Daniel Hand High School Science Department Chemical Hygiene Plan

September 1, 2021 to June 30, 2022

Note Changes in red

Daniel Hand High School Science Department Chemical Hygiene Plan

In accordance with the Federal Laboratory Standard and the Connecticut State Department of Education guidelines and the Ct-OSHA Laboratory Standard, the Madison Board of Education and Superintendent recognize their responsibility for the protection of their employees. The attached chemical hygiene plan is therefore instituted to assist the overall safety program for the high school's Science Department staff. Representing the Madison Board of Education, the Superintendent hereby appoints Paul T. Mezick to be its high school Science Department's Chemical Hygiene Officer for the 2021-2022 school year.

Although we have designated a Chemical Hygiene Officer, we realize that the success of the Chemical Hygiene Plan rests with all employees. The ultimate responsibility for the Chemical Hygiene Plan rests with the School District, Superintendent and the Madison Board of Education.

Paul T. Mezick Date 9/3/2021

Table of Contents

Additional Information for Teachers

Connecticut Science Supervisors Association

Introduction

This Chemical Hygiene Plan applies to all science classrooms, laboratories and chemical store rooms/prep rooms in Daniel Hand High School; specifically, Rooms 204, 205 (Storage), 207, 219, 226, 242, 244 (Storage), 249, 304, 305 (Storage), 307, 318 (Storage), 319, 326, 342, 344 (Storage), 349 and the Greenhouse. This Chemical Hygiene Plan has been developed in conformance with OSHA regulations at 29 CFR 1910.1200, known as the "Hazard Communication Standard" and 29 CFR 1910.1450, known as the "Laboratory Standard".

The Laboratory Standard outlines the basic components of a Chemical Hygiene Plan, as follows:

- Standard Operating Procedures, i.e. general laboratory rules and procedures relevant to health and safety considerations
- Criteria the School System will use to determine and implement control measures to reduce exposure to chemical hazards, e.g. Engineering Controls (hoods, eyewashes, etc.), administrative procedures (SOPs), and use of Personal Protective Equipment (PPE)
- A requirement that hoods and other protective equipment are functioning properly
- Provision for employee information and training
- The circumstances under which a particular laboratory procedure will require prior approval from the School System or its designee
- Provisions for medical consultation and examination in the event of a chemical exposure
- Designation of Chemical Hygiene Officer and others personnel that are responsible for enforcement of this Chemical Hygiene Plan
- Provisions for additional employee protection for work with particularly hazardous chemicals

This Chemical Hygiene Plan is to be reviewed and updated annually.

A. General Employee Rules and Procedures

Conditions for employment in science classrooms require that teachers and other employees abide by the following principles and guidelines, especially when working with chemicals for instructional purposes.

1. Take proven measures to minimize all chemical exposures.
2. Avoid skin contact or inhalation of chemicals
3. Wear safety goggles and other necessary Personal Protective Equipment at all times when working with chemicals.
4. Know and understand the hazards for any chemical used. Know and understand the procedure for proper use, handling, storage and disposal of any chemicals used.
5. Ensure that classroom occupants have unrestricted access to basic safety equipment including a fire blanket, safety goggles, fire extinguisher, eyewash, and shower station.
6. Properly label all chemicals dispensed including those temporarily stored in a classroom. Include special hazard(s) where appropriate.

7. Do not store chemicals in a classroom for extended periods. If chemicals are to be stored for several days in order to perform a scheduled experiment, then all potentially hazardous chemicals must be stored in a cabinet.
8. Only authorized personnel are allowed in chemical storerooms.
9. In the case of teachers or students performing demonstrations, a teacher should perform and document a hazard risk assessment, provide a safety briefing to students, and place a safety barrier (as required) between the audience and the demonstration.
10. Know where and how to use master utility controls to shut off gas, electrical and water supplies. Gas jets must be turned off when not in use.
11. Do not dispense chemicals directly from a stock bottle nor return dispensed chemicals to a stock bottle.
12. Inform students and support staff of the locations of classroom safety devices (e.g., eyewash, fire extinguisher, etc.). Provide instruction on how to properly use classroom safety devices during a laboratory emergency.
13. Require all students to return signed DHHS Laboratory Safety Agreement for each science course, and to pass a science safety assessment.
14. No experiment should be conducted in a laboratory in which the exhaust system is not properly functioning. If, while running an experiment, the exhaust system fails for any reason, the experiment must be halted and all exposed chemicals properly sealed.
15. Certain chemicals must only be used in the fume hoods. If the fume hood is not working properly, the chemical cannot be used until the hood is repaired.
16. No more than the legal occupancy limit of students is allowed in the lab.
17. All laboratory users, including, but not limited to instructors and students, shall be trained prior to laboratory use and at least annually on the Emergency Evacuation Plan (page 13 Chemical Hygiene Plan).
18. The Madison School System reserves the right to prohibit the purchase or use of certain particularly hazardous chemicals that would endanger staff and students.
19. The Madison School System will not allow any staff member to facilitate laboratory instruction who is not properly trained in the Chemical Hygiene Plan, the safe handling of chemicals or other science-related hazards.

B. General Laboratory Rules and Procedures for Students

1. To insure that all chemistry laboratory experiences are safe, positive experiences, the student will be required to abide by all of the following guidelines:
2. All students will be issued a Laboratory Safety Acknowledgement. They will return a copy of this acknowledgement, signed by both the student and the parent or guardian. This acknowledgement is required for participation in laboratory activities. It will be kept on file by the instructor.
3. Always conduct yourself in a responsible manner at all times. No horseplay or other fooling around should ever occur in the laboratory.
4. Work only in your assigned lab station. Please do not wander around the room and distract other students or interfere with their work.

5. Be properly prepared to conduct all experiments. Read written procedures in advance. Many experiments will have special safety instructions and techniques. Pay attention to laboratory safety instructions and be sure you understand what you are doing before you proceed.
6. Wear the appropriate Personal Protective Equipment as designated by your instructor. Wear safety goggles, gloves, aprons, and face shields where required. Failure to use proper protective equipment may result in your being expelled from the classroom.
7. Perform all experiments as directed. Do not do anything that is not part of an approved experimental procedure. Follow all instructions, both written and verbal, that are provided by your instructor. Obtain approval before making any changes. Do not perform any unauthorized experiments.
8. Never work alone in the laboratory without instructor supervision.
9. Wear appropriate clothing in the laboratory. Shoes should cover the entire foot, clothing should not be loose and floppy, especially the sleeves.
10. Tie back long hair to keep it away from flames and chemicals.
11. Keep the aisles clear at all times. Put large book bags completely under the tables or leave them in your locker. Push stools and chairs under the tables when they are not in use.
12. Know the locations of the fume hoods, eyewash, fire blanket, and fire extinguishers.
13. Absolutely no food or beverages for human consumption are allowed in the laboratory area. Do not eat in the laboratory area.
14. Never take chemicals, supplies or equipment out of the laboratory without the knowledge and consent of the instructor.
15. Do not enter the laboratory chemical stockroom without specific permission from your instructor.
16. Handle all chemicals with care. Never taste a chemical. Check odors when instructed to do so by gently wafting some of the vapor toward your nose by hand.
17. Read chemical labels and hazard warnings very carefully. Make sure that you have the correct substance in the correct concentration. Check the label twice before removing any of the contents. Review the instructor's safety instructions for handling hazardous materials.
18. Report all accidents, spills, or injuries to your instructor immediately.
19. Always protect the balance pans when weighing chemicals. If you spill material, clean it up immediately. Never return chemicals to the original stock bottles.
20. Use the fume hood or make appropriate provisions for trapping hazardous gases that might be evolved during an experiment.
21. Clean up spills immediately. Clean all lab equipment when you are finished with the laboratory experiment. Return your equipment to the place designated by your instructor when you are finished.
22. Dispose of waste chemicals properly according to your instructor's instructions. Do not put hazardous chemicals or other solids in the sinks.

23. If you break any glassware, inform your instructor and list the item broken on the breakage inventory sheet (See Appendix G for a sample sheet).
24. Turn off your Bunsen burner when it is not in use.
25. Treat burns immediately by putting the burned area under cold water.
26. Do not leave glass thermometers unattended. Store them between the water tap and gas jets when you are not actually using them.
27. I agree to provide my instructor with a list or allergies or other medical problems that could endanger my safety in the laboratory.

C. Personal Hygiene Guidelines for Instructors and Students

1. Do not eat or drink, or apply cosmetics in the laboratory.
2. Wash your hands thoroughly after working in the laboratory.
3. Never smell chemicals directly.
4. Never bring foods, open or closed into the laboratory.

D. Protective Clothing Requirements for Instructors and Students

1. Eye protection must be worn at all times when working with chemicals in the laboratory.
2. Additional safety clothing such as aprons and gloves may be required when the experiment warrants it. These MUST BE WORN if your instructor requires it.
3. Wear closed-toe and low-heeled shoes.
4. Do not wear clothing with loose or balloon sleeves that will get in the way of chemicals, flames or other objects.
5. Avoid ties and hanging jewelry.
6. Keep book bags and personal items out of the aisles and emergency exits.

E. Instructor's 'Housekeeping' Rules

1. Do not keep chemicals that are not involved in a current experiment stored in your lab. Chemicals that are in involved in a current experiment should be either stored in a working hood or placed in a locked cabinet.
2. Properly dispose of waste chemicals.
3. Waste disposal containers should be properly marked.
4. All chemicals including solutions should be properly labeled with hazards.
5. All spills should be cleaned up promptly and properly.
6. Work areas and floors should be cleaned regularly.
7. Access to all safety equipment must be kept clear at all times.
8. If a circuit breaker panel box is located in a room, it must be (a) kept locked, and (b) the outlined area marked on the floor must be kept clear at all times.
9. The main gas supply for the student lab stations must be turned off via the emergency shut off switch when not in use.

F. Accidents and Spills

In the event of an emergency, all students will be evacuated from the laboratory using the nearest exit. Students will exit using the posted classroom evacuation route. All chemical spills will be cleaned up immediately using approved spill cleanup procedures.

- A Type ABC fire extinguisher will be kept available in each chemistry lab.
- A supply of sodium carbonate will be available to neutralize acid spills.
- A supply of spill cleanup absorbent will be available to contain spills.

G. General Chemical Storage Rules for the Chemical Hygiene Officer

1. An updated inventory will be kept detailing all chemicals in stock and their location. Stored chemicals will be inspected periodically.
2. All stored chemical solutions will be labeled with the chemical identity, concentration and hazard information
3. All new chemicals will be dated on arrival.
4. Chemicals will be stored in a separate secure area.
5. All incoming chemicals will be opened and transported by qualified science teachers.
6. All chemicals will be stored in compatible chemical groupings using an approved storage scheme (such as Flynn Scientific's system).
7. All flammable chemicals will be stored in approved flammable storage cabinets, away from ignition sources and oxidizers, out of direct sunlight and at the recommended temperature.
8. Chemicals will not be stored under fume hoods.
9. The chemical storage area will be labeled to properly identify the hazardous chemicals that are stored within.
10. Storage areas should be well ventilated with continuous ventilation to the outside air (no recirculation of storage room air is allowed).
11. Food shall not be stored in a laboratory refrigerator.
12. Chemicals shall not be exposed to heat or direct sunlight.
13. Compressed gases shall be handled as high energy sources and therefore potential explosives.
14. Compressed gas cylinders will be chained or otherwise securely fastened to the wall so they do not fall over.
15. Small gas cylinders of flammable gasses must be stored in their OWN Flammables cabinet
16. Corrosives will be stored in separate corrosive cabinets. Nitric Acid and Acetic Acid will be stored separately from other acids.
17. Water-active solids such as sodium and potassium will be stored under dry oil. The presence of water-active solids/metals requires the presence of a Type D Fire Extinguisher in the storeroom and a Type D Powder Fire Extinguisher in each classroom in which these chemicals are in use.

H. Specific Safety Rules for Hazardous Chemicals and Biologicals

1. All chemicals that emit potentially hazardous vapors should be used in the fume hood.
2. The fume hood will be used whenever a chemical is used that has a Permissible Exposure Limit less than 50 ppm.
3. Mutagens and teratogens will not be purchased or used in the laboratory.
4. Special care and handling will be exercised when using any chemical that is corrosive or toxic.
5. Use extreme caution when working with finely-divided powders and dust-like materials. Be aware that finely-divided materials may form explosive mixtures in air.
6. Glycerin and other potential hazardous materials shall be kept under the control of the instructor.
7. No alcohol lamps will be purchased or used.
8. No Peroxide-forming or Pyrophoric chemicals will be purchased or used (see Appendix G for a list of chemicals which are banned from purchase or use in DHHS).
9. No culturing of unknown bacteria or viruses will be allowed.
10. No work will be performed on human blood, human cells or other human substances without proper training and use of Personal Protective Equipment.

I. Safety Equipment

1. The school shall maintain adequate safety equipment in each laboratory in compliance with the Laboratory Standard. This equipment shall include, but not be limited to the following items:
    a. Indirectly-vented safety goggles for each student potentially subjected to liquid splash; impact-resistant safety glasses for each student potentially subjected to physical impacts only
    b. Aprons for each student
    c. Nitrile gloves for each student working in all chemical laboratories; vinyl gloves are acceptable in biological and physics laboratories
    d. Eyewash
    e. Safety Shower
    f. Fire extinguisher
    g. Fire blanket
2. All safety equipment will be maintained, inspected, and kept in working order.
3. **Dosimeters will be used monthly to ensure that goggle cabinet bulbs emit 100 mj/cm^2 during a 15 minute disinfection cycle.**
4. Fume hoods will be inspected weekly and tested annually by an outside service company that shall certify that each hood meets standards, i.e. a level of 70-100 linear feet per minute.
5. The laboratory ventilation system shall be periodically tested to insure that the accepted ventilation standard of 4-12 air exchanges per hour is maintained.

6. An online version of Safety Data Sheets shall be maintained, updated and made available to all instructors and the School Nurse.
7. There will be one double outlet for every four students with appropriate circuits.

J. Employee Safety Training

The Madison Public Schools will provide initial safety training upon hire/assignment to all instructors to any science laboratory/classroom and ongoing safety training sessions for all Science instructors. This training shall include:

1. Content and location of the Chemical Hygiene Plan.
2. Potential hazards in using laboratory chemicals.
3. Proper handling, labeling, storage, and disposal of chemicals.
4. Signs and symptoms of overexposure to chemicals.
5. Location and use of Safety Data Sheets.
6. Procedures to teach students to respect and comply with accepted safety procedures.
7. The School Nurse will provide First Aid training specific to potential laboratory hazards.

K. Exposure Evaluation of Instructors

It is the policy of Daniel High School to promptly investigate any suspected overexposure to chemicals. In the event of an overexposure, we will document all chemicals and circumstances involved in the overexposure. This information shall be used to review safety procedures and further improve laboratory safety.

Signs of overexposure could include, but are not limited to, the following:

- Accidental breakage of a hazardous materials container
- A skin rash or irritation occurring after contact with a chemical
- Caustic splash to the eyes or face
- Symptoms of dizziness or nausea

If the monitoring of the air is deemed to be necessary, the results of such tests shall be made available to employees within 2 weeks.

L. Medical Evaluations

Medical consultation shall be available to the employee when:

- There has been a significant spill or uncontrolled release of chemical fumes.
- Monitoring indicates that an overexposure to a chemical has occurred
- There is a sign or symptoms of chemical overexposure

1. The attending physician shall be provided with the name of the chemicals used and the conditions under which the overexposure occurred.

2. Medical examinations dealing with chemical exposure shall be documented and other employees working under the same conditions shall be notified. All documentation shall be kept on file.
3. All medical examinations and consultations shall be performed under the direct supervision of a licensed physician, and shall be provided to the employee without cost.

M. Monitoring

Monitoring will be necessary for substances regulated by a standard only if there is reason to believe that the exposure levels for the substance routinely exceed the Permissible Exposure Limit (PEL) for that substance. If monitoring shows no evidence of exposure, that monitoring may be discontinued.

If the initial monitoring shows evidence for exposure exceeding the PEL, steps must be taken immediately to reduce the exposure below the Permissible Exposure Limit. Monitoring then shall continue periodically to verify that those steps have been effective. Monitoring may be discontinued after it can be demonstrated that no further hazard exists. The results of all monitoring shall be fully accessible and available to all employees.

N. Emergency Evacuation Plan

1. In most cases, the teacher in charge of the classroom or affected area shall make the decision to evacuate.
2. In the event that evacuation of the entire building should be deemed necessary, the school office shall be immediately notified. An alarm shall be sounded and the building evacuated according to standard fire drill practices.
3. If only a classroom is to be evacuated, students shall exit by the nearest available exit. They shall then proceed out of the building in accordance with the standard fire drill practices.
4. In all cases, the teacher shall notify to school office to alert the building as to a possible hazard. The chemical hygiene officer shall also be notified to make a determination of the level of hazard.

O. Electrical Safety

1. Check electrical equipment and inspect for frayed cords and damaged connections; do not use and report damage to your supervisor immediately. Electrical tape is prohibited.
2. Multiple outlet strips must be plugged directly into a wall outlet. Power strips should have a circuit breaker. Extension cords are not to be permanently used with power strips.
3. Extension cords are not to be used in place of permanent wiring (use allowed if only on a temporary, immediate, basis)
4. Ensure extension cords are 14-gauge (heavy duty) at a minimum, and temporarily servicing only one appliance or fixture

5. Ensure extension cord is plugged directly into receptacle. Extension cords should never be used plugged end-to-end; use the proper length cord.
6. If extension cords are used, ensure cords are not running through walls, ceilings, under carpets or doors, and do not present a tripping hazard.
7. Cord guards should be provided across an aisle or other passageway to prevent tripping.
8. All electrical equipment must be properly grounded (three-prong plugs) or double-insulated. 3-prong plugs may only be used for 3-prong receptacles, and never altered to fit into an outlet.
9. Ground Fault Circuit Interrupters should be in place where electrical outlets are in use within 6 feet of water. Ensure GFCI's are working properly by using the "test" button.
10. All electrical boxes, panels and receptacles should be covered to protect against electrocution.
11. Control switches, circuit breakers and electrical panels must be free of obstruction. These items must be accessible at all times.

P. Disposal of Sharps

Sharps are defined as any object having acute corners, edges or protuberances capable of cutting or piercing, e.g. syringe needles, razor blades, glass, etc. These items cannot be disposed of in the normal lab trash or dumpsters. Every year custodians are injured by sharps in laboratory trash cans. Therefore, please follow these guidelines:

1. Lab glassware **NOT** contaminated by hazardous materials (e.g. pyrex, borosilicate) Custodial staff will **not** remove glass trash from lab. Place broken or unbroken glass into a labeled *"Broken Glass"* trash box that is located in every science laboratory.

2. Needles and razor blades **NOT** contaminated by hazardous materials. These are particularly dangerous and require *extra precautions* beyond those of glassware:
   - Each Biology lab is supplied with a sharps container. Needles and razor blades (scalpels) should be disposed of in these designated containers.
   - When full, notify the Chemical Hygiene Officer so that he can remove the filled container and supply you with a new container.

Q. First Aid

Safety incidents requiring first-aid or first responder assistance for science teachers working in school laboratories include:

Heat/Chemical Burns: Chances are good that someone will get burned in the laboratory from Bunsen burners, matches, ring stands, hotplates, etc. Should that happen, immediately soak the burned area in cold water. Request immediate assistance from the school's health care provider.

Electrical Burns: Severity of the burn depends on the type, amount and length of contact. The electrical incident may also cause the heart to stop or beat erratically. Respiratory arrest may also occur. Signs of electrical injury include – unconsciousness, dazed, confused behavior, breathing difficulty, obvious burns on the surface of the skin, weak, irregular or absent pulse, burns both where the current entered and where it exited. You can also suspect a possible electrical injury if a sudden low noise such as a pop or bang is heard. An unexpected flash of light may also indicate an electrical incident. If the teacher is trained or certified in CPR, initiate emergency care. Otherwise, request immediate assistance from the school's health care provider.

Bleeding: Bleeding can occur as a result of cuts from glass, metal, scalpels and other sharp objects. In situations where arterial bleeding occurs, prompt action is required. Direct pressure over the wound with use of a barrier such as a rubber glove. If a glove is not handy, use a shoe with the hand inside of it. The barrier is needed as a standard precaution. Request immediate assistance from the school's health care provider.

Chemical Exposure: With an increased emphasis on hands-on, process and inquiry-based science, chemical exposure has a heightened probability of happening. Be certain to have the SDS and/or SDS available for each hazardous chemical used and review it prior to any laboratory work being done. Should there be an exposure, have the injured person immediately (within 10 seconds) use the eyewash or acid shower, as appropriate. Flush with copious amounts of tepid water for a minimum of 15 minutes. Request immediate assistance from the school's health care provider.

Swallowed Poisons: Accidental swallowing of poisonous chemicals in the laboratory can happen. It is critical to review SDS and/or SDS with students prior to use of these chemicals so all are familiar with their potential harm to the body. If the person becomes unconscious or is convulsing, do not induce vomiting. The same is true should the person complain of a "burning feeling" in their throat. Provide plenty of water or milk if available. Request immediate assistance from the school's health care provider. It is also wise to contact the **Poison Control Center 800-222-1222** if you know what poison has been accidentally taken.

Penetrating Objects: Use of projectiles, walking in a laboratory with sharp hazards, etc., can be hazardous and cause body penetration. **Do not remove the object.** Try to keep the individual calm and still. Request immediate assistance from the school's health care provider.

Lacerations: Broken glassware or other sharp objects can cause cuts in the skin. If bleeding occurs, try to have the injured person put on latex or NIOSH approved plastic gloves and apply direct pressure to control bleeding. If that is not possible, use caution to keep a barrier (glove) between you and the injured person while trying to apply direct pressure. Request immediate assistance from the school's health care provider.

Shock: Symptoms of shock include faint pulse, clammy skin, nausea and/or vomiting and increased breathing. The victim should be lying down with feet elevated. Cover with a blanket to keep warm. Request immediate assistance from the school's health care provider.

Automatic External Defibrillator

AEDS or Automatic External Defibrillators are small, lightweight devices that look at a person's heart rhythm (through special pads placed on the torso) and can recognize ventricular fibrillation (VF), also known as "sudden cardiac arrest" or SCA. If SCA is present, an AED will advise, and will talk the responder through some very simple steps to defibrillate. AEDs are designed to be used by lay rescuers and "first responders". The AED is part of CPR. For maximum survivor benefits, both tools must be used together!

Only certified AED and CPR trained employees are allowed to administer these tools in a cardiac emergency.

APPENDIX A: FORMS
Laboratory Instructor's General Checklist

1. Each student experiment and teacher demonstration is reviewed by the Department for possible dangers prior to being performed. Substitute experiments and/or demonstrations are developed as needed. _____

2. The teacher promotes a positive student attitude toward safety. _____

3. The teacher models appropriate, safe behaviors. _____

4. Good housekeeping rules are maintained by the staff and students. _____

5. Long hair, loose student clothing, and dangling jewelry are restricted to prevent injury. For the same reason, appropriate footwear is required. _____

6. Frequent, regular safety inspections of instructional areas are performed. _____

7. All work surfaces are thoroughly cleaned following each use. _____

8. Students and staff are not permitted to bring food and beverages into the lab. _____

9. Mouth pipetting of liquids is never allowed. _____

10. The teacher provides safety instruction and has students sign the Student Safety Acknowledgement at the start of every new course. Instructions are reinforced throughout the year. _____

11. Copies of the Accident/Incident Report Form are available and used following all accidents. In addition, all accidents are reported as required by the District. _____

DHHS TEACHER ACCIDENT/INCIDENT REPORT

(Office use only)

Report # _____

Name of staff member completing this report: _____

Complete all information relating to the accident/incident:

Date: _____ Time: _____

Classroom: _____ Location: _____

Staff/student(s) who witnessed or were involved in the accident/incident:

_____

_____

Have all staff/students filed Witness Accident/Incident Reports? _____ (Please attach)

Teacher description of the accident/incident: (Attach additional sheets if necessary)

_____

_____

Immediate action taken to deal with the emergency:

_____

_____

Corrective action(s) taken to avoid a repeat of accident/incident in the future:

_____

_____

Comments

_____

_____

DHHS STAFF/STUDENT WITNESS ACCIDENT/INCIDENT REPORT

(Office use only)

Report # _____

Name of person completing this report: _____

Staff ____ or Student ____

Date: _____ Time: _____

Classroom: _____ Location: _____

Description of the accident/incident:

_____

_____

_____

_____

_____

_____

_____

_____

Date report completed: _____ _____

(Signature of person completing report)

DHHS REQUEST FOR CORRECTION OF SAFETY CONCERN

(Teacher's Copy)

Date: _____

Room: _____

The following is a safety concern in my classroom:

_____

_____

Name: _____

Signature: _____

DHHS REQUEST FOR CORRECTION OF SAFETY CONCERN

(Administrator's Copy)

Date: _____

Room: _____

The following is a safety concern in my classroom:

_____

_____

Name: _____

Signature: _____

DHHS C.H.O. NOTICE OF NONCOMPLIANCE WITH CHEMICAL HYGIENE PLAN

Date: _____ Location: _____ Person responsible for location: _____

Area of noncompliance:

Hazard Communication ___ or Chemical Hygiene ___ or Other _____

Noncompliance observed:

_____

_____

Required action and timeline:

_____

_____

Previous notification dates and actions:

_____

_____

Comments:

_____

_____

_____

_____
(Signature of person responsible for location)

Report submitted to: (Select one)

____ Department Coordinator

____ Building Administrator

____ Superintendent

DHHS C.H.O. MONTHLY SCHEDULE FOR SAFETY COMPLIANCE

School Year _____

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Additions to Inventory									
Biological waste collection									
Chemical waste collection									
Eyewash Fountains Flushed									
Safety Showers Flushed									
Fire Extinguishers									
Goggles hygiene									
Hood velocity check									
SDS Updates									
Staff Training									

DHHS WEEKLY SCHEDULE FOR SAFETY COMPLIANCE

Eyewash Flush, Hood & Safety Equipment Inspection Record

Room	Eyewash Flushed	Hood Inspected	GFCI	Fire Blanket	Fire Extinguisher	Gas Jets	SDS Folder	Goggle Sanitizing
204 Physics	Hand Held	NA						
205 Storage	NA	NA	NA	NA	NA	NA	NA	NA
207 Physics	Hand Held	NA						
219								
226								
242								
244 SR 2	NA	NA	NA	NA	NA	NA	NA	NA
249								
304								
305 Storage	NA	NA	NA	NA		NA	NA	NA
307								
318 SR 3	NA		NA	NA	NA	NA	NA	NA
319								
326								
342								
344 Storage	NA	NA	NA	NA	NA	NA	NA	NA
349								
Greenhouse (Spring)	NA	NA		NA		NA		
Wood Shop 418		NA		NA		NA		
Metal Shop		NA		NA		NA		
Photo 509		NA		NA	NA	NA		
Dark Room		NA		NA	NA	NA		NA
Art Studio		NA		NA	NA	NA		NA
Cafeteria		NA		NA		NA		NA

Signature of Inspector _____ Date _____

Notes _____

_____

DHHS Goggle Sanitation Record

Room # _____

Goggles must be *properly sanitized after every use*.

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Date: _____ **Initials:_____**

Note: Please leave completed copies affixed to goggle cabinet. The chemical hygiene officer will collect and retain completed goggle sanitation records.

DHHS LABORATORY SAFETY VIOLATION

Student's Name _____

Period _____ Date _____

Violation:

☐Failure to wear proper eye protection during laboratory procedures

☐Unapproved and/or dangerous behavior

☐Failure to follow laboratory instructions

☐Failure to follow established safety instructions

☐Other _____
_____
_____
_____

Consequence: _____
_____

_____ _____

Teacher's Signature Date

APPENDIX B
Daniel Hand High School
Laboratory Safety Acknowledgement

Purpose

Science is a hands-on laboratory class. You will be doing many laboratory activities, some of which require the use of hazardous chemicals. Safety in the science classroom is the #1 priority for students, teachers and parents. To ensure a safe science classroom, a list of rules has been developed and provided to you in this student safety acknowledgement. These rules must be followed at ALL times.

Take this acknowledgement home, review it with your parents or guardian, fill out and sign the last page and return that to your teacher. You will keep the Laboratory Safety Acknowledgement in your science notebook as a constant reminder of the safety rules.

General Guidelines

1. Conduct yourself in a responsible manner at all times in the laboratory.
2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of the procedure, ask the teacher before proceeding.
3. Never work alone in the laboratory. No student may work in the laboratory without an instructor present.
4. When first entering a science classroom, do not touch any equipment, chemicals or other materials in the laboratory area until you are instructed to do so.
5. Do not eat, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
6. Perform only those experiments authorized by the instructor. Never do anything in the laboratory that is not called for in the laboratory procedures or by your instructor. Carefully follow all instructions, both written and oral. Unauthorized experiments are prohibited.
7. Be prepared for your work in the laboratory. Read ALL procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.
8. Observe good housekeeping practice. Work areas should be kept clean and tidy at all times. Bring only your laboratory instructions, worksheets, and/or reports to the work area. Other materials (books, purses, backpacks, etc.) should be stored in the area designated by the instructor.
9. Keep the aisles clear. Push the chairs aside and form aisle for possible escape.
10. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash, safety shower, fire extinguisher and fire blanket. Know where the fire alarm and the exits are located.
11. Always work in a well-ventilated area. Use the fume hood when working with volatile substances or poisonous vapors. Never place your head into the fume hood.
12. Be alert and proceed with caution at all times in the laboratory. Notify the instructor

immediately of any unsafe conditions that you observe.

13. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water and those solutions designated by the instructor. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper waste containers, not in the sink. Check the label of all waste containers twice before adding your chemical waste to the container.
14. Labels and equipment instructions must be read carefully before use. Set up and use the prescribed apparatus as directed in the laboratory instructions or by your instructor.
15. Keep hands away from face, eyes, mouth, and body while using chemicals or preserved specimens. Wash your hands with soap and water after performing all experiments. Clean (with detergent), rinse, and wipe dry all work surfaces (including the sink) and apparatus at the end of the experiment. Return all equipment clean and in working order to the proper storage area.
16. Experiments must be personally monitored at all times. You will be assigned a laboratory station at which to work. Do not wander around the room, distract other students, or interfere with the laboratory experiments of others.
17. Students are never permitted in the science storage rooms or preparation areas unless given specific permission by their instructor.
18. Know what to do if there is a fire drill during the laboratory period; Containers must be closed, gas valves turned off, fume hoods turned off, and any electrical equipment turned off.
19. Handle all living organisms used in a laboratory activity in a humane manner. Preserved biological materials are to be treated with respect and disposed of properly.
20. When using knives and other sharp instruments, always carry with tips and points pointing down and away from your body. Never try to catch falling sharp instruments. Grasp sharp instruments only by the handles.

Clothing

1. Any time chemicals, heat, or glassware are used, students will wear laboratory goggles. There will be no exceptions to this rule. FAILURE TO DO SO WILL RESULT IN YOU HAVING TO LEAVE THE LAB, TAKING A ZERO FOR IT AND NO CHANCE TO MAKE IT UP.
2. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.
3. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose torn or baggy clothing are a hazard in the laboratory. Long hair must be tied back and dangling jewelry and loose or baggy clothing must be secured. Torn clothing must be replaced with un-torn clothing. Shoes must completely cover the foot. No sandals are allowed.
4. Lab aprons have been provided for your use and should be worn during laboratory activities. Failure to do so may cause you to ruin your clothing for which the school cannot be responsible.

Accidents and Injuries

1. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.
2. If you or your lab partners are hurt, immediately yell out "Code one, Code one" to get the instructor's attention.
3. If a chemical should splash in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 20 minutes. Notify the instructor immediately.
4. When mercury thermometers are broken, the mercury must NOT be touched. Notify the instructor immediately.

Handling Chemicals

1. All chemicals in the laboratory are to be considered dangerous. Do not touch, taste or smell chemicals unless specifically instructed to do so by your instructor. The proper technique for smelling chemical fumes will be demonstrated to you.
2. Check the labels on chemical bottles twice before removing any of the contents. Take only as much chemical as needed.
3. Never put any excess chemicals back into the original container. Dispose these chemicals where the instructor specifies.
4. Never use mouth suction to fill a pipette. Use a rubber bulb or a pipette pump.
5. When transferring reagents from one container to another, hold the containers away from your body.
6. Acids must be handled with extreme care. You will be shown the proper method for diluting strong acids. Always add acid to water and swirl or stir solution. Be careful of the heat produced, particularly with sulfuric acid.
7. Never dispense flammable liquids anywhere near an open flame or source of heat. Handle these liquids over another container to contain possible spills.
8. Never remove chemicals or other materials from the laboratory area.
9. Take great care when transferring acids and other chemicals from one part of the laboratory to another. Hold them securely and walk carefully.

Handling Glassware and Equipment

1. Carry glass tubing, especially long pieces, in a vertical position to minimize the likelihood of breakage and injury.
2. Never handle broken glass with your hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.
3. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thermometers etc.) before attempting to inset it in a stopper. Always protect your hands with towels or cotton gloves when inserting glass tubing into,

or removing it from, a rubber stopper.

4. If a piece of glassware becomes "frozen" in a stopper, take it to your instructor for removal.
5. Fill wash bottles only with deionized water and use only as intended, e.g. rinsing glassware and equipment, or adding water to a container. Unauthorized use of a deionized water bottle will cause disciplinary action to be taken.
6. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be completely dry before touching an electrical switch, plug, or outlet.
7. Examine glassware before each use. Never used chipped or cracked glassware. Never use dirty glassware.
8. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires and loose connections. Do not use damaged electrical equipment.
9. If you do not know how to use a piece of equipment, ask the instructor for help.
10. Do not immerse hot glassware in cold water; it may shatter.

Heating Substances

1. Exercise extreme caution when using a gas burner. Take care that hair, clothing and hands are a safe distance from the flame at all times. Do not put any substance in the flame unless specifically instructed to do so. Never reach over an exposed flame. Light gas or alcohol burners only as instructed by the teacher.
2. Never leave a lit burner unattended. Never leave anything that is being heated or is visibly reacting unattended. Always turn the burner or hot plate off when not in use.
3. You will be instructed in the proper method of heating and boiling liquids in test tubes. Do not point the open end of a test tube being heated at yourself or anyone else.
4. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary.
5. Never look down into a container that is being heated.
6. Do not place hot apparatus directly on the laboratory desk. Allow plenty of time for hot apparatus to cool before touching it. Follow the teacher's instructions if a hot object needs to be moved.
7. When bending glass, allow time for the glass to cool before further handling it. Hot and cold glass have the same visual appearance. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.

DANIEL HAND HIGH SCHOOL
LABORATORY SAFETY ACKNOWLEDGEMENT

I, _____, have read and agree to follow all of the safety rules set forth in this acknowledgement. I realize that I must obey these rules to insure my own safety, and that of my fellow students and instructors. I will cooperate to the fullest extent with my instructor and fellow students to maintain a safe laboratory environment. I will also closely follow all oral and written instructions provided by my teacher. I am aware that any violation of this safety acknowledgement that results in unsafe conduct in the laboratory or misbehavior on my part may result in my being removed from the laboratory, detention, receiving a failing grade, and/or dismissal from the course.

_____ _____
Student's signature Date

Dear Parent or Guardian:

We feel that you should be informed regarding the school's effort to create and maintain a safe science classroom/ laboratory environment.

With the cooperation of the instructors, parents and students, a safety instruction program can eliminate, prevent, and correct possible hazards. You should be aware of the safety instructions your son / daughter will receive before engaging in any laboratory work. Please read the list of safety rules above. No student will be permitted to perform laboratory activities unless this acknowledgement is signed by both the student and parent/guardian and a photocopy is on file with the teacher.

Your signature on this acknowledgement indicates that you have read the Student Safety Acknowledgement, are aware of the measures taken to insure the safety of your son/daughter in the science laboratory, and will instruct your son/ daughter to uphold his/her agreement to follow these rules and procedures in the laboratory.

_____ _____
Parent's/Guardian's signature Date

QUESTIONS

Do you wear contact lenses? □ YES □ NO

Are you color blind? □ YES □ NO

Do you have allergies? □ YES □ NO

If "yes", please list:

APPENDIX C
Fire Marshal Waivers Received by the Daniel Hand Science Department

Waiver 1 – Allows science classes w/laboratory component, to use a "Maximum of 24 students" rather than following the "square footage" requirement.

From: DeBurra, Sam
Sent: Tuesday, June 24, 2014 10:48 AM
To: Salutari, Anthony
Cc: McMinn, William
Subject: Chem Labs

Mr. Salutari,

After researching the code more, with exception of Assembly use, the occupant load factors in the code are used to determine the minimum occupant load to provide egress for. The code's intent is not to restrict the occupant load of the building based on the floor area of the building. Nor is the code specifying the minimum area needed by each occupant for efficient use of the space. If code provisions can be met for a larger number of persons than the calculation determines, the larger number of occupants is permitted to be present, provided that all corridors, aisles, stairs, and other means of egress components can accommodate the larger occupant load.

Each of your laboratories/classrooms has two doors leading to the corridor. I do not see any issues with egress for your current class sizes.

If you have any further questions please contact me.

Thank you,

Samuel E. DeBurra Jr.
Fire Marshal
Town of Madison
(203) 245-5617

Waiver 2 – Allows classroom storage within 18 inches of the ceiling.

STATE OF CONNECTICUT
DEPARTMENT OF CONSTRUCTION SERVICES
OFFICE OF STATE FIRE MARSHAL

MODIFICATION REQUEST # FM-0361-13

PROJECT NAME: DANIEL HAND HIGH SCHOOL

ADDRESS: 284 GREEN HILL ROAD

TOWN: MADISON

STATE FIRE MARSHAL

In accordance with Section 29-296 of the Connecticut General Statutes, the decision of the Office of the State Fire Marshal in this matter is:

This request seeks relief from the requirement of Part IV Section 15.3.5 of the Connecticut State Fire Safety Code (CSFSC) as amended August 1, 2009 and October 2, 2012 specifically the subsequent reference by CSFSC Part IV Section 9.7.1.1 to NFPA 13 section 8.6.6.1 for the obstructions to sprinkler discharge (standard pendent and upright spray sprinklers). With consideration of the newly changed language in the 2013 edition of NFPA 13 Standard for the Installation of Sprinkler Systems for the obstructions to sprinkler discharge for standard pendent and upright spray sprinklers, pecifically to section 8.6.6.2.1 which states "where shelving is installed on a wall and is not directly below sprinklers, the shelves, including storage thereon, shall extend above the of a plane located 18 in. below sprinkler deflectors.", the configuration as shown in the photographs regarding the conforms to the language, this request is *ACCEPTABLE*.

Evaluated by: Joseph Bisogno

Decision endorsed by:

William Abbott.
STATE FIRE MARSHAL

Date:

"In accordance with Connecticut General Statute 29-309, any person determined to have the right to appeal may appeal the decision of the State Fire Marshal in this matter to the State Codes & Standards Committee within thirty (30) days after receipt".

State Codes & Standards Committee
1111 Country Club Road, Middletown, CT 06457
Tel: 860-685-8300

SUPPLEMENT INFORMATION SHEET

If Modification request is for a building or structure, please complete the following:

Date of Construction: 2002 Date of Occupancy for Present Use: 2002

Number of Stories (Above grade) 3 Dimension / Area Per Floor: 197,000

Attic: ☐ Full ☒ Partial ☐ None

Basement – # of Levels: ____ ☐ Full ☐ Partial ☐ None ☐ Finished ☐ Storage ☐ Crawl Space

Type of Occupancy (Check all that apply) ☐ New ☒ Existing ☐ Addition ☐ Renovation of building

☐ Change of Occupancy: From ____ to ____

☐ Assembly
Occupant Load: ____ persons
☒ Educational
☐ Business
☐ Single Tenant
☐ Multiple Tenant
☐ Mercantile
☐ Class A
☐ Class B
☐ Class C
☐ Covered Mall

☐ Detention
☐ with locking II
☐ with locking III
☐ with locking IV
☐ with locking V
☐ Apartment
No. of Units: ____
☐ Day Care
☐ Adult
☐ Family
☐ Group

☐ Residential Board
☐ Large ☐ Small
☐ Prompt
☐ Slow
☐ Impractical
☐ Health Care
☐ Hospital
☐ Nursing Home
☐ Ambulatory
☐ Limited

☐ Hotel/Motel/Dorm
☐ Lodging/Rooming
☐ Bed & Breakfast
☐ 1 & 2 Family
☐ Industrial
☐ Storage
☐ High Rise
☐ Underground
☐ Windowless
☐ Other:
☐ Other:

Type of Construction per NFPA 220: (Check all that apply)

☐ Type I
☐ I (443)
☐ I (332)

☒ Type II
☒ II (222)
☐ II (111)
☐ II (000)

☐ Type III
☐ III (211)
☐ III (200)

☐ Type IV
☐ (2HH)

☐ Type V
☐ V (111)
☐ V (000)

Approved Systems Provided (Check all that apply):

☒ Automatic Sprinklers
☒ NFPA 13 ☒ Throughout the Building
☐ NFPA 13R ☐ Partial: Location
☐ NFPA 13D ☐ Electrically Supervised
☐ CSFSC 7-7.1.2 Isolated Hazardous Area System
Location:

☒ Fire Alarm
☒ Manual Activation ☒ Occupant Notification
☒ Automatic Activation ☒ General ☐ Zoned
☐ Throughout the Building ☒ Voice Evacuation
☐ Partial Location:
☐ Water Flow ☐ Special System:

☒ Emergency Lighting ☐ NFPA 96 Hood System
☐ Other Activation Means:

☐ Smoke Control ☒ Standpipe; Class: 1
☐ Other Systems:

Other Information

State of Connecticut, Department of Public Safety
Division of Fire, Emergency & Building Services
Office of State Fire Marshal

APPLICATION FOR REQUEST FOR MODIFICATION OF A REQUIREMENT OF A FIRE SAFETY REGULATION
ADOPTED PURSUANT TO CHAPTER 541 OF THE CONNECTICUT GENERAL STATUTES

NOV – 7 2013
Reference No

Facility Name: Daniel Hand High School

Facility Address: 284 Green Hill Road (Number, Street) Madison (City) Connecticut (State) 06443 (Zip)

Facility Owner: Town of Madison Board of Education Telephone: 203-245-6300

Owner's Address: 10 Campus Drive (Number, Street) Madison (City) CT (State) 06443 (Zip)

Applicant's Name: Thomas Scarice Telephone: 203-245-6300

Applicant's Address: 10 Campus Drive (Number, Street) Madison (City) CT (State) 06443 (Zip)

Contact Person: Thomas Scarice Telephone: 2032456300

Type of Facility: Education
(Office Building, Fuel Gas Bulk Plant, Automotive Service Station, etc.)

This Facility is: ☐ New; ☒ Existing; ☐ Renovation; Date of Construction: 2002 ; Date of Present Use:2002

Previous modifications for this Facility: ☐ Unknown, ☒ No; ☐ Yes, Modification Numbers:

☐ Check if a Modification Request to the State Building Code is being submitted to the Office of State Building Inspector

I, the above named applicant, being a lawful agent of the owner, request modification/relief from a requirement of the CT:

☐ Moving Picture Theater Code pursuant to C.G.S. § 29-109
☐ Amusements/Tent and Portable Shelter Codes pursuant to C.G.S. § 29-140
☒ State Fire Safety Code pursuant to C.G.S. §29-296
☐ Oil Burning Equipment Code pursuant to C.G.S. §29-317(c)
☐ Flammable & Combustible Liquids Code pursuant to C.G.S. §29-321
☐ Gas Equipment & Piping Code pursuant to C.G.S. §29-329(c)
☐ Liquefied Petroleum Gas & Liquefied Natural Gas Code pursuant to C.G.S. §29-333
☐ Hazardous Chemical Code pursuant to C.G.S. §29-338
☐ Fireworks and Special Effects Code pursuant to C.G.S. §29-357(c)
☐ Model Rocketry Code pursuant to C.G.S. §29-368

For the requirement as prescribed in:

Regulation Number: 29-292-13e., 29-292 Ref. 29-317-1b (Number) Standard NFPA 13, (If Applicable) NFPA 30, NFPA 54, etc Section Number: 8.6.6.1 (Identify Section)

I request this modification/relief due to the following reasons:

☐ Equivalent Alternative ☐ Practical Difficulty ☒ Requirements Unwarranted

Describe area of non-conformance with the appropriate regulation, its location in the facility, and a brief description why code compliance cannot be achieved; specify dimensions as applicable

To allow storage on top of shelving/storage units which are attached to the wall. The 2002 editon of NFPA requires 18" of clearance from the sprinkler deflector to storage. This condition exists in many of the classrooms. Relief of above regulation is being sought because it is now allowed in NFPA 2013 edition, Section 8.6.6.2.1.

APPENDIX D

Chemicals Acceptable for Disposal as Regular Trash

Adapted from Flynn Scientific

Acacia powder, Gum Arabic	Magnesium Chloride
Acid, Acetic (less than 6 M)	Magnesium Oxide
Acid, Ascorbic	Magnesium Sulfate
Acid, Benzoic	Maltose
Acid, Boric	Manganese Chloride
Acid, Citric	Methyl Red
Acid, Hydrochloric (less than 6 M)	Methylene Blue
Acid, Lactic	Nutrient Agar
Acid, Nitric (less than 3 M)	Paraffin
Acid, Stearic	Petroleum Jelly
Acid, Succinic	Potassium Acetate
Acid, Sulfuric (less than 3 M)	Potassium Bicarbonate
Agar(s)	Potassium Bromide
Agarose Gels	Potassium Carbonate
Albumen	Potassium Carbonate
Aluminum Oxide	Potassium Chloride
Ammonium Bicarbonate	Potassium Ferricyanide
Ammonium Phosphate	Potassium Iodide
Ammonium Sulfate	Potassium Phosphate
Beef Extract	Potassium Sulfate
Bromophenol Blue	Potassium Sulfite
Broth, Nutrient	Sand
Calcium Carbonate	Silica Gel (unused)
Calcium Chloride	Silicon Carbide
Calcium Phosphate	Sodium Acetate
Calcium Sulfate	Sodium Ammonium Phosphate
Detergent	Sodium Bicarbonate
Chromatographic Absorbents	Sodium Bromide
Crystal Violet	Sodium Carbonate
Dextrose	Sodium Chloride
Diatomaceous Earth	Sodium Citrate
Ferric Oxide (rust)	Sodium Iodide
Ferric Phosphate	Sodium Phosphate
Ferric Sulfate	Sodium Sulfate
Ferrous Ammonium Sulfate	Sodium Sulfite
Galactose	Starch
Gelatin	Stearic Acid
Gum Arabic	Sucrose
Lactose	Sugars
Lauric Acid	Sulfur
Litmus	Tin Metal
Magnesium Carbonate	Urea

APPENDIX E
Regulations Concerning Eye Protective Devices
As Authorized by Section 214a of the
Connecticut General Statutes

The regulations of Connecticut state agencies are amended by adding sections 10-21 4a-1 to 10-21 4a-3, inclusive as follows:

Section 10-21 41-1. By whom, when and where eye protective devices shall be worn: definitions. Any person who is working, teaching, observing, supervising, assisting in or engaging in any work, activity or study in a public or private elementary or secondary school laboratory or workshop where the process used tends to damage the eyes or where protective devices can reduce the risk of injury to the eyes concomitant with such activity shall wear an eye protective device of industrial quality in the manner in which such device was intended to be worn. For the purposes of sections 10-21 4a-1 to 10-21 4a-3, inclusive, "workshop" and "laboratory" shall include any room or area used to teach or practice industrial arts, vocational and technical education; science, arts and crafts, or any similar skill, activity or subject. The following list of sources of danger to the eyes and the type of protection required to be worn in each case is exemplary, not exclusive.

Source of Danger to the Eyes	**Type of Protection Required**
Caustic or explosive chemicals	Clear goggles, splash proof
Explosives, solids or gases	Clear goggles
Dust producing operations	Clear goggles, splash proof
Electric arc welding	Welding helmet
Oxy-acetylene welding	Colored goggles or welding helmet
Hot liquids and gases	Clear goggles, splash proof
Hot solids	Clear or colored goggles, or spectacles
Molten metals	Clear or colored goggles
Heat treatment or tempering of metals	Clear or colored goggles metals
Glare operations	Colored spectacles or goggles, or welding helmet
Shaping of solid materials	Clear goggles
Repairing or servicing of vehicles when hazard is foreseeable	Clear goggles or spectacles
Spraying and dusting	Clear goggles, splash proof

Other similar activity being conducted in the instructional program which risks damage to the eyes	Proper eye protective device

Section 10-21 4a-2. Minimum standards for the design, construction and quality of eye protective devices used in schools. Any eye protective device used in such school workshops or laboratories shall be designed and constructed to resist impact, provide protection against the particular hazard for which it is intended, fit snugly without interfering with the movements of the user and be durable, cleanable, and capable of frequent disinfection by the method prescribed for such device by the school medical adviser.

All materials used in such eye protective devices shall be mechanically strong and lightweight, non-irritating to perspiring skin and capable of withstanding washing in detergents and warm water, rinsing to remove all traces of detergent and disinfection by methods prescribed by the school medical adviser without visible deterioration or discoloration. Metals used in such devices shall be inherently corrosion resistant. Plastics so used shall be non-flammable and shall not absorb more than five percent of their weight in water.

Section 10-21 4a-3. Responsibilities of public and private elementary and secondary school governing bodies. The governing board or body of each public and private elementary and secondary school in the state shall require the use of appropriate eye protective devices in each laboratory and workshop by any person in such areas during any activity engaged in, and shall post warnings and instructions in laboratories and workshops which include the list of hazards and protection required set form in Section 10-21 4a-1. Such boards shall make and enforce rules for the maintenance of all eye protective devices in clean, safe condition and shall replace any such protector which becomes irritating to the skin.

Purpose: To direct the school administrators in the kinds, construction, times and uses of devices for eye protection of teachers and pupils in school laboratories and workshops.

Connecticut Law Journal

January 9, 1968

This two-page document must be posted in all school classrooms in which goggles are required under these State laws.

APPENDIX F
Summary of Applicable OSHA Standards

29 CFR 1910.1200 Hazard Communication Standard

- Requires that Safety Data Sheets be current and available for all hazardous chemicals, and further requires the employer keep current a list of all hazardous chemicals on site.
- Mandates a written Hazard Communication Program, training for new employees, and training for employees potentially exposed to new hazardous materials.
- Sets standards for the labeling of hazardous chemicals.
- Requires training for non-routine tasks which might involve exposure to hazardous chemicals, and for outside contractors, brought onto the work site, who might be exposed to hazardous materials.

29 CFR 1910.1450 Laboratory Standard

- Requires that the employer monitor and limit employee exposure to hazardous chemicals.
- Mandates the appointment of a qualified Chemical Hygiene Officer, and the development of a written Chemical Hygiene Plan detailing standard work practices and policies, and procedures for working with hazardous chemicals.
- Requires initial and periodic employee training in the content of the Chemical Hygiene Plan including: chemical hazards; the content of MSDS; measures, including protective clothing and equipment, to minimize exposure to hazardous chemicals; emergency procedures; exposure limits and signs of overexposure; and the availability of medical consultation and treatment.
- Requires that a current inventory of hazardous chemicals be maintained and that all hazardous chemicals be appropriately labeled.
- Mandates that records of air concentration monitoring results, exposure assessments, medical consultations and examinations be maintained for at least 30 years.

29 CFR 1910.1030 Occupational Exposure to Blood borne Pathogens

- Requires a written plan to eliminate or minimize employee exposure including the determination of the likelihood of exposure, and the tasks in which exposure might occur.
- Mandates the listing of precautions to limit exposure and a description of work practices and protective equipment.
- Requires employee training in techniques to avoid exposure, medical treatment available, including the availability of pre- and post-exposure Hepatitis B vaccination, and the accessibility and contents of the Exposure Control Plan.
- Requires documentation of employee training (kept for three years) and post-exposure medical records (maintained for term of employment + 30 years).

APPENDIX G
Chemical Compatibility

Introduction

If incompatible chemicals are mixed, a fire, explosion, or toxic release can occur. Chemicals can often fall into more than one hazard category and therefore the chemical label and/or Safety Data Sheet (SDS) should be reviewed for storage requirements. Separate chemicals by adequate distance, or preferably by using physical barriers (e.g. storage cabinets). Avoid using the fume hood for chemical storage - this practice may interfere with the proper air flow of the hood. For especially dangerous materials, use a secondary container (e.g. plastic tub) large enough to contain a spill of the largest container. This chart indicates the most obvious chemical incompatibilities, and provides a basic segregation plan.

Acids

Examples: Acetic Acid; Chromic Acid*; Hydrochloric Acid; Hydrofluoric Acid; Nitric Acid*; Perchloric Acid*; Phosphoric Acid; Sulfuric Acid (*Indicates strong oxidizing acids and most of these will not be purchased or used by Daniel Hand High School.)

Storage Precautions:

- Store bottles on low shelf areas, or in acid cabinets.
- Segregate oxidizing acids from organic acids, and flammable materials.
- Segregate acids from bases, and from active metals such as sodium, potassium, etc.
- Segregate from chemicals which could generate toxic gases such as NaCN, iron sulfide, etc.

Bases

Examples: Ammonium Hydroxide; Potassium Hydroxide; Sodium Hydroxide

Storage Precautions:

- Separate bases from acids.
- Store bottles on low shelf areas, or in acid cabinets.

Flammables

Fuels are reducing agents, examples:

Acetone	Hexane
Benzene	Isopropyl Alcohol
Cyclohexane	Methanol
Ethanol	Propanol
Ethyl Acetate	Tetrahydrofuran
Ethyl Ether	Toluene
Gasoline	Xylene

Storage Precautions:

- Store in approved flammable storage cabinet(s) (required if there is > 10 gallons in the lab).

- Separate from oxidizing acids and oxidizers.
- Keep away from any source of ignition (flames, localized heat or sparks).
- Use only "flammable storage" (de-sparked) refrigerator

Oxidizers
React violently with organics (solvents, paper, wood, etc.)

Examples of Solids
Iodine
Nitrates, Salts of
Peroxides, Salts of
Potassium Ferricyanide
Sodium Nitrite

Examples of Liquids
Bromine
Hydrogen Peroxide
Nitric Acid
Perchloric Acid
Chromic Acid

Storage Precautions:
- Keep away from organic solvents, and other combustible materials (i.e. paper).
- Keep away from reducing agents.

Peroxide Forming Chemicals
Peroxides can be explosive and shock-sensitive. Examples: Ethers and acetals with alpha-hydrogen (e.g. ethyl ether, THF); Alkenes with allylic hydrogen (e.g. cyclohexene). Store tightly sealed to exclude oxygen. Label with date of receiving AND opening. Dispose within recommended guidelines – usually 6 months for ethers.

The following Peroxide-Forming chemicals will NOT be purchased or used by Daniel Hand High School:

Class B

Acetal	P-dioxane
Acetaldehyde	Ethylene glycol dimethyl ether
Benzyl alcohol	4-Hepanol
2-Buanol	2-Hexanol
Cumene	Methyl cyclopentane
Cyclohexanol	MIBK
Cyclohexene	2-Pentanol
Diacetylene	2-Propanol
Dicyclopentadiene	Tetrahydrofuran
Diethylene glycol dimethyl ether	Tetrahydronathpalene

Diethyl ether
Trimethylbenzene
Vinyl esters

Class C

Acrylic Acid
Acrylonitrile
Butadiene
Chloroprene
Chlorotrifluoroethylene
Methyl methacrylate
Styrene
Tetrafluroethylene
Vinyl Acetate
Vinyl Chloride
Vinyl pyridine
Vinyladiene chloride

Pyrophoric Substances

Spontaneously ignite in air.

Examples: Some finely divided metals; Some organoaluminum compounds ($LiAlH_4$, $Al(CH_3)_3$); Silane; phosphorus, yellow (should be stored and cut under water)

Storage Precautions:

- Rigorously exclude air and water from container.
- Store away from flammables.

Pyrophoric chemicals will NOT be purchased or used by Daniel Hand High School.

Water Reactives

React violently with water to yield flammable or toxic gases.

Solids: Calcium carbide, magnesium, lithium, potassium, sodium

Liquids: phosphorous trichloride, thionyl chloride

Storage Precautions:

- Rigorously avoid exposure to water and air
- Store away from flammables
- Lithium, Potassium and sodium should be stored under kerosene or mineral oil

Water-reactive metals will NOT be purchased or used by Daniel Hand High School.

Highly Toxics, Carcinogens, and Reproductive Toxin

These chemicals can be very hazardous by themselves, or in combination with other chemicals. If they are easily inhaled, (gases and volatile liquids) then they are particularly hazardous.

Liquids - Seal tightly and store in a ventilated cabinet apart from incompatibles. Use secondary containment (e.g. plastic tub) to contain any spills.

Examples: Formaldehyde; Carbon disulfide; Mercury; Nickel carbonyl; Cyanide solutions

Gases - Store in a gas cabinet or other ventilated cabinet

Examples: Chlorine; Fluorine; Hydrogen chloride; Nitric Oxide; Hydrogen Cyanide

Solids -Store away from incompatibles (usually acids) that would release toxic gas upon contact.

APPENDIX H
Guide for Variable Air Volume (VAV) Hoods ("Phoenix" system)

Variable Air Volume (VAV) hoods — unlike a standard hood — automatically adjust the face velocity to stay within recommended safe work levels (~ 100 ft./min). A VAV hood is easily distinguished by the gray control box on the hood.

If the low-flow alarm engages, lower the sash until the alarm stops. DO NOT over-ride the safety alarm by permanently engaging the "Mute" or "Emergency" button (e.g., with tape). If your hood is consistently sounding the alarming, call maintenance.

Always work with the sash at or below the level of the red arrow indicated point shown on the hood sticker, because:

- If most building sashes are raised, this will generate a hood alarm, and at your neighbor's hood, due to the limited capacity of your building's ventilation.

- A lowered sash protects you against airborne chemicals and incidents up to 100 times more than at sash full open.

- The lower the sash, the greater the energy conservation – lower sash when not in use.

- During the performance of an experiment, store only the minimum of equipment and chemicals in your hood because:

- Excess materials block air flow into the slots at back of the hood. Permanent equipment should be raised on a stand to allow the air flow into the lower slot.

- Most lab fires/explosions occur in hoods. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.

- Always work at least 6 inches inside the hood to maximize hood capture efficiency.

APPENDIX I
Flammable Liquid Safety

Safety Precautions

All flammable liquids found in school environments are also organic compounds. Their principal hazard is flammability. Many are also slightly toxic by inhalation and are body tissue irritants. Mild headaches or dizziness may be a symptom of overexposure to an organic vapor. Good ventilation is highly recommended whenever volatile organic compounds are used. Specific hazards for common organic solvents are presented in this review. Always wear chemical splash goggles, chemical-resistant gloves, and chemical-resistant apron whenever using flammable liquids. Consult current Material Safety Data Sheets for specific safety, handling, and disposal information.

Using and Dispensing Flammable Liquids

- If volatile organic solvents are going to be used, the lab must be well ventilated or have a working purge fan to ventilate the lab. The laboratory should also be equipped with one or two ABC, dry chemical fire extinguishers and fire blankets
- In addition to the other normal safety equipment (safety eyewash, safety shower, etc.).
- Always review the SDS before using any hazardous material in the laboratory.
- Flammable liquids should not be mixed with strong oxidizing agents. As the organic material is oxidized, heat is evolved and may ignite the material resulting in a fire.
- Extreme care must be taken when using flammable liquids around any heat source, flames, or electrical equipment. Laboratory equipment (stirrers, meters, etc.) are designed to be spark proof, but limiting vapors is always a good safety precaution.
- Organic vapors are heavier than air and will quickly travel along a lab bench or floor to an ignition source. Never use flammable liquids around an ignition source. Try to minimize the amount of volatile liquids used and be aware that organic vapors can travel great distances.
- Flammable liquids are very volatile. Dispense them in an operating fume hood.
- Use lab mats and/or plastic trays when dispensing organic solvents to contain spills and drips.
- Students should dispense flammable liquids from smaller bottles to limit spills and fumes. Do not allow students to dispense flammable liquids from containers larger than 1 liter. Larger volume containers increase the possibility of contamination and also increase the amount of fuel that will be available in case of a fire.
- During lab, dispense the flammable liquid from a central dispensing location and have students bring a graduated cylinder or test tube to the dispensing area. This will help to minimize spills and accidents as well as limit the amount of flammable liquid being transported back to the lab bench.

- Instruct students to remove only the amount of flammable liquid needed for the experiment from the reagent bottle. Never add chemicals back to reagent bottles.
- Have spill cleanup materials readily available whenever flammable liquids are used. If a spill occurs, immediately restrict unprotected personnel from the area, remove all ignition sources, and ventilate the area. If the spill is too large to contain, the vapors are overpowering, or ignition sources cannot be completely removed, immediately evacuate the school and call the fire department. If the spill is small, contain the spill with sand or an absorbent material. Depending on the spill material and the amount, allow the spilled material to evaporate off the sand or absorbent material in a fume hood or deposit it in a sealed bag or container.

Personal Protective Equipment and Safety Aids

- Consult the SDS for the specific personal protective equipment required and other safety precautions for the flammable material being used.
- Neoprene rubber gloves are recommended for use when handling organic solvents. Plastic or vinyl gloves will provide some protection against the occasional splash, small spill, and splatter that may occur when using or dispensing solvents.
- Operating eyewashes must be available in any classroom or laboratory where chemicals are used. Approved eyewashes must treat both eyes and provide a stream of clean, potable water for at least 15 minutes.
- Chemical splash goggles must be worn anytime flammable liquids are used. Safety glasses are not adequate protection.
- During demos, it is very important that students wear chemical splash goggles anytime flammable liquids are used. The possibility of an explosion or fire always exists and both students and teachers must be protected. If safety goggles are not available, use a heavy duty safety shield to protect your students.

First Aid

- Always seek professional medical attention upon exposure to any hazardous chemical, especially volatile organic solvents. For most organic solvents, the major hazards are flammability and inhalation. If there is a spill or accident, immediately remove any flames, heat, or electrical equipment from the area and begin to ventilate the area.
- If an organic liquid is splashed in the eyes, use an eyewash to irrigate the eyes with fresh, potable water for at least 15 minutes. Make sure the eyelids are held open to properly irrigate them. Ask the victim to look up, down, and sideways to better reach all parts of the eye. After using the eyewash, immediately seek professional medical help.
- If a flammable liquid is splashed onto bare skin, rinse the area with cool water for at least 15 minutes. Many organic solvents will “dry out” the skin and cause minor dermatitis. If the liquid causes burns or other skin irritations, seek medical help immediately.
- If a large amount of flammable liquid is splashed onto clothing, consider removing the clothing immediately and placing the clothing in a fume hood or outdoors. If flammable

liquid splashes onto your skin and clothing, remove clothing and then begin rinsing the affected areas with water (using the safety shower is ideal).

- If an organic liquid is ingested, please consult the SDS and immediately contact the school's Health Office or call the poison control center (1-800-222-1222) or local hospital emergency room. Follow their directions and seek medical attention as soon as possible. For most organic solvents, the goal is to trap the chemical in the stomach and prevent further injury caused by vomiting. Activated charcoal is sometimes given to help trap the chemical. **Do not** give the victim anything to drink or induce vomiting unless instructed by a medical professional.

APPENDIX J
Safety Guidelines for Chemical Demonstrations

(Guidelines from the American Chemical Society—Division of Chemical Education)

Chemical demonstrators must:

1. Know the properties of the chemicals and chemical reactions involved in all demonstrations presented.
2. Comply with all local rules and regulations.
3. Wear appropriate eye protection for all chemical demonstrations.
4. Warn the members of the audience to cover their ears whenever a loud noise is anticipated.
5. Plan the demonstration so that harmful quantities of noxious gases (e.g., NO_2, SO_2, H_2S) do not enter the local air supply.
6. Provide safety shield protection whenever there is the slightest possibility that a container, its fragments, or its contents could be propelled with sufficient force to cause personal injury.
7. Arrange to have a fire extinguisher at hand whenever the slightest possibility of fire exists.
8. Not taste or encourage spectators to taste any nonfood substances.
9. Not use demonstrations in which parts of the human body are placed in danger (such as placing dry ice in the mouth or dipping hands into liquid nitrogen).
10. Do not use "open" containers of volatile, toxic substances (e.g., benzene, CCl_4, CS_2, formaldehyde) without adequate ventilation as provided by fume hoods.
11. Provide written procedure, hazard, and disposal information for each demonstration whenever the audience is encouraged to repeat the demonstration.
12. Arrange for appropriate waste containers for and subsequent disposal of materials harmful to the environment.

Additional safety guidelines from Flinn Scientific Inc.

1. Always practice all demonstrations before performing them in front of students. A demonstration should only be attempted after all the potential pitfalls and hazards have been identified.
2. Never attempt a demonstration that will place you or your students at risk.
3. Have students wear safety goggles or use a safety shield if there is the slightest possibility that a container, its fragments or its contents could be propelled with sufficient force to cause personal injury. A good rule of thumb is if heat or pressure are involved, audience protection is required.
4. If heat is involved in the demonstration, make sure all glassware is borosilicate (e.g., Pyrex®) glass and check for chips and cracks before using.

5. If a flammable liquid is used in a demonstration, make sure to cap all reagent bottles after dispensing the appropriate quantities and be aware of heat sources and flammable vapors. Never repeat a demonstration using flammable liquids until all containers and surfaces are cool to the touch.
6. Use fresh chemicals and clean glassware to prevent possible contamination.
7. All demonstrations should have an educational objective. If the demonstration uses toxic chemicals or a potentially hazardous procedure, review the demonstration again and be sure it has educational benefits.
8. Always ensure that electrical devices are properly grounded and inspect every electrical circuit before turning the current on.

APPENDIX K
Safety References

Your plan for teaching science safely and in compliance with OSHA regulations should include provisions for a library of safety-related materials. The following resources will be useful additions to your library.

Art Hazards News, Center for Safety in the Arts, 5 Beekman St., Suite 820, New York, N.Y. 10038.

CHEMECOLOGY, Chemical Manufacturers Association, 2501 M St. N.W., Washington, D.C.

Chemical Catalog Reference Manual, Flinn Scientific Inc., P.O. Box 219, Batavia, IL 60510-1261.

Chemical Health and Safety, American Chemical Society, Division of Chemical Health and Safety, Publications Marketing Dept., 1155 Sixteenth St. N.W., Washington, D.C. 20077-5768, 1994.

Compliance Magazine, HIS Publishing Group, P.O. Box 512. Libertyville, IL 60048-0512

Developing a Chemical Hygiene Plan, Jay A. Young, Warren K. Kingsley, George H. Wahl, Jr., American Chemical Society, 1155 16th St., N.W., Washington, D.C. 20003.

Flinn Fax! Flinn Scientific Inc., P.O. Box 219, Batavia, IL 60510-1261.

Life Safety Code Handbook, National Fire Protection Association, 1 Battermarch Park, P.O. Box 9191, Quincy, MA 02269-9904, 1994.

Manual of Safety and Health Hazards in the School Science Laboratory, Laboratory Safety Workshop, 101 Oak St., Wellesley, MA 02181-4723.

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Prudent Practices in the Laboratory: Handling and Disposing of Chemicals, National Academy Press, 2101 Constitution Ave., Washington, D.C. 20418, 1995.

Safety in the Elementary Science Classroom, Robert A. Dean, et al., National Science Teachers Association, 1840 Wilson Blvd., Arlington, VA 22201-3000.

Safety News, VWR Scientific, 6411 Ivy Lane #714, Greenbelt, MD 20770-9888.

Understanding Chemical Hazards: A Guide for Students, American Chemical Society, 1155 16th St., N.W., Washington, D.C. 20003.

Written Hazard Communication Program for Schools and Colleges, Forum for Scientific Excellence, Inc., J.B. Lippincott Co., East Washington Square, Philadelphia, PA 19105.

Websites

Environmental Protection Agency
http://www.epa.gov/enviro/html/emci/chemref/index.html

OSHA
http://www.osha.gov/safelinks.html

National Institute for Occupational Safety and Health (NIOSH)
http://www.cdc.gov/niosh/homepage.html

Additional Information for the Science Teacher

Steps You Can Take to Prove You're a "Responsible" Science Teacher (this was produced by Flinn Science, Inc.)

Student X had a bad accident involving a chemical he obtained at school. As a senior in high school chemistry, the student was able to obtain a sizeable piece of elemental potassium from the stockroom. He wrapped the potassium in a paper towel and placed it inside his front pants pocket. Soon after, he walked home and by the time he was inside his house, the potassium spontaneously ignited and caught his pants on fire. The student sustained third-degree burns to his leg and abdomen and required skin grafting.

All science teachers dread the thought of having this type of "event" occur at their school. Who's responsible? The teacher? Student? School? A good definition for "who is responsible" is: "If you can reasonably foresee the consequences of what you're about to do, or are not about to do, you will be held responsible."

Today's science teachers must not only act responsibly, they must also be prepared to prove to others how they acted responsibly. Below are a few inexpensive ideas you can use in your classroom to document that you are a responsible science teacher.

Every member of the Science Department has been issued a copy of the Laboratory Manager's Professional Reference (Holt Science) and it is expected that each instructor has made themselves familiar with this reference.

Safety Agreements

On the first day of class every science class, you need to establish a contractual relationship with your students. (It is important to know that a student who takes a 1 trimester course and has completed a safety agreement MUST complete a new safety agreement if he/she enrolls in another course for a new course in the next trimester, i.e., one safety agreement DOES NOT cover a student for any other science course they may enroll in. A student safety agreement is a detailed listing of all of the rules of the laboratory. Review the safety agreement with your students and have them sign and date it. Students should then take the agreement home so their parents or guardians can review and sign the agreement as well. As a responsible science teacher, you think safety is so important that you want the parents to be involved the very first day of school. If the student, or parent, does not sign the agreement, the student will not be allowed to participate in any laboratory activity and will be given a failing grade for each day missed.

- Does the safety agreement have any legal weight? No, it does not. However, it does tell the students and parents that you are very serious about safety. Signed safety agreements will also go a long way in establishing that you are a responsible science teacher. Signed safety agreements document that the rules of the laboratory have been reviewed by all of the students in your class and you have their signatures to prove it.

Lesson Plans

- Your lesson plan book is a very valuable document to have should you ever have to prove to someone that you are a responsible science teacher. Your lesson plan book is your personal journal or diary that documents all of the activities you have done in class for the entire school year. Your lesson plan book is also a great place to document all the safety discussions you have with your students.
- Every time you discuss safety in class, jot down in your lesson plan book what you talked about. For instance, the day you discuss the safety contract, your lesson plan book should note that the safety contract was reviewed and discussed. Every time a lab or demonstration is done, select one of the rules from the safety contract, remind the students of the rule, and make note in your lesson plan book accordingly. Responsible science teachers constantly reinforce safety rules every day and get in the habit of writing in their lesson plan book what was discussed.

Safety Posters

Your students are visually oriented. Bright, colorful safety posters throughout the classroom/laboratory will help remind students that safety is important. While we would love for you to order our Flinn Scientific Safety Posters, we urge you to have students make their own. The next time you are absent from school and a substitute teacher watches the class, make that day a "safety day!" Provide the students with crayons, poster board, paper, and markers and have them make safety posters based on the safety contract. Decorate the walls with their homemade posters. Of course, your lesson plan book will clearly show that you think science safety is so important that your students spent the entire day making safety posters. What would normally have been a video day or worksheet day has now become an important safety day!

Firm Goggle Policy

A responsible science teacher must adopt a firm goggle policy. The policy we hope your school will adopt is "Any time chemicals, glassware, or heat is used, you must wear your laboratory goggles. No exceptions!"

Chemical Terms

When discussing laboratory safety the first couple weeks of school, you will be using terms like corrosive, flammable, oxidizer, etc. Do your students understand the meaning of these terms? Probably not! Try to explain and demonstrate to students what these terms mean.

Conclusion

"If you can reasonably foresee the consequences of what you are about to do, or are not about to do, you will be held responsible." Begin to implement some of the ideas we have suggested. Safety contracts, lesson plans, safety posters, a firm goggle policy, and definition of terms, will all go a long way in helping to prove you are a responsible science teacher.

Where and Why Science Accidents Occur

In 1996, Larry Duff, Ed.D. of Omaha, Nebraska released the results of a lab safety survey he conducted of junior and senior high school physical science/chemistry teachers in Nebraska. The response rate to his survey was over ninety-five percent.

Two very important findings came out of this survey.

- In grades 9-12, seventy percent of all accidents occurred at the ninth grade level.
- Ninety-three percent of all teachers surveyed said the largest reason for accidents occurring in the science lab was "Students' failure to carefully read and understand laboratory activity instructions."

Accidents occur because of "students' failure to carefully read and understand laboratory activity instructions". When told of this data, teachers simply nod their heads in agreement. If students did a better job following written and verbal instructions, fewer accidents would occur. What can educators do to help solve this problem? Here are a few possible solutions:

1. Instead of the teacher presenting the prelab safety instructions, have one of the student lab teams present the prelab safety instructions. A portion of their lab grade can be based on their prelab safety presentation. Depending on the number of labs you do a year, each student lab team should be able to prepare and present the prelab instructions 2-3 times a year. Students can consult their *Lab* manual, review Safety Data Sheets, look through the *Flinn Scientific Catalog/Reference Manual*, consult reference books like the Merck Index or perhaps even go "on-line" to reference safety information via the Internet. Students will learn and understand important safety rules if they have to do the research and present safety instructions to their peers. Maybe the safety message you want your students to hear will be better understood when it's coming from someone other than you.

2. Another possible solution is to pretest students on the techniques, procedures and safety information they must know in order to successfully perform the lab experiments. Students who don't pass the pretest, miss the lab experiment and receive a zero. Yes, a zero is harsh, but students need to understand that they cannot enter the lab and perform an experiment unless they fully understand what they are doing.

3. Make sure students read and understand the safety rules you have established in the science lab for conduct and behavior. A detailed safety contract outlining the rules of the lab must be the foundation of your science safety program. Discuss these rules and reinforce them throughout the school year.

   The data in Dr. Duff's survey is invaluable. For the first time we have data which not only tells us where most of the high school science accidents occur, but also why. Give ninth

grade science students an extra dose of safety training and let's develop techniques to ensure students are prepared to perform lab experiments properly and safely.

Practical Solutions for Instructors to Reduce Their Liability

Teaching science is different than teaching other academic subjects because to properly teach science, students must receive instruction and engage in appropriate hands-on activities. More importantly, science teachers must teach in an environment using materials and equipment that have the potential to cause serious harm to both teacher and student. Science teachers must be trained in more than just teaching methods and classroom management. They must also receive specific training in laboratory safety. Science teachers must know, understand, and follow many rules and regulations to ensure the safety of students in their classrooms. Science teachers also owe their students a duty of care to properly supervise, instruct, maintain equipment and facilities, and warn students of potential harm in their classrooms. Accidents will happen in the classroom.

Teachers can, however, significantly reduce their risk of negligence liability and prevent classroom mishaps by following a few simple rules.

- Know the safety statutes that affect your classroom and carefully abide by them.
- Check with the State Department of Education, State Occupational Safety and Health Administration for statutes and regulations that apply to your classroom. At a minimum, each school should have in place an up-to-date Chemical Hygiene Plan (CHP) that describes the safety procedures that are required at your school.
- Document all efforts to resolve safety issues in your classroom. Any safety issues or equipment problems that need repair must be carefully documented in writing and submitted to the proper administrator for immediate action. If you cannot successfully resolve the issue at the site level, send a letter to the superintendent or school board describing the problem, your efforts to correct the condition, and possible solutions for resolving the problem. Attach copies of your documentation. Save all letters and documentation.
- Do not leave your classroom during any instructional period. Every teacher has a primary duty to properly supervise students. Never leave students unsupervised for any reason.
- All students should wear the appropriate personal protective equipment while working in the laboratory. Chemical splash goggles, and chemical resistant aprons should be worn whenever any chemicals (no matter how minimal the risk of perceived injury) are to be used by students. Protective eyewear must be worn during all laboratory activities and demonstrations.
- Teach safety all year and review safety procedures often. Teachers have a duty to provide proper safety instruction. Start the year with a student safety contract. Then get in the habit of reviewing a safety rule every day at the beginning of lab. It is critical that you review the appropriate safety precautions with students prior to beginning any laboratory activity. Remember to document all safety instruction that you provide in your lesson plan book.

- Make safety a priority in the classroom by establishing and modeling safe chemical handling practices. Set a good example for your students by always wearing appropriate personal protective equipment and performing laboratory procedures in a safe manner. Not only will your actions speak louder than words to your students, but if an injury to a student occurs, their attorney will not be able to use your good practices against you.
- Use smaller volumes and amounts of chemicals. Smaller chemical quantities result in smaller spills, reduced vapors, and less material for disposal. Smaller chemical quantities also usually result in less severe injuries to your students. Microscale as many labs as possible, particularly those that use volatile or hazardous chemicals.
- Demand appropriate safety training related to your duty of care in the science classroom. Your school district is responsible for appropriate training to enable you to meet your duty of care in the classroom. Science laboratories are industrial areas requiring specialized training and knowledge that must be updated frequently.
- Do not permit students to use damaged or defective equipment. Damaged or defective equipment can cause serious harm to students. Until the equipment can be repaired, do not use it. If the conditions of your laboratory facility are unsafe, then document the safety issues and do not permit laboratory activities until the conditions are remedied.
- Do not permit students to take chemicals or any other school equipment home to perform "experiments." Theft of unlocked chemicals, performance of unauthorized experiments, and unsupervised home experiments expose students to potential injury and teachers to negligence liability.
- Be proactive rather than reactive.

Responsibilities of the Teacher

The science teacher's responsibilities begin with a duty to offer appropriate instruction to students. In a laboratory situation, this requires that careful attention be given to the materials and techniques used by both teacher and student. The location and proper use of emergency equipment, evacuation procedures, and proper procedures for the handling of supplies and equipment should be taught in formal, planned lessons (See Appendix B for the Student Safety Agreement.) Students should be tested formally on the topics, and the material should be reviewed and reinforced periodically.

Specifically, directions for laboratory activities should be provided in *written* form, with the instructor reviewing the directions with students before the activity is done. In discussing the activity, the teacher should remind students of the procedures to be followed and of appropriate methods for the safe use and disposal of materials to be used. Students' knowledge and practice of laboratory safety techniques should be evaluated on an ongoing basis by the direct observation of students in laboratory situations, and the inclusion of safety-related questions on tests and quizzes administered throughout the year.

The requirement for appropriate instruction extends also to field trips and to projects done outside the school, e.g., as part of science fairs or exhibits. Even if the activity is being done as a "home" assignment, the teacher must be aware of the materials the student is using and must determine that safe procedures are being followed. The same safety guidelines used for in-class laboratory activities should be applied to out-of-class projects, whether they are independent science projects or school-related investigations. Written parental or legal guardian permission should be obtained before a student embarks on any out-of-school independent science project. In the case of a science field trip or planned class outdoor experiment, emergency medical information as well as written permission must be provided. Where necessary, specialized safety equipment may be required and should be available.

A second responsibility of the teacher is that of adequate supervision of student activities. The laboratory is a potentially dangerous environment, requiring the careful attention of the instructor. Lessons in laboratory safety should emphasize appropriate student behavior. Students should not conduct laboratory activities without supervision, and should be allowed in the laboratory only if the teacher is present. It is recommended that short-term substitute teachers not be permitted to conduct laboratory activities. If an extended teacher absence requires that regular classwork continue, the long-term substitute teacher must be both certified and qualified to conduct laboratory investigations.

Special-needs students may require an increased level of supervision. It is important that these students be active participants in the science program. However, their safety is the greatest consideration. The teacher must take into account the limitations and abilities of each special-

needs student and decide, on an individual basis, which experiments are appropriate for each one of these students to perform. Handicapped stations, both portable and those that can be permanently installed in a lab room, are available.

While teachers are aware of the need to exercise care in the use of chemicals, they must also be alert to the potential hazards in the biological and physical science laboratories. For example, the teacher must provide adequate instruction and supervision in students' use, handling, and disposal of live and preserved specimens. The physical science laboratory may present problems related to the use of electrical devices or in the handling of projectiles. Finally, the teacher must develop an awareness of potential allergens which may be used in the laboratory or which may pose a hazard in laboratory, field trips, or outdoor investigations.

Since the maintenance of a safe laboratory environment is an additional responsibility of the science teacher, the teacher must be aware of, and take steps to correct, unsafe conditions. The written notification of supervisors should be followed by additional requests for the correction of the problem, and documentation of the requests should be maintained by the teacher. (See Appendix A for sample forms.)

Additional concerns for the science teacher are the physical design and the condition of the laboratory. Of particular importance are:

A. **Safety Equipment and Supplies**

The Occupational Safety and Health Administration (OSHA) requires the presence of eyewash fountains and safety showers. Fire extinguishers and fire blankets should be a part of the basic equipment of every laboratory. The local fire marshal can be a source of information as to the appropriate type and placement of extinguishers. State and local codes will dictate the presence and location of shut-off valves for gas, electricity and water in the laboratory, as well as for the installation of ground-fault interrupters.

Materials for the containment and clean-up of chemical spills should be readily available. Commercial spill kits may be purchased from most school laboratory supply companies. Teachers or staff members who administer emergency treatment are protected from civil damages for ordinary negligence if they have satisfactorily completed a course in first aid with a local health department or with one of several organizations, such as the American Red Cross.

Each school district's purchasing agent will be able to provide the names of companies specializing in safety and emergency equipment and supplies. Also, the National Science Teachers Association publishes a document containing the names of suppliers of safety and emergency equipment and materials. A list of resources is given in the Appendix K.

B. **Chemical Purchase, Storage, Disposal**

While some element of risk is inherent in most laboratory activities, the responsibility of assessing the hazards and usefulness of chemical reagents is of particular concern to the teacher. The following should be considered when deciding on the chemicals to use in the science program:

- Identification of chemicals requiring particular care in handling, storage, and/or disposal;
- Identification and subsequent elimination of chemicals deemed too hazardous for use in a school science laboratory; and
- Revision of existing laboratory experiments which employ materials and/or procedures deemed too hazardous for use in a school science laboratory. The teacher is advised to consult professional literature on a regular basis in order to ensure that information is both current and correct.

Security is a vital element of chemical storage. All storage rooms and cabinets should be kept locked. The storage of chemicals in classrooms is inappropriate. Although alphabetical arrangement of chemicals is convenient, it may result in incompatible chemicals being placed in close proximity to one another. Recommended storage patterns may be found in the references listed in the Appendix G.

For reasons of health and safety, OSHA guidelines require the maintenance of a current chemical inventory. A copy of the inventory must be available, and the location of hazardous and flammable chemicals should be noted. In order to ensure that school personnel have access to information on hazardous chemicals present in the school, OSHA guidelines require the creation and maintenance of a file of Safety Data Sheets (SDS).

Proper maintenance of stored chemicals includes periodic inspections for signs of aging or deterioration of both the chemicals and their storage containers. Aging and deteriorating chemicals, chemical waste generated by the science program, and unwanted hazardous chemicals must be disposed of in an appropriate manner. The U.S. Environmental Protection Agency has identified reagents that present specific risks to the environment. It has specified procedures for the disposal of these reagents. Chemicals identified as hazardous must be disposed of in licensed landfills, and must be transported to these landfills by licensed disposal services. The Connecticut State Department of Environmental Protection maintains lists of licensed waste handlers and of state-licensed disposal companies. Since the cost of disposing of unwanted chemicals can be considerably greater than their purchase price, the teacher is advised to become familiar with disposal requirements before chemicals are purchased.

Copies of the Chemical Hygiene Plan, the Standard Operating Procedures, the Hazard Communication Program, and Materials Safety Data Sheets must be kept on file and be readily accessible to all school personnel.

C. Standards for Class Size

This section has been vastly reduced in size due to a wavier received in July, 2014 from the Fire Marshal for the Town of Madison which stipulates that, due to proper safety features in each science classroom, Daniel Hand High School is exempt from the minimum square footage requirement for science classrooms and can maintain their current policy of a maximum of 24 students per each science course that has a laboratory requirement as a requirement for the course.

Please see Appendix C for the documentation received for the two (2) waivers that Daniel Hand High School has been granted by the Fire Marshal for the Town of Madison.

NOTE: Remember that because you are a licensed science education professional, there is an expectation by the legal system relative to your performance. The science educator may determine, based on these safety codes/standards, that it is in fact unsafe in their science laboratory to conduct certain experimentation. In such cases, the science educator needs to consider alternatives for the short term such as altering the curriculum or omitting unsafe laboratory activities. The legal system would not look favorably on a science professional who was aware of an unsafe working environment, but didn't attempt to effect any change and had a safety incident. Negligence and liability can be very costly for all involved! Science can be fun, a learning experience and safe. In the long term, it takes knowledge, planning, commitment and cooperative initiatives with the school's administration/board of education to provide for a laboratory with a safe working environment.
By Dr. Ken Roy

Dr. Ken Roy is the Director of Science & Safety for Glastonbury Public Schools in Glastonbury, CT, an authorized OSHA instructor, and a member of the Board of Directors of the Laboratory Safety Workshop.

Author's Note: Special thanks goes to John Dembishack, Building Plan, Revision and Inspection, Office of the State Fire Marshal, State of Connecticut, for his review of this column. Additional thanks are given to Richard Snedeker, Architect Design Reviewer, State of Connecticut, Department of Education, School Facilities Group, for his input relative to the contents of this column.