation, ingestion, and skin contact.

The following safety precautions must be followed when using clay and glazes:

- Read the product label and SDS. When possible, choose the safest materials available (e.g., those with few or no cautionary/warning labels). Follow the labeled instructions at all times. **Do not use a product unless all safety measures as directed by the product label and SDS can be followed.**
- When possible, use premixed clays and liquid glazes to avoid exposure to large amounts of dust.
- When possible, use lead-free glazes or those with sodium, potassium, calcium, or magnesium fluxes.
- Avoid inhaling dust. Ensure appropriate ventilation at all times. If adequate mechanical ventilation is not available inside of the classroom, powdered products may be mixed outside by teachers only (students are not allowed to participate). In very limited situations, toxic dust respirators approved by the National Institute for Occupational Safety and Health (NIOSH) may be used by the teacher only. Completion of a professional fit testing program is required for respirator use. Please contact your local health department for further information.
- Wear protective clothing, gloves, and eyewear.
- To reduce the risk of dust inhalation while using these products indoors, do not pulverize dry clay or sand “green ware”. Finish “green ware” (unbaked molded & shaped pottery) while damp/wet.
- When cleaning do not sweep dust. Use a wet mop, rags, and/or vacuum with a HEPA filter system.
- Label lead- and cadmium-containing pieces with phrases such as “Contains Lead, Not for Food Use” or “Contains Lead, For Decoration Only”. Consider designing or puncturing holes in utilitarian objects to discourage use with food/beverages.

- A glaze labeled "food safe" does not mean that it is lead free, rather it means that if fired and applied properly it will not leach lead or cadmium at concentrations above those allowed by the FDA into food and beverages.
- Do not mix different glazes together because this disrupts the balance of ingredients and could make a "food safe" glaze into an unsafe product.
- Indoor use of ceramic kilns (electric or fuel fired) requires mechanical ventilation to the outdoors. Adverse health effects from firing clays and glazes are possible via inhalation (common kiln emissions include chlorine, fluorine, carbon monoxide, metallic vapors, and ozone), dermal contact (burns), and eye exposure (heating ceramic materials to glowing emits infrared radiation). Use appropriate PPE and wear infrared goggles or a welding shield.

3.8.2 PAINTING

The primary hazards from paints are primarily associated with some of the solvents (e.g., aliphatic and aromatic hydrocarbons, ketones, and alcohols) and pigments (e.g., lead carbonate, chrome yellow, and cobalt arsenate) used in the product. All of these components may be toxic by inhalation, ingestion, and skin contact.

The following safety precautions must be followed when paints, solvents, and any associated materials:

- Read the product label and SDS. When possible, choose the safest materials available (e.g., those with few or no cautionary/warning labels). Follow the labeled instructions at all times. **Do not use a product unless all safety measures as directed by the product label and SDS can be followed.**
- When possible, use premixed paints to avoid inhalation of dry pigments, dyes, and powders.
- Use water-based products whenever possible and select products that are labeled to indicate that they conform with the ASTM "AP", "CP", or "NON TOXIC" standards. Be aware that there are significant safety hazards associated with products labeled as ASTM "CL".
- Be aware that small amounts of formaldehyde, bleach, and phenol used as preservatives in some paints may cause allergic reactions in sensitive individuals.
- Ensure appropriate ventilation, especially when spraying or airbrushing paint. Mechanical ventilation such as a spray booth or fume hood must be provided when using these applications.
- If adequate mechanical ventilation is not available inside of the classroom, paints products may be sprayed outside on a limited basis. In very limited situations, toxic dust respirators approved by the National Institute for Occupational Safety and Health (NIOSH) may be used by the teacher only. Completion of a professional fit testing program is required for respirator use. Please contact your local health department for further information.

- Wear protective clothing, gloves, and eyewear.
- Remove paint from hands with vegetable oil or baby oil then wash with soap and water.
- Close containers of paint, pigments/dyes, and solvents when not in use.
- Avoid turpentine and mineral spirits and be aware of the flammability potential of solvents.

3.8.3 METALWORKING – SOLDERING AND WELDING

There are a number of hazards associated with metalwork. Metals can contain cadmium, lead, and antimony which may be toxic and can pose inhalation hazards from gases and fumes that are emitted during the process. The associated solvents, fluxes, and cleaners used in metalwork can also contain toxic components including acids, borax, and fluoride which may produce toxic fumes.

The following safety precautions must be followed when working with metal processing methods:

- Read the product label and SDS. When possible, choose the safest materials available (e.g., those with few or no cautionary/warning labels). Follow the labeled instructions at all times. **Do not use a product unless all safety measures as directed by the product label and SDS can be followed.**
- Use lead-free and cadmium free solder. Avoid fluxes with fluoride.
- Follow safety standards established by federal and state government and other organizations (e.g., the American Welding Society, National Fire Protection Association, and the American National Standards Institute) when working with welding equipment.
- Formal training in a certified program for welding is recommended.
- Use care when handling gas cylinders (e.g., oxygen, acetylene, propane, nitrogen, carbon dioxide, etc.)
- Ensure appropriate ventilation for protection from potentially dangerous gases, metal fumes, and heat. Mechanical ventilation such as local exhaust ventilation or a fume hood must be provided when using these applications.
- Infrared and ultraviolet radiation generated during welding may be an eye hazard. Wear appropriate eye protection including safety eyewear and welding shields.
- All protective clothing, welding shields, and welding helmets used during participation, observation, or when in close proximity to welding activities must meet the ANSI Z49.1-2014 Standard – Safety in Welding, Cutting, and Allied Processes.
- Wear protective clothing, gloves, and eyewear for soldering.

3.8.4 WOODWORKING

Safety precautions must be taken when working with wood and associated materials such as glue and preservatives. Wood dust contains a variety of substances that have potential toxic effects when inhaled. Irritation of the lungs, allergic reactions, headaches, cardiac symptoms, and even cancer can all occur from various types of wood dust.

The following safety precautions must be followed when woodworking:

- Become familiar with the potential toxic effects associated with the particular types of wood being used.
- Read the product label and SDS of all stains, glues, and wood preservatives. When possible, choose the safest materials available (e.g., those with few or no cautionary/warning labels). Follow the labeled instructions at all times. **Do not use a product unless all safety measures as directed by the product label and SDS can be followed.**
- Avoid inhaling wood dust by ensuring adequate ventilation through the use of local exhaust ventilation in the form of a centralized dust collection system and/or dust collection equipment on each piece of equipment.
- Students may use dust masks in addition to, but not in place of, adequate mechanical ventilation. Toxic dust respirators approved by the National Institute for Occupational Safety and Health (NIOSH) may be used by the teacher only. Completion of a professional fit testing program is required for respirator use. Please contact your local health department for further information.
- Use appropriate gloves, protective clothing, and protective eyewear.
- Provide adequate hearing protection when using loud equipment.
- Ensure that all filter media on air filtration units in areas of high dust or paint use are changed as needed.

SECTION 4: CHEMICAL SAFETY CONTROLS

Chemical safety controls include engineering controls, administrative controls, and PPE. Elements of these three categories should be used in a layered approach to minimize exposure to hazardous chemicals and provide the necessary protection to students and staff.

4.1 ROUTES OF EXPOSURE

There are four primary routes of exposure in which hazardous substances can enter the body: inhalation, absorption, ingestion, and injection. The most likely routes of exposure in the laboratories, classrooms, and shops that use hazardous chemicals are by inhalation or skin absorption.

4.2 ENGINEERING CONTROLS

Exposure to hazardous materials must be controlled to the greatest extent feasible by use of engineering controls. Examples of engineering controls that reduce or eliminate exposures to hazardous chemicals include:

- Substitutions with less hazardous equipment and chemicals; and
- Use of forced ventilation systems (e.g., chemical fume hoods, dust collection systems, local exhaust ventilation systems).

4.2.1 CHEMICAL FUME HOODS

A chemical fume hood is a type of local exhaust ventilation that is designed to limit exposure to hazardous or toxic fumes, vapors, or dusts. To determine is a chemical is required to be used inside of a chemical fume hood, first check the SDS for that chemical. Statements found in Section 2 on a SDS such as “do not breathe dust, fumes, or vapors” or “toxic by inhalation” indicate the need for ventilation. As a best practice, always use a chemical fume hood for all work involving the handling of open chemicals (e.g., preparing solutions, transferring chemicals) whenever possible.

Experiments that use chemicals with a National Fire Protection Association (NFPA) Health rating of 3 or 4, and chemicals with a Permissible Exposure Limit (PEL) of less than 50 ppm may only be used under a chemical fume hood. This information can be found on the SDS.

If a chemical fume hood is required or recommended to be used, the following guidelines must be followed at all times:

- Chemical fume hoods must be marked to indicate the proper sash position for optimum hood performance. The sash position at this point should provide a minimum face velocity of 100 feet per minute (fpm) and a maximum of 120 fpm.

- The sash height should be set at a level where the operator is shielded to some degree from any splashes, explosions, or other violent reactions which could occur and where optimum air flow dynamics are achieved. The sash height must be high enough to allow normal work to proceed. Most chemical fume hoods are not intended to be used with the sash fully open.
- Only equipment and chemicals essential to the specific procedure or process should be placed in the chemical fume hood. Fume hoods should not be used for storage.
- Do not allow the vents or air flow baffles to be blocked, as this can interfere with the designed and optimal air flow of the chemical fume hood.
- All chemical fume hoods should routinely be checked for airflow and tested annually to measure the face velocity. Documentation of annual testing must be maintained. Testing can be conducted in-house or through a service provider. Contact your local public health agency for additional information on testing options.

4.2.2 LOCAL EXHAUST VENTILATION SYSTEMS (LEV)

Local exhaust ventilation (LEV) and ventilated work stations are engineering controls that protect the user from exposure to hazardous substances such as chemical vapors, mists, dusts or other airborne contaminants by containing or capturing them locally, at the emission point. LEV systems must be capable of providing clean air flow to the student and drawing contaminated air away from the users breathing zone. Blowing air around with a fan without a source of clean air is not adequate ventilation, and can actually increase exposures to harmful substances.

There are various types of LEV systems commonly used in visual art, industrial art, and vocational art classrooms to protect students and staff from exposures to air contaminants. Some of the more common systems used include paint spray booths, finishing rooms, welding booths, soldering stations, and wood dust collection systems.

The following general guidelines must be implemented to ensure adequate ventilation is provided:

- Passive ventilation is not approved (e.g., opening windows) for areas of chemical storage or activities where the product labeling or SDS requires adequate or mechanical ventilation.
- Outdoor use of chemical products such as spray painting should be done only by staff and only on an infrequent basis due to uncontrolled conditions that could contribute to inhalation hazards of airborne contaminants.
- Toxic dust respirators approved by the National Institute for Occupational Safety and Health (NIOSH) may be used by the teacher only. Completion of a professional fit testing program is required for respirator use. Please contact your local health department for further information.
- Do not allow the vents or air flow baffles to be blocked, as this can interfere with the designed and optimal air flow.

- All LEV systems should routinely be checked for airflow and tested annually to measure the face velocity. Documentation of annual testing must be maintained. Testing can be conducted in-house or through a service provider. Contact your local public health agency for additional information on testing options.

4.3 EMERGENCY SAFETY EQUIPMENT

4.3.1 SAFETY SHOWERS AND EYEWASH STATIONS

All laboratories, classrooms, and shops using corrosive or irritating hazardous chemicals must have immediate access to a safety shower and eyewash station that meets the ANSI Z358.1-2009 Standard. If an individual is exposed to a hazardous chemicals, 911 should be dialed and the safety shower and eyewash units should be used for 15 minutes or until emergency response have arrived and begin treatment. Ensure that the following conditions are met for emergency eyewash and safety showers:

- The eye wash fountain must be permanently plumbed, provide a continual hands-free flow of water, and provide a flow of water capable of flushing both eyes simultaneously.
- The use of portable eye wash bottles is not permitted.
- A highly visible sign must mark the locations of eyewash fountains and safety showers.
- Safety showers and eyewash fountains must be easily accessible. Easily accessible means no more than 55 feet from storage or use of corrosive or irritating hazardous chemicals so that it can be reached with impaired vision within 10 seconds or less.
- Safety showers can be centrally located so as to serve more than area if doors are not locked, and convenient prompt access is available.
- It is also recommended that they are flushed until the water runs clean on a monthly basis to relieve the unit of any rust and pipe build-up.
- Eye wash fountains and safety showers must be tested on an annual basis and documented with the date, initials of the staff member conducting the test and test results.

To test the eyewash fountain:

- Visually inspect the unit, looking for damage and ensuring that the protective nozzle covers are still in place and functioning correctly. Covers protect the nozzles from dust and other contaminants but should be fitted in such a way that they are easily removed by the force of water when the eye wash is activated.
- Test the valve activation: it should open in one second or less and stay on without being held.
- Ensure that flushing to both eyes can be provided simultaneously.
- Eye wash stations are required to have a 0.4 gallons per minute (gpm) flow rate. To measure the flow rate use a flow meter or a 1-gallon container. The eye wash should fill a

1 gallon container in 2 minutes 30 seconds or less. The flowmeter should read at least 0.4 gallons per minute.

- The temperature of water should remain between 60-100ºF.
- Be sure to document your testing and the results annually.

To test safety showers:

- Visually inspect pipes for leaks and damage and ensure that they are free of any obstructions.
- Open the faucet valve fully and verify that it stays open without having to holding it open.
- Safety showers must deliver a flow rate of at least 20 gpm. To measure the flow rate use a five-gallon container, with a mark at the three gallon level. Use a funnel or plastic sheeting, if necessary, channel the flow of water into the five-gallon container. If after 9 seconds you are able to collect at least three gallons of water, you have verified a flow rate of at least 20 gpm.
- The temperature of the water should remain between 60-100ºF.
- Be sure to document your testing and the results annually.

4.3.2 FIRE EXTINGUISHERS AND FIRE BLANKETS

An easily accessible fire blanket and fire extinguisher must be provided in each laboratory, classroom, or shop where an open flame is used per NFPA 45 Fire Protection for Laboratories Using Chemicals. Dry chemical Class ABC extinguishers are recommended for laboratory, classroom, and shop use. All fire extinguishers and fire blankets should be mounted on a wall in an area free of clutter where there are no obstructions to access or visibility. The fire blanket must be meet NFPA 45 standards as a fire retardant treated 100% wool blanket. Asbestos fire blankets are not approved and need to be replaced.

In addition, if combustible metals (Mg, Na, K) are present, laboratories must have a Class D extinguisher or those agents shown to be effective in controlling metal fires as well.

Extinguishers must be tested on an annual basis and documented with the date, initials of the staff member conducting the test and test results. It is also recommended that following items are inspected routinely:

- Extinguishers are in their designated places.
- There are no obstructions to access or visibility.
- Safety seals are not broken or missing.
- There is no evidence of physical damage, corrosion, leakage or clogged nozzle.
- Pressure gauge readings are in the proper range or position.
- Operating instructions are legible and facing outward.
- Extinguisher appears full – confirmed by weighing or lifting.
- Required maintenance and recharging of extinguisher is completed on-time.

4.3.3 EMERGENCY SHUT-OFF SWITCHES

Emergency shut off switches including master gas valves and electrical shut off switches must be tested on an annual basis and the test results documented. Documentation may consist of a tag connected to the shut off switch that shows the date the test was conducted, the name of the person conducting the test, and the test results. A passing result is defined as a valve or switch that, when activated, immediately ceases to supply power or gas to connected equipment.

4.4 ADMINISTRATIVE CONTROLS

Administrative controls are procedural measures which can be taken to reduce or eliminate hazards associated with the use of hazardous materials. Administrative controls include, but are not limited to the following:

- Ensuring that staff and students are provided with adequate and documented training for safe work with hazardous materials.
- Careful planning of experiments and procedures with safety in mind; planning includes the development of written SOPs and hazard assessments for the use of restricted chemicals.
- Discussing safety on a regular basis with students (e.g., daily safety orientations).
- Restricting access to areas where hazardous materials are used.
- Using safety signs or placards to identify hazardous areas (designated areas).
- Labeling all chemicals.
- Substitution of toxic materials with less toxic materials, when possible.
- Good housekeeping and good personal hygiene such as routine handwashing and regular cleaning of areas that are possibly chemically contaminated such as bench-tops and fume hoods.
- Prohibiting eating and drinking where chemicals are used or stored.

4.4.1 STANDARD OPERATING PROCEDURES (SOPS)

SOPs are written instructions that detail the steps that will be performed during a given procedure and include information about potential hazards and how these hazards will be mitigated. The process of evaluating the hazards associated with the procedure is referred to as a hazard assessment. The following steps should be taken to complete a hazard assessment:

- Describe the task.
- List the potential hazards associated with the chemical(s) being used (e.g., toxic, flammable).
- List the potential hazards associated with each body part (e.g., Eyes: Chemical Splash).
- Determine the appropriate PPE requirements for each hazard (e.g., Eyes: Safety Goggles).
- List the other control measures required such as engineering and administrative controls (e.g., always prepare solutions in the chemical fume hood).

- All of the information listed above can be obtained from the chemical SDS.

The information obtained from the hazard assessment should be included with the instructions detailing the steps that will be performed during a given procedure to complete a written SOP for the procedure. As a best practice, SOPs should be developed for all hazardous tasks using chemicals as well as for hazardous equipment such as for ceramic kiln operation. An individual SOP is not required for every hazardous task performed or chemical used in the laboratory; SOPs can be written in a comprehensive manner that encompasses many similar hazards. For example, if a procedure in the lab requires the use of acetone and ethyl acetate, both of which are flammable liquids, one SOP on flammable liquids can be created rather than a separate SOP for both acetone and ethyl acetate.

4.4.2 SOPS FOR RESTRICTED CHEMICALS

SOPs should be prepared for chemicals listed as restricted in the regulations. An individual SOP is not required for every restricted chemical used; SOPs can be written in a comprehensive manner that encompasses the same hazards. For example, if a procedure in the lab requires the use of acetone and ethyl acetate, both of which are restricted flammable liquids, one SOP on flammable liquids can be created rather than a separate SOP for both acetone and ethyl acetate.

SOP templates for restricted chemicals with the same hazards (e.g., toxic, corrosive, flammable, combustible, water reactive) are available at the following link:

- Restricted Chemical SOP Templates (https://www.colorado.gov/pacific/cdphe/schools). Instructions for using the templates are provided at the top of each template.
- The restricted chemical SOP templates are organized by the general chemical class or the type of hazard(s) associated with the individual restricted chemical. The specific hazard(s) associated with restricted chemicals can be found in the “Hazard*” column next to the restricted chemical on the list in the regulations (Appendix B).

SECTION 5: PERSONAL PROTECTIVE EQUIPMENT (PPE) POLICY

The selection of appropriate PPE for each experiment or procedure requires the completion of a hazard assessment and the development of a SOP (see section 4.4.1, Standard Operating Procedures). Some operations may warrant specific PPE, as indicated by the SDS, and this should be included on the SOP for the chemical(s) being used.

5.1 MINIMUM PPE REQUIREMENTS

This section details the minimum PPE requirements for all laboratories, classrooms, and shops using hazardous chemicals. The requirements listed do not cover all operations that may be conducted. Some operations may warrant further PPE, as indicated by the SDS, and the SOP for the chemical(s) being used.

5.1.1 HEAD PROTECTION

If there is a serious risk of falling objects or "bump" hazards , such as may occur in an automotive shop, protective helmets should be worn by students and staff.

Welding helmets that meet the requirements of ANSI Z49.1-2014 Standard – Safety in Welding, Cutting, and Allied Processes must be worn by all students participating in, observing, or in close proximity to welding.

Protective helmets shall be issued clean and properly sanitized and stored in a protected place if shared among users. UV light cabinets can be used to sanitize helmets, as well as alcohol wipes approved sanitizing products.

5.1.2 HEARING PROTECTION

Certain equipment and processes, particularly in vocational art shops can expose staff and students to high levels of noise, which can cause permanent hearing loss. Implementing administrative and engineering controls such as choosing low-noise tools and machinery and restricting student access to a suitable distance away from the noise source is preferable. If these controls are not an option, hearing protection devices, such as earmuffs and earplugs must be provided to all users and individuals exposed to the noise source. If you are concerned about the level of exposure to high levels or noise, contact your local public health agency for guidance on developing a hearing conservation program.

Hearing protection devices must be issued clean and properly sanitized and stored in a protected place if shared among users. UV light cabinets can be used to sanitize earmuffs, as well as alcohol wipes and approved sanitizing products.

5.1.3 RESPIRATORY PROTECTION

When ventilation (e.g., fume hoods, local exhaust ventilation systems) is not adequate to provide protection against an inhalation hazard, respiratory protective equipment may be necessary. Students are not allowed to use respiratory protective equipment unless approved by your local public health department. In very limited situations, toxic dust respirators approved by the National Institute for Occupational Safety and Health (NIOSH) may be used by the teachers only. Completion of a professional fit testing program is required for respirator use. Please contact your local health department for further information.

5.1.4 EYE AND FACE PROTECTION

Eye protection that meets the American National Standards Institute's Practice for Occupational and Face Protection, ANSI Z87.1-1989 must be worn by all students participating in, observing, or in close proximity to any experiment or activity which could result in eye injury.

Eye protection glasses, goggles, face shields, and similar eye protection devices shall be issued clean and properly sanitized and stored in a protected place.

Hearing protection devices shall be issued clean and properly sanitized and stored in a protected place if shared among users. UV light cabinets can be used to sanitize eyewear, as well as alcohol wipes approved sanitizing products.

5.1.5 HAND PROTECTION

Students and staff exposed to potential skin contact with hazardous chemicals, cuts, abrasions, punctures, or harmful temperature extremes must wear appropriate hand protection. Chemical-resistant gloves must be worn while handling any hazardous chemical container; regardless of whether the container is open or closed.

When selecting appropriate gloves, it is important to evaluate the effectiveness of the glove type to the specific hazardous chemical being handled. Some gloves are more suitable for certain chemicals than others. The SDS for the specific chemical being handled and the glove manufacturer’s glove chart should be consulted to select the most appropriate glove. Do not purchase gloves from a manufacturer that does not provide an adequate glove chart.

It is recommended that each laboratory, classroom, or shop purchase a general purpose disposable nitrile glove with a minimum of a 4 mil thickness that is suitable for general chemical handling. When handling chemicals or equipment with harmful temperature extremes such as liquid nitrogen or autoclaves, appropriate protection such as cryogenic gloves or heat resistant gloves must be worn. Thicker and more durable gloves such as butyl rubber should be

considered to provide adequate protection when working with large volumes of chemicals such as during photo making.

5.1.6 BODY PROTECTION

Full length pants or a full length skirt must be worn at all times by individuals that are participating in activities using hazardous chemicals. All unprotected skin surfaces that are at risk of injury should be covered. Lab coats, coveralls, aprons, or protective suits should be worn while working on or adjacent to, all procedures using hazardous chemicals. Protective clothing and smocks worn for welding must comply with ANSI Z49.1-2014 Standard – Safety in Welding, Cutting, and Allied Processes.

SECTION 6: CHEMICAL WASTE MANAGEMENT

The chemical inventory must be monitored routinely for chemical waste. Chemical wastes can include those that are spent, expired, no longer needed, those that are partially or wholly crystallized, solidified or otherwise changed chemically, or whose containers are damaged or leaking, and those chemicals listed as prohibited in the regulations.

Chemicals that are past the manufacturer's shelf life or expiration date may become unstable, and are also considered waste. The chemical manufacturer should provide information regarding the shelf life of the chemical. This information can typically be found on the product label or on the SDS.

All chemicals stored in amounts that cannot be used within their shelf life, or that are no longer needed are considered wastes. In addition, any chemical that can no longer be used for its original purpose is considered a waste. Chemicals with a poor shelf life may degrade quickly and no longer be useful for their original purpose and should be properly disposed of within one year of purchase.

FIGURE 3. Provides general guidelines when determining shelf life of chemicals:

Figure 3. Chemical Shelf Life

Shelf Life Description	Timeframe
Poor	Less than one year
Fair	1 to 3 years
Good	3 to 5 years
Excellent or Indefinite	Greater than 5 years

6.1 WASTE STORAGE REQUIREMENTS

Chemical waste is also generated in volume during routine experiments in the laboratory when spent products and solutions are produced. These wastes must also be managed properly and stored in designated chemical waste containers before being removed from the school.

The following rules must be followed at all times when managing chemical waste in laboratories, classrooms, and shops:

- All waste must be stored in containers.
- Containers must be in good condition and compatible with the waste that they contain (e.g., no corrosive waste in metal containers).
- Containers must be kept closed at all times except when adding or removing waste.
- Containers must be labeled or clearly marked with words that describe the contents of the waste (e.g., liquid chromatography waste) and the words “Chemical Waste” or “Hazardous Waste”.
- Containers must stored at or near the point of generation and under the control of the generator of the waste (wastes should remain the in the same room they were generated in). A central waste collection room should not be established at the school.
- All chemical waste must be stored in a designated area away from normal classroom operations and away from sinks and floor drains.
- The waste storage volume should never exceed 55 gallons.
- Containers should be segregated by chemical compatibility during storage (e.g., acids away from bases). Secondary containment methods can be used as a means of segregation.
- Avoid halogenated and non-halogenated wastes in the same container.
- Do not mix incompatible waste streams in the same container (e.g., acids with bases, oxidizers with organic solvents.
- Collect all highly toxic, reactive, mercury and any exotic wastes separately even if they are chemically compatible with other waste streams. Failing to do so can result in costly disposal fees.
- All spills and leaks should be cleaned up immediately.

6.2 WASTE DISPOSAL PROCEDURES

Every effort should be made to prevent the accumulation of chemical waste in the school. Arrangements for routine pickup and removal of chemical waste should be made with school district staff if available. In general, the following guidelines should be followed to ensure the safe and legal removal and disposal of chemical waste:

- Do not pour chemical waste down the drain. In very limited circumstances, specific types of treated chemical waste may be disposed of down the drain only if expressed approval has been provided by the local sewer authority.

- Depending on the type of chemical, wastes may be treated and disposed of safely in a manner described in the Flinn Science Catalog Reference Manual. Please refer to the manual prior to making waste disposal decisions. The manual may be obtained at the following link provided below:
    - Flinn Science Catalog Reference Manual (http://flinnsci.com).
- Review the chemical waste disposal requirements that are provided on the chemical SDS or as otherwise indicated by the manufacturer.
- Explore disposal options that may available at the local level, such as through a household hazardous waste event.
- Contact professional, licensed hazardous waste haulers/transporter that will ensure proper disposal.
- A hazardous waste determination must be made for all chemical waste in accordance with 6 CCR 1007-3 Section 262 of the Colorado Hazardous Waste Regulations. Hazardous waste chemicals must be properly disposed of at a permitted facility by a professional, licensed hazardous waste hauler/transporter. Hazardous waste chemicals cannot be disposed of on-site.

6.3 UNKNOWN CHEMICAL WASTE

Unknown chemical waste is a serious problem. Mysterious chemicals are often stored in labs and shops for years before personnel notice the unidentified items. However steps can be taken to assist with the proper management of unknowns.

Until the unknown chemical can be properly identified by teaching staff or a licensed hazardous waste hauler, the container should be labeled with the following information: “Unknown hazardous chemical, awaiting proper characterization”.

Every effort should be made by teaching staff to identify unknown chemicals. The following steps can be taken to help in this effort:

- Ask other teaching staff if they are responsible for, or can help identify the unknown chemical.
- The type of experiments of procedures conducted can be useful information for making this determination. Eliminating certain chemicals as a possibility helps narrow the problem as well.
- For trade products, contact the manufacturer or search online to obtain a SDS.

Preventing the generation of unknown chemical waste should be a priority. Here are a few tips that will help:

- Label all chemical containers, including beakers, flasks, vials, and test tubes. The label should be placed in the container, not the cap to avoid accidental mislabeling.
- Immediately replace labels that have fallen off or that are deteriorated.
- Label containers using chemical names. Do not use abbreviations, structure, or formulae.

SECTION 7: CHEMICAL SPILLS

Chemical spills can pose a significant risk to human health and the environment. All teaching staff and students must be trained on how to properly respond to chemical spills in order to minimize risk. In general, chemical spills can be placed into one of two categories: non-emergency chemical spills, or emergency chemical spills.

7.1 NON-EMERGENCY CHEMICAL SPILL PROCEDURES

Non-emergency chemical spills are generally defined as less than 1 liter, do not involve a highly toxic or reactive material, do not present a significant fire or environmental hazard, and are not in a public area such as a hallway. These spills can be cleaned up by properly trained teaching staff using conventional lab PPE (e.g., safety glasses/goggles, lab coat, gloves) and the designated spill kit. In general, when a non-emergency spill occurs the area around the spill should be isolated , everyone in the lab should be made aware of the spill, and the spilled material should be absorbed and collected using either pads or some other absorbent material such as oil dry or kitty litter. Decontamination off the spill area should be conducted using an appropriate solvent (soap and water is often the most effective). Additionally, review the SDS(s) (specifically Section 6, "Accidental Release Measures") to obtain chemical-specific cleanup information.

As a best practice, mercury thermometers and other devices should be replaced with safer alternatives such as alcohol based thermometers. However, in the event that a mercury thermometer breaks in the laboratory the following cleanup procedures should be followed:

- Small Mercury Spills (e.g., a broken thermometer)
    - Evacuate the affected area.
    - Close off interior doors and windows, and heating and air conditioning vents in the incident room or area.
    - Open exterior doors and windows to move the inside air outside.
    - Never use vacuum cleaner collect mercury.
    - Follow specific cleanup instructions detailed by the EPA available here: http://www.epa.gov/mercury/spills/

7.2 EMERGENCY CHEMICAL SPILL PROCEDURES

Emergency chemical spills are generally defined as greater than 1 liter, involve a highly toxic or reactive compound, present an immediate fire or environmental hazard, or require additional PPE (e.g., respirator) and specialized training to properly cleanup.

An evacuation plan should be developed in collaboration with school officials and routine evacuation training should be provided to staff and students. The evacuation plan should be posted on the door to classroom(s) and laboratories.

The following procedures should be followed in the event of an emergency chemical spill:

- Cease all activities and immediately evacuate the affected area (make sure that all personnel and students in the area are aware of the spill and also evacuate).
- If chemical exposure has occurred to the skin or eyes, the affected personnel should be taken to the nearest safety shower and eyewash station.
- Dial 911, if the situation is, or could become an emergency (e.g., chemical exposure has occurred, a fire or explosion had occurred).
- The fire alarm should be pulled, which will initiate building evacuation, if any of the following occurs:
    - A fire and/or explosion has occurred (or there is a threat of fire and/or explosion);
    - The large spill (which is either highly toxic or presents an immediate fire or environmental hazard) is in a public area such as a hallway;
    - Toxic vapors are leaving the area where the spill has occurred, such as seeping from the laboratory into the hallway or neighboring rooms;
    - You are unsure of the hazards and feel that the spill could be harmful to building occupants.
    - Ensure that no one else is allowed to enter the area until the spill has been properly cleaned up.
- Chemical spills involving quantities of mercury of one pound or more (i.e., if it Looks like Two Tablespoons or More) must be treated as a serious situation. Any time one pound or more of mercury is released to the environment, it is mandatory to call the National Response Center (NRC). The NRC hotline operates 24 hours a day, 7 days a week. Call (800) 424-8802. Note that because mercury is heavy, only two tablespoons of mercury weigh about one pound.

7.3 CHEMICAL SPILL KITS

Each laboratory, classroom, and shop should have a spill response kit available for use. Spill kits can either be purchased from a vendor or created at the school, but each spill kit should be equipped to handle small spills of the most common hazards. The location of the spill kit should be made in a central location and high visibility signage should be used to indicate its location. Training should also be provided to staff and students on the location and use of the spill kits. The kit should be equipped with response and cleanup materials such as:

- Absorbent materials such as pads, booms, oil dry or kitty litter, or pillows.
- Neutralizing agents (e.g., Neutrasorb®) for acids and/or bases if high volumes of acids and/or bases are stored in the laboratory. Spills involving acids can also be neutralized with powdered

sodium hydrogen carbonate (sodium bicarbonate/baking soda), or spills involving bases can be neutralized using vinegar (5% acetic acid solution.

- Containers such as drums, buckets, and/or bags to containerize spilled material and contamination debris generated during the cleanup process.
- PPE such as gloved, safety glasses and/or goggles, lab coat or apron, and chemical resistant booties.
- Caution tape or some other means to warn people of the spill.

SECTION 8: TRAINING

Effective training is crucial to a successful chemical safety program. Teaching staff must actively participate in the training process for students as well as for themselves. This section details the minimum training requirement for both teaching staff and students.

8.1 CHP TRAINING

All teaching, administrative, and facility maintenance staff involved with the use of hazardous chemicals on any level should receive documented CHP training before any work with hazardous chemicals occurs. Initial CHP training should include the following:

- Review the CHP its entirety.
- Review the laboratory, classroom, or shop-specific hazard assessments.
- Review lab/procedure specific SOPs and restricted chemical specific SOPs.
- Review any other lab-specific protocol or requirements.

All training related to the CHP should be documented in **Table 3. Documentation of Teaching Staff CHP Review and Training.**

After receiving the initial documented CHP training, all teaching staff should receive annual CHP refresher training as well. The annual refresher training can be a condensed version of the initial CHP training, but should include at least the following elements:

- Review of the laboratory, classroom, or shop-specific hazard assessments.
- Review of the lab/procedure specific SOPs and restricted chemical specific SOPs.
- Review of any other lab-specific protocol or requirements.
- Review of chemical spill and lab emergency procedures.

8.2 STUDENT CHEMICAL SAFETY TRAINING

At the start of each semester, comprehensive safety training should be provided to students. General rules and safe work practices should be covered in detail. This should include rules for using personal protective equipment, rules for addressing accidents and emergencies, and rules for handling chemicals. A review of any special hazards associated with the specific hazardous substances that will be used should also be covered.

8.2.1 STUDENT SAFETY CONTRACT

A written set of these safety rules should be distributed to each student prior to working with any chemicals. This training must be also documented through the use of a *safety acknowledgement* or *safety contract*. A safety contract is an important component of student safety and it evidences that safety instruction was provided. The safety contract should be reviewed and signed by the student and parent/guardian at the beginning of each semester. A copy of the contract and any other related safety training documentation such as safety tests or quizzes should be kept on file for a period of at least 3 years.

To ensure that all critical safety areas are addressed with students, a student safety contract must include the following:

- General safe work practices and conduct (refer to Section 2.4 General Chemical Safety for a detailed description of safe work practices);
- Medical/allergy/special needs of student;
- Disclosure of corrective/contact lens wearer and if color blind;
- Agreement by student that they will abide by rules;
- Parent/guardian contact information;
- Parent/guardian agreement and signature; and
- Consequences of imprudent behavior (e.g. alternative assignments will be assigned if misbehavior continues, student removed from participation).

A template version of a generic student safety contract that can be used for all areas of the school using hazardous chemicals is available in Appendix B.

8.2.2 ROUTINE SAFETY ORIENTATIONS

A safety orientation should be provided prior to any class participation by students working with hazardous substances or hazardous devices. Specific hazards associated with the substances or devices should be discussed as well as a general review of safe work practices. Safety orientations should be incorporated into daily lesson plans and through providing safety tests and quizzes throughout the semester. Documentation of routine safety training should be documented and maintained alongside the student safety contracts on file for a period of at least 3 years.

TAB 1:

STANDARD OPERATING PROCEDURES FOR RESTRICTED CHEMICALS

ENSURE THAT SOPS FOR ALL RESTRICTED CHEMICALS USED IN EACH DIFFERENT CLASSROOM OR LABORATORY SHARING THE CHP ARE CLEARLY INDICATED.

TAB 2:

ADDITIONAL SOPS, SAFETY RULES, EQUIPMENT PROTOCOLS, PROCEDURES, ETC.

ENSURE THAT INFORMATION SPECIFIC TO EACH DIFFERENT CLASSROOM OR LABORATORY SHARING THE CHP ARE INCLUDED AND CLEARLY INDICATED.

TAB 3:

STUDENT SAFETY CONTRACTS

ENSURE THAT CONTRACTS FOR ALL CLASSROOMS OR LABORATORIES SHARING THE CHP ARE INCLUDED.

TAB 4:

MISCELLANEOUS INFORMATION (INSPECTION REPORTS, VARIANCES, PLANS OF ACTION, ETC.)

APPENDIX A:

RECOMMENDED PROCEDURES FOR CONDUCTING A CHEMICAL INVENTORY SAFELY

GOAL: To determine what chemical substances are present in your schools, the quantities and their condition.

PURPOSES:

- To remove from schools excess, unused, deteriorated or outdated chemicals.
- To identify potentially dangerous chemicals that should not be present or used.
- To ensure that all chemicals are managed appropriately.
- To comply with all local, state and federal regulatory requirements.

1. PLAN BEFORE YOU START.

- Never work alone.
- Don't involve students.
- Use appropriate personnel protective equipment.
- Have spill materials available and insure that emergency showers are operational.
- Know whom to call for help if needed.

2. TAKE THE INVENTORY.

You may find a voice recorder useful for this part of the task.

AVOID TOUCHING OR MOVING CONTAINERS. OLD CHEMICALS MAY BE UNSTABLE. SOME CHEMICALS FORM EXPLOSIVE COMPOUNDS AS THEY AGE. IF IN DOUBT, CALL FOR HELP.

- FOR EACH SUBSTANCE RECORD:

- The full name
- The CAS number
- Manufacturer's name
- Size of the container
- Type of container i.e., metal, glass, gas cylinder…
- The color of the container, i.e., clear, tinted, amber, opaque…
- Amount of the substance in liters/ml., grams/kg. Or cubic feet for gases
- Characteristics, i.e., percent solid and/or liquid, presence of crystals on lid or inside bottle, presence of and % of emersion oil covering/not covering metal salts, presence of paraffin coating around lid, contents are flowable/non-flowable, color of contents
- Expiration date or approximate age of the substance.
- Storage situation and location, i.e. Shelf, refrigerator, cabinet (locked or not locked, fire approved or not), chemistry/biology/storage room location and shelf.

3. **Once you have recorded the inventory information on paper, ASSIGN COMPATIBLE FAMILY DESIGNATIONS AND HAZARD DATA TO EACH LISTING.**

4. **DECIDE WHAT STAYS AND WHAT GOES.**

- Determine the hazardous characteristics and storage requirements for each chemical.
- Plan to eliminate all chemicals that are beyond their shelf life.
- Plan to eliminate all chemicals that are unusable or unneeded.
- Plan to eliminate all chemicals identified as shock sensitive, explosive, highly toxic, carcinogenic, mutagenic or teratogenic.

BEFORE DISPOSING OF ANY CHEMICAL BE SURE THAT YOU HAVE MADE A HAZARDOUS WASTE DETERMINATION AND HAVE CONFIRMED THAT YOUR DISPOSAL METHOD IS SAFE AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.

- **CONTACT YOUR LOCAL FIRE DEPARTMENT FOR ASSISTANCE.**
- **DO NOT DRAIN-DISPOSE OF ANY MATERIALS OR WASTES WITHOUT PRIOR APPROVAL FROM THE LOCAL WASTE WATER TREATMENT DEPARTMENT.**
- **DO NOT DISPOSE OF ANY CHEMICALS INTO THE TRASH WITHOUT CONTACTING YOUR SOLID WASTE DISPOSAL COMPANY FOR APPROVAL.**

5. **REORGANIZE THE REMAINING SUBSTANCES INTO CHEMICAL FAMILIES ENSURING VERTICAL AND HORIZONTAL COMPATABILITY AND COMPLIANCE WITH LOCAL FIRE CODE.**

6. **ESTABLISH AND IMPLEMENT A PLAN FOR PURCHASING, MANAGING, STORING AND DISPOSING OF CHEMICALS IN THE FUTURE.**

APPENDIX B:

STUDENT SAFETY CONTRACT TEMPLATE

STUDENT SAFE WORK PRACTICES AND SAFETY CONTRACT

General Rules

1. Conduct yourself in a responsible manner at all times. Do not run, or engage in horseplay, practical jokes, pranks or other dangerous behavior.
2. Stay at your assigned work station and do not wander around the room, distract other students, or interfere with the work of other students.
3. Follow all written and verbal instructions carefully and perform experiments or work precisely as directed by the teacher. Ask questions if you do not understand.
4. Be prepared for the work that will be conducted by reading and understanding the procedures before beginning work.
5. Read all chemical labels and equipment instructions carefully prior to use. Set up and use the prescribed equipment as directed by the teacher.
6. Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
7. Examine glassware before each use. Never use chipped or cracked glassware.
8. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wire, and loose connections. Do not use damaged electrical equipment.
9. Do not touch any equipment, chemicals, or other materials until you are instructed to do so.
10. Know and understand the hazards of the chemical as stated in the Safety Data Sheets (SDS) or other available reference materials. Know the location of where the SDS is kept.
11. Never work alone or without the supervision of a teacher.
12. Always be alert and proceed with caution during a work session. Notify the teacher immediately of any unsafe conditions you observe.
13. Do not enter a chemical storage or preparation room unless given specific permission by the teacher.
14. Keep work areas clean and free of any unnecessary objects at all times. Bring only your laboratory instructions and other absolutely necessary materials to work at your station. Leave other materials stored in the classroom area.
15. Coats, bags, and other personal items must be stored in designated areas, not on the work stations or in the aisles.
16. Keep aisles clear. Push your chair under the desk when not in use. Never block access to exits or emergency equipment.
17. Experiments and work with chemicals must be personally monitored at all times. Never leave experiments while they are in progress.
18. Do not leave Bunsen burners unattended.
19. Turn off all heating equipment, gas valves, and water faucets when not in use.
20. Food or drink, open or closed, should never be brought into the area where toxic or hazardous substances are being used unless expressed permission from your teacher is given. A personal water bottle is allowed only in areas where these substances are not being used.
21. Keep hands away from face, eyes, mouth, and body while using chemicals. Wash your hands with soap and water at the end of each session.
22. Do not handle your cell phone while wearing protective gloves.
23. Do not apply cosmetics while in the area where chemicals are being used.
24. Thoroughly clean your workspace and all equipment at the end of each session. Return all equipment clean and in working order to the proper storage area.
25. Dispose of all chemical waste properly and as instructed by the teacher.
    a. Never mix chemicals in sink drains. Sinks are only to be used only for water and those solutions designated by the teacher.
    b. Solid chemicals, metals, matches, filter paper, gloves, paper towels, weigh boats, and all other insoluble materials are to be disposed of in the designated waste container, not in the sink or regular trash.
    c. Place chemical waste in appropriately labeled waste containers. Check the label of all waste containers twice before adding chemical waste to the container.
26. Clean up spills properly and promptly as instructed by the teacher.

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Accidents and Emergencies

1. Know the locations and operating procedures of all emergency and safety equipment, including:
    a. Fire extinguishers
    b. Fire blankets
    c. Emergency shut-off switches (gas and electric)
    d. Eye washes
    e. Safety showers
    f. First aid kits
    g. Spill kits
    h. Fire alarms
    i. Exits
2. Know what to do if there is a fire drill during a period of time while working with chemicals; containers must be closed, gas valves turned off, fume hoods turned off, and any electrical equipment turned off.
3. In case of an emergency or accident, follow the established emergency plan as explained by the teacher and evacuate the building via the nearest exit.

4. Report any accident (spill, breakage, etc.) or injury (cut burn, etc.) to the teacher immediately.
5. If a chemical splashes in your eye(s) or on your skin notify you instructor immediately and flush with running water from the eyewash station of safety shower for at least 20 minutes.
6. If a mercury thermometer breaks, mercury must not be touched. Notify the instructor immediately.
7. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken glass in the designated glass disposal container.

Personal Protective Equipment and Clothing

1. Always wear appropriate eye protection (safety glasses, chemical splash goggles, etc) at all times.
2. Inspect all personal protective equipment for defects before use.
3. Contact lenses should not be worn in areas where chemicals are being used unless you have expressed permission from your teacher. Please let your teacher know if you wear contact lenses.
4. Long hair must be tied back. Remove or secure jewelry. Loose or baggy clothing must be secured (especially loose long sleeves, neck ties, or scarves).
5. Shoes must completely cover the foot. Low-heeled shoes with non-slip soles are preferable.
6. Always wear assigned long-sleeved, full length laboratory aprons, chemical resistant smocks, or other protective clothing as required by your teacher. Long pants that completely cover the legs are preferable.
7. Wear appropriate chemical resistant gloves as instructed by the teacher while handling chemical. Gloves are not universally protective against all chemicals.
8. Remove any personal protective equipment (i.e. gloves, lab coat or apron, goggles) before leaving the area**.**

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Chemical Handling

1. All chemicals are to be considered dangerous. Do not touch, taste, or smell any chemicals unless specifically instructed to do so by your teacher.
2. Never place the chemical container directly under your nose and inhale the vapors.
3. Check the label on chemical bottles twice to verify that it is the correct substance before using it.
4. Take only as much chemical as you need. Weigh out or remove on the amount of chemical you need. Never return unused chemicals to their original containers. Dispose of excess in the appropriate waste container designated by your teacher.
5. Never use mouth suction to fill a pipet. Use a use a rubber bulb or pipet pump.
6. Hold chemicals away from the body when transferring a chemical from one container to another.
7. Always use a spatula or approved scoop to remove a solid reagent from a chemical container.
8. Never use a metal spatula when working with peroxides. Metals will decompose explosively with peroxides.
9. Acids must be handled with extreme care. Always add concentrated acid to water slowly. Never add water to a concentrated acid.
10. Handle flammable liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.
11. Take great care when transporting acids and other chemicals from one part of the laboratory to another. Hold them securely and walk carefully.
12. When transporting chemicals (especially 250 mL or more), place the immediate container in a secondary container or bucket (rubber, metal or plastic) designed to be carried and large enough to hold the entire contents of the chemical.
13. Never handle bottles or containers that are too heavy for you.
14. Use a hot water bath to heat flammable liquids. Never heat directly with a flame.
15. Do not immerse hot glassware in cold water; it may shatter.
16. Never look into a container that is being heated.
17. Do not place hot apparatus directly on the work bench or table. Always use an insulating pad. Allow plenty of time for the equipment to cool before touching it.
18. Never store chemicals over, under, or near a sink.
19. Always work in a well ventilated area. Use the laboratory chemical fume hood, or other local exhaust ventilation as required by your teacher if you are working with chemicals that can release vapor, gases, or dust.
20. When working under a fume hood ensure the following precautions are taken:
    a. Ensure the sash is opened to the height indicated
    b. Keep your head and body outside of the hood face.
    c. Chemicals and equipment should be placed at least six inches within the hood to ensure proper air flow.
    d. Never use a fume hood for long term storage of chemicals.

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Additional Safety Rules

(Please use the space below for additional safety rules or special rules for specific materials that will be used):

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APPENDIX C:

REFERENCES AND ADDITIONAL RESOURCES

The content of this document was developed through the adaption of several primary resources. These resources as well as other documents important to the development of a comprehensive chemical safety program are provided below:

1. Purdue University, Radiological and Environmental Management, Chemical Hygiene Plan and Chemical SOPs.
   https://www.purdue.edu/ehps/rem/ih/chp.htm
2. National Institute for Occupational Safety and Health, School Chemistry Laboratory Safety Guide, 2007.
   http://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf
3. U.S. Consumer Product Safety Commission, Art and Craft Safety Guide.
   http://www.cpsc.gov//PageFiles/112284/5015.pdf
4. Flinn Scientific, Student Safety Contract.
   http://www.flinnsci.com/documents/miscpdfs/safety_contract.pdf
5. Colorado Department of Public Health and Environment, Division of Environmental Health and Sustainability, Schools.
   https://www.colorado.gov/pacific/cdphe/schools