

Title: Chemical Hygiene Plan Program**Effective Date:** March 21, 2006**Revision Date:** May 5, 2015**Responsible Office:** EH&S**I. Scope**

This program applies to all William & Mary faculty, staff and students who by the nature of their work may be exposed to hazardous chemicals in the course of their assignments, and all individuals whose primary duty is laboratory operations, are required to follow the provisions of the Chemical Hygiene Plan (CHP).

II. Purpose

The purpose of the Chemical Hygiene Plan is to protect employees from the health hazards presented by hazardous chemicals used in the work place. The Plan functions to keep employee exposures to hazardous chemicals, to which they may be occupationally exposed to in their laboratories, below the permissible exposure limits specified in the standard. This Plan is intended to meet the requirements of 29 CFR 1910.1450, the VAOSHA standard for occupational exposures to hazardous chemicals in laboratories. This Plan is to be used in conjunction with, and makes reference to the College's [Hazard Communication Program](#).

III. Definitions

Action Level: A concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Allergen: Substance causing altered body reactivity to a toxic substance in response to a first exposure.

Chemical Hygiene Officer: An employee designated by the employer, qualified by training or experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan. At William & Mary, the Chemical Hygiene Officer is the Environment, Health and Safety Director.

Chronic: Long term degenerative effect of a hazardous substance marked by frequent reoccurrence over a long period of time.

Designated Area: An area which may be used for work with select carcinogens, reproductive

toxins or highly acute toxic substances. A designated area may be the entire laboratory or a device as a fume hood.

Embroyotoxin: A harmful agent that retards the growth, or adversely affects the development of an unborn child.

Glove Box: A seal, protectively lined compartment, having ports to which are attached gloves for use in handling materials inside the compartment.

Hazardous Chemical: Any chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed employees. This includes select carcinogens, reproductive toxins, irritants, corrosives, sensitizers, and other substances which may damage lungs, skin, eyes, or mucous membranes.

Hazardous Material: any substance or material that could adversely affect the safety of the public, handlers or carriers during transportation. This includes laboratory chemicals, radioactive materials, compressed gases, biological agents, refrigerants, and instruments that contain hazardous materials.

Highly Acutely Toxic: Any hazardous chemical with a short term health effect which could be fatal or cause damage to target organs as a result of a single exposure or several exposures of short duration.

Laboratory Facility: Any facility/room/location/area where hazardous chemicals are used. It is a workplace where relatively small amounts are used on a non-production basis.

Laboratory Worker: An individual employed in a laboratory facility who may be exposed to hazardous chemicals in the course of his/her work. This includes individuals who, because of their work assignment, may be required to enter a laboratory facility. VAOSHA considers maintenance and custodial personnel as meeting this definition, but not occasional visitors such as guests or sales person. Students are not employees unless they are serving in the capacity of a paid status and working in a laboratory. Students performing academic activities in a laboratory should be trained and protected from hazards in the same manner as employees.

Materials of Trade: a hazardous material, other than a hazardous waste, that is carried on a motor vehicle 1) for the purpose of protecting the health and safety of the motor vehicle operator or passengers 2) for the purpose of supporting the operation or maintenance of a motor vehicle or 3) by a private motor carrier in direct support of a principal business that is other than transportation by motor vehicle.

Other Regulated Material for Domestic Transport (ORM-D): a marking for mail or shipping in the United States that identifies other regulated materials for domestic transport only.

Packages bearing this mark contain hazardous material in a limited quantity that presents a limited hazard during transportation, due to its form, quantity and packaging.

Oxidizer: A chemical that ignites or promotes combustion in other materials, thereby causing fire either to itself or through the release of oxygen or other gases.

Oxidizing Agent: Oxygen-containing material which can decompose, generating oxygen.

Particularly Hazardous Substance: chemicals with special acute or chronic toxicity. These chemicals are defined as being a select carcinogen, reproductive toxin, or have a high degree of acute toxicity.

Permissible Exposure Limit (PEL): the maximum amount or concentration of a chemical that a worker may be exposed to on a measurement of an 8-hour time weighted average, established by VAOSHA.

Peroxide-forming Chemicals: a class of compounds that under normal conditions have the potential to generate and accumulate peroxide crystal formations, which may violently detonate when subjected to thermal or mechanical shock. Many of the organic solvents commonly used in laboratories have the potential to form explosive peroxide crystals. Peroxide formation is accelerated by exposure to air, light, heat, moisture and contamination from metals. Peroxides may form in containers that have not been opened as they may have been packaged while exposed to air.

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

Reactivity: The proclivity of a compound to chemically react with other substances or itself, resulting in the liberation of energy. Can cause the formation of toxic or corrosive materials, pressure build up, and temperature fluctuations.

Reproductive Toxin: Any chemical which affects the reproductive capabilities including chromosomal damage (mutagens), lethal effects on the fertilized egg, developing embryo, or fetus (embryotoxin) and malformation of the fetus (teratogens).

Teratogen: An agent or factor that causes malformation of an embryo.

Threshold Limit Value (TLV): A time weighted average air concentration based on an 8-hour

day, established by the American Conference of Governmental Industrial Hygienists (ACGIH)

Transportation: The act or process of moving or shipping goods or things from one place to another. Common forms of transportation include planes, trains, automobiles and other two-wheel devices such as bikes or motorcycles.

Water Reactive: A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

IV. Responsibilities

- A. Vice Provost and Deans: The Vice Provost and Deans have ultimate responsibility for chemical hygiene at the University and must, with other administrators, provide continuing support for institutional chemical hygiene.
- B. Next Level Supervisors: Associate/Assistant Directors, Department Heads, and other Supervisors, are responsible for supporting the institutional chemical hygiene within their respective organizations. Sets the example and demonstrates continuous support, to effectively implement this Plan.
- C. Environment, Health and Safety (EH&S) Office: Develops, coordinates, implements, maintains and monitors the University's Chemical Hygiene Plan. Provides assistance to the Chemical Hygiene Officer as required under this Plan.
- D. Chemical Hygiene Officer (CHO): Provides technical guidance in the development and implementation of this Plan. The CHO is qualified by training and experience to have the knowledge and competence to use the appropriate equipment and testing procedures to identify and evaluate various situations and to suggest abatement procedures for health and safety hazards.

The CHO works with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices. The CHO is aware of current legal requirements concerning regulated substances, ensures that appropriate audits are maintained, helps principal investigators develop necessary precautions and adequate laboratory facilities, and suggests ways to improve the chemical hygiene program.

- E. Principal Investigators, Project Supervisors, and Laboratory Supervisors: Overall responsibility for chemical hygiene within the laboratory. Ensures that laboratory workers, including students, know and follow the chemical hygiene rules (Section C), use

protective equipment, ensures safety items are available and in working order, and that appropriate training has been provided. Provides regular, formal chemical hygiene and housekeeping inspections including routine inspections of safety and emergency equipment. Knows the current legal requirements for regulated substances used in his/her laboratory. Ensures the Safety Data Sheets (SDS) for materials used in the lab are available to laboratory workers and students. Determines the required levels of personal protective equipment (PPEE) and ensures its use. Establishes lab-specific procedures and activities performed, associated hazards, and controls established to prevent injury/incidents. Ensures that facilities and training for the proper use of hazardous materials being ordered/used in the laboratory are adequate. Prepares, maintains, and updates as needed a list of chemicals/materials and accessible file of safety data sheets for all chemicals within each lab. The University's electronic SDS Library is available at: <http://hq.msdsonline.com/cowm2934/Search/Default.aspx>.

- F. Laboratory Workers: Plans and conducts all operations in accordance with institutional chemical hygiene procedures to include those published in this Plan. Develops and follow good personal chemical hygiene habits.

V. Program

- A. General Principles. In addition to the more detailed recommendations listed in this Plan, the following general principles for working with laboratory chemicals are established.
1. Minimize Exposure. It is prudent to minimize all chemical exposures. Since few laboratory chemicals are without hazards, general precautions of handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Inhalation, ingestion, and skin contact with chemicals should be avoided.
 2. Minimize Risk. Under-estimation of risk must be avoided. Even for substances of no known significant hazard, exposure should be minimized. Substances which present special hazards require that special precautions be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
 3. Ventilation. Adequate ventilation always must be provided. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by the use of fume hoods, exhaust fans, or other ventilation devices.

4. Use the Plan. The mandatory Chemical Hygiene Program established by this Plan is designed to minimize exposures to hazardous or potentially hazardous chemicals. The Plan should be a regular, continuing effort, not merely a standby or short-term activity. Its recommendations should be followed by academic teaching laboratories as well as by full-time research laboratories.
5. Observe Exposure Limits. The Permissible Exposure Limits (PELs) of OSHA 29 CFR 1910.1000, as amended by VAOSHA regulations, should not be exceeded. Permissible Exposure Limits and Threshold Limit Values (TLVs) for specific substances may be found on material safety data sheets (SDSs).
6. Hazardous Waste Disposal. Properly dispose of all hazardous chemicals generated in the laboratory. Procedures for this action are contained in the University's [Hazardous Waste Management Program](#).

B. Laboratory Facilities

1. Design.
 - a. Each laboratory should have an appropriate general ventilation system suitable for that specific location, with air intake/exhaust located so as to avoid intake of contaminated air that exceeds PELs or TLVs levels.
 - b. Each laboratory also must provide adequate, well-ventilated storage areas, laboratory hoods, and sinks.
 - c. Where required, other safety equipment including eyewash stations, drench hoses and showers, must be provided.
 - d. Appropriate arrangements for waste storage and disposal must exist.
 - e. All building utility/mechanical system, including electrical, water supply, sanitary plumbing, compressed air etc., must be adequate and appropriate for equipment, processes and activities in the laboratory.
2. Maintenance. Chemical hygiene related equipment (hoods, refrigerators, etc.) should undergo continuing inspection (at least annually) and be modified, improved, replaced or repaired by qualified personnel as needed.

3. Usage. The type of work being performed and its scale or level of effort must be appropriate to the size and type of the laboratory facility available and especially to the quality of the ventilation system.
4. Ventilation.
 - a. General ventilation system should provide a source of air for breathing and for input to local ventilation devices. It should not be relied on for protection from toxic substances released into the laboratory. It should ensure that laboratory air is continually replaced, preventing increase of air concentrations toxic substances during the working day. It should direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.
 - b. Laboratory fume hoods with at least 2.5 linear feet of hood space per person should be provided for every 2 workers that spend most of their time working directly with hazardous chemicals. Each hood, if possible, should have a monitoring device to allow convenient confirmation of adequate hood performance before use. If not, work with substances of unknown toxicity should be avoided or an alternate type of ventilation device should be provided.
 - c. Local exhaust ventilation, canopy hoods, snorkels, etc., should be provided as needed. Each system should have a separate exhaust duct.
 - d. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or another treatment facility before release into the regular exhaust system. Cold/warm rooms should have provisions for rapid escape for escape in case of power failure.

Laboratory fume hoods with at least 2.5 linear feet of hood space per person.
 - e. Modifications to ventilation systems should be made only if testing shows that these modifications will ensure that worker protection from airborne toxic substances will continue to be adequate. Modifications shall be made only by a qualified/authorized technician. The Chemical Hygiene Officer shall be informed of any changes.

Request for modification shall be submitted to Facilities Management Code Review Team for review and then approved by the University's Building Code Official, if needed, before proceeding with modifications.

- f. In reference to performance, four to twelve room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control. General air flow should not be turbulent and should be relatively uniform throughout the area, with no high velocity or static areas. Airflow into and within the hood should not be excessively turbulent. Hood face velocity should be adequate.

Typically, the face velocity would be 80 – 100 feet per minute (FPM). Ventilation system should be evaluated upon installation, tested annually, and regulated whenever changes are made.

5. Safety Recommendations. For information on safety hazards which may have implications on chemical hygiene, contact the Chemical Hygiene Office in the EH&S Office.

C. Working with Chemicals. This section will detail standard practices to follow with working with chemicals. Particularly hazardous substances should be

1. General Safety Rules.

- a. Follow all safety instructions carefully.
- b. Perform only authorized experiments. Researchers who are responsible for their own experimental programs should inform others working in the area of chemicals being used and their potential hazards.
- c. No "horse play." This is extremely dangerous and unnecessary.
- d. Avoid working alone.
- e. Do not eat, drink, smoke, chew gum, or apply cosmetics or lip balm in areas where laboratory chemicals are present. Wash hands

before conducting these activities.

- f. Confine long hair and loose clothing.
- g. Wear close-toed shoes at all times in the laboratory. Open-toed shoes, sandals, crocs or “flip flops” are not to be worn in the laboratory areas.

2. Accidents and Spills

- a. If you suspect that the rescue squad or other emergency services might be needed, then they are needed. Have someone contact them immediately either through the Campus Police or by calling 911 on a campus phone. Please note, a cell phone call using 911 connects you to a different emergency operator.
- b. Eye contact: promptly flush eyes with waster for at least 15 minutes, and seek medical attention.
- c. Ingestions: encourage the victim to dink large amounts of water. Seek immediate medical attention. Refer to the SDS for additional information
- d. Skin contact: promptly flush the affected area with water and remove any contaminated clothing; use a safety shower when contact is extensive. Flush and rinse with large volume of waster for at least 15 minutes.

If symptoms persist after washing, seek medical attention.
- e. Report all accidents and unusual occurrences to the Laboratory Supervisor or Principal Investigator AND to the Director, EH&S.

3. Allergens and Embryotoxins

- a. When working with allergens such as diazomethane, isocyanate, and dichromates, wear suitable gloves to prevent hand contact.
- b. When working with Embryotoxins such as organomercurials, lead compounds, and formamide, females of childbearing age should handle these substances only in a hood, using appropriate

protective apparel (gloves) to prevent skin contact.

- c. Store these materials, properly labeled, in adequately ventilated areas in unbreakable secondary containers whenever possible.
- d. Notify supervisors and the Director, EH&S of all incidents of exposure or spills.

4. Moderate Chronic or High Acute Toxicity Chemicals

- a. Examples of these chemicals are hydrofluoric acid, hydrogen cyanide and diisopropylfluorophosphate.
- b. Use and store these chemicals only in areas of restricted access that are posted with special warning signs. These areas should include a hood with an average face velocity of at least 80 Linear Feet per Minute (LFM) or other containment device when procedures may result in the generation of aerosols or vapors containing the chemical.
- c. Always avoid skin contact by use of gloves and long sleeves. Check the chemical compatibility charts to be sure that gloves used are appropriate for the chemical used. Wash hands and arms immediately after use.
- d. Assure that at least 2 people are present if the material in use is highly toxic or of unknown toxicity.
- e. Be prepared for accidents and spills. Store breakable containers of this substance in chemical-resistant trays. Cover work and storage surfaces, if possible with removable, absorbent, plastic backed paper. Know where spill kits are located.

5. High Chronic Toxic Chemicals

- a. Examples of these chemicals are dimethyl mercury, nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, and any other human carcinogen or substance with high carcinogenic potency in animals.

- b. 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 high chronic toxicity chemicals, for which all people with access are aware of the substances being used and necessary precautions). Prepare a written plan for use and disposal of these materials and obtain the approval of the laboratory supervisor.
- c. Decontaminate vacuum pumps and other equipment such as glassware in the hood before removing them from the controlled area. Decontaminate the controlled area before any other normal work is resumed there. Remove protective equipment and thoroughly wash hands, forearms, face and neck before leaving controlled area.
- d. If toxicologically significant amounts of these substances are being used on a regular basis (i.e., 3 or more times per week), a qualified physician should be consulted concerning desirability of regular medical surveillance. Should a physician be consulted, the EH7S Office and the worker’s immediate supervisor should be given copies of the physician’s suggestion or recommendations. The costs of the medical surveillance and evaluation will be paid for by the departments.
- e. Adequate records should be kept of the amounts stored and used, dates of use, and names of users.
- f. The controlled area should be conspicuously marked with warning signs and restricted access signs and all containers should be appropriately labeled. Contact the Chemical Hygiene Officer for assistance in developing proper signs.
- g. These chemicals should be stored only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant secondary containers.

6. Carcinogens

- a. There are many known carcinogens and the list is growing as necessary studies of suspected carcinogens are completed. It is recommended that non-carcinogenic substances be substituted

whenever possible for chemical carcinogens. If substitution is not possible, care is required to avoid exposures by inhalation, ingestion, or skin contact.

- b. Chemical carcinogens have been defined in two classes. Classes: The Experimental Animal Carcinogens which present a minimum hazard, and the Suspected and Known Human Carcinogens which present a high degree of hazard.
- c. The only carcinogens specifically regulated as such in VAOSHA 29 CFR part 1910, Subpart Z are those for which individual regulatory standards have been issued.
- d. These standards are not replaced by the Occupational Exposure to Hazardous Chemicals in Laboratories Standard.
- e. Users of these materials are expected to adhere to the provisions of all applicable substances-specific standards if employee exposure routinely exceeds the VAOSHA mandated permissible exposure limit or (action level, if specified).
- f. Copies of these standards may be obtained from the EH&S Office. Substances currently regulated by VAOSHA as carcinogens are:
 - i. Asbestos N-Nitrosodiethylamine
 - ii. 4-Nitrobipenyl Vinyl Chloride
 - iii. alpha-Naphtylamine Arsenic (inorganic)
 - iv. 4,4' - Methylene bis(2-chloroaniline) Lead
 - v. Methyl chloromethyl ether Cadmium
 - vi. 3,3' - Dichlorobenzidine (and salts) Benzene
 - vii. bis-Chloromethyl ether Cotton dust
 - viii. beta-Naphthylamine 1,2-Dibromo-3-chloropropane
 - ix. Benzidine Acrylonitrile
 - x. 4-Aminodiphenyl Ethylene oxide Ethyleneimine
 - xi. Formaldehyde
 - xii. beta-Propiolactone 4,4' - Methylene dianiline
 - xiii. 2-Acetylaminofluorene 1,3 Butadiene
 - xiv. 4-Dimethylaminoazobenzene Methylene Chloride
- g. In addition to all general safety rules cited above, when working with carcinogens, the following procedures should also be

employed:

- i. Prepare a written plan for use and disposal of these materials and obtain the approval of the laboratory supervisor. Forward a copy of the approved plan to the CHO.
- ii. Consult the safety data sheets and complete a protocol outline (Appendix A) and submit to the CHO for review. A copy of this document should be filed with the Principal Investigator and Lab Supervisor as well.
- iii. Conduct all transfers and work with these materials in a “controlled area” (a restricted access hood, glove box, or portion of a lab, designated for use of carcinogens, for which all people with access are aware of the substances being used and necessary precautions).
- iv. The controlled area must be marked with “Caution, Cancer Suspect Agent.”
- v. Entrances into areas where known carcinogens are used in appreciable quantities shall be posted:

“Cancer-Suspect Agent, Authorized Personnel Only.”
- vi. These chemicals hold be stored only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant secondary containers.
- vii. Adequate records should be kept of the amounts sorted and used, dates of use, and names of users.

7. Flammables

- a. When handling flammables, know the location and proper use of fire extinguishers and other pertinent safety equipment in your area.
- b. Never heat flammable liquids with an open flame, hot plate, or uninsulated resistance heaters. Use a heating mantle, steam bath, or hot water bath instead. Electrically driven stirrers should be explosion proof.
- c. Handle solvents in exhaust hoods or a well-ventilated area.
- d. Keep solvents to a minimum in lab.

- e. Since static electricity can start flammable solvent fires, electrically ground containers when transferring from one container to another if hot or a potential for sparking exists.
- f. Formaldehyde is a colorless, flammable, strong-smelling chemical widely used in laboratories on campus. The Formaldehyde Program (Appendix C) details procedures/guidelines to protect the health and safety of all persons in the University community who may be occupationally exposed to formaldehyde gas, its solutions, and/or materials that release formaldehyde.

8. Reactives

- a. Under certain conditions, reactive chemicals spontaneously may generate large quantities of heat, light, gases, or toxic chemicals.
- b. Reactive chemicals include explosives, acid-sensitive oxidizers and reduces, water sensitive materials, and pyrophoric.
- c. The hazards of reactive chemicals are specific to each chemical.
- d. Understand the possible dangers before use.
- e. Keep the amount used in the laboratory to a minimum.
- f. Use a hood sash, a safety shield, or a face shield.
- g. Segregate chemicals that are capable of explosive reactions with each other, and take greater precautions as the quantities of such chemicals increase.

9. Corrosives

- a. Understand possible dangers before using.
- b. Store in proper containers.
- c. Inspect containers regularly for damage and see that lids fit properly.

- d. Follow all rules pertaining to good housekeeping, labeling, handling, and disposal. Avoid spillage.
- e. Use appropriate protective equipment.
- f. Keep sealed when not in use.

10. Compressed Gases

- a. Do not store compressed gases near heat sources or in unventilated areas such as storage trailers and closets, or anywhere the temperature exceeds 125°F (252°C).
- b. Store combustible or flammable gases at least 20 ft. (6 m) from oxygen cylinders and other oxidizing chemicals, or separate them by a fire-rated partition.
- c. Store bulk quantities of gases outside buildings, and well away from building ventilation intakes, Request guidance from the Chemical Hygiene Officer on maximum quantities of compressed gases allowed in your work area.
- d. Never store a flammable gas container in an unventilated cabinet. Flammable liquid storage cabinets are not intended for the storage of small cylinders of compressed or liquefied gases.
- e. Except when part of an apparatus specifically designed for the purpose, all cylinders in use shall be upright and secured with straps, chains, or other means to prevent tipping. If cylinders of various sizes are stored together, ensure there are provisions for securing all of them. (Exception: Lecture bottles may be stored horizontally).
- f. Always store fuel-gas cylinders in an upright position.
- g. Use special racks or cradles whenever moving gas containers by crane, forklift, or truck. The containers must be upright and secured by chains or straps in the racks and the protective caps must be in place.

- h. Other compressed gas cylinders should also be stored upright. In certain temporary or transient situations, or where upright storage is impractical, cylinders may be stored horizontally if they are secured to prevent rolling. Be alert to extra hazards such as dropping cylinders while moving them from vertical to horizontal.
- i. Label all storage areas for compressed gases as to contents, and identify empty and full cylinder storage racks with signs. Individual cylinders or tanks must be labeled as to contents and important precautions.
- j. Cylinder storage areas should be well drained to prevent bottom corrosion.
- k. Gas cylinders will cause bone-crushing foot injuries if dropped. Wear safety footwear when you are moving cylinders.
- l. Always use a reducing valve or a pre-set pressure controller.
- m. Do not lubricate, modify, or tamper with a cylinder valve.

11. Select Agents

- a. Select agents are specifically regulated pathogens and toxins as defined in Title 42, CFR, Part 73. Under Federal Regulations, certain classes of activity require formal review before they may be undertaken by employees or students of the University.
- b. Faculty members who have select agents or toxins, or those who plan to purchase them in the coming term, to notify the Director, EH&S **immediately**, with information on type, quantity, storage location and safety precautions against theft, diversion and misuse.
- c. Empty select agent containers, including shipping containers, should be deactivated using a 1:10 bleach solution. Containers should be marked “Deactivated” prior to turning them in for disposal.

12. Peroxide-Forming Chemicals (PFCs).

- a. Some common organic chemicals can react with air to form unstable and dangerous peroxide compounds. Peroxides are a class of chemical compounds with unusual stability issues and are one of the most hazardous classes of chemicals routinely handled in the laboratory. A complete list of chemicals is listed in Appendix A of. [WM Guidelines for Peroxide-Forming Chemicals.](#)
- b. All users of PFCs should be familiar with [WM Guidelines for Peroxide-Forming Chemicals](#)
- c. Faculty members who have peroxide-forming chemicals should affix a label to the container indicating the date received, date opened and name of owner.
- d. Prior to using, PFCs should be evaluated for peroxide content.
 - i. Users should verify container shows no visible discoloration, liquid stratification or crystallization around the cap or in the solution.
 - ii. Users should test liquids for peroxide content using either EM Quant peroxide test strips or Quantofix peroxide test strips. Assessing peroxide levels is identified on the test strips bottle.

13. Safety Data Sheets. The EH&S Office maintains an electronic library of SDS for all materials on campus. Instructions to access the SDS online library are posted on the back of every laboratory door. The Office either has or can obtain additional information on specific materials on request.

D. Handling Laboratory Equipment

1. Glassware

- a. Do not use broken, chipped, starred or badly scratched glassware.
- b. Clean all glassware before and after use.
- c. Do not pick up broken glassware with bare hands.

- d. Use gloves, wet paper towels or sweep up.
- e. Protect hands with gloves, towels or tubing holder when inserting tubing into stoppers.
- f. Lubricate tubing with water or glycerin.

- g. Keep hand on tubing close to the stopper and out of the line with the end of the tube.
- h. Protect glass vessels when heating over a burner.
- i. Handle hot beakers with proper size and type of tongs.
- j. Do not attempt to catch falling glassware.
- k. Follow [Laboratory Glassware Disposal](#) guidelines for disposal of broken glassware.

2. Distillation Apparatus (Vacuum)

- a. Do not use cracked, starred, badly scratched or creased flasks. They could implode.
- b. Use round bottom flasks (maximum size of 5 liters).
- c. Use protective shatterproof shields.
- d. Use sifter, boiling chips or capillary tube with inert gas flowing through it to prevent bumping.
- e. Use steam or heating mantles to heat flasks.
- f. Relieve vacuum slowly avoiding sudden pressure changes which could cause breakage or spattering of contents.
- g. Do not relieve vacuum until flask has cooled.

3. Distillation Apparatus

- a. [Rotary Evaporators Task Hazard Analysis](#) should be utilized.
- b. Secure glass joints with wire or clamps to prevent vapor leakage.
- c. Make sure system is vented and watch for plugging the condenser.
- d. Use boiling chips or stirring to prevent bumping.
- e. Use heating mantle where possible.
- f. Avoid overheating still bottoms at end of distillation.
- g. Do not distill ethers until peroxides have been removed.

4. Vacuum Equipment

- a. Apply vacuum only to glassware made for such service.
- b. Be sure filter crucible can't slip through holders.
- c. Shield desiccators that are under vacuum in metal desiccator guards.
- d. Do not subject glassware under vacuum to mechanical shock.
- e. Use protective shatterproof shields.
- f. Always wrap glass Dewar flask with tape before use.
- g. Do not stopper glass flasks containing hot, condensable vapors.
- h. Check condition for mechanical vacuum pumps before using.
- i. Relieve vacuum in all parts of system before opening apparatus.

5. Pressure Equipment

- a. Except for pressure transfer from carboys or other large containers, do not apply pressure to glassware.

- b. When transferring liquids by pressure, use a pressure reducing regulator valve.
- c. Never use direct line pressure. Do not use more than 4.5 psi pressure on glass carboys.
- d. Inspect all equipment before using.
- e. See your supervisor for precise operating instructions.
- f. Provide adequate shielding.
- g. Set up equipment in a hood if reaction products are in anyway toxic.
- h. Vent pressure in all parts of the system before opening.

E. Laboratory Experiments

1. Planning Experiments

- a. Principal investigators should develop standard operating procedures (SOPs) relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals. The Standard Operating Procedures template (Appendix A) should be utilized.
- b. At minimum, SOPs should include details such as:
 - i. The chemicals involved and their hazards.
 - ii. Special hazards and circumstances.
 - iii. Use of engineering controls (i.e. fume hoods).
 - iv. Required personal protective equipment.
 - v. Spill response measures.
 - vi. Waste disposal procedures.
 - vii. Decontamination procedures.
 - viii. Description of how to perform the experiment or operation.
 - ix. Training required.
 - x. Responsibilities and Authority
 - xi. Background/Overview of the procedure; where it

will be performed; why is it being performed; duration; program or research protocol with which it is associated etc.

- c. List all possible reactions, including side reactions, before starting experiments. When working with select carcinogens, reproductive toxins, and chemicals with high acute toxicity, the protocol outline for the use of particularly hazardous substances (Appendix B) should be utilized.
- d. Think through all reactants, intermediates, and products in terms of flammability, toxicity, and reactivity hazards.
- e. Follow recognized safety procedures concerning protective equipment, housekeeping and handling.
- f. In an unknown reaction, always start with small quantities of material and carefully observe reaction characteristics such as temperature, color, viscosity, and physical state.
- g. Obtain safety data on reactants and products from chemical reference books, laboratory analysis, or SDS.
- h. If possible, determine from thermodynamic and kinetic considerations the total quantity and rate of evolution of heat and gases to be released during the reaction.
- i. Provide adequate cooling, ventilation, pressure relief, and gas purging.
- j. Isolate the reaction vessel, if possible and make frequent inspections of equipment during the reaction.

2. Required Prior Approvals

- a. Prior approval for any operation outside the purview of normal operations being conducted in that specific laboratory facility must be obtained in advance from the laboratory supervisor.
- b. This approval process should be documented. Employees must obtain prior authorization from their supervisor to proceed with, or

resume a task when:

- i. A new procedure or test is to be performed that involves a hazardous chemical. Non-routine procedures, such as those performed as part of an experiment, should be reviewed prior to the start of the project and as needed throughout its duration.
 - ii. There is reason to suspect a failure of any of the equipment used in the process, especially controls such as fume hoods.
 - iii. Members of the staff have become ill, suspect exposure, smell chemicals, or otherwise suspect a failure of any controls.
 - iv. Whenever an activity presents specific, foreseeable chemical hazards to the employee. These activities include off-hours work, sole occupants of the building, and unattended operations.
- c. Each supervisor/PI must establish the minimum number of qualified persons that must be present or sufficiently available for an activity involving hazardous materials.
 - d. Post appropriate hazard warning signs and contact information outside of an area or room where an unattended process involving hazardous chemicals is in progress. Such unattended processes should follow an approved written procedure.

F. Procurement/Storage/Labeling

1. Procurement. Before a hazardous substance is received, information on proper handling, storage, and disposal should be known to those who will use it. No container should be accepted without an adequate identifying label. In addition, no container should be accepted if there are visible signs of damage or deterioration. If possible, all substances should be received in a central location.
2. Storage Areas.
 - a. Hazardous chemicals should be segregated into well-identified areas with proper ventilation.
 - b. Highly toxic chemicals or other chemicals whose containers are opened or damaged should be unbreakable secondary containers.

- c. Stored chemicals should be examined several times per year for deterioration, container integrity, and possible replacement.
- d. Storage areas should not be used for any other operations; should be accessible only during normal working hours; and only to those every few individual with a need to retrieve stored chemicals.

3. Storage Precautions

- a. Acids. Store large bottles on low shelves or in acid cabinets. Segregate oxidizing acids from organic acids, flammable and combustible materials. Segregate acids from bases and active metals such as sodium, potassium, magnesium.
- b. Bases. Segregate bases from acids. Store solutions of inorganic hydroxides in polyethylene containers.
- c. Flammables. Store only in approved safety cans or cabinets. Segregate from oxidizing acids and oxidizers. Keep away from any source of ignition (flames, localized heat, or sparks). Store highly volatile flammable liquids in properly ventilated, cool storage areas.
- d. Oxidizers. Store in a cool, dry place. Keep away from flammable and combustible materials such as paper and wood. Keep away from reducing agents such as zinc, alkaline metals, and formic acid.
- e. Water reactive chemicals. Store in a cool, dry place. Post appropriate warning signs not to fight fire with water.
- f. Pyrophoric. Store in a cool, dry place in airtight containers.
- g. Peroxides formers. Store in airtight containers with receiving, opening and future disposal dates.
- h. Carcinogens and teratogens. Store according to the hazard category of the chemical and ensure that all containers are labeled as such.
- i. Select Agents. Store in locked cabinets.

4. Laboratory Storage.

- a. Amount of solvents and chemicals stored in the laboratory working areas should be as small as possible.
 - i. The entire Integrated Science Center is divided into Control Zones. There is a set limit for the total allowable aggregate amount of flammable, combustible, oxidizing, reactive and toxic materials that may be stored within any zone.
 - ii. For this reason, it is important that Principal Investigators keep the amount of chemicals that they have on hand to a minimum.
- b. They should be stored in protected areas to avoid inadvertent spills or breakage.
- c. Exposure to heat or direct sunlight should be avoided.
- d. Unused or unneeded items should be discarded as hazardous waste or returned to the storage area.

5. Signs and Labels

- a. All containers stored in an area shall be labeled with the following information: identity, appropriate hazard warnings, name and address of manufacturer.
- b. Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits, food and beverage consumption areas, and storage areas should be posted. Warning signs, denoting restricted areas or hazardous equipment are also required. The CHO or the EH&S Office can assist in determining the proper type and placement of signs.

6. Emergency Response to Spills and Accidents. Refer to the [Hazardous Waste Management Program](#) document.

G. Transportation

1. Materials of Trade

- a. In support of University-related work, William & Mary employees may transport small quantities of hazardous materials (non-waste) in a university-owned or personal vehicle on campus or on public roads, in accordance with the Hazardous Materials Regulations Materials of Trade (MOTs) exception (49 CFR 173.6). Quantity limitations, packaging requirements, marking and labeling requirements are listed [U.S. Department of Transportation Materials of Trade](#) document.
 - i. Faculty, staff or students moving hazardous materials should be trained and familiar with its hazards and basic handling properties.
 - ii. A secondary containment shall always be utilized to move hazardous material.
 - iii. When using a vehicle, the container containing the hazardous materials should be secured, and not in the passenger section of the vehicle. Ensure liquids are sealed appropriately to avoid leaks.
- b. William & Mary employees shall contact the Environment, Health & Safety Office prior to transporting hazardous material off campus and report the following information:
 - i. Reason for transport off campus
 - ii. Destination
 - iii. Verification that coordination with safety representative or appropriate personnel at new location has taken place.

H. Employee Exposure Determination and Reduction Actions

1. Procedures.

- a. Initial monitoring of potential exposure of laboratory personnel to a hazardous substance is required only if the substance is regulated by a standard which requires monitoring AND if there is reason to believe that exposure levels for that substance are routinely exceeding the action level, TLV, or PEL, whichever is appropriate.
- b. If monitoring is initiated, it will be performed in accordance with the relevant standard.
- c. Laboratory workers will be informed of the results of any monitoring within 15 days after receipt of the data. Notification

will be made in writing, either to the individual (s) concerned, or by posting results in an appropriate location that is accessible to the laboratory workers.

2. Exposure Reduction Actions

- a. As stated in earlier sections of this Plan, hoods, proper ventilation, equipment including clothing, personal hygiene, safety shields, glove boxes, and prudent work practices are all measures that can be taken to reduce probability of laboratory worker exposure.
- b. The CHO will make periodic checks of laboratory facilities, in particular the high-risk areas, to ensure that these actions are being implemented. It is recommended that the laboratory supervisor accompany the CHO whenever possible.

I. Fume Hood Management

1. Maintenance.

- a. Fume hoods and other associated protective equipment should be maintained in satisfactory operating condition at all times.
- b. Monitoring of performance and any scheduled preventive maintenance should be done in accordance with the manufacturer's recommendations.

2. Proper Chemical Fume Hood Use.

- a. Materials stored in the hood should be kept to a minimum and should not block vents or air flow. Too much equipment and the presence of bulky objects in the hood are common causes of poor performance (air turbulence and dead spots). To minimize air turbulence and dead air, raise necessary bulky objects off the work surface of the hood. Turbulence will be reduced by allowing some air to flow underneath.
- b. A fume hood shall not be used for chemical storage, unless storage is its sole function. When used for storage, the fume hood shall remain ON at all times and the sash shall be maintained in a CLOSED position.

- c. Place work well inside the hood. The forward six inches are most subject to drafts and turbulence. Pour and transfer materials as far back as possible.
- d. Do not place your head inside the hood. This would defeat the purpose of the hood.
- e. Maintain the hood sash at the smallest open area. Use the sash as a protective shield.
- f. Keep the hood clean. Clean up spills immediately to avoid buildup of contaminants inside the hood.

J. Information and Training Program

1. Information. Information under the Chemical Hygiene Plan includes:
 - a. The contents of this Plan and its appendices.
 - b. The location and availability of PEL data for VAOSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no exposure standard.
 - c. Signs and symptoms associated with exposure to hazardous chemicals used in the laboratory.
 - d. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in University laboratories to include the Safety Data Sheets (SDS).
2. Training. The initial training provided to all faculty, staff, and students will be accomplished through the use of lectures, discussions, videotapes, and/or other media and will include discussion of:
 - a. Methods and observations that may be used to detect the presence or release of a hazardous chemical.
 - b. The physical and health hazards of chemicals in the work area.

K. Housekeeping, Maintenance, and Inspections

1. Housekeeping.

- a. Each person is responsible for keeping his/her work area neat and orderly. All persons using community areas such as hoods, ovens, and balances should share responsibility for keeping those areas clean.
- b. Floors, counter tops, etc. should be cleaned regularly. Laboratory benches, aisles, stairways and hallways should not be used as storage areas. They should be cleared immediately after completion of each experiment. Compressed-gas cylinders never should be stored commonly used hallways.
- c. Access to exits, emergency equipment, and utility controls should never be blocked.
- d. Laboratory apparatus should be assembled in a stable, orderly fashion.
- e. All small spills (less than one liter) and leakages should be cleaned up immediately. Small acid spills can be neutralized with sodium carbonate and alkali spills with boric acid. However, all spills without regard to size must be reported to the EH&S Office to ensure proper cleanup and disposal of residua resulting from the cleanup.

2. Inspections

- a. Formal housekeeping and chemical hygiene inspections should be held annually.
- b. Records of these inspections shall be maintained by the EH&S.
- c. Office with copies to the laboratory supervisor.
- d. Findings and their corrective actions will be traced in the Corrective Actions Track System (CATS).

- e. The laboratory supervisor shall conduct informal inspections on a routine basis.

3. Maintenance.

- a. Safety equipment such as eye wash fountains, safety showers, respirators, and other protective equipment shall be inspected monthly by the PI or his/her designated alternate.
- b. Safety equipment testing shall be performed annually by Facilities Management Operations & Maintenance Staff.
- c. All maintenance and repair needs should be requested through the Facilities Management work request system.

L. Medical Program

1. General. All employees working with hazardous chemicals will be provided an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following conditions:
 - a. Whenever the employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
 - b. When exposure monitoring reveals an exposure level routinely above the action level (or PEL) for a VAOSHA regulated substance for which there are exposure monitoring and medical surveillance requirements.
 - c. 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.
 - d. All medical examination and consultations shall be performed by or under the direct supervisors of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

2. Emergency Medical Assistance. The Williamsburg Fire Department provides emergency medical service. Call 911 from a campus phone and give instructions to the Campus Police explaining the emergency and location to respond. Should the patient be contaminated with any chemical, especially any hazardous substances, it is imperative that the dispatcher be so informed in the initial call and the rescue squad members be informed at the time of their arrival on scene.
3. Medical Information. Whenever an employee is referred to a physician under this Chemical Hygiene Plan, the physician should be provided with the following information:
 - a. The identity of the hazardous chemicals (s) to which the employee may have been exposed, including, if possible a copy of the SDS. A description of the conditions under which the exposure occurred including quantitative exposure data, if available.
 - b. A description of the signs and symptoms of exposure that the employee is experiencing, if any.
4. Physician's Written Opinion. The written evaluation from the examining physician shall include:
 - a. Any recommendation for further medical follow-up.
 - b. The results of the medical examination and any associated tests.
 - 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 chemical found in the work place.
 - 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.
 - e. This written opinion shall not reveal any specific findings of diagnoses not related to the occupational exposure.

5. Record Keeping. Accurate records shall be maintained by the CHO of any measurements taken to monitor employee exposures and medical consultation/examinations including tests or written opinions required by this Plan. Information copies will be provided upon request to the Workers' Compensation Program representative.

M. Protective Equipment

1. General. Any personal protective equipment (PPE) required, such as clothing, gloves, respirators, or goggles, will be provided at no cost to the employee.
 - a. PPE will be compatible with the hazardous chemical being handled.
 - b. The SDS provides information as the type of PPE to be used.
 - c. Actual selection may vary depending on availability of other equipment such as fume hoods, ventilation systems, etc.
 - d. Assistance in selecting and in training the individual on the use and care of the PPE will be provided by the CHO on request
 - e. Other equipment such as safety showers, eyewash fountains, decontamination material, fire extinguishers, alarms, fire blankets, etc., shall be requested as needed using normal purchasing procedures.
 - f. Necessary funds for these materials and any other safety related items, should be included in the contract or grant budgets and the normal operating budgets of the research or service departments.
2. Respirators. Where the use of respirators is necessary to maintain exposure below the PEL, they shall be provided at no cost to the employee and selected based on the specific hazardous chemicals being used. Procedures for selection of the proper respirator and subsequent qualitative/quantitative fit testing are provided in the University's [Respiratory Protection Program](#).
3. Eye Protection. Eye protection for laboratory workers is of such importance that all person working directly with hazardous chemicals in the laboratory must have

eye protection of some type.

- a. This may include safety glasses, safety goggles, face shields, exhaust hoods, or protective shatterproof shields.
 - b. Refer to the Personal Protective equipment Matrix for specific requirements. The only exceptions to wearing eye protection are as follows:
 - i. At the discretion of the Department Head or Chair, persons working at their desks in lab areas or adjacent to lab benches need not wear eye protection.
 - ii. In offices removed from likely contact with laboratory materials.
 - iii. Specialized laboratories as designated by the Department Head.
4. Gloves. Skin contact is a potential route of exposure to hazardous materials. Dermatitis, burns and absorption of toxic and/or carcinogenic chemicals are some of the consequences of exposing skin to hazardous liquids.

- a. Proper protective gloves need to be worn when working with toxic or corrosive materials or with materials of unknown toxicity.
- b. Gloves are great tools to protect your skin if used properly however no one glove is suitable for handling all chemicals. Additionally, gloves designed to protect against chemical hazards generally are not good choice for protection against physical hazards such as very hot or very cold materials.
- c. Chemical protective gloves should be selected on the basis of the material being handled and their suitability for the particular laboratory operation.

N. Waste Disposal. Chemical wastes should be collected for disposal in accordance with the [Hazardous Waste Management Program](#).

Appendix A

Standard Operating Procedures

- I. **Purpose:** The purpose of this experiment is to ...
- II. **Background:**
- III. **Authority and Responsibility:**
- IV. **Hazard Analysis:**
 - A. Hazard Identification
 - B. Hazard Mitigation
 - C. Waste Disposal:
 - D. Hazardous Materials:

V. Procedures:

- A. Step by step description of procedure – it is perfectly acceptable to point laboratory personnel to other sources of information. Examples to include as part of SOPs include: “To use this piece of equipment, see page 4 in the operators manual (located in file cabinet #4).” “The chemical and physical hazards of this chemical can be found in the Material Safety Data Sheet (MSDS) electronic library at: <https://msdsmanagement.msdsonline.com/site-notification/?guid=055e23b0-e3c0-4fb5-aac1-ef313f1c72f0>
- B. Read the MSDS before using this chemical.”
- C. Laboratory Clean-up:

VI. Training:**VII. Emergency Response:****VIII. References****APPENDIX B**Protocol Outline for the Use of
Particularly Hazardous Substances (PHS)**DATE:****1. Project director or Principal Investigator's name:****2. Experience.** Summary of prior training and experience:**3. Personnel** conducting the work and their prior training and experience:**4. Identification of particularly hazardous substance. (Attach SDS):**

Full chemical name CAS #

5. Health hazard data:

VAOSHA (PEL):

ACGIH (TLV-TWA):

VAOSHA (STEL):

NIOSH (REL):

5.1 Routes of exposure:

5.2 Effects of overexposure (chronic and acute)

6. Standard operating procedures

6.1 Maximum quantity to be purchased or stored:

6.2 Designated area where material will be stored and handled:

6.3 Ventilation provisions:

6.4 Special weighing areas to be used:

6.5 Weighing techniques that will be used:

6.6 Experimental procedures:

6.7 Amounts expected to be used per month or week:

6.8 Solvents to be used:

6.9 Where the experiment is to be conducted (*e.g.* hood, glove box):

6.10 All designated areas. Where each part of the procedure will be conducted:

6.11 A summary of the rationale for using this hazardous substance:

7. Safety precautions that will be taken.

7.1 Include personal protective equipment, ventilation requirements, and any analytical methods available for monitoring possible exposure levels:

7.2 Emergency procedures including first aid procedure for eye or skin contact, inhalation, and ingestion:

7.3 Spill and leak cleanup requirements should be outlined with an emphasis on personal protective equipment required for cleanup of each of the possible physical states of the materials (liquid or solid).

8. Waste management and deactivation/disposal procedures:

APPENDIX C

Formaldehyde Program

I. INTRODUCTION

A. Purpose

The purpose of the formaldehyde program is to establish procedures/guidelines to protect the health and safety of all persons in the College community who may be occupationally exposed to formaldehyde gas, its solutions, and/or materials that release formaldehyde. The Virginia Occupational Safety and Health Administration (VAOSHA) has issued a standard to assure proper protection of all workers exposed to formaldehyde. VAOSH has established a permissible exposure limit of 0.75 parts formaldehyde per million parts of air (0.75 ppm) as an 8-hour time weighted average (TWA) and a short-term exposure limit (STEL) of two parts formaldehyde per million parts of air (2 ppm) in a 15-minute period.

The Formaldehyde Program consists of methods to be used to minimize possible workplace exposures to formaldehyde and to monitor the exposures and procedures and actions to be followed should exposures exceed specific levels or should there be a spill.

B. SCOPE AND APPLICATION

This program applies to all persons (faculty, staff, students, and visitors) in work areas under the operation or management of the College who may have an exposure to formaldehyde. Each

operational area has specific requirements for monitoring formaldehyde and the areas are monitored periodically to accurately determine exposure concentrations. It is the policy of the College to ensure that formaldehyde is handled in the safest possible manner and in compliance with all applicable codes and standards.

C. DEFINITIONS

Formaldehyde: The chemical formaldehyde (HCHO) has an irritating pungent odor and is classified as an upper respiratory irritant because of its high solubility in water. Formaldehyde is used in a variety of operations but tissue preservation is the primary source of exposure within the College community. See the Material Safety Data Sheet (SDS) for additional information.

PEL (Permissible Exposure Limit): The maximum permissible airborne concentration of formaldehyde to which any employee may be exposed. The PEL is published and enforced by VAOSHA as a legal standard. The PEL for formaldehyde is 0.75 ppm.

Action-Level: The exposure level below which respiratory protection and many other requirements of the Formaldehyde Standard need not be implemented. The current action level for formaldehyde is 0.5 ppm 8-hour TWA.

STEL (Short-Term Exposure Limit): The maximum concentration of formaldehyde to which workers can be exposed continuously over a period of 15 minutes. The STEL for formaldehyde currently is 2.0 ppm.

TLV/TWA (Threshold Limit Value/Time Weighted Average): The time weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which it is believed nearly all workers may be repeatedly exposed, day after day, without adverse effect. These values are published yearly by the American Conference of Governmental Industrial Hygienists (ACGIH).

Time Weighted Average (TWA): The actual measured exposure level averaged over an 8-hour time period.

II. EXPOSURE MONITORING

Employees in work areas of the College which may involve exposure to formaldehyde are monitored periodically to accurately determine exposure concentrations. Representative monitoring will be conducted to determine employee short-term and full-shift exposures to formaldehyde. Every employee need not be measured if a "high" exposure employee can be

identified. TWA measurements shall be determined primarily through the use of passive dosimeters for personal samples. If the formaldehyde monitoring indicates a TWA above 0.5 ppm (the "action" level) then the area supervisor will be contacted and recommendations made to reduce employee exposure. In addition, if the action level is exceeded, development of a written exposure control plan describing the corrective actions that are being taken to reduce employee exposures is required. Every effort should be made by the area supervisor and by the exposed personnel to reduce exposure levels to below 0.5 ppm. If there are tasks that involve brief but intense exposures to formaldehyde, employee exposures must be measured to assure compliance with the STEL. Sample collections are for brief periods (15 minutes) but several samples may be needed to identify the peak exposure.

Monitoring will be conducted by the EH&S Office in such manner as to be representative of the 8-hour TWA of each employee. Representative 8-hour TWA employee exposures shall be determined on the basis of one or more samples representing full-shift exposure for each shift for each job classification in each work area. The frequency of such monitoring is required as follows:

- Initially, wherever there may be exposure by employees above the PEL to establish a baseline exposure level.
- Whenever there is a change in processes, equipment, personnel or control measures which may result in new or additional exposure to formaldehyde.
- Semiannually, whenever the most recent monitoring result reveals a TWA exposure above the 0.5 ppm action level.
- Annually, whenever the most recent monitoring result reveals employee exposure at or above the STEL.

Semiannual and annual monitoring, as specified above, are not required when two consecutive formaldehyde monitoring sessions which have been executed at least 7 calendar days apart and both indicate TWA and/or STEL exposures below 0.5 ppm and/or 2.0 ppm, respectively.

TWA levels measured to be in excess of 0.5 ppm are considered to remain above this level until 2 consecutive monitoring periods performed at least 7 calendar days apart confirm that the exposure concentration has dropped to below 0.5 ppm.

III. REPORTING MONITORING RESULTS

The area supervisor shall report the results of all formaldehyde monitoring to the affected person(s) within 15 calendar days of the date on which the area supervisor receives the results. Notification must be in writing, either by distributing copies of the results of the exposure monitoring to the affected (those conducting the same job tasks) employees or by posting the results. Results should be posted for a minimum of three days. If the PEL has been exceeded, affected employees must be notified, in writing, of the corrective action being taken.

TWA measurements may be taken at any time, at the discretion of the area supervisor or the EH&S OFFICE. If monitoring results indicate that either the PEL or the STEL has been exceeded, the use of respirators and/or other protective equipment is required by all personnel in the area, as soon as the report is received. (NOTE: Gloves, goggles, face shields, and other protective clothing may be necessary at much lower exposure levels.) VAOSHA specifies full-face piece respirators with cartridges specifically approved for formaldehyde exposure. The EH&S Office will provide assistance in selection of protective clothing and equipment based upon the form of formaldehyde to be encountered, the condition of use, and the hazard to be prevented. The College shall provide these protective devices to the employee at no cost to the employee and assure that the employee wears them. The rotation of employees in order to lower formaldehyde exposure levels is prohibited by VAOSHA.

IV. MEDICAL REMOVAL

If an employee reports significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization attributed to workplace formaldehyde exposure, and then he/she should be evaluated by a physician. If the physician finds that significant irritation is the result of workplace formaldehyde exposure and recommends restrictions or removal, the employer must promptly comply. The employer must remove the affected employee from the current formaldehyde exposure and transfer the employee to other work having no or significantly less exposure to formaldehyde. The employee should not be required to incur any direct expense for the medical evaluation nor should the

employee be required to lose pay for the time required for the medical evaluation.

V. INFORMATION AND TRAINING

All employees exposed to formaldehyde concentrations of 0.1 ppm or greater must receive training annually. The training program shall be conducted in a manner in which the employee is able to understand and shall include the following information:

1. The requirements of the VAOSHA regulations concerning formaldehyde (29 CFR 1910.1048) and a discussion of the material safety data sheet.
2. A description of the operations in the work area where formaldehyde is present and an explanation of the safe work practices appropriate for limiting the exposure to formaldehyde.
3. A description of the potential health hazards associated with an exposure to formaldehyde and a description of the signs and symptoms of an exposure to formaldehyde. As a minimum, specific health hazards include: cancer, irritation and sensitization of the skin and respiratory system, eye and throat irritation, and acute toxicity.
4. A discussion of monitoring and other methods used to detect the presence of formaldehyde in the work area.
5. The measures employees must take to protect themselves from hazards associated with formaldehyde exposure. The purpose for, proper use of, and limitations of the required personal protective clothing and equipment.
6. The purpose for and a description of the medical surveillance program required by the standard. A medical surveillance program is required for all employees exposed to formaldehyde at concentrations at or exceeding the action level or exceeding the STEL. Medical surveillance is also required during the following instances:
 - If an employee develops signs and symptoms of an overexposure to formaldehyde.
 - If an employee is exposed to formaldehyde during an emergency.
If requested by an employee's examining physician.

7. A review of emergency procedures for the handling of spills, emergencies, and clean-up.

8. An explanation of the importance of engineering and work practice controls for employee protection and any necessary instruction in the use of these controls.

VI. ENGINEERING CONTROLS

Ventilation is the most widely applied engineering control method used for reducing the concentration of airborne substances in the breathing zones of workers. Either local exhaust ventilation or general dilution ventilation should be used for this purpose whenever possible. Work practices and administrative procedures are also an important part of a control system. If an employee is asked to perform a task in a certain manner to limit the exposure to formaldehyde, it is extremely important that the recommended procedures are followed.

If it is determined that there are areas where the concentration of airborne formaldehyde exceeds either the TWA or the STEL, the College will regulate those areas and post and maintain legible signs bearing the following information at all entrances or access ways:

DANGER

FORMALDEHYDE

IRRITANT AND POTENTIAL CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

VII. LEAK, SPILL, AND EMERGENCY PROCEDURES

Small spills should be cleaned up with absorbent material and placed into properly labeled containers for later disposal. The Chemical Hygiene Officer or other representative of the EH&S Office must be informed. In an area where a large amount of formaldehyde could be released from an accident, the supervisor should develop an emergency plan assigning tasks to specific individuals and specifying procedures to be followed in the event of an emergency.

In case of a large leak or spill, the area should be evacuated immediately except for those individuals who have specific emergency duties. While leaving the area, lab personnel should shut off all ignition sources, if this can be done without risk. No one without specific training and personal protective equipment should touch the spill or attempt to clean it up. Persons designated in the lab's emergency plan should isolate any hazard area and deny entry except for necessary personnel protected by suitable protective clothing and respirators adequate for the exposure. The EH&S Office should be contacted immediately.

Individuals with a potentially excessive exposure to formaldehyde should have prompt medical attention and evaluation. Eye and skin irritation and respiratory distress are symptoms of formaldehyde exposure. If there is any concern about the severity of the medical problem, the rescue squad should be called to transport the individual to an emergency facility.