PATERSON PUBLIC SCHOOLS
90 DELAWARE AVE.
PATERSON, NJ

CHEMICAL HYGIENE PLAN FOR PATERSON CITY PUBLIC SCHOOLS

Occupational Exposure to Hazardous Chemicals
In Laboratories Standard
Title 29 Code of Federal Regulations
Part 1910.1450

May 25, 2014

Document approved by: Resolution of the Paterson Board of Education

Paterson Public Schools Representative: Dr. Donnie Evans

Chemical Hygiene Officer: Mrs. Brenda Zemo

Annually Reviewed by: BRENDA ZEMO AND THE CHEMICAL HYGIENE COMMITTEE Date: May 25, 2014 completed

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2. 0 BACKGROUND

The Federal Occupational Safety and Health Administration's Occupational Exposure to Hazardous Chemicals Standard, Title 29 Code of Federal Regulations, Part 1910.1450 became effective on May 1st, 1990. This legislation, commonly referred to as the "Laboratory Standard," was designed specifically to apply to employers engaged in laboratory use of hazardous chemicals.

The New Jersey State Public Employees Occupational Health and Safety (PEOSH) Program has adopted this federal Standard to protect public sector workers. A copy of this Standard appears at the end of this document as Appendix K.

The goal of this Standard is to protect all affected workers with regard to health and safety issues in laboratories. Paterson Public Schools have the additional responsibility to protect teachers and students alike in laboratories and classrooms where hazardous chemicals are used and or stored.

It is the policy of Paterson Public Schools that all chemical handling and related operations are required to be performed in a safe and responsible manner, including maintaining exposure to chemical agents within acceptable established limits. This policy further requires that exposures be minimized by the use of hazard elimination, engineering controls, personal protective equipment, and administrative controls.

To that end, the Standard requires this written Chemical Hygiene Plan (CHP), a Chemical Hygiene Committee (CHC) and a Chemical Hygiene Officer (CHO).

3.0 CHEMICAL HYGIENE PLAN (CHP):

The purpose of this CHP is to provide guidance to all affected Paterson Public School employees, students, contractors, visitors, and guests for the safe handling, use and storage of hazardous materials in laboratories and classroom

3.1. Chemical Hygiene Officer:

The CHO is required by the OSHA Laboratory Standard to be specifically "qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. The Current CHO designees are listed in Appendix L.

Designated Chemical Hygiene Officer	
Environmental, Occupational Health & Safety - Mrs. Brenda Zemo	973-321-0593 office 973-518-1053 cell

3.2. CHEMICAL HYGIENE COMMITTEE (CHC):

The duties and responsibilities of the CHC shall include:

- Assisting in the implementation of the CHP
- Meet on a quarterly basis (more often, as needed) to discuss any health and safety concerns which may come to light, incidents, and ways to correct problems.
- Meet annually to review the CHP and provide input on any necessary changes.

The CHC shall consist of the Director of Science, Science Subject Matter Leaders from various schools and the Chemical Hygiene Officer. The following table shows the present composition of the CHC. The current members of the Chemical Hygiene Committee are listed in Appendix L.

Name & Title	School	Contact Telephone Number
Director of Science	Paterson Public Schools.	973-321-0793
Schools representatives	See Appendix L	

The OSHA Lab Standard and General Duty Clause places the responsibility for employee safety squarely on the shoulders of the employer, and the OSHA Laboratory Standard makes the CHO the employer's representative for laboratory safety. Some of these duties involve the following:

- Work with administrators, teachers and other employees to develop and implement appropriate chemical hygiene policies and practices
- Monitor procurement, use, and disposal of chemicals used in the laboratories
- See that appropriate audits are conducted and maintained
- Help develop precautions and adequate, safe school laboratory facilities
- Know the current legal requirements concerning regulated substances; and
- Seek ways to improve the chemical hygiene program.

See Appendix B of the Laboratory Standard for a more complete description the duties of the CHO.

4. INTRODUCTION

The general intent of the Chemical Hygiene Plan for Paterson Public Schools is:

4.1 To protect Science Teachers and any other laboratory employees from health hazards associated with the use of hazardous chemicals in our laboratory, and

4.2 To assure that our Science Teachers and any other laboratory employees are not exposed to substances in excess of the Permissible Exposure Limits adopted by New Jersey Public Employees Occupational Safety and Health Act (PE-OSHA) [29 CFR 1910 subpart Z].

4.3 The plan will be available to all employees for review and a copy will be located in the following areas:

- Office of the Environmental Health and Safety
- Office of the Director of Science
- Each School Science Department
- Facility Supervisor
- Each School Main Office

This plan will be reviewed annually by the Chemical Hygiene Committee

Appendix E will be used to document the orientation of all new employees to ensure that all elements as written in this checklist have been met. Appendix F will be used after the chemical Hygiene Plan training has been completed.

5. EMERGENCY PROCEDURES-STANDARD OPERATING PROCEDURES (SOPs)

Emergency Procedures and SOPs relevant to laboratory safety and health are to be followed in all district laboratories when using, storing or disposing chemicals.

5.1. Emergency Situations:

5.1.2 Accidents, Spills and Releases:

The most important consideration is the safety of the personnel in the area. Evacuation of personnel and immediate application of appropriate first aid when needed, should take priority.

Accidents may include falls, slips, cuts, and inhalation of airborne chemicals, chemical contact to the eyes or skin, or chemical ingestion. If chemical exposure has occurred, take the following steps, depending on the part(s) of the body affected:

- Eye Contact – Immediately go to nearest eye/face wash and flush eyes for a period of at least fifteen (15) minutes. A second party should immediately summon medical attention by contacting the School Nurse or dialing 911.

- Skin Contact – Immediately go to a sink or emergency shower and wash affected area for at least fifteen (15) minutes. Summon medical attention after the affected person has been attended to. The affected employee, or others who may be providing assistance, should wear appropriate gloves and remove any affected clothing. Get medical attention by immediately contacting the School Nurse, or dialing 911.

- Inhalation – Avoid breathing in hazardous chemical contaminants. Should there be an exposure, remove the exposed party to fresh air and call for the nurse's office for help

- Ingestion – Immediately contact the School Nurse, or dial 911 and follow any first aid instructions on the container, SDS, or Hazardous Substance Fact Sheet. If necessary, contact the **Poison Control Center at 1-800-222-1222** for appropriate first aid and antidote information.

Incidents which do not involve chemical exposures should also be immediately reported to the School Nurse. If an individual has been injured, do not move the person unless they are in further danger by not being moved. If there is bleeding, put on latex, or nitrile gloves, which are available in first aid kits located in each laboratory, and try to control the bleeding by compressing the wound with a cloth, paper towels, or whatever else is available.

Once personnel have been brought to safety, then the chemical should be confined and neutralized, provided the person doing the work is properly trained and equipped. If necessary, contact a HazMat response team.

Spills of less than four liters can be handled by trained staff. Spills should be immediately cleaned up using appropriate protective equipment and proper disposal techniques. All spills should be reported to the Director of the Science and the Office of The Facility Supervisor.

These officials must determine if school staff has the proper equipment, supplies and experience to safety clean up the spill, or if an outside hazardous materials spill cleanup contractor is needed. If so, the following contractors are authorized to respond:

Spill Response Group	Location	Telephone Number
Paterson Fire Department	850 Madison Ave. Paterson	911
TTI Environmental, Inc.	1253 No. Church St. Moorestown, NJ 08057	856-840-8800
Passaic County Sheriff Office	77 Hamilton St. Paterson	973-881-4200

The following lists the school and the location of the nearest fire station. In the event of an emergency these fire stations will respond

School	Firehouse Emergency Responder
School No. 1 589 11th Avenue Paterson, NJ 07514	Station 5 Lafayette- East 16th. St.
School No. 2 22 Passaic Street Paterson, NJ 07501	Station 7 Grand- Quinn
School No. 3 448 Main Street Paterson, NJ 07501	Station 7 Grand- Quinn
School No 4 55 Clinton Street Paterson, NJ 07522	Station 4 Temple- Presidential
School No. 5 430 Totowa Avenue Paterson, NJ 07502	Station 2 Union-Sherwood
School No. 6 137 Carroll Street Paterson, NJ 07501	Station 1 Madison-Market
School No. 7 106 Ramsey Street Paterson, NJ 07501	Station 7 Grand- Quinn
School No. 8 35 Chadwick Paterson, NJ 07503	Station 6 Getty Ave.- St Joseph's Hospital
School No. 9 9 Getty Avenue Paterson, NJ 07503	Station 6 Getty Ave.- St Joseph's Hospital
School No. 10 48 Mercer Street Paterson, NJ 07524	Station 5 Lafayette- East 16th. St
School No. 11 350 Market Street Paterson, NJ 07501	Station 1 Madison-Market
School No. 12 121 North 2nd Street Paterson, NJ 07522	Station 4 Temple- Presidential
School No. 13 690 East 23rd Street Paterson, NJ 07504	Station 1 Madison-Market
School No. 14 522 Union Avenue Paterson, NJ 07522	Station 4 Temple- Presidential
School No. 15 98 Oak Street Paterson, NJ 07501	Station 1 Madison-Market
School No. 17 Urban Leadership 112 No. 5th Street Paterson, NJ 07522	Station 4 Temple- Presidential
School No. 18 51 East 18th Street Paterson, NJ 07524	Station 5 Lafayette- East 16th. St
School No. 19 31 James Street Paterson, NJ 07502	Station 2 Union-Sherwood
School No. 20 500 37th Street Paterson, NJ 07504	Station 3 Trenton- 23rd Ave.
School No. 21 322-10th Avenue Paterson, NJ 07514	Station 5 Lafayette- East 16th. St
School No. 24 50-19th Avenue Paterson, NJ 07513	Station 1 Madison-Market
School No. 25 287 Trenton Avenue Paterson, NJ 07503	Station 3 Trenton- 23rd Ave.

School No. 26 1 East 32nd Street Paterson, NJ 07514	Station 5 Lafayette- East 16th. St
School No. 27 250 Richmond Avenue Paterson, NJ 07502	Station 2 Union-Sherwood
School No. 28 Temple Street/Presidential Blvd. Paterson, NJ 07522	Station 4 Temple- Presidential
School	**Firehouse Emergency Responder**
School No. 29 88 Danforth Avenue Paterson, NJ 07501	Station 7 Grand- Quinn
Martin Luther King School 851 East 28th Street Paterson, NJ 07513	Station 1 Madison-Market
Edward W. Kilpatrick 295-315 Ellison Street Paterson, NJ 07501	Station 1 Madison-Market
New Roberto Clemente 482-506 Market Street, Paterson, NJ 07501	Station 1 Madison-Market
Roberto Clemente 434 Rosa Parks Blvd Paterson, NJ 07501	Station 5 Lafayette- East 16th. St
Dale Avenue 21 Dale Avenue Paterson, NJ 07505	Station 1 Madison-Market
Norman S. Weir 152 College Blvd. Paterson, NJ 07505	Station 1 Madison-Market
Early Learning Center 660-14th Avenue Paterson, NJ 07504	Station 1 Madison-Market
Yes Academy 45 Smith Street Paterson, NJ 07505	Station 4 Temple- Presidential
Don Bosco Technical Academy 151 East 33rd Street. Paterson, NJ 07504	Station 2 Union-Sherwood
Alexander Hamilton Academy 11-27 16th Avenue Paterson, NJ 07501	Station 5 Lafayette- East 16th. St
John F. Kennedy H.S. Complex 61-127 Preakness Ave. Paterson, NJ 07502	Station 2 Union-Sherwood
Eastside H.S. Complex 150 Park Avenue Paterson, NJ 07501	Station 1 Madison-Market
Rosa Parks H.S. 413-12th Avenue Paterson, NJ 07514	Station 5 Lafayette- East 16th. St
Silk City 2000/Adult School 151 Ellison Street Paterson, NJ 07505	Station 1 Madison-Market
Great Falls Academy 11-22nd Avenue Paterson, NJ 07513	Station 3 Trenton- 23rd Ave.
SWING SPACE 137 Ellison Street Paterson, NJ 07505	Station 1 Madison-Market
PANTHER Academy 203 Memorial Drive Paterson, NJ 07505	Station 1 Madison-Market
Sports & Business / Public Safety Academy and Destiny 47 State Street Paterson, NJ 07501	Station 1 Madison-Market
STARS Academy 175 Main Street Paterson, NJ 07505	Station 1 Madison-Market
Garrett Morgan 200 Grand Street Paterson, NJ 07505	Station 7 Grand- Quinn
HARP Academy 175 Main Street Paterson, NJ 07505	Station 1 Madison-Market
International H.S. 200 Grand Street, Paterson, NJ 07505	Station 7 Grand- Quinn

If an outside contractor is determined not to be needed, the following procedures will take place:

- There are two (2) convenient containment/absorbent materials, sand and paper towels that are available in each laboratory area. Vermiculite or absorbent clay materials, like "Speedi-Dry" or cat liter may also be safely used for special chemicals.

- Sodium bicarbonate solutions are available in the chemistry laboratories and should be used to neutralize spills of strong acids. Sodium citrate can be used for bases. There are commercially prepared spill kits available for such spills as well. For other materials the

- SDS or Hazardous Substance Fact Sheets should be consulted following the containment of the material.

- Teachers who are working with known hazardous materials in quantities larger than one (1) liter of liquid, or 100 grams of solid should locate or prepare the appropriate neutralizer in advance.

- While working on containing a spill, all available ventilation systems should be put into operation to minimize toxic vapors.

5.1.3. Fires:

The most important consideration is the safety of students and personnel in the area. If large quantities of flammable liquids, or solids, are released, evacuation of students and teachers should take priority, even if the release did not cause an immediate fire. Should anyone get injured, immediately seek application of appropriate first aid measures.

In the event of any laboratory fire, immediately pull the nearest fire alarm to summon professional help. If the fire is very small and there is little risk of it spreading or harming someone, you may then try smothering it with a non-flammable material such as an inverted beaker or watch glass, or use the nearest fire extinguisher.

Whenever there is an uncontrolled release of flammable materials in a laboratory, students and staff should be instructed to immediately turn off all sources of ignition, such as electrical equipment, as well as additional fuel sources, like gas jets. This includes turning off the emergency gas shutoff valve that services that area.

5.1.4 Accident and Incident Reports:

- A written report of the event, whether it is an accident, spill or fire shall be filed by the Teacher in charge and shall be submitted to the Chemical Hygiene Officer.

- Accident/Incident Report Forms are available from the Environmental Science Health and Safety Office, 200 Sheridan Ave., Paterson, NJ.

- These reports will be reviewed periodically (monthly or quarterly) by the Chemical Hygiene Officer and the Chemical Hygiene Committee.

5.2. General Safety Policies to Help Avoid Routine Exposures:

Teachers working in laboratory situations should develop and encourage safe habits, striving to minimize exposure to chemicals through inhalation, skin contact and ingestion.

Lab participants should not smell, or taste any chemical. Appropriate engineering controls (e.g., laboratory fume hoods), personal protective equipment (e.g., chemical splash goggles, impermeable gloves, etc.) and safe work practices must be followed to prevent or minimize chemical exposures. Engineering controls and safety equipment should always be inspected before each use.

Attached to this plan in Appendix C are the Standard Operating Procedures (SOP's) in place at Paterson Public Schools for the safe handling of chemicals in our laboratories. These Standard Operating Procedures are to be used as a hand book while writing lesson plans and reviewed prior to any laboratory procedure or demonstration.

5.2.1. Choice of Chemicals:

Choose the safest chemicals to use as possible. Use only those chemicals for which there are existing devices capable of controlling the hazard. For example, ventilation provided by laboratory fume hoods will provide protection from breathing in gases, vapors, mists, dusts, fumes or smoke. Appendix H is to be used to Order New Chemicals in conjunction with the procedures in the Hazard Communication Program. For example, instead of using benzene, a carcinogen, substitute with toluene.

5.2.2. Entering and Exiting:

Enter and leave the laboratory, chemical storage rooms and preparation areas by the normal exits. In case of emergency, follow the School's Emergency Evacuation Plans and leave the problem area by taking the nearest safe exit.

Teachers should seek information and advice about potential hazards involving chemicals, or other types of hazards in the laboratory. If hazardous materials, or processes, are to be used, Teachers should plan appropriate protective procedures and the proper positioning of equipment. The Director of the Science will maintain a list of chemicals that should not be used, which will also be included in this Chemical Hygiene Plan, see section 9.0. Appendix G will be used for Laboratory Specifications for new Experiments.

Signage:

Warning and requirements for personal protective equipment shall be posted outside of the laboratory. (Here is where we can add eye protection, closed shoes, etc.)

5.2.3. Waste disposal:

In planning any laboratory activity, plans for waste disposal should also be made. Appendix C can be used to determine chemicals that can be combined for waste disposal. Appendix C lists incompatible Chemicals.

- Chemical wastes must be deposited in appropriately labeled receptacles and teachers should follow all other waste disposal procedures that are indicated in this Chemical Hygiene Plan.
- Disposal Containers are available for Chemistry by contacting the EOHS Officer.
- SOP 21 WASTE STREAM LOG shall be submitted April 15, annually, whether or not there is waste.
- In the case there is no waste, simply indicate no waste. Form is signed by the principal or building administrator.
- Chemicals shall be checked annually for expiration and added to the Waste Stream log for disposal.
- Hazardous waste shall be secured in each building until the annual disposal date has been determined.
- Estimated laboratory waste shall be listed in the waste stream log that may accumulate between April 15 and the end of year.
- Principal or Building Administrator shall ensure that SOP 21 Waste Stream Log is submitted to the EOHS OFFICER ON APRIL 15, ANNUALLY.
- EOHS Officer shall notify principal/building administrator, sector supervisors and chief custodians of the disposal date.
- Chief custodian shall be advised and given access to the location of the hazardous waste storage.

6. CRITERIA FOR USE OF CONTROL MEASURES TO REDUCE EMPLOYEE EXPOSURE TO HAZARDOUS CHEMICALS

6.1 The following operations shall be performed in **LABORATORY HOODS:**

- Preparation, transfer or other work with corrosive solutions, such as diluting concentrated acids, dissolving caustic solids, etc.
- Use of flammable or combustible liquids
- Use of volatile organic solvents
- Experiments that might present a hazard
- Use of toxic gases
- Use of Vacuum pumps and distillation columns.

6.2 Respirators shall be used in accordance with the respiratory protection policy of Paterson Public Schools, and with the PEOSH respiratory protection standard 29 CFR 1910.134. At this time Paterson Public Schools does not have a respirator protection program.

6.3. Appropriate protective apparel compatible with the required degree of protection for substances handled shall be used. The Director of Science will advise employees on glove, gown, eye protection, etc. use. Permeability charts are available in the Office of the Director of Science.

6.4 Employees will be instructed on the location and use of eye wash stations and safety showers. The Environmental Science Health and Safety Officer or his/her designee is responsible for this instruction.

6.5 Employees will not use fire extinguishers and other fire protection systems.

7.0 MAINTENANCE OF FUME HOODS AND OTHER PROTECTIVE EQUIPMENT

7.1 FUME HOODS will should be inspected and certified twice a year, by either the Paterson Public Schools or, or a consultant; the adequacy of face velocity will be determined by a hand held velometer; reports of hood inspections are filed in office of the Director of Science for employee review. Appendix I LISTS ALL FUME HOODS IN THE DISTRICT. Appendix I will be used as a checklist.

7.2 CHEMICAL STORAGE LOCATIONS will be inspected every month by the Director of Science, or someone else (including a consultant) may be assigned this duty; proper storage and housekeeping will be verified on a monthly checklist, which will be filed in the Office of the Director of Science.

7.3 SAFETY SHOWERS will be inspected monthly by a representative of the Office of the Facility Supervisor, or a consultant; proper operation will be noted on an inspection form and filed in the Office of the Facility Supervisor.

7.4 EYE/FACE WASH STATIONS will be inspected weekly by the Office of The Facility Supervisor, or a consultant; proper operation will be noted on an inspection form and filed in the Office of the Facility Supervisor.

7.5 EMERGENCY GAS SHUT-OFF VALVES will be inspected monthly by the Office of The Facility Supervisor, or a consultant; proper operation will be noted on an inspection form and filed in the Office of The Facility Supervisor.

7.6 FIRE EXTINGUISHERS will be inspected monthly by the office of the Facility Supervisor, or a consultant, proper operation will be noted o an inspection form and filed in the Office of the Facility Supervisor.

8.0 EMPLOYEE INFORMATION AND TRAINING

8.1 Each employee covered by the laboratory standard will be provided with information and training so that they are apprised of the hazards of chemicals present in their work area. This training will be given at the time of initial assignment and prior to new assignments involving different exposure situations. Refresher training will be given annually.

8.2 The training/information sessions shall include:

- The contents of 29 CFR 1910.1450 and its Appendices. A copy of the standard shall be available to employees at the Main Office of each Paterson Public School building/facility.
- The availability and location of the written Chemical Hygiene Plan.
- Information on PEOSH Permissible Exposure Limits (PELs) where they exist, and other recommended exposure limits.
- Signs and symptoms associated with exposure to hazardous chemicals in laboratories.
- Location of reference materials, including all SDSs and NJ Hazardous Substance Fact Sheets received, on the safe handling of chemicals in laboratories.
- Methods to detect the presence or release of chemicals (i.e. monitoring, odor thresholds, etc.)
- The physical and health hazards of chemicals in laboratory work areas.
- Measures to protect employees from these hazards including:
  - Standard operating procedures
  - Work practices
  - Emergency procedures
  - Personal protective equipment
  - Details of the chemical hygiene plan

- The CHO, or designee, which may include a consultant, is responsible for conducting the training sessions, which will consist of lecture, videotape, slides, etc.). An outline of the training program is in Appendix D.
- Each employee will sign a form documenting that they have received training.
- The CHO or designee is responsible for developing Standard Operating Procedures, Appendix C. The CHO, or his designee, is responsible for the portion of the training on Standard Operating Procedures.

9.0 PRIOR APPROVAL FOR SPECIFIC LABORATORY OPERATIONS

9.1 A review of all experiments & procedures for safety before implementation into a course should be done. Certain laboratory procedures, which present a serious chemical hazard, are prohibited. These include working with:

- Hydrofluoric acid Benzene
- Methylene Chloride
- Cyanide salts
- Highly flammable materials such as ether, elemental sodium
- Perchlorates
- Picric acid
- Other highly toxic or highly hazardous materials
- Selected carcinogens, teratogens, and mutagens

9.2 Some hazardous operations require prior approval by the CHO and the CHC before work can begin. There are none at this time.

10.0 MEDICAL CONSULTATION AND EXAMINATION

10.1 Paterson Public Schools shall provide to affected employees medical attention including follow-up examinations which the Head Nurse at each building/facility determines is necessary under the following circumstances:

- Whenever an employee develops signs and symptoms associated with a hazardous chemical to which he/she may have been exposed, the employee shall be provided an opportunity to receive appropriate medical examination.

- Where exposure monitoring reveals an exposure level routinely above the PEOSH
- Action Level (AL) (or in the absence of an AL, exposure above the PEOSH
- Permissible Exposure Limit (PEL)) for PEOSH regulated substances for which there are medical monitoring and medical surveillance requirements, medical surveillance shall be established for that employee.
- Currently our laboratory does not use any substances where the permissible exposure limit is reach or exceeded.
- Whenever an event takes place in the work area, such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation.
- This consultation is for the purpose of determining the need for a medical examination.
- All medical examinations and consultations are provided by St. Joseph Hospital. All aspects of these examinations are provided by a licensed physician, or supervised by a licensed physician.

- These examinations are provided without cost to the employee, without loss of pay, and at a reasonable time and place.
- The Chemical Hygiene Officer will provide the following information to the physician:

  - Identity of the hazardous chemical to which the employee may have been exposed.
  - A description of the conditions of the exposure including exposure date if available.
  - A description of signs and symptoms of exposure that the employee is experiencing (if any).
  - The written opinion that the employer receives from the physician shall include:

Recommendations for future medical follow-up.

  - Results of examination and associated tests.
  - Any medical condition revealed which may place the employee at increased risk as the result of a chemical exposure.
  - A statement that the employee has been informed by the physician of the results of the examination/consultation and told of any medical conditions that may require additional examination or treatment.

The material returned to Paterson Public Schools by the physician shall not include specific findings and diagnosis which are unrelated to occupational exposure.

11.0 RESPONSIBILITIES UNDER THE CHEMICAL HYGIENE PLAN

11.1 The Paterson Public Schools Chemical Hygiene Committee shall meet quarterly, or more frequently, as may be necessary. Minutes taken at these meetings shall be filed in Environmental Science Health and Safety Office. A summary of issues and actions taken will be discussed with all affected employees.

12.0 ADDITIONAL PROTECTION FOR WORK WITH SELECT CARCINOGENS, REPRODUCTIVE TOXINS, AND CHEMICALS WITH HIGH ACUTE TOXICITY

12.1 Since the Science Department is not equipped to handle highly toxic materials and if proper safeguards cannot be provided in a laboratory situation, teachers will not work with allergens, carcinogens, teratogens, reproductive toxins, or chemicals with high acute toxicity.

12.2 The Director of the Science Department shall maintain a list of known or probable carcinogens and explosives.

APPENDIX A

PRIOR VERSIONS OF THE CHEMICAL HYGIENE PLAN

Date	Audit Findings	Revisions	Authorized Auditor Signature
Nov. 2008	Initial plan		
May 6,2010	Resignation of Risk Mgr. Fall 2009, State Contractor Change. Change Appendix L	Remove Risk Mgr. from committee, page 3. Remove Veolia to TTI, page 5, additional CHC members.	*Brenda A. Zemo*
May 6, 2011	No changes		*Brenda A. Zemo*
April 17, 2012	Outdated school names & addresses, Garden state Environmental no longer consultant. Glen Korenda retired.	Updated addresses on page 7 . Removed Glen Korenda from CHC. Removed GSE reference from page 2	*Brenda A. Zemo*
April 18, 2013	P 68 Appendix k added, training records to be maintained electronically in PDPRO, p69 revised yr. strike N.Lombardi, E.Anastasio		*Brenda A. Zemo*
May 25, 2014	Material Safety Data Sheets, MSDS, p 5,88,12,19,20,26,38,42,59,65. Page 58 addition of date. P. 10 5.2.3 Waste disposal. P. 8 outdated address. Appendix C- issue 1, Spring 2008. P 25- 5 minutes. P41 pictures, chemical labeling.	Update to Safety Data Sheets to be in line with Global Harmonization System. P 58 add: must be submitted to EOHS Officer annually, no later than April 15. Page 10- detail requirements for waste disposal. P. 8 update address. Change Appendix C Issue 2, Spring 2014. P25 change to 10 minutes. Update language to reflect new requirements under Global Harmonization System.	*Brenda A. Zemo*

APPENDIX B

DUTIES OF THE CHEMICAL HYGIENE OFFICER (CHO)

1. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.

   The CHO should solicit input from school administration, science teachers and other knowledgeable individuals on present safety policies and procedures, as well as, formulating additional rules believed to be necessary to protect students and teachers alike. After establishing the guiding principles for safe laboratory operations, the CHO should communicate with all parties to ensure their understanding of what is required.

2. Monitor procurement, use, and disposal of chemicals used in the lab.

   The CHO in concert with the Chemical Hygiene Committee should try to ensure that a standardized procedure is in place for purchasing chemical materials. Oversight in this matter is critical to maintaining safe and sound purchasing practices, for example, ordering only the quantities needed for special projects or for the duration of a school year

3. See that appropriate audits are maintained.

   The CHO and members of the CHC should periodically audit the laboratories and chemical storage rooms in all district schools for continued compliance with the general safety rules and policies, safe storage, handling and use of chemicals, as well as, determining the effectiveness of the procurement plan.

4. Help project directors develop precautions and adequate facilities.

   The CHO should serve as a focal point for assisting all science teachers in creating appropriate safety policies and precautions whenever new chemicals are brought into the school, say, for special projects or new curricula. Likewise, the CHO can be instrumental in ensuring that all engineering controls for minimizing potential exposures to chemical or health hazards are operating at acceptable and legal limits. Laboratory fume hoods must be periodically checked for efficacy, as must chemical store room ventilation exhaust blowers. Other engineering controls must be similarly inspected to determine adequacy of the laboratory facilities.

5. The CHO must know the current legal requirements concerning regulated substances.

6. Working with the CHC, periodically seek ways to improve the chemical hygiene program.

APPENDIX C
PATERSON CITY PUBLIC SCHOOLS STANDARD OPERATING PROCEDURES FOR LABORATORY SAFETY, SOP
ISSUE 2
Spring 2014
ADDITIONAL SOP'S WILL BE ADDED AS NEEDED AS THEY PERTAIN TO THE CURRENT CURRICULUM AND UPON REVIEW BY THE CHEMICAL HYGIENE COMMITTEE

APPENDIX C
Table of Contents

SOP-1
General Safety Principles

The following guidelines have been established to minimize hazards and to maintain basic safety in the laboratory.

Before beginning any new procedure:

- Examine the known hazards associated with the materials being used. Never assume all hazards have been identified. Carefully read the label before using an unfamiliar chemical. Review the SDS for special handling information to determine the potential hazards and use appropriate safety precautions.

- Be familiar with the location of emergency equipment - fire alarms, fire extinguishers, fire blankets, emergency eyewash, and shower stations and know the appropriate emergency response procedures.

- Avoid distracting or startling other workers when they are handling hazardous chemicals.

- Use equipment and hazardous chemicals only for their intended purposes.

- Always be alert to unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.

- Wear eye and face protection during lab prep and lab experiments.

- Always inspect equipment for leaks, tears, and other damage before handling a hazardous chemical. This includes fume hoods, gloves, goggles, etc.

- Never taste or smell hazardous chemicals.

Health and Hygiene

The following practices have been established to protect laboratory employees from health risks associated with the use of hazardous chemical:

- Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.
- Confine long hair and loose clothing and always wear footwear which fully covers the feet.

- Do not mouth pipette.

- Use appropriate safety equipment whenever exposure to gases, vapors or aerosols is suspected and ensure exhaust facilities are working properly.

- Wash thoroughly with soap and water after handling chemicals, before leaving the laboratory and before eating or drinking.

- Replace personal protective equipment as appropriate.

- Laboratory employees shall be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure. (Check SDS Sheets)

Food and Drink in the Laboratory

The following statement is the accepted practice on food and drink in laboratories and should be followed at all times:

There shall be no food, drink, smoking or applying cosmetics in laboratories which have radioactive materials, biohazard materials, and/or hazardous chemicals present. There shall be no storage, use or disposal of food or drink in laboratories (including refrigerators within laboratories). There will be no food or drink in the laboratory prep rooms.

SOP-2
PERSONAL PROTECTIVE EQUIPMENT
Use and Maintenance of Eyewear

Safety eyewear should be as comfortable as possible, fit snugly over the eyes and around the face, and not interfere with the movement of the wearer. Safety glasses must have side shields.

Safety glasses must always be worn in laboratories where hazardous materials are stored or used. Glasses should be available for visitors if visitors are allowed into the lab.

When it is appropriate, signs should be posted outside the door stating that eye protection is required before entering the room.

Eye protection must always be worn when using:

Glassware under reduced pressure	***Cryogenic Materials***
Glassware under elevated pressure	***Explosives***
Caustics, Irritants or Corrosives	***Biohazards***
Radioactive Materials	***UV Light***
Toxic Chemicals	***Carcinogens***
Flammable Materials	***Lasers***

Eye safety equipment must be capable of being cleaned and disinfected.

Eye protection must always be kept in good condition. Staff must wash the goggles in warm soapy water and or follow the manufacturer's guidelines. Goggles and safety glasses are to be stored in a cool dry place.

All safety eyewear must be in accordance with ANSI (American National Standards Institute) Z87.1. This Z87.1 will be stamped somewhere on the frame of the glasses if they meet the ANSI design, construction, and tests.

The type of eye protection required depends on the hazard. Where there is a danger of splashing chemicals or a flying particle hazard, goggles are required. For more hazardous operations, a combination face shield and safety goggles may be required.

Corrective and Contact Lenses

Laboratory staff whose vision requires the use of corrective lenses should wear safety eye protection of one of the following types:

- Prescription safety glasses with protective lenses. These glasses must have safety frames and side shields.
- Safety eye wear that can be worn over prescription glasses without disturbing the adjustment of the glasses.

Contact Lenses

- Laboratory personnel who must wear contact lenses while performing laboratory work should be aware of the following potential hazards:

- It is virtually impossible to remove contacts from the eyes following some chemical splashes affecting the eye area.
  Contact lenses will interfere with emergency flushing procedures.
- Contacts may trap and collect fumes and solid materials on the eyes.
- If chemicals contact the eye area and the laboratory worker is unconscious, rescue personnel may be unaware that contact lenses are present.
- Certain gaseous environments can cause contact lenses to adhere to the eye.

Use of contact lenses should be considered carefully. If contact lenses are to be worn in laboratories where chemicals are used, safety goggles must always be worn over them. In a gaseous atmosphere, non-vented goggles must be worn.

Protective Clothing

Lab Coat

The lab coat is designed to protect the clothing and skin from chemicals that may be spilled or splashed. It should always be properly fitted to the wearer and should cover at least the knees. There are several different types of lab coats for different types of protection.

Lab coats or other protection outer wear (scrubs) should be worn at all times while working in laboratories where hazardous chemicals, biological agents, and radioactive materials are used.

Cotton -- protects against flying objects, sharp or rough edges, and offers some protection against minor chemical splashes.

Wool -- protects against splashes of molten materials, small quantities of acid, and small flames.

Synthetic Fibers -- protect against sparks, infrared and ultraviolet radiation. However, synthetic fiber lab coats can adversely magnify the effects of some laboratory hazards. For instance, some solvents may dissolve particular classes of synthetic fibers, thereby diminishing the protective ability of the coat. In addition, on contact with flames, some synthetic fibers will melt and adhere to the skin. This molten material can cause painful skin burns and release irritating fumes.

Aluminized and Reflective Clothing -- protect against radiant heat.

The construction of the material must also be considered (twill, felt, plain, etc.), as the materials are rated differently by various manufacturers. Lab coats should be made with snaps/fasteners which afford the wearer quick removal in the event of an emergency.

Pyrolon - fire retardant material; good chemical resistance; this material, however, is as you might guess not breathable, so it tends to keep your body quite warm and is very uncomfortable over long periods of time unless the atmosphere is quite cool.

Aprons

An apron provides an alternative to the lab coat. It is usually made of plastic or rubber to protect the wearer against corrosive materials and irritating chemicals. Paterson Public School students will use aprons.

Hand Protection

It is a good idea to always get into the habit of wearing protective gloves in the laboratory. Aside from acting as a shield between hands and hazardous materials, some gloves can also absorb perspiration and protect the hands from temperature extremes as well as cuts, abrasions, etc.

Certain glove types can dissolve when in contact with solvents, it is important to take extra care in matching the protective glove with the nature of the job. Before use, always check to make sure the gloves are in good condition and free from holes, punctures, and tears. Remember that no one glove material will protect you from all types of chemicals - choose the glove for the material being handled.

Glove types

Gloves should be selected on the basis of the material being handled and the particular hazard involved. No one glove material protects against all types of chemicals.

- Latex - not recommended for use with chemicals; used mostly in medical labs; provides light protection against irritants (some people can have an allergic reaction to latex which can lead to a serious medical condition)
- Nitrile - offers good protection for many common laboratory chemicals; the 8 mil disposable and heavy-duty nitrile should be used for more toxic chemicals and chemicals that easily penetrate the skin.
- Natural Rubber - protects against light corrosive material and electric shock.
- Neoprene - for working with solvents, oils, or light corrosive material.
- Cotton - absorbs perspiration, keeps objects clean, provides some fire retarding properties; provide **no** chemical protection.
- Zetex - when handling small burning objects. These are a good replacement for asbestos gloves.

When working with extremely corrosive material, wear thick gloves. Take extra precaution in checking for holes, punctures, and tears.

Foot Protection

Foot protection is designed to prevent injury from corrosive chemicals, heavy objects, electrical shock, as well as giving traction on wet floors. If a corrosive chemical or heavy object were to fall on the floor, the most vulnerable portion of the body would be the feet. For this reason, shoes that COMPLETELY COVER AND PROTECT the foot are required.
Fabric shoes, such as tennis shoes, absorb liquids readily. If chemicals happen to spill on fabric shoes, remove the footwear immediately.

When selecting footwear for the lab, choose sturdy leather shoes that cover the foot. These will provide the best protection.

The following shoe types may not be worn in the laboratory:

- sandals
- clogs
- high heels
- shoes that expose the foot in any manner.

Head Protection

Unrestrained long hair can be hazardous. The use of caps, elastic bands, or hair nets will prevent the hair from coming in contact with instrument/machinery parts or flame-producing source.

Respiratory Protection

Because certain laboratory procedures can produce noxious fumes and contaminants, respiratory protection may be required in your work environment. Some of the most hazardous substances have been removed from the district. Respirators are not needed at this time. **Lab personnel noting changes in air quality should contact their immediate supervisor and express their concerns.**

Whenever necessary fume hoods will be used as per the guidelines of this Standard Operating Procedures.

SOP-3

Safety Equipment

Safety Showers

Safety showers provide an immediate water drench of an affected person.

- The location of showers should be clearly marked, well lighted and free from obstacles.
- Custodial Staff will flush showers monthly. A log documenting flushes shall be maintained.

Eye Wash Facilities

Eye wash facilities are required in all laboratories where injurious or corrosive chemicals are used and/or stored.

- Optimally, those affected must have both hands free to hold open the eye to ensure an effective wash behind the shields. Eye wash facilities must be operated by a quick release system and simultaneously drench both eyes.
- Eye wash facilities must provide the minimum of a 15 minute water supply at no less than 0.4 gallons per minute.
- Eye wash facilities must not exceed 25 PSI.
- Custodial staff shall be responsible to flush out eyewash stations for ten minutes once per week. A log documenting flushes shall be maintained.

Ventilation Controls

Ventilation controls are those controls intended to minimize employee exposure to hazardous chemicals by removing air contaminants from the work site. There are two main types of ventilation controls:

General (Dilution) Exhaust: a room or building-wide system which brings in air from outside and ventilates within. Laboratory air must be continually replaced, preventing the increase of air concentration of toxic substances during the work day. General exhaust systems are not recommended for the use of most hazardous chemicals.

Fume Hoods: a ventilated, enclosed work space intended to capture, contain and exhaust harmful or dangerous fumes, vapors and particulate matter generated by procedures conducted with hazardous chemicals.

Certain types of fume hoods are not designed for the use of hazardous chemicals. If fume hood capabilities are not fully understood, check the manufacturer's specifications before using hazardous chemicals in the system.

To determine ventilation requirements, assess the SDS. Some SDS terminology, as listed below, may indicate a need for special ventilation considerations beyond general exhaust ventilation:

- use with adequate ventilation
- avoid vapor inhalation
- use in a fume hood
- provide local exhaust ventilation

Proper Use of Fume Hoods: Once a fume hood is installed in a work area, it must be used properly to be effective. For use of hazardous chemicals warranting local ventilation controls, the following guidelines should be observed:

- Conduct all operations which may generate air contaminants at or above the appropriate PEL or TLV inside a fume hood.
- Keep all apparatus at least 6 inches back from the face of the hood and keep the slots in the hood baffle free of obstruction by apparatus or containers. Large equipment should be elevated at least two inches off the base of the fume hood, to allow for the passage of air underneath the apparatus.
- Do not use the hood as a waste disposal mechanism.
- Minimize foot traffic and other forms of potential air disturbances past the face of the hood.
- Keep the hood sash closed at all times except when the hood is in use.
- NO storage of chemicals or apparatus in the hood.
- Do not have sources of ignition inside the hood when flammable liquids or gases are present.
- Use sash as a safety shield when boiling liquids or conducting an experiment with reactive chemicals.
- Prior to use, check the air flow in the hood using a continuous monitoring device or another source of visible air flow indicator. If air flow has changed, contact the Chemical Hygiene Officer for repair.
- **CAUTION**: The system must be checked prior to each use to assure it is operating.
- **CAUTION**: Never work with hazardous chemicals if the required ventilation system is not working.

  Hood inspections audits will be conducted semiannually by an independent auditor. After an inspection, hoods are passed or failed for use based on the following criteria:

1. The face velocity of air being drawn into the hood at maximum sash height is measured quantitatively in feet per minute (fpm) by a thermo Anemometer (a hot wire). One measure is taken per square foot of face space and averaged. Hoods must have an average face velocity of 60-150 fpm, depending on their design, with 100 fpm being the ideal average face velocity.

2. The turbulence of the air is measured qualitatively by releasing smoke from a smoke tube. The smoke must be captured by the hood, with a minimum of turbulence.

If the exhaust system does not pass the face velocity test and/or has excessive turbulence, it will be posted as "failed" by the inspector. The lab instructor must contact Chemical Hygiene Officer to have the system repaired before hazardous chemicals can be used in the hood.

If the exhaust system does pass, the inspector will post the date of inspection and will mark the hood to indicate proper sash position for optimum hood performance. The hood sash should be set at this point for procedures which could generate toxic aerosols, gases or vapors. In general, the sash height should be set at a level where the operator is shielded to some degree from any explosions or violent reactions which could occur and where optimum air flow dynamics are achieved. If a fume hood has no markings regarding sash height or inspection dates, please contact the Chemical Hygiene Officer to arrange for an inspection.

Proper use of Ductless Ventilation Systems: Ductless, or portable fume hoods, which employ filtration media, may be an option to conventional fume hoods. The Chemical Hygiene Committee must approve these systems prior to installation. All such equipment must be UL and ANSI approved.

Laboratory Chemical Fume Hoods

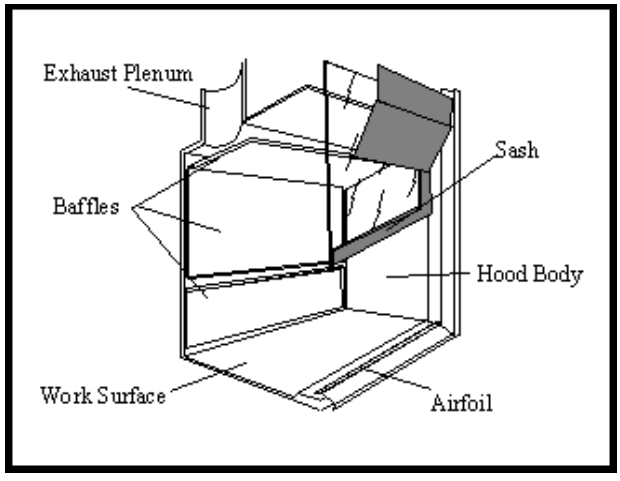
Chemical hoods capture, contain, and expel emissions generated by hazardous chemicals. In general, it is a good idea to conduct all laboratory chemical experiments in a chemical hood. While you may be able to predict the release of undesirable or hazardous effluents, in some laboratory operations surprises can always happen. Therefore, the fume hood offers an extra measure of protection.

Before use, check to see that your hood has an inspection tag. This will tell you the date of the most recent hood evaluation. If the last inspection occurred more than six months ago, contact the Chemical Hygiene officer. If the chemical hood in your lab does not appear to be in good working order (a Kimwipe or tissue paper, held inside the hood, can indicate if airflow is present if there is no working monitor on the hood), or if you have any questions, contact Chemical Hygiene Officer..

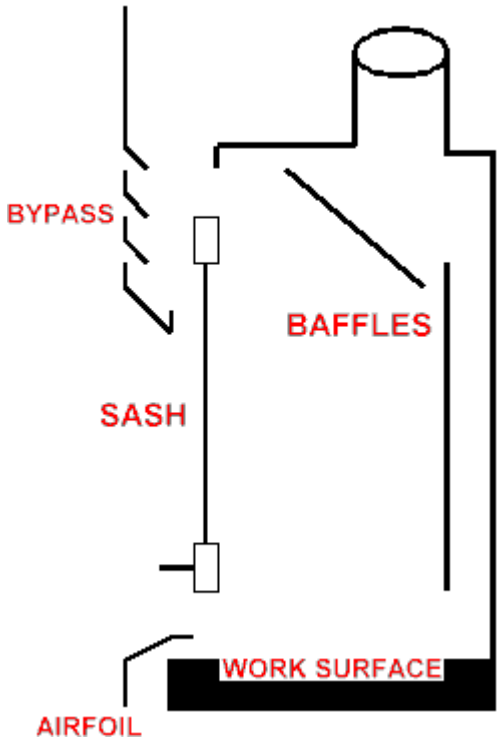
Certain laboratory procedures may require the use of perchloric acid. The use of this material may cause the formation of explosive perchlorate crystals. Special hoods, commonly known as **Perchloric Acid Fume Hoods**, **MUST** be used for this purpose. These hoods have self-contained wash-down units to inhibit crystal formation. These hoods must be posted for "Percchloric Acid use ONLY". **At this time, the Chemical Hygiene Plan and the PATERSON SCHOOL DISTRICT DOES NOT allow the use of perchloric acid.**

The purpose of a laboratory chemical hood is to prevent the escape of contaminants into the laboratory. This is accomplished by drawing air from the laboratory, past the operator, into the hood. The concentration of the contaminant in the actual breathing zone of the operator must be kept as low as possible. The ability of the hood to provide adequate protection is dependent upon the following prime concerns.

Diagram of a Chemical Fume Hood



Cutaway of a Chemical Hood



Turbulence within the Hood

As air enters the hood, it is drawn past equipment and sources of contamination toward the exhaust slots. At an air flow greater than needed to provide a good vector and containment, excessive turbulence can cause a "rolling effect" in the hood chamber. This increases the potential for greater mixing of contaminated air and room air at the face of the hood. Under poor laboratory hood arrangements, greater turbulence can result in excessive spill-out of contaminated air into the room.

Baffles/exhaust slots in chemical hoods should not be adjusted by laboratory personnel. Care should be taken to position equipment and other items in the hood so as not to block these slots.

For this reason, substandard hood operations cannot be upgraded merely by increasing air flow.

Recommended Work Practices when using the Fume Hood

All laboratory workers with access to a laboratory chemical hood should be familiar with its use.

Always work at least six inches back into the hood (six inches beyond the sash line) keeping the sash line between your body and your work.

Don't use chemical hoods as chemical storage cabinets -- keep the work surfaces clean and uncluttered. Only those chemicals/equipment in immediate use should be inside the hood.

Do not work in the hood with the sash raised above 18"--lower if possible. The hood may not perform adequately at higher sash heights. Also, the sash provides a shield between you and the operation being performed inside the hood.

Keep hood sash closed when not in use.

Keep hood "on" whenever there is any chemical activity in the hood or whenever chemicals are in the hood or chemicals stored in cabinets under the hood require ventilation.

Avoid rapid movements and excessive pedestrian traffic around the hood.

Do not block or make any adjustment to the air baffles or any part of the hood.

Do not remove the airfoil or make any change to the hood.

If the hood you are working in does not have a hood alarm/monitor that is properly functioning, place a strip of tissue on the bottom corner at each end of the sash. This will provide basic information as to whether the hood is pulling air inward. If the tissue is not pulled inside and does not show movement, the hood sash should be closed and a maintenance order sent to the Chemical Hygiene Officer and Committee.

Maintenance of Chemical Hoods

Chemical hoods are surveyed twice a year by an independent auditor.

The hood must always be in good condition and capable of routine use. Any hood or component of ventilation not properly functioning must be taken out of service and clearly tagged.

The lab worker should not be able to detect strong odors released from materials in the hood area. If odors are detected, check to make sure that the ventilation fan is turned on. To have the operating condition of a fume hood checked, contact the Chemical Hygiene Officer.

An emergency plan should exist in case of hood ventilation malfunction.

All protective clothing should be worn when working with chemicals in the hood. In addition to gloves, safety glasses, and lab coats, a face shield, as required when referring to the Material Safety Data Sheets, will provide an extra measure of safety from reactive chemicals.

Solid objects or materials should not be allowed to enter the exhaust ducts at the rear of the hood, as they can become lodged in the duct or fan.

SOP- 4
Laboratory Fume Hood Operation Checklist

School Building:_____ **Room/Laboratory #:** _____

Fume Hood Number: _____

Fume Hood Location in Lab: _____

#	FUME HOOD OPERATIONS	YES	NO	N/A
1.	**Blower Motor Fan Switch is in working order**			
2.	**With blower fan on, air flows into fume hood from room.** (Test with sash lowered at least 2/3s of way down. A piece of tissue paper held at the bottom edge of sash will be pulled toward inside of hood. Note that this is just a simple qualitative test and is no guarantee of optimal hood performance)			
3.	**Interior Fume Hood light is operable**			
4.	**Window sash can be moved up and down freely**			
5.	**Equipment in hood, if any, is needed for present project**			
6.	**There is no excess equipment present**			
7.	**Equipment is set back at least 6 inches from front of fume hood**			
8.	**The chemicals in the hood will be used for the present project**			
9.	**Fume Hood appears to be functioning normally and may be used.**			
9a.	**If "NO" has been checked for # 9, DO NOT USE this fume hood.**			
9b.	**An "Out Of Order" sign has been taped to the sash.**			
9c.	**A Service Technician or Maintenance Worker will be contacted before the end of day.**			

Date inspection:_____ Name (Print): _____

Signature: _____

Copy this form for: **The Chemical Hygiene Officer or the Science Department Director**

Fume Hood Out Of Order Sign

Out Of Order Sign

CAUTION

OUT OF ORDER!

DO NOT USE UNTIL ITEM IS REPAIRED OR REPLACED.

Paterson Public Schools

SOP-5
PROCEDURES TO BE CARRIED OUT UNDER A FUME HOOD OR BEHIND A SHIELD

I. The following procedures will be carried out under a fume hood when using concentrated materials that can produce dangerous levels of gases or vapors.
For example:

1. Concentrated acids, bases or ammonia
2. Organic Solvents
3. Some specifics
    a. Noxious gas release
    b. HCL
    c. Nitric Acid
    d. Sulfuric Acid
    e. Acetic Acid

II. Experimental demonstrations will be carried out behind a protective demonstration shield if there is a potential for exposure to chemical or physical hazards.

III. Student Use of Fume Hoods is permissible under the supervision of a faculty member who has been trained in fume hood use. Students may never be left alone while working under the fume hood.

SOP-6

Emergency/Medical Procedures

Emergency / Medical Procedures

Basic Steps for Emergency and Spill Response

Releases of hazardous substances that pose a significant threat to health and safety or that, by their very nature, require an emergency response regardless of the circumstances surrounding the release or the mitigating factors are emergency situations. The following definitions designate an emergency situation:

1. The spill of an unknown chemical is unclear to the person causing or discovering the spill.

2. The release of a chemical hazard requires immediate evacuation of persons.

3. A chemical release that can lead to:

   a. Fire, suspected fire, explosion or other imminent danger

   b. Conditions that are Immediately Dangerous to Life and Health (IDLH)

   c. High levels of exposure to toxic substances.

4. The person(s) in the work area is incapable of handling the severity of the hazardous release which could easily exceed the exposure limit.

BASIC STEPS FOR SPILL RESPONSE

Conversely, releases that do not pose significant safety or health hazards to person(s) in the immediate vicinity or to the person(s) cleaning releases, do not have the potential to become emergencies within a short time frame are not emergency situations. The following situations **ARE NOT emergency situations**:

1. The person causing or discovering the release understands the properties and can make an informed decision as to the exposure level.

2. The release can be appropriately cleaned up by the lab personnel, who have been trained, using authorized (certified) spill kits

3. The materials are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to persons in the immediate work area or those assigned to clean up the activity.

4. Incidental releases of hazardous substances that are routinely cleaned up by trained custodians from outside the immediate release area..

EMERGENCY SITUATION- FIRE PROCEDURE TO FOLLOW

Only employees who have been trained in the proper use of handling a fire extinguisher may use a fire extinguisher.

If you have not been trained you may NOT use a fire extinguisher.

Each employee should make themselves familiar with the locations of fire extinguishers, fire blankets, and fire alarms.

NEVER place yourself at risk to extinguish a fire. The following steps are basic protocol for handling a fire or fire-related emergency situation in the laboratory:

1. Pull the fire alarm.

2. Evacuate

3. Call -9-1-1 from a safe location.

4. Notify the building administrator from a safe location.

5. Notify the School Nurse

EMERGENCY SITUATION – SPILL

If the spill is of high toxicity, a carcinogen, has a low LD_{50}, is flammable, or you are incapable of handling the spill or is the spill greater than four liter, execute the following:

1. Call 9-1-1

2. Notify the School Nurse

3. Evacuate personnel from the spill area and alert neighbors to the spill.

4. Isolate the spill area and close doors to the room where the spill occurred.

5. Remove ignition sources and shut down equipment.

6. Establish exhaust ventilation to the outside of the building only.

7. Open windows.

Evacuation of the building is mandatory if chemicals or contaminants could enter the air circulation system of the building or in the case of fire.

Emergency Situation for a victim with a body splash:

1. Remove person(s) from spill area to fresh air only if attempt to rescue victim(s) does not present a danger to the rescuers.

2. Remove contaminated clothing while under an emergency shower.

3. Flood affected area with cold water for at least 15 minutes or longer if pain persists.

4. Wash skin with mild soap and water - do not use neutralizing chemicals, unguents, creams, lotions, or salves.

5. Call 9 1 1 or direct a bystander to call.

6. Contact the Chemical Hygiene Committee and inform what chemical(s) is involved.

Attend to victims for an eye splash of a hazardous substance:

1. Notify the School Nurse

2. Remove victim(s) from spill area to fresh air only if attempt to rescue victim(s) does not present a danger to the rescuers.

3. Lead the victim(s) immediately to an emergency eye wash facility.

4. Hold eye lids open.

5. Flush eyes for at least 15 minutes or longer if pain persists.

6. Call 9 1 1 or direct a bystander to call.

7. Contact Chemical Hygiene Committee and inform what chemical(s) is involved.

Spill Kits

Ready access to a chemical spill kit is required in laboratories that work with hazardous chemicals. The kits will be stored in a five gallon plastic pail. Minimally, such a kit should contain:

Splash resistant goggles	Chemical resistant gloves
Disposable apron	Chemical Resistant boots, non skid
Plastic bags	Multi-chemical sorbent (enough for 2 gallon spill)
Scooper	Tongs
Small socks to contain the spill	Chemical absorbent pads
Hazard Waste Labels	

Most spills greater than 4 liters in volume require assistance from trained personnel, the CHO or his designee.

Some sorbents are chemically specific. The best sorbents are those which can be used to clean up all types of chemical spills. Check absorbents in spill kits for their absorbency range. Each laboratory's spill kit should be kept in a readily accessible location and each employee should be trained on how to use the spill kit.

Non-Emergency Situation - Spill.

If the spill is less than four liters and the chemical involved is of low toxicity and a low flammable hazard, handle it in the following manner:

If there are questions about proper spill response techniques, call the Chemical Hygiene Officer.

1. Locate the spill kit.
2. Wear the proper protective equipment.
3. Always wear gloves and protective eye wear.
4. Use additional protective equipment such as an apron, coveralls, or boots.
5. Confine or contain the spill.

For non-reactive spills:

1. Cover liquid spills with spill kit absorbent and scoop into a plastic disposal bag.
2. Sweep solid materials into a dust pan and place in a sealed container.
3. Dispose of waste as normal trash as long as substance is non-volatile, non- hazardous.

For reactive or potentially reactive spills:

1. Cover liquid spill with spill kit absorbent and scoop into an appropriate disposal container.
2. Wet mop dry substances to avoid spreading hazardous dust, provided it is non- water reactive.
3. If spilled chemical is a volatile solvent, transfer disposal bag to a hood for evaporation of solvent.

Power Outages.

Evacuate the building after the following steps have been taken:

1. Place lids on all open containers of volatile chemicals.
2. Lower the sash on chemical fume hoods.
3. Shut down all equipment (leaving cooling water and purge gases on as necessary).
4. Turn off ignition sources.
5. Secure or isolate reactions that are underway (boiling liquid on a hot plate, distillations).
6. Close fire doors.
7. Take your books, coats, purse/wallet, keys, etc. with you.
8. Lock the outside door to the lab.
9. Have a flashlight conveniently located or other emergency lighting.

10. Make sure that all emergency contact numbers on the door are accurate and updated.

Injury and Illness

For medical treatment, under current Paterson City Public School policies and procedures, affected employees must seek care from the school district's authorized treatment center.

The supervisor or building administrator must ensure that the appropriate injury forms are completed. The forms are available from the Office of Risk Management. If you have any questions regarding injury and illness procedures, contact your supervisor, principal, vice principal or the **Chemical Hygiene Officer**.

Minor First Aid

First Aid Kits. First aid kits are accessible in each laboratory. These kits are for use on minor injuries only, cut, scrapes, etc. Anyone providing first aid must be authorized under the Exposure Control Plan.

Do not put any ointments or creams on wounds or burns. Use cool water. The SDS contains specific first aid information for a given chemical, but emergency room treatment is best.

Medical Consultations and Examinations

The district will provide when requested the following information to a physician treating an employee.

1. The identity of the hazardous chemical(s) to which the employee may have been exposed.

2. A description of the conditions surrounding the exposure, including available quantitative exposure date.

3. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

Medical Surveillance

The surveillance is based upon "risk assessment" -- an evaluation of the particular exposures and risk category of the individual employee. This may vary from time to time for an individual, depending upon personal health factors and changes in exposures. Documents such as the material safety data sheets, hazardous substance fact sheets and information collected from NIOSH, HMIS, NFPA are used to determine the necessity for surveillance.

Based on the current curriculum, it has been determined that medical surveillance is not required at this time.

SOP-7
Housekeeping

Safety follows from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

1. Keep work areas clean and uncluttered with chemicals and equipment. Clean up work areas upon completion of an operation or at the end of each work day.

2. Dispose of waste as per the Paterson City Public School Hazardous Waste Management Plan, available in the main office of each building and the Chief Custodian's Office.

3. A separate waste receptacle must be designated for non-contaminated glass. Follow guidelines established in the Paterson City Public School Hazardous Waste Management Plan for disposal of contaminated glass.

4. Clean spills immediately and thoroughly, as per the guidelines established in section five of the Chemical Hygiene Plan and the emergency/medical procedure SOP. Ensure a chemical spill kit is available and that employees know how to use it.

5. Do not block exits, emergency equipment or controls or use hallways and stairways as storage areas.

6. Assure hazardous chemicals are properly segregated into compatible categories (see SOPS FOR Chemical handling).

7. Complete SOP- 8.

SOP-8
LABORATORY/STOREROOM HOUSEKEEPING INSPECTION CHECKLIST

✔	Good Housekeeping Inspection Items
	Laboratory and Storeroom floors are clean and free of hazards.
	There are no carelessly discarded objects, dropped objects, or spilled material on the floor.
	No chemical containers are stored on the floor.
	Walking/working surfaces do not have any visible spilled liquids or solids.
	Tables, chemical hoods, floors, aisles, and desks are clear of all material not being used.
	Frequently used bench apparatus is kept well away from any edges and secured whenever possible.
	Storage shelves, bench tops and bench liners are free of visible contamination.
	Sharp or pointed tools are properly sheathed or stored.
	Excess cardboard boxes, Styrofoam, packing materials, etc. are not stored under lab benches, on shelves, or in cabinets anywhere in the laboratory.
	Work areas are cleaned upon completion of an experiment or at the end of each day.
	There is clear space around storage shelves, safety showers, eyewashes, fire extinguishers, and electrical controls.
	All passageways to exits are clear of obstructions.
	Doors, drawers and cabinets are kept closed.
	All safety signage posted: goggles, closed toe shoes, chemical resistant gloves, lab coat, and aprons.
☝	***Note: Any unchecked items must be corrected immediately or by the end of the day!***

	Corrective action was taken during inspection.
	Corrective actions still to be taken: _____ _____ _____

Building: _____ Storage Room, Laboratory or Work Area Inspected: _____
Name:_____ Date: _____
Signature: _____

SOP-9
Proper Chemical Labeling & Warning

All applicable labeling criteria must be followed as per the Paterson City Board of Education Hazard Communication Program. This serves as a brief summary. Please refer to the Hazard Communication Program and the Global Harmonization System, GHS, for more details. Laboratory supervisors must ensure that all incoming containers of hazardous materials bear a label specifying:

- Appropriate hazard warnings.
- Identification of the chemical in the container and identification of the hazardous component(s).
- Name, address, and telephone number of the chemical manufacturer, importer, or responsible party (e.g. principle investigator).
- Date of receipt or generation of the chemical.

Laboratory instructors must not remove or deface labels on containers of hazardous chemicals.

When chemicals are transferred from the manufacturer's original container to a secondary container, that new container must be appropriately labeled as to chemical identity and hazard warning(s) to both the Hazard Communication Standard and the NJ Community Right to Know Universal Labeling requirements.

Chemical Labeling -- Hazard Information

Hazard warnings found on the labels of hazardous chemical containers may be composed of pictograms, symbols, and signal words, or any combination thereof which convey the hazard(s) of the chemical.
Hazard warnings

PICTOGRAMS

Pictograms shall replace all pictures to be in line with GHS. The pictogram on the label is determined by the hazard classification.

Symbol

Symbol hazard warnings provide basic information in determining what precautionary measures to use when handling hazardous chemical substances and/or dealing with a fire.

The National Fire Protection Association (NFPA) uses a symbol system designed as a diamond-shaped label containing four differently colored squares.

A number (0 - 4) or an abbreviation is added to each square indicating the order of hazard severity (4 indicating the highest degree of severity).

SOP-10
Chemical Handling and Storage

The decision to use a hazardous chemical should be a commitment to handle and use the chemical properly from initial receipt to disposal.

- Information on proper handling, storage and disposal of hazardous chemicals and access to related SDS must be made available to all laboratory employees prior to the use of the chemical.
- Always purchase the minimum amount necessary to maintain operations.
- Chemical containers with missing or defaced labels or that violate appropriate packaging regulations must not be accepted.
- Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.
- Chemicals must not be stored on high shelves above eye level and large bottles should be stored no more than two feet from floor level.
- Chemicals shall be segregated by compatibility.
- Chemical storage areas must be labeled as to their contents.
- Storage of chemicals at the lab bench or other work areas should be kept to a minimum.
- Any chemical mixture shall be assumed to be as toxic as its most toxic component.
- Substances of unknown toxicity shall be assumed to be toxic.

Transferring of Chemicals

When transporting chemicals outside the laboratory, precautions should be taken to avoid dropping or spilling chemicals. Some of the precautions are but are not limited to the following:

- Use of the proper container as specified in the SDS.
- Cap the container when transporting.
- Use the correct container for dilution.
- Use the correct container when dispensing from a larger container into a smaller vessel.
- Label all containers as required under the Hazardous Communication Standard , GHS and the NJ Community Right to Know Universal Labeling Requirements.
- Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.
- When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.

SOP-11
CORROSIVE CHEMICALS

General information:

Corrosive chemicals because of their nature, prevalence in the laboratory, and variety of concentrations, constitute a series of hazards ranging from poisoning, burning and gassing, through explosion. Serious injury can result from exposure to strong acids or caustics in either the liquid, solid, or gaseous states.

Common corrosives are the halogens, acids, and bases. Skin irritation and burns are the typical results when the body contacts an acidic or basic material.

NEVER try to neutralize an acid or caustic spill on living tissue. Eye wash fixtures or safety showers must be used within ten seconds after exposure for at least fifteen minutes to prevent extensive damage. Contact lenses must not be worn when using corrosives.

Storage of corrosive chemicals:

- Corrosive chemicals must be stored in approved corrosive storage cabinets may be used. Storage trays or sand boxes must be of sufficient volume to contain all the acid from the bottles if all the bottles were to break. The storage area or cabinet must be labeled to identify the agents stored therein and the hazards present, along with decontamination and first aid instructions.

SOP-12
FLAMMABLE CHEMICALS

General information:

The vast majority of flammable chemicals used by laboratories are flammable liquids, organic solvents whose vapors can form ignitable mixtures with air.

Flammable liquids are classified by their flash points. A flash point is defined as the lowest temperature at which a fuel-air mixture present above the surface of a liquid will ignite if an ignition source is introduced. The dangers of ignition of these solvents can be particularly insidious because they generate vapors with densities greater than air. The vapors tend to be immiscible with air and they flow along surfaces and still remain within their flammable limits in air. Ignition of vapors at a remote source can trigger a flashback along the vapor trail to the liquid source.

It is important to remember that the ignition source DOES NOT have to be in the form of a spark or flame, room temperature alone can supply the energy.

Three signal words are used to describe the degree of hazard posed by flammable liquids:

DANGER! (highest degree of hazard)
Class 1A & B flammable liquids - flash point is less than 73 F.

WARNING! (intermediate degree of hazard)
Class 1C flammable liquid flash point is at or above 73 F but below 100 F.

CAUTION! (lowest degree of hazard)
Class II flammable liquid - flash point is at or above 100 F but below 140 F.

Storage of flammable and combustible liquids:

- NO bulk quantities of flammable and combustible liquids will be stored.
- Working supplies of flammable or combustible liquids within laboratory areas will be stored in NFPA-approved flammable liquid safety storage cabinets when not in use. Working supplies of flammable or combustible liquids outside of approved safety cabinets shall not exceed one (1) gallon.
- The volume of flammable and combustible liquids stored in ALL flammable safety cabinets shall not exceed the quantities specified in Table 1. The maximum size of individual containers shall not exceed the volume specified in Table 2.

- Flammable or combustible liquids shall not be stored in any refrigerator other than an Underwriter Laboratory (UL) approved, explosion-proof refrigerator. All other refrigerators and freezers shall be labeled "CAUTION! - NOT SUITABLE FOR STORAGE OF FLAMMABLES".

- Flammable and combustible liquids must be isolated from oxidizers, chemicals capable of spontaneous heating, explosives, materials reacting with air or moisture to liberate heat, and ignition sources.

- Previously opened ether cans must be stored in an area ventilated enough to prevent build up of vapor.

TABLE 1
Maximum Quantities (Gallons) of Flammable & Combustible Liquids Allowed in Laboratories

	Sprinkled Flammable or Combustible Liquid Class		**Un-Sprinkled Flammable or Combustible Liquid Class**	
Square Feet of Laboratory	Flammable (Class I Liquids)	Total Flammable and Combustible	Flammable (Class I Liquids)	Total Flammable and Combustible
100	4	8	2	4
200	8	16	4	8
300	12	24	6	12
400	16	32	8	16
500	20	40	10	20
600	24	48	12	24
700	28	56	14	28
800	32	64	16	32
900	36	72	18	36
1000	40	80	20	40
1500 & larger	60 = max	120 = max	30 = max	60 = max

TABLE 2
Maximum Allowable Container Capacity

	Flammable Liquids			**Combustible Liquids**	
Container Type	**IA**	**IB**	**IC**	**II**	**IIIA**
Glass	1pt	1qt	1 gal	1 gal	5 gal
Metal or Approved Plastic	1 gal	5 gal	5 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal	5 gal	5 gal

[1]. In teaching laboratories, no container for Class I or II liquids shall exceed a capacity of 1 gal. except that safety cans may be of 2-gal capacity.

[2]. Glass containers as large as 1 gal (3.785 L) shall be permitted to be used if needed and if the required purity would be adversely affected by storage in a metal or an approved plastic container, or if the liquid would cause excessive corrosion or degradation of a metal or approved plastic container.

Control measures for safe use of flammable and combustible liquids:

- Transfer flammable and combustible liquids in a functioning fume hood.
- Eliminate sources of ignition (i.e. open flames, hot plates, etc.) from work areas where flammable and combustible liquids are used.
- Ethers shall be used ONLY in a working fume hood from which all possible ignition sources have been removed.
- Dry chemical fire extinguishers or CO_2 extinguishers can be used to fight a flammable or combustible liquid fire. The dry chemical extinguisher is the best choice.

SOP-13

OXIDIZERS, WATER REACTIVE MATERIALS, PYROPHORIC MATERIALS, PEROXIDIZABLE CHEMICALS, LIGHT SENSITIVE MATERIALS AND UNSTABLE MATERIALS

Oxidizers:

These are materials which react with other substances by giving off electrons and undergoing reduction. This reaction may result in fire or explosion. The intensity of the reaction depends on the oxidizing-reducing potential of the materials involved.

1. Know the reactivity of the materials involved in the experiment or process. Ensure there are no extraneous materials in the area which could become involved in a reaction.

2. If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.

Water Reactive Materials:

These are materials which react with water to produce a flammable or toxic gas or other hazardous conditions. A fire or explosion often results. Safe handling of water reactive materials will depend on the specific material and the conditions of use and storage. Examples of water reactive chemicals include alkali metals such as lithium, sodium, and potassium; acid anhydrides, and acid chlorides.

Peroxidizable Chemicals (Organic Peroxides):

These are materials which undergo auto-oxidation (a reaction with oxygen in the air) to form peroxides (an O_2 group) which can explode with impact, heat, or friction. Since these chemicals may be packaged in an air atmosphere, peroxides can form even though the container has not been opened, necessitating careful handling.

Date all peroxidizables upon receipt and upon opening. Dispose of or check for peroxide information after 6 months of opening following all Hazard Waste Plan Requirements.

- Do not open any container which has obvious solid formation around the lid.
- Addition of an appropriate inhibitor to quench the formation of peroxides is specified in the Material Safety Data Sheet.
- It is recommended to chemically test for peroxides periodically.

- Follow the same basic handling procedures as for flammable materials.

Light-Sensitive Materials:

These are materials which degrade in the present of light, forming new compounds that can be hazardous, or resulting in conditions such as pressure build-up inside a container which may be hazardous. Examples of light sensitive materials include chloroform, tetrahydrofuran, ketones and anhydrides.

1. Store light-sensitive materials in a cool, dark place in amber colored bottles or other containers which reduce or eliminate penetration of light.

Unstable Materials:

These are compounds which can spontaneously release large amounts of energy under normal conditions, or when struck, vibrated, or otherwise agitated. Some chemicals become increasingly shock-sensitive with age. Of great concern in the laboratory is the inadvertent formation of explosive or shock-sensitive materials such as peroxides, perchlorates (from perchloric acid), picric acid and azides.

SOP-14
REACTIVE AND EXPLOSIVE CHEMICALS

Reactivity hazards:

A reactive material is one that can undergo a chemical reaction under certain specified conditions. Generally, the term "reactive hazard" is used to refer to a substance that undergoes a violent or abnormal reaction in the presence of water or under normal ambient atmospheric conditions.

Explosive hazards:

An explosive is a substance which undergoes a very rapid chemical transformation producing large amounts of gases and heat. The gases produced, for example, nitrogen, oxygen, carbon monoxide, carbon dioxide, and steam, (due to heat produced), rapidly expand at velocities exceeding the speed of sound. This creates both a shock wave and noise .Types of explosive hazards are:

1. High (detonating) explosive: Chemical transformation occurs very rapidly with detonation rates as high as four miles per second. The rapidly expanding gases produce a shock wave which may be followed by combustion.

a. Primary high explosive: Detonating wave produced in an extremely short period of time. May be detonated by shock, heat or friction. Examples are lead azide, mercury fulminate, nitroglycerin and lead styphnate.

b. Secondary high explosive: Generally needs a booster to cause detonation. Relatively insensitive to shock, heat or friction. Examples are tetryl, cyclonite, dynamite, and TNT.

2. Low (Deflagrating) explosive: Rate of deflagration up to 1,000 feet per second. Generally, combustion is followed by a shock wave. Examples are smokeless gunpowder, magnesium metal, and Molotov Cocktails.

3. Practically speaking, the designation of an explosive as high or low does not indicate the explosion hazard (i.e. the power and hence, resultant damage from explosion), but only the rate of the chemical transformation. Explosions can and do occur as a result of reactions between many chemicals not ordinarily considered as explosives! Ammonium nitrate, a common fertilizer, can explode under the right conditions. Alkali metals and water will explode, as will water and peroxide salts. Picric acid and certain other compounds become highly explosive with age. Gases, vapors, and finely divided particulates, when confined, can also explode if an ignition source is present.

Handling reactive and explosive chemicals:

ALWAYS exercise extreme caution when working with reactive chemicals.

Protective gear must be worn. The work area must be equipped with a safety shower, eye wash station, and appropriate fire fighting equipment.

Storage of reactive and explosive chemicals:

Containers of reactive chemicals must be tightly sealed and stored by class away from other classes of chemicals, particularly organic materials, flammables, corrosives and toxicants. They must be protected from extremes of temperature, rapid temperature changes, shock and excessive vibration.

Ethyl ether, isopropyl ether, dioxane, tetrahydrofuran and many other ethers tend to absorb and react with oxygen from the air to form unstable peroxides which may detonate with violence. Always check the expiration date on the container before use. The approximate shelf life of isopropyl ether is three months and for most other ethers is twelve months, (or one month after opening). All containers of peroxide forming chemicals must be marked with the date received, date first opened and the expiration date.

Table 1: Approved Reactive and Explosive Chemicals

Chemical	Approved Quantity
Magnesium	
Iso-Octane	
Ferric Chloride	
Acetone	
Acetalaldehyde	

SOP-15
Compressed Gases

Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.

A. **Cylinders with regulators must be individually secured.** Only cylinders with valve protection caps securely in place may be safely gang-chained (chained in groups).

B. When sorting or moving a cylinder, have the valve protection cap securely in place to protect the stem.

C. Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.

D. Use an appropriate cart to move cylinders.

E. Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.

F. Oil or grease on the high pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Use an oxygen approved regulator.

G. Always wear goggles or safety glasses with side shields when handling compressed gases.

H. Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled.

I. When work with a toxic, corrosive, or reactive gas is planned, the CHC must be contacted for information concerning specific handling requirements. Generally, these gases will need to be used and stored with local exhaust ventilation such as a lab hood or a gas cabinet designed for that purpose.

SOP-16

Unattended Operations

At times, it may be necessary to leave a laboratory operation unattended. Follow these basic guidelines in the design of an experiment to be left unattended:

A. Always check with your CHC or its designee or laboratory supervisor to determine if it is necessary to leave a laboratory operation unattended. If necessary, develop a protocol with your CHC for the unattended operation of potentially dangerous equipment or methods. Develop a protocol for potential interruptions in electric, water, inert gas and other services, and provide containment for toxic substances as part of the protocol.

B. A warning notice must be posted in the vicinity of the experiment if hazardous conditions are present.

Working Alone

Avoid working alone whenever possible. Students working after hours are not permitted to conduct experiments alone. A qualified faculty member MUST BE available in the lab/prep room.

SOP-17

MERCURY SPILLS

Elemental Mercury is a heavy, silvery metal element that is liquid at room temperature. Liquid mercury evaporates at room temperature and these vapors are invisible, odorless, and at high levels, are very toxic. Mercury vapors can harm the nervous system, cardiovascular system, digestive tract, kidneys, and the development of young children. Upon spilling it will bead up and spread readily. The amount of vapor elemental mercury produces is related to the amount spilled, surface area (amount of beads produced), temperature (vapor increases with warmer air), air flow and physical disturbance of the spill.

Since Mercury is highly toxic, **NO PATERSON CITY PUBLIC SCHOOL EMPLOYEE WILL CLEAN ANY MERCURY SPILL**.

Limit access to the area and contact the Environmental Science, Health and Safety Officer immediately at 10953 or 973-518-1053 (cell phone).

SOP-18

Chemicals that Can Be Combined for Disposal

Halogenated

butyl chloride (n-)
chlorobenzene
chlorotoluene (o-)
cyclohexane
dichlorobutanone (1,4)
ethylene dichloride
methylene chloride; dichloromethane
tetrachloroethane (1,1,2,2-)
trichloroethane (1,1,1-)

Non Halogenated

acetone
acetonitrile
amyl acetate
amyl acetate (iso-)
amyl alcohol
amyl alcohol (N-)
aniline
anisole
benzene
butanol (1-)
butanol (iso-)
butanone (2-)
butyl alcohol (sec-)
butyl benzene
butyl "cellosolve"
cyclododecanecyclohexene
diethylene glycol
ethyl acetate
ethyl alcohol
ethyl benzene
ethyl formate

Non Halogenated (con't)

ethyl hexanol (2-)
formamide
heptane
heptanone (2-)
heptanone (3-)
heptanone (5-)
heptyl alcohol
hexane
hexyl alcohol (n-)
Karl Fischer Reagent
methoxy-methoxy ethanol
methoxyethanol (2-)
methyl alcohol; methanol
methyl acetate
methyl benzoate
methyl cyclohexane
methyl salicylate
methyl-2-pentanol (4-)
methyl-2,4-pentanediol (2-)
nitrobezene
octane (iso-)
octanol (2-)
pentanol (2-)
pentanone (2-)
pentanone (3-)
petroleum ether; ligroin
propyl alcohol
propylene oxide
pyridine
tetrahydrofuran
toluene
xylene

SOP-19

COMMON LAB CORROSIVES

Organic Acids	Elements	Inorganic Acids (con't)
	Bromine (g)	Tin Chloride
Acetic Anhydride	Chlorine (g)	Titanium Tetrachloride
Acetyl Bromide	Fluorine(g)	
Acetyl Chloride	Iodine(g)	**Organic Bases**
Benzoyl Bromide	Phosphorus	Ethylenediamine
Benzoyl Chloride		Ethylimine
Benzyl Bromide	**Acid Salts**	Hexamethylenediamine
Benzyl Chloride	Aluminum Trichloride	Hydroxylamine
Butyric Acid	Ammonium Bifluoride	Phenylhydrazine
Chloroacetic Acid	Antimony Trichloride	Piperazine
Chloroacetyl Chloride	Calcium Fluoride	Tetramethylammonium Hydroxide
Chlorotrimethylsilane	Ferric Chloride	Tetramethylethylenediamine
Dichlorodimethylsilane	Sodium Chloride	Trimethylamine (aa)
Dimethyl Sulfate	Sodium Fluoride	
Formic Acid		
Methyl Chloroformate	**Inorganic Acids**	
Oxalic Acid	Bromine Pentafluoride	
Phenol	Chlorosulfonic Acid	
Propionyl Bormide	Chromerge(a)	
Propionyl Chloride	Hydrobromic Acid	
Salicylic Acid	Hydrochloric Acid	
Trichloroacetic Acid	Hydrofluoric Acid	
	Hydroiodic Acid	
Inorganic Bases	Nitric Acid	
Ammonium Hydroxide	No-Chromix*(a)*	
Ammonium Sulfide	Perchloric Acid	
Calcium Hydride	Phosporus Pentachloride	
Calcium Hydroxide	Phosphorus Tribromide	
Calcium Oxide	Phosphorus Trichloride	
Hydrazine	Sulfuric Acid	
Potassium Hydroxide	Sulfuryl Chloride	
Sodium Hydride	Thionyl Chloride	
Sodium Hydroxide	Tin Bromide	

References:

The Foundations of Laboratory Safety, S. R. Rayburn, 1990.
Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council, 1981.

SOP-20
EXAMPLES OF INCOMPATIBLE CHEMICALS FOR DISPOSAL

From: "Safety in Academic Chemistry Laboratories," American Chemical Society

Chemical	Is Incompatible With
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitries, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens

Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen: flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

SOP 21
WASTE STREAM LOG

Use this log for each waste stream container, in addition to the Hazard Waste Label, if applicable.
School_____ Lab/ Prep Room # _____ Container # _____

Circle one: Hazardous Waste Stream or Non Hazardous Waste Stream. Complete this log each time you add to this waste container. One log will be used for each waste stream container. MUST BE SUBMITTED TO EOHS OFFICER ANNUALLY NO LATER THAN APRIL 15.

DATE	WASTE STREAM	VOLUME	CONCENTRATION	pH	SIGNATURE

APPENDIX D

LABORATORY STANDARD TRAINING PROGRAM ELEMENTS

I. Occupational exposure to hazardous chemicals in laboratories standard (29 CFR 1910.1450):

A. Content of the standard and appendices.

B. Location and explanation of the Chemical Hygiene Plan.

C. Location of reference materials and Safety Data Sheets (SDSs).

II. Physical Hazards:

A. Combustible liquid

B. Compressed gas

C. Explosive

D. Flammable

E. Organic peroxide

F. Pyrophoric

G. Unstable (reactive)

H. Water reactive

III. Health Hazards:

A. Local

1. Irritants

2. Corrosives

B. Systemic

1. Toxics

a. Acute/Chronic

b. Nervous System Effects

c. Respiratory System Effects

d. Reproductive System Effects

2. Sensitizers

IV. Route of Exposure:

A. Inhalation

B. Skin Absorption

C. Ingestion

V. Amount of Absorption:

A. Gases/Vapors

B. Particulates

1. Dust

2. Mist

3. Fume

VI. Dose:

A. Work Practices

B. Personal Hygiene

C. Weight

D. Personal Protective Equipment

E. Environmental Controls

VII. Duration of Exposure:

VIII. Exposure Limits Including Permissible Exposure Limits (PEL's):

A. Definition

B. Established by:

1. Chemical similarity

2. Animal studies

3. Human studies

IX. Air Sampling:

A. Required by PEOSH

B. Employee reports of illness

C. Confined space work

D. Other

X. Response:

A. Age

B. Gender

C. Body size

D. Health status

E. Personal habits

F. Other exposures

XI. Employee Concerns:

A. Symptoms limited/many causes

B. Documentation

C. Referral

D. Refusal to work

XII. Facility Specific Standard Operating Procedures (see Appendix C)

Appendix E

Paterson NEW EMPLOYEE HEALTH AND SAFETY CHECKLIST

INSTRUCTIONS:
This form provides a guide for the joint review, between THE Chemical Hygiene Committee, supervisor and employee, of necessary safety precautions and potential hazards involving the employee's job tasks. The supervisor and employee must initial and date all items appropriate to the employee's position and activities. Indicate non-applicable items as "N/A".

Submit completed form to the CHC within the employee's first 2 weeks of duty.

Employee Name:	Date Reported For Duty:
Bldg/Room:	Ext:
Supervisor Name:	School:

Item	Date	Supervisor Initials	Employee Initials
1. SAFE WORK PRACTICES AND PROCEDURES REVIEWED			
a. Protective clothing			
b. Head, foot, ear protection			
c. Prot. eye-ware obtained			
d. Baseline med. exam sched.			
e. Copies of Hazardous Agent Protocols provided			
f. Workers' comp. benefits explained			
g. Other (specify)			
2. SAFETY MANUAL SECTIONS REVIEWED			
a. Emergency Procedures			
b. Hazard Communication Program*			
c. Hazardous Materials**			
d. Hazardous Waste Disposal**			
e. Other (specify)			
3. USE OF SPECIAL EQUIPMENT, TOOLS AND FACILITIES EXPLAINED (List)			

* Required for all laboratory workers.
** Required for all employees working with hazardous materials.

APPENDIX F Awareness Certificate

The Occupational Safety and Health Administration (OSHA) requires that all laboratory employees be made aware of the Chemical Hygiene Plan (CHP) at their place of employment.

By signing the certification form, you acknowledge that you are aware of the PATERSON CHP and the policies and procedures applicable to the OSHA Laboratory Standard and have read the Safety Manual AND you have received training.

NAME

_____

PLEASE PRINT

_____

SIGNATURE

APPENDIX G

Laboratory Specific Standard Operating Procedure

Please fill out the form, print it, and either post in the lab or place in appropriate safety manual.

GENERAL INFORMATION

Date:	Prepared By:
Instructor	Phone Number:
Building & Room Number	

DESCRIPTION

☐ Hazardous Process ☐ Hazardous Chemical ☐ Biological Agent

☐ Ionizing Radiation ☐ Laser

DESCRIPTION OF HAZARDOUS PROCESS, HAZARDOUS CHEMICAL, BIOLOGICAL AGENTS, IONIZING RADIATION, OR LASER

POTENTIAL HAZARDS

PERSONAL PROTECTIVE EQUIPMENT

APPENDIX H
HOW TO ORDER CHEMICALS

1. Check the Department Approved list under the Hazard Communication Program

Before ordering a chemical, you **MUST** check this database - located in the Hazard Communication Program. If the chemical you wish to order is on the database, check the inventory date.

2. Ordering a Chemical

If the chemical you require is not available in the department, you may obtain a request form from the hazard communication program. You must follow all protocols for new purchases as per the hazard communication program.

Fill out the request form completely and have the director of Science review your request. Once the new product has been reviewed and approved an order may be placed.

3. SDS Sheets

After you have ordered the chemical, secure a copy of the SDS sheet (Safety Data). You must keep a copy of the SDS in the department files and also ensure that a copy is placed in the Central file and all appropriate appendices filled out.

4. Empty Bottles

If you use the last of a chemical or there is only a small portion of the chemical remaining, do the following:

a. Report it to your supervisor or department head. They will place an order for a replacement.

b. Give the empty bottle to the head custodian for disposal. THIS IS VERY IMPORTANT. The item must be removed from the chemical inventory so that future users will not anticipate stock of the chemical when it is actually spent.

5. When your Chemical Arrives

You will be notified through e-mail when the chemical arrives. You will be responsible to ensure that the proper labels are in place as per the guidelines set forth in the Hazard Communication Program. You may obtain the proper labels from the manufacturer or create one yourself.

APPENDIX I

SCHOOL	NUMBER OF HOODS	ROOM NUMBER	FUME HOOD NUMBER
Kennedy HS	4	347	347-1 (NEAR DOOR TO 347.5
		347	347-2 (WINDOW SIDE)
		346	346-3 (NEAR DOOR TO 346.5)
		346	346-4 (WINDOW SIDE)
Eastside HS	0		
Rosa Parks Academy	1	109	109-5
Garrett Morgan	1	212	212-6
Pre Collegate	1	204	204-7
Panther Academy	1	307	307-8
Silk City Academy	1	B3	B3-9
PS # 9	1	303	303-10
PS#27	1	206N	206N-11
The New Roberto Clemente School	2	2B-04	2B-04-12
		2B-07	2B-07-13
Martin Luther King School	1	321	321-14
International High School	1		-15

APPENDIX J

Inspection Process for Fume Hoods

A two-step process shall be used when inspecting a fume hood to validate proper working condition.

Step 1. Inspection of Hood

A complete inspection both inside and outside the fume hood shall be performed by the inspector to evaluating the following:

1. Use of proper materials designed for that fume hood;
2. Excessive storage of any materials inside the fume hood;
3. Physical damage to the fume hood;
4. Items that should not be inside the fume hood;
5. The ability of the sash to open, close and stay in a stationary position; and
6. Proper function of the fume hood flow indicator and alarm, if present.

Step 2. Determination of the Fume Hood's Face Velocity

The face velocity of the hood shall be determined by using a velometer or other approved device. If the fume hood fails to meet the required face velocity with the sash open to a maximum of 18 inches, the sash shall be lowered and the hood re-tested. This process shall be performed until the fume hood meets the required feet per minute rating.

Note: The sash cannot be lowered to a point less than 12 inches from the base of the sash opening.

Once the inspection is completed, a certification sticker indicating the date of inspection and face velocity in feet per minute at a specified height in inches shall be placed at the point the sash was adjusted to reach certification.

If a fume hood fails certification, a warning sign shall be placed at a prominent location on the sash of the fume hood indicating that the fume hood should not be used until it has been serviced and is working properly.

This sign shall ONLY be removed by CHO or his designee once the fume hood has passed certification requirements.

APPENDIX K

PATERSON PUBLIC SCHOOLS
SAMPLE CHEMICAL HYGIENE TRAINING DOCUMENTATION

TOPIC: _____ **DATE: _____**
(Attach outline of material covered)

NAME OF INSTRUCTOR: _____ **POSITION: _____**

TRAINING RECORDS TO BE MAINTAINED ELECTRONICALLY IN PDPRO

APPENIDIX L

Paterson Public Schools
Current Chemical Hygiene Committee
Year __2014-2015_____

Name & Title	School	Contact Telephone Number
Science Supervisor	East Side High School	973-321-0510
Mr. E. Lesser, Chemistry Teacher	Kennedy High School	973-321-0500
Ms. L Craft	Director of Nurses	973-321-0722
Ms. Inthumathy Natarajah	Rosa Parks High School	973-321-0520
Ms. Heidi Schwegler	New Roberto Clemente	973-321-0240
Ms. Paulette Szalay	PS # 15	973-321-0150
Ms. Wanda Mathis-Brown	PS # 30 MLK	973-321-0300
Ms. Arrington	PS # 7	973-321-0070
Mr. Kendrick Ramdath	Garrett Morgan	973-321-2540

Designated Chemical Hygiene Officer	
Brenda Zemo, Environmental, Occupational Health & Safety	973-321-0593

Appendix M OSHA LABORATORY STANDARD

1910.1450(a)
Scope and application.
1910.1450(a)(1)
This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.
1910.1450(a)(2)
Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:
1910.1450(a)(2)(i)
For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.
1910.1450(a)(2)(ii)
Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
1910.1450(a)(2)(iii)
Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.
1910.1450(a)(3)
This section shall not apply to:
..1910.1450(a)(3)(i)

1910.1450(a)(3)(i)
Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.
1910.1450(a)(3)(ii)
Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:
1910.1450(a)(3)(ii)(A)
Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and
1910.1450(a)(3)(ii)(B)
Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.
1910.1450(b)
Definitions --

Action level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (***see select carcinogen***).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is

not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

Combustible liquid means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Compressed gas means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg C) regardless of the pressure at 70 deg. F (21.1 deg. C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable means a chemical that falls into one of the following categories:

(i) ***Aerosol, flammable*** means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) ***Gas, flammable*** means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) ***Liquid, flammable*** means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) ***Solid, flammable*** means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as

follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Hazardous chemical means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, and neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

(i) Chemical manipulations are carried out on a "laboratory scale;"

(ii) Multiple chemical procedures or chemicals are used;

(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Organic peroxide means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard means a chemical for which there is scientifically valid evidence tat it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

Protective laboratory practices and equipment means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins means chemicals which affect the reproductive chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Select carcinogen means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

Unstable (reactive) means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

1910.1450(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

..1910.1450(d)

1910.1450(d)

Employee exposure determination --

1910.1450(d)(1)

Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

1910.1450(d)(2)

Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

1910.1450(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(4)

Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

1910.1450(e)

Chemical hygiene plan -- General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

1910.1450(e)(1)

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

1910.1450(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii)

Capable of keeping exposures below the limits specified in paragraph (c) of this section.

1910.1450(e)(2)

The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

1910.1450(e)(3)

The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

1910.1450(e)(3)(i)

Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(e)(3)(ii)

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

1910.1450(e)(3)(iii)

A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

..1910.1450(e)(3)(iv)

1910.1450(e)(3)(iv)

Provisions for employee information and training as prescribed in paragraph (f) of this section;

1910.1450(e)(3)(v)

The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

1910.1450(e)(3)(vi)

Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

1910.1450(e)(3)(vii)

Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

1910.1450(e)(3)(viii)

Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

1910.1450(e)(3)(viii)(A)

Establishment of a designated area;

1910.1450(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D)

Decontamination procedures.

1910.1450(e)(4)

The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f)

Employee information and training.

1910.1450(f)(1)

The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

1910.1450(f)(2)

Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

1910.1450(f)(3)

Information. Employees shall be informed of:

1910.1450(f)(3)(i)

The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii)

the location and availability of the employer's Chemical Hygiene Plan;

..1910.1450(f)(3)(iii)

1910.1450(f)(3)(iii)

The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

1910.1450(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(f)(3)(v)

The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

1910.1450(f)(4)

Training.

1910.1450(f)(4)(i)

Employee training shall include:

1910.1450(f)(4)(i)(A)

Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

1910.1450(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

1910.1450(f)(4)(i)(C)

The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

1910.1450(f)(4)(ii)

The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

1910.1450(g)

Medical consultation and medical examinations.

1910.1450(g)(1)

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1910.1450(g)(1)(i)

Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

1910.1450(g)(1)(ii)

Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

1910.1450(g)(1)(iii)

Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

..1910.1450(g)(2)

1910.1450(g)(2)

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

1910.1450(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

1910.1450(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4)

Physician's written opinion.

1910.1450(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A)

Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B)

The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(C)

Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and

1910.1450(g)(4)(i)(D)

A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

1910.1450(g)(4)(ii)

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

1910.1450(h)

Hazard identification.

1910.1450(h)(1)

With respect to labels and material safety data sheets:

1910.1450(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii)

Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

..1910.1450(h)(2)(i)

1910.1450(h)(2)(i)

If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

1910.1450(h)(2)(ii)

If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

1910.1450(h)(2)(iii)

If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.

1910.1450(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j)

Recordkeeping.

1910.1450(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

1910.1450(k)
Dates --
1910.1450(k)(1)
Effective date. This section shall become effective May 1, 1990.
1910.1450(k)(2)
Start-up dates.
1910.1450(k)(2)(i)
Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.
1910.1450(k)(2)(ii)
Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.
1910.1450(l)
Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996]

National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory) - 1910.1450 App A

• Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Z
• Subpart Title:	Toxic and Hazardous Substances
• Standard Number:	1910.1450 App A
• Title:	National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

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2. Allergens and Embryotoxins
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G. Material Safety Data Sheets
Foreword

As guidance for each employer's development of an appropriate laboratory Chemical Hygiene Plan, the following non-mandatory recommendations are provided. They were extracted form "Prudent Practices" for Handling Hazardous Chemicals in Laboratories" (referred to below as "Prudent Practices"), which was published in 1981 by the National Research Council and is available from the National Academy Press, 2101 Constitution Ave., NW,. Washington DC 20418.

"Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by members of the laboratory community through the sponsorship of the National Research Council. However, none of the recommendations given here will modify any requirements of the laboratory standard. This Appendix merely presents pertinent recommendations from "Prudent Practices", organized into a form convenient for quick reference during operation of a laboratory facility and during development and application of a Chemical Hygiene Plan. Users of this appendix should consult "Prudent Practices" for a more extended presentation and justification for each recommendation.

"Prudent Practices" deal with both safety and chemical hazards while the laboratory standard is concerned primarily with chemical hazards. Therefore, only those recommendations directed primarily toward control of toxic exposures are cited in this appendix, with the term "chemical Hygiene" being substituted for the word "safety". However, since conditions producing or threatening physical injury often pose toxic risks as well, page references concerning major categories of safety hazards in the laboratory are given in section F.

The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized, and headings have been added. However, their sense has not been changed.

Corresponding Sections of the Standard and this Appendix

The following table is given for the convenience of those who are developing a Chemical Hygiene Plan which will satisfy the requirements of paragraph (e) of the standard. It indicates those sections of this appendix which are most pertinent to each of the sections of paragraph (e) and related paragraphs.

Paragraph and topic in laboratory Standard	Relevant appendix section
(e)(3)(i) Standard operating procedures for handling toxic chemicals.	C, D, E

(e)(3)(ii) Criteria to be used for implementation of measures to reduce exposures.	D
(e)(3)(iii) Fume hood performance	C4b
(e)(3)(iv) Employee information and training (including emergency procedures).	D10, D9
(e)(3)(v) Requirements for prior approval of laboratory activities.	E2b, E4b
(e)(3)(vi) Medical consultation and medical examinations.	D5, E4f
(e)(3)(vii) Chemical hygiene responsibilities.	B
(e)(3)(viii) Special precautions for work with particularly hazardous substances.	E2, E3, E4

In this appendix, those recommendations directed primarily at administrators and supervisors are given in sections A-D. Those recommendations of primary concern to employees who are actually handling laboratory chemicals are given in section E. (Reference to page numbers in "Prudent Practices" are given in parentheses.)

A. General Principles for Work with Laboratory Chemicals

In addition to the more detailed recommendations listed below in sections B-E, "Prudent Practices" expresses certain general principles, including the following:

1. It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals (2,10). Skin contact with chemicals should be avoided as a cardinal rule (198).

2. Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken (10, 37, 38). One should assume that any mixture will be more toxic than its most toxic component (30, 103) and that all substances of unknown toxicity are toxic (3, 34).

3. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices (32, 198).

4. Institute a chemical hygiene program. A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity (6,11). Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers (13).

5. Observe the PELs, TLVs. The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded (13).

B. Chemical Hygiene Responsibilities

Responsibility for chemical hygiene rests at all levels (6, 11, 21) including the:

1. Chief executive officer, who has ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene (7, 11).

2. Supervisor of the department or other administrative unit, who is responsible for chemical hygiene in that unit (7).

3. chemical hygiene officer(s), whose appointment is essential (7) and who must:

(a) Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices (7);

(b) Monitor procurement, use, and disposal of chemicals used in the lab (8);

(c) See that appropriate audits are maintained (8);

(d) Help project directors develop precautions and adequate facilities (10);

(e) Know the current legal requirements concerning regulated substances (50); and

(f) Seek ways to improve the chemical hygiene program (8, 11).

4. Laboratory supervisor, who has overall responsibility for chemical hygiene in the laboratory (21) including responsibility to:

(a) Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided (21, 22);

(b) Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment (21, 171);

(c) Know the current legal requirements concerning regulated substances (50, 231);

(d) Determine the required levels of protective apparel and equipment (156, 160, 162); and

(e) Ensure that facilities and training for use of any material being ordered are adequate (215).

5. Project director or director of other specific operation, who has primary responsibility for chemical hygiene procedures for that operation (7).

6. Laboratory worker, who is responsible for:

(a) Planning and conducting each operation in accordance with the institutional chemical hygiene procedures (7, 21, 22, 230); and

(b) Developing good personal chemical hygiene habits (22).

C. The Laboratory Facility

1. Design. The laboratory facility should have:

(a) An appropriate general ventilation system (see C4 below) with air intakes and exhausts located so as to avoid intake of contaminated air (194);

(b) Adequate, well-ventilated stockrooms/storerooms (218, 219).

(c) Laboratory hoods and sinks (12, 162);

(d) Other safety equipment including eyewash fountains and drench showers (162, 169); and

(e) Arrangements for waste disposal (12, 240).

2. Maintenance. Chemical-hygiene-related equipment (hoods, incinerator, etc.) should undergo continual appraisal and be modified if inadequate (11, 12).

3. Usage. The work conducted (10) and its scale (12) must be appropriate to the physical facilities available and, especially, to the quality of ventilation (13).

4. Ventilation - (a) General laboratory ventilation. This system should: Provide a source of air for breathing and for input to local ventilation devices (199); it should not be relied on for protection from toxic substances released into the laboratory (198); ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day (194); direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building (194).

(b) Hoods. A laboratory hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they

spend most of their time working with chemicals (199); each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use (200, 209). If this is not possible, work with substances of unknown toxicity should be avoided (13) or other types of local ventilation devices should be provided (199). See pp. 201-206 for a discussion of hood design, construction, and evaluation.

(c) Other local ventilation devices. Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed (199). Each canopy hood and snorkel should have a separate exhaust duct (207).

(d) Special ventilation areas. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system (208). Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure (209).

(e) Modifications. Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate (12, 193, 204).

(f) Performance. Rate: 4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control (194).

(g) Quality. General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas (194, 195); airflow into and within the hood should not be excessively turbulent (200); hood face velocity should be adequate (typically 60-100 lfm) (200, 204).

(h) Evaluation. Quality and quantity of ventilation should be evaluated on installation (202), regularly monitored (at least every 3 months) (6, 12, 14, 195), and reevaluated whenever a change in local ventilation devices is made (12, 195, 207). See pp 195-198 for methods of evaluation and for calculation of estimated airborne contaminant concentrations.

D. Components of the Chemical Hygiene Plan

1. Basic Rules and Procedures (Recommendations for these are given in section E, below)

2. Chemical Procurement, Distribution, and Storage

(a) Procurement. Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved (215, 216). No container should be accepted without an adequate identifying label (216). Preferably, all substances should be received in a central location (216).

(b) Stockrooms/storerooms. Toxic substances should be segregated in a well-identified area with local exhaust ventilation (221). Chemicals which are highly toxic (227) or other chemicals whose containers have been opened should be in unbreakable secondary containers (219). Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity (218-19).

Stockrooms/storerooms should not be used as preparation or repackaging areas, should be open during normal working hours, and should be controlled by one person (219).

(c) Distribution. When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible (223).

(d) Laboratory storage. Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom (225-6, 229).

3. Environmental Monitoring

Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices (12) or when a highly toxic substance is stored or used regularly (e.g., 3 times/week) (13).

4. Housekeeping, Maintenance, and Inspections

(a) Cleaning. Floors should be cleaned regularly (24).

(b) Inspections. Formal housekeeping and chemical hygiene inspections should be held at least quarterly (6, 21) for units which have frequent personnel changes and semiannually for others; informal inspections should be continual (21).

(c) Maintenance. Eye wash fountains should be inspected at intervals of not less than 3 months (6). Respirators for routine use should be inspected periodically by the laboratory supervisor (169). Other safety equipment should be inspected regularly. (e.g., every 3-6 months) (6, 24, 171). Procedures to prevent restarting of out-of-service equipment should be established (25).

(d) Passageways. Stairways and hallways should not be used as storage areas (24). Access to exits, emergency equipment, and utility controls should never be blocked (24).

5. Medical Program

(a) Compliance with regulations. Regular medical surveillance should be established to the extent required by regulations (12).

(b) Routine surveillance. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable (11, 50).

(c) First aid. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby (173). See pp. 176-178 for description of some emergency first aid procedures.

6. Protective Apparel and Equipment

These should include for each laboratory:

(a) Protective apparel compatible with the required degree of protection for substances being handled (158-161);

(b) An easily accessible drench-type safety shower (162, 169);

(c) An eyewash fountain (162)

(d) A fire extinguisher (162-164);

(e) Respiratory protection (164-9), fire alarm and telephone for emergency use (162) should be available nearby; and

(f) Other items designated by the laboratory supervisor (156, 160).

7. Records

(a) Accident records should be written and retained (174).

(b) Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations (7).

(c) Inventory and usage records for high-risk substances should be kept as specified in sections E3e below.

(d) Medical records should be retained by the institution in accordance with the requirements of state and federal regulations (12).

8. Signs and Labels

Prominent signs and labels of the following types should be posted:

(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers (28);

(b) Identity labels, showing contents of containers (including waste receptacles) and associated hazards (27, 48);

(c) Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits (27) and areas where food and beverage consumption and storage are permitted (24); and

(d) Warnings at areas or equipment where special or unusual hazards exist (27).

9. Spills and Accidents

(a) A written emergency plan should be established and communicated to all personnel; it should include procedures for ventilation failure (200), evacuation, medical care, reporting, and drills (172).

(b) There should be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms (172).

(c) A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting (175).

(d) All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit (8, 28).

10. Information and Training Program

(a) Aim: To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs (5, 15).

(b) Emergency and Personal Protection Training: Every laboratory worker should know the location and proper use of available protective apparel and equipment (154, 169).

Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures (6).

Such training as well as first aid instruction should be available to (154) and encouraged for (176) everyone who might need it.

(c) Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations (217).

(d) Frequency of Training: The training and education program should be a regular, continuing activity - not simply an annual presentation (15).

(e) Literature/Consultation: Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources (14).

11. Waste Disposal Program.

(a) Aim: To assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals (5).

(b) Content (14, 232, 233, 240): The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations (244).

(c) Discarding Chemical Stocks: Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened (24, 27).

Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage (226).

(d) Frequency of Disposal: Waste should be removed from laboratories to a central waste storage area at least once per week

and from the central waste storage area at regular intervals (14).

(e) Method of Disposal: Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste (14, 238, 241).

Indiscriminate disposal by pouring waste chemicals down the drain (14, 231, 242) or adding them to mixed refuse for landfill burial is unacceptable (14).

Hoods should not be used as a means of disposal for volatile chemicals (40, 200).

Disposal by recycling (233, 243) or chemical decontamination (40, 230) should be used when possible.

E. Basic Rules and Procedures for Working with Chemicals

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

1. General Rules

The following should be used for essentially all laboratory work with chemicals:

(a) Accidents and spills - Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (33, 172).

Ingestion: Encourage the victim to drink large amounts of water (178).

Skin Contact: Promptly flush the affected area with water (33, 172, 178) and remove any contaminated clothing (172, 178). If symptoms persist after washing, seek medical attention (33).

Clean-up. Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal (24, 33). See pp. 233-237 for specific clean-up recommendations.

(b) Avoidance of "routine" exposure: Develop and encourage safe habits (23); avoid unnecessary exposure to chemicals by any route (23);

Do not smell or taste chemicals (32). Vent apparatus which may discharge toxic chemicals (vacuum puPPS, distillation columns, etc.) into local exhaust devices (199).

Inspect gloves (157) and test glove boxes (208) before use.

Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres (209).

(c) Choice of chemicals: Use only those chemicals for which the quality of the available ventilation system is appropriate (13).

(d) Eating, smoking, etc.: Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24).

Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).

(e) Equipment and glassware: Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware (25). Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur (25). Use equipment only for its designed purpose (23, 26).

(f) Exiting: Wash areas of exposed skin well before leaving the laboratory (23).

(g) Horseplay: Avoid practical jokes or other behavior which might confuse, startle or distract another worker (23).

(h) Mouth suction: Do not use mouth suction for pipeting or starting a siphon (23, 32).

(i) Personal apparel: Confine long hair and loose clothing (23, 158). Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers (158).

(j) Personal housekeeping: Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day (24).

(k) Personal protection: Assure that appropriate eye protection (154-156) is worn by all persons, including visitors, where chemicals are stored or handled (22, 23, 33, 154).

Wear appropriate gloves when the potential for contact with toxic materials exists (157); inspect the gloves before each use, wash them before removal, and replace them periodically (157). (A table of resistance to chemicals of common glove materials is given p. 159).

Use appropriate (164-168) respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls (164-5), inspecting the respirator before use (169).

Use any other protective and emergency apparel and equipment as appropriate (22, 157-162).

Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken (155).

Remove laboratory coats immediately on significant contamination (161).

(l) Planning: Seek information and advice about hazards (7), plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation (22, 23).

(m) Unattended operations: Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation (27, 128).

(n) Use of hood: Use the hood for operations which might result in release of toxic chemical vapors or dust (198-9).

As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm (13).

Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made (200); keep materials stored in hoods to a minimum and do not allow them to block vents or air flow (200).

Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off" (200).

(o) Vigilance: Be alert to unsafe conditions and see that they are corrected when detected (22).

(p) Waste disposal: Assure that the plan for each laboratory operation includes plans and training for waste disposal (230).

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (22, 24).

Do not discharge to the sewer concentrated acids or bases (231); highly toxic, malodorous, or lachrymatory substances (231); or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow (242).

(q) Working alone: Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous (28).

2. Working with Allergens and Embryotoxins

(a) Allergens (examples: diazomethane, isocyanates, bichromates): Wear suitable gloves to prevent hand contact with

allergens or substances of unknown allergenic activity (35).

(b) Embryotoxins (34-5) (examples: organomercurials, lead compounds, formamide): If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.

Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.

Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.

Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

3. Work with Chemicals of Moderate Chronic or High Acute Toxicity

Examples: diisopropylfluorophosphate (41), hydrofluoric acid (43), hydrogen cyanide (45).

Supplemental rules to be followed in addition to those mentioned above (Procedure B of "Prudent Practices", pp. 39-41):

(a) Aim: To minimize exposure to these toxic substances by any route using all reasonable precautions (39).

(b) Applicability: These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities (39).

(c) Location: Use and store these substances only in areas of restricted access with special warning signs (40, 229).

Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 60 linear feet per minute) (40) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance (39); trap released vapors to revent their discharge with the hood exhaust (40).

(d) Personal protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate) (39). Always wash hands and arms immediately after working with these materials (40).

(e) Records: Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved (40, 229).

(f) Prevention of spills and accidents: Be prepared for accidents and spills (41).

Assure that at least 2 people are present at all times if a compound in use is highly toxic or of unknown toxicity (39).

Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper (40).

If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment (41).

(g) Waste: Thoroughly decontaminate or incinerate contaminated clothing or shoes (41). If possible, chemically decontaminate by chemical conversion (40).

Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite) (40).

4. Work with Chemicals of High Chronic Toxicity

(Examples: dimethylmercury and nickel carbonyl (48), benzo-a-pyrene (51), N-nitrosodiethylamine (54), other human carcinogens or substances with high carcinogenic potency in animals (38).)

Further supplemental rules to be followed, in addition to all these mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance) (47). (Procedure A of

"Prudent Practices" pp. 47-50).

(a) Access: Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions (48).

(b) Approvals: Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor (48).

(c) Non-contamination/Decontamination: Protect vacuum puPPS against contamination by scrubbers or HEPA filters and vent them into the hood (49). Decontaminate vacuum puPPS or other contaminated equipment, including glassware, in the hood before removing them from the controlled area (49, 50).

Decontaminate the controlled area before normal work is resumed there (50).

(d) Exiting: On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck (49).

(e) Housekeeping: Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder (50).

(f) Medical surveillance: If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance (50).

(g) Records: Keep accurate records of the amounts of these substances stored (229) and used, the dates of use, and names of users (48).

(h) Signs and labels: Assure that the controlled area is conspicuously marked with warning and restricted access signs (49) and that all containers of these substances are appropriately labeled with identity and warning labels (48).

(i) Spills: Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available (233-4).

(j) Storage: Store containers of these chemicals only in a ventilated, limited access (48, 227, 229) area in appropriately labeled, unbreakable, chemically resistant, secondary containers (48, 229).

(k) Glove boxes: For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water (48). For a positive pressure glove box, thoroughly check for leaks before each use (49). In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood (49).

(l) Waste: Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel (49, 50, 233).

5. Animal Work with Chemicals of High Chronic Toxicity

(a) Access: For large scale studies, special facilities with restricted access are preferable (56).

(b) Administration of the toxic substance: When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters (56).

(c) Aerosol suppression: Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood) (55, 56).

(d) Personal protection: When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or juPPSuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (shoe and head coverings, respirator) (56).

(e) Waste disposal: Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products (238); otherwise, package the waste appropriately for burial in an EPA-approved site (239).

F. Safety Recommendations

The above recommendations from "Prudent Practices" do not include those which are directed primarily toward prevention of physical injury rather than toxic exposure. However, failure of precautions against injury will often have the secondary effect of causing toxic exposures. Therefore, we list below page references for recommendations concerning some of the major categories of safety hazards which also have implications for chemical hygiene:

1. Corrosive agents: (35-6)
2. Electrically powered laboratory apparatus: (179-92)
3. Fires, explosions: (26, 57-74, 162-64, 174-5, 219-20, 226-7)
4. Low temperature procedures: (26, 88)
5. Pressurized and vacuum operations (including use of compressed gas cylinders): (27, 75-101)

G. Material Safety Data Sheets

Material safety data sheets are presented in "Prudent Practices" for the chemicals listed below. (Asterisks denote that comprehensive material safety data sheets are provided).

o Acetyl peroxide (105)
o Acrolein (106)
o Acrylonitrile
Ammonia (anhydrous)(91)
o Aniline (109)
o Benzene (110)
o Benzo[a]pyrene (112)
o Bis(chloromethyl) ether (113)
Boron trichloride (91)
Boron trifluoride (92)
Bromine (114)
o Tert-butyl hydroperoxide (148)
o Carbon disulfide (116)
Carbon monoxide (92)
o Carbon tetrachloride (118)
*Chlorine (119)
Chlorine trifluoride (94)
o Chloroform (121)
Chloromethane (93)
o Diethyl ether (122)
Diisopropyl fluorophosphate (41)
o Dimethylformamide (123)
o Dimethyl sulfate (125)
o Dioxane (126)
o Ethylene dibromide (128)
o Fluorine (95)
o Formaldehyde (130)
o Hydrazine and salts (132)

Hydrofluoric acid (43)
Hydrogen bromide (98)
Hydrogen chloride (98)
o Hydrogen cyanide (133)
o Hydrogen sulfide (135)
Mercury and compounds (52)
o Methanol (137)
o Morpholine (138)
o Nickel carbonyl (99)
o Nitrobenzene (139)
Nitrogen dioxide (100)
N-nitrosodiethylamine (54)
o Peracetic acid (141)
o Phenol (142)
o Phosgene (143)
o Pyridine (144)
o Sodium azide (145)
o Sodium cyanide (147)
Sulfur dioxide (101)
o Trichloroethylene (149)
o Vinyl chloride (150)

References (Non-Mandatory) - 1910.1450 App B

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1450 App B
- **Title:** References (Non-Mandatory)

The following references are provided to assist the employer in the development of a Chemical Hygiene Plan. The materials listed below are offered as non-mandatory guidance. References listed here do not imply specific endorsement of a book, opinion, technique, policy or a specific solution for a safety or health problem. Other references not listed here may better meet the needs of a specific laboratory. (a) Materials for the development of the Chemical Hygiene Plan:

1. American Chemical Society, Safety in Academic Chemistry Laboratories, 4th edition, 1985.

2. Fawcett, H.H. and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, Wiley-Interscience, New York, 1982.

3. Flury, Patricia A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield IL, 1978.

4. Green, Michael E. and Turk, Amos, Safety in Working with Chemicals, Macmillan Publishing Co., NY, 1978.

5. Kaufman, James A., Laboratory Safety Guidelines, Dow Chemical Co., Box 1713, Midland, MI 48640, 1977.

6. National Institutes of Health, NIH Guidelines for the Laboratory use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.

7. National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.

8. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981.

9. Renfrew, Malcolm, Ed., Safety in the Chemical Laboratory, Vol. IV, J. Chem. Ed., American Chemical Society, Easlon, PA, 1981.

10. Steere, Norman V., Ed., Safety in the Chemical Laboratory, J. Chem. Ed. American Chemical Society, Easlon, PA, 18042, Vol. I, 1967, Vol. II, 1971, Vol. III, 1974.

11. Steere, Norman V., Handbook of Laboratory Safety, the Chemical Rubber Company Cleveland, OH, 1971.

12. Young, Jay A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons, Inc. New York, 1987.

(b) Hazardous Substances Information:

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, 6500 Glenway Avenue, Bldg. D-7, Cincinnati, OH 45211-4438.

2. Annual Report on Carcinogens, National Toxicology Program U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC, (latest edition).

3. Best Company, Best Safety Directory, Vols. I and II, Oldwick, N.J., 1981.

4. Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.

5. Bretherick, L., Hazards in the Chemical Laboratory, 3rd edition, Royal Society of Chemistry, London, 1986.

6. Code of Federal Regulations, 29 CFR part 1910 subpart Z. U.S. Govt. Printing Office, Washington, DC 20402 (latest edition).

7. IARC Monographs on the Evaluation of the Carcinogenic Risk of chemicals to Man, World Health Organization Publications Center, 49 Sheridan Avenue, Albany, New York 12210 (latest editions).

8. NIOSH/OSHA Pocket Guide to Chemical Hazards. NIOSH Pub. No. 85-114, U.S. Government Printing Office, Washington, DC, 1985 (or latest edition).

9. Occupational Health Guidelines, NIOSH/OSHA. NIOSH Pub. No. 81-123 U.S. Government Printing Office, Washington, DC, 1981.

10. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY (Five Volumes).

11. Registry of Toxic Effects of Chemical Substances, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Revised Annually, for sale from Superintendent of documents US. Govt. Printing Office, Washington, DC 20402.

12. The Merck Index: An Encyclopedia of Chemicals and Drugs. Merck and Company Inc. Rahway, N.J., 1976 (or latest edition).

13. Sax, N.I. Dangerous Properties of Industrial Materials, 5th edition, Van Nostrand Reinhold, NY., 1979.

14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals, Noyes Publications. Park Ridge, NJ, 1981.

(c) Information on Ventilation:

1. American Conference of Governmental Industrial Hygienists Industrial Ventilation (latest edition), 6500 Glenway Avenue, Bldg. D-7, Cincinnati, Ohio 45211-4438.

2. American National Standards Institute, Inc. American National Standards Fundamentals Governing the Design and Operation of Local Exhaust Systems ANSI Z 9.2-1979 American National Standards Institute, N.Y. 1979.

3. Imad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.

4. National Fire Protection Association, Fire Protection for Laboratories Using Chemicals NFPA-45, 1982.

Safety Standard for Laboratories in Health Related Institutions, NFPA, 56c, 1980.

Fire Protection Guide on Hazardous Materials, 7th edition, 1978.

National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

5. Scientific Apparatus Makers Association (SAMA), Standard for Laboratory Fume Hoods, SAMA LF7-1980, 1101 16th Street, NW., Washington, DC 20036.

(d) Information on Availability of Referenced Material:

1. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.

2. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

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