West Virginia University
POTOMAC STATE COLLEGE

POTOMAC STATE COLLEGE PROCEDURE

APPROVED: _____

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Chemical Hygiene Plan

Purpose

The Occupational Safety and Health Administration, in Federal Law 29CFR, part 1910, requires the establishment of a written Chemical Hygiene Plan (CHP) for Potomac State College. The CHP will establish general rules for the safe handling, storage, and disposal of hazardous chemicals. Within the CHP will be specific directives for dealing with specific hazardous chemical substances.

It is the responsibility of every member of the college community (administration, faculty, staff, and students) to carry out the CHP.

ADMINISTRATION OF THE CHEMICAL HYGIENE PLAN

The CHP will be administered on all levels, but there are specific duties to be outlined for certain individuals.

Campus President or Equivalent CEO: The Campus President or equivalent CEO has the ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene, including the enforcement of the directives of the CHP.

Division Chair, Unit Coordinator, or other Equivalent Administrator: These individuals have the responsibility for chemical hygiene within their unit. They oversee the operations of the unit.

Faculty and Staff: These individuals are responsible for planning and conducting each operation (lab class, research project, or preparation for lab) in accordance with institutional chemical hygiene procedures, supervising chemical hygiene procedures in laboratory class or in

chemical hygiene procedures, supervising chemical hygiene procedures in laboratory class or in any chemical handling procedure, and developing good personal hygiene habits in the laboratory, prep room, or work area. Faculty are responsible for communicating appropriate portions of the CHP to students who are under their supervision.

Faculty and staff are responsible for filling out accident report forms (available in the CHO Office – extension 26962) for accidents involving the spill of chemicals and/or injury to themselves and/or students caused by chemicals. These forms are to be filed with the CHO in no less than one week after the accident. Failure to report accidents or spills involving chemicals will result in disciplinary action by the President's Office.

In addition to these persons, the law specifies the appointment of a Chemical Hygiene Officer (CHO) who is knowledgeable in the requirements of the CHP. The CHO will be permanently designated by the Campus President or equivalent CEO.

The duties of the CHO will include:

1. Working with the administration and other employees to develop and implement appropriate chemical hygiene policies and practices for the campus;
2. Monitoring procurement, use, and disposal of chemicals used on campus;
3. Seeing that appropriate audits and inventories are maintained;
4. Helping faculty, administrators, and project directors develop precautions and adequate facilities;
5. Knowing current legal requirements concerning regulated substances;
6. Seeking ways to improve chemical hygiene on campus;
7. Ensuring employees know and follow the CHP rules and that protective equipment is available and in proper working order and that employees are trained in its use;
8. Providing regular formal chemical hygiene and housekeeping inspections;
9. Determining that levels of protective equipment and apparel and training for the use of any material being ordered are adequate; and
10. Providing biannual CHP retraining of the faculty and staff that handle chemicals.

Hazardous chemical in the context of this CHP will mean 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, toxins, or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, or agents that act on the hematopoitic systems, and agents which damage the lungs, skin, eyes or mucus membranes, explosives or powerful oxidizing agents.

Storerooms/Stockrooms

Highly toxic substances should be segregated from the rest of the chemical stock. Chemicals which are highly toxic or other chemicals that have been opened should be stored in such a way that their accidental opening cannot occur. This may include their enclosure in a larger container. Bottles should not be packed onto shelves. There must be clearance of 1.5 inches between the bottle and the edge of the shelves. Shelves used to store stock chemicals should have lips at their edges to prevent the accidental falling of these bottles. These lips should be at least ¼ inch high and extend the full length of the shelves. Shelves with wide edges and those on the very bottom shelves are exempt. Shelves in the laboratory (so-called ready service

shelves) are exempt from this rule as they are in constant use and are watched over carefully by those in the lab.

Stockrooms and storerooms should be open only during normal operation hours of the laboratory classes and be controlled by a single person. Stockrooms and/or storerooms are to be kept closed and locked when they are not in immediate use.

Distribution: When chemicals are carried by hand, the container must be placed in an outside container such as a bucket. The use of carts is required for transport of chemicals from floor to floor or over long distances on a single floor or transport of large quantities or large volumes of chemicals within a building. A method to get carts to and from the outdoor storage facility is required.

Laboratory Storage: Amounts of chemicals stored in the laboratory should be as small as possible and practical. Permanent storage of chemicals under hoods or on bench tops is forbidden. Storage spaces where chemicals will be exposed to heat or sunlight are to be avoided. Periodic inspections of chemicals and chemical storage areas should be made, with unneeded items being discarded. Chemicals should be inspected on a yearly basis for replacement. Deterioration of the container will lead to failure of the container's integrity. Ethers and other dated substances should not be kept past their expiration date. These must be disposed of by methods suggested by the CHO. Bottles of chemicals must have the date they were received stamped or written on them.

Housekeeping, Maintenance Inspections: Cleaning of floors should be accomplished on a regular basis. Inspections of housekeeping will be held annually; informal inspections will be continual. It is the responsibility of the faculty member in charge of an area to get the apparatus off the floor for cleaning. Aisles and other exits must be kept clear of all obstructions.

Eyewash stations should be checked and inspected once per semester, and safety showers should be checked once per semester. Inspection tags will be hung near the shower and eyewash stations with the date of the inspections and the initials of the person doing the inspection. Malfunctions are to be reported to maintenance immediately. Shower and eyewash stations are never to be blocked by carts or other equipment.

Passageways, stairs, and hallways are not to be used for storage of equipment or chemicals. Access to emergency equipment and exits should never be blocked or obstructed. Clear pathways to and from storerooms and within them are required.

First aid trained personnel (college nurse) should be on duty during all laboratory classes that use chemicals.

Accident report forms are available at the Chemical Hygiene Office. These forms are to be filled out for any accident, no matter how minor, and sent to the Chemical Hygiene Office. The CHO will decide which reports are to be filed. Accident report forms are to be retained for a period of not less than five (5) years or more than ten (10) years in the Chemical Hygiene Office.

Inventory records for high risk substances should be kept in a central location within the unit. Any and all high risk substances should be reported to the CHO.

For outdoor storage facilities, a form called a "withdrawal form" must be instituted. This form should have space for the name of the person making the withdrawal of chemicals, the name

and quantity of chemicals withdrawn, as well as the date of the withdrawal. This form should be removed for inventory purposes at least once per year. An accurate inventory of the chemicals located in all departments/units will be maintained within the office of the unit coordinator or equivalent administrator and a yearly update will be sent to the Chemical Hygiene Office upon request. The usual time of the request is December of the calendar year. This report will be filed in the Chemical Hygiene Office for federal records.

Signs and Labels

Emergency telephone numbers such as emergency squads, fire department, HazMat team, Safety Office, ambulance, etc. should be posted at all telephones. It is important that instructions on how to obtain an outside line also be posted.

Large signs specifying that safety glasses or other safety equipment are required for entry into certain rooms must be posted. Also post limited access areas with appropriate warning signs.

Identity labels showing contents of containers (including waste) along with NFPA diamond codes and other associated warnings should be on each container that is to come into contact with students. Those kept in the preparation rooms may retain the label from the company of origin. Help in determining exactly what codes are needed can be obtained from the CHO. Labels for waste must contain the date when the waste was first entered and the approximate percent composition of the material in the bottle. The bottles of mixed waste must not have percentages that sum to greater than 100%. Waste containers cannot be stored for more than one (1) calendar year.

Location signs for safety showers, eyewash stations, first aid kits, and other safety-related materials, including exits, must be posted clearly.

Warnings at areas where special equipment or automatic operating equipment and/or places where special hazards or unusual conditions exist must be clearly posted.

Emergency Plans

A written emergency evacuation plan has been established and communicated to all personnel. It includes procedures for evacuation of each building on campus and is posted in several easily seen places on each floor of each campus building. It must be posted in a way that will make accidental or deliberate removal difficult. Faculty should inform students during the first few weeks of each semester of the proper way they are to evacuate a building in case of an emergency.

For a chemical-related emergency, evacuate the building by activation of the local fire alarm, then call Campus Police and the CHO. Follow procedures specified in College Procedure #24.

HazMat team members on this campus are fully acquainted with the use of emergency equipment and will undergo continuous training in emergency activities.

Emergency and Personal Protection

Every laboratory worker should know the location and proper operation of available emergency and safety equipment and apparel. They should know and understand the College HazMat Policy (PSC Procedure #18).

Receiving rooms and stockroom personnel should be made aware of the hazards and proper equipment and apparel to use in case of a spill in those confined areas. They should also know the operation of the ventilation system for that area. Training and education programs should be a regular and continuing activity.

A single person should be in control of chemical stockrooms and be present during operational hours of laboratory classes. The number of persons having access to the stockrooms will be kept to a minimum. Keys will be issued only to those persons actually working in that area and not to student workers. Keys to chemical storage facilities and/or laboratories must never be in the control of a student.

Literature and consultation is readily available to laboratory personnel, all campus employees, and students in the Chemical Hygiene Office. M.S.D.S. forms for the chemicals in the chemistry inventory as well as campus chemical inventories are kept in the Chemical Hygiene Office.

A waste disposal program has been created in conjunction with the WVU Office of Environmental Health and Safety and is fully explained in Potomac State College Procedure #21. All interested parties are herewith referred to that procedure.

Student workers must never be left alone in a chemical preparation room while they are making solutions or handling hazardous chemicals. A faculty member must be present during these operations. However, a faculty member knowledgeable in spill procedures and the nature of those chemical substances being used must be on the same floor during all student work activities.

General Chemical Handling Safety Regulations

1. Performance of highly dangerous experiments must be cleared through the Chemical Hygiene Office. Those using large quantities of explosive, deadly, poisonous, and/or hazardous substances must be cleared through the Chemical Hygiene Office.

2. All personal injuries involving chemical contamination on any part of the body other than the hands and those contaminations of the hands resulting in chemical burns must be reported in writing to the CHO within five (5) working days of the accident.

3. Any accident resulting in the spilling of a quantity of dangerous or corrosive chemical in excess of 100ml or 50g solid must be reported in writing to the CHO within five (5) working days of the accident.

4. Each and every worker involved in operations using chemicals must be aware of the location and proper use of fire extinguishers, safety showers, eyewashes, and first aid kits in the area in which the chemical operations are being conducted. Chemical handling operations and experiments are to be carried out only in areas which are designed for that

purpose and have the proper emergency apparatus and ventilation for those chemical operations.

5. Practical jokes and boisterous conduct are forbidden during operations using chemicals and in areas used to store or prepare chemicals.

6. No chemicals or glassware of any kind may be removed from the campus without approval and written record in the Office of the CHO. This does not include the proper disposal of broken equipment or glassware.

7. Smoking, eating, the use of smokeless tobacco, chewing of gum, and drinking are forbidden during operations involving the use of chemicals. These activities are strictly forbidden in all college laboratories.

8. No person is permitted to work alone in a laboratory or during operations using toxic and/or hazardous chemicals. A competent member of the college staff or faculty familiar with these chemicals and/or these operations must be present on the same floor (area) within easy access and within hearing range of distress calls.

9. All gas, electrical, air, and water services are to remain off unless they are required. All services are to be secured before leaving the work area or lab.

10. Preparation rooms and/or chemical storage facilities are limited access areas. The CHO will designate those persons who may have keys and have common access. The CHO should limit access as much as possible. These areas are not to be entered by students, except those designated as work-study laboratory assistants. Chemical storage areas designated specifically for that purpose should be double locked with a dead bolt and/or pad lock with limited access keys.

11. Never taste, smell, or touch any chemical unless you are completely acquainted with its properties and the history of the bottle in which it is kept. If you need more information, contact the CHO.

12. Never point open reaction vessels (flasks, test tubes, etc.) or chemical spraying apparatus at anyone. These materials are not toys and should be handled with appropriate caution and respect.

13. Be sure all connections on your apparatus are secure and that proper support has been provided. Be sure glassware is not chipped or cracked prior to use and that spraying apparatus, etc. is functioning property before filling it with chemicals.

14. When mixing chemicals be sure to use the proper ventilation and be aware of any heat or gases that may be evolved in the reaction. Always pour acid into water with stirring – never the reverse. Be careful with solutions – the chemicals in them are just as hazardous as in the solid state.

15. Never use chemical apparatus for any other purpose. Do not use reagent bottles to hold anything but chemicals. Never use spraying equipment for any other purpose except spraying pesticides.

16. Do not store food or drink in refrigerators or ice machines designated for chemical or biological storage or use.

17. Use the appropriate attire for the work you are doing. In the lab wear shoes that cover the toes, not canvas or nylon mesh. No sandals or high-heeled shoes are allowed. Do not wear hats, coats, or sweaters in the lab during operational hours and especially not during chemical handling operations. Do not wear shorts or short skirts when handling chemicals. Long pants and skirts that extend to the ankles give added protection to the legs. Remember, prevention of contact with chemicals is of primary importance.

18. In lab classes during the use of chemicals and in outside operations that use chemicals, if you must wear contact lenses (because of a medical reason that doesn't give you the option of wearing glasses), you must wear goggles specifically designed for that purpose. Ordinary lab goggles are not appropriate. These special goggles have no air vents, are anti-fog, and fit tightly against the face. Those persons wearing prescription lenses must wear goggles over their glasses. Those persons not wearing prescription lenses must wear safety glasses or goggles. Face shields may be required for certain specific hazards. Check with the Chemical Hygiene Office for the eye protection needed for your specific operation.

19. Keep your work area clean and free of unnecessary apparatus and bottles. Keep flammables and their containers away from open flames. Be sure there is adequate light and proper ventilation for your specific job. Use a fume hood and/or respirators when you have to use them. If you are not sure, seek advice from the Chemical Hygiene Office.

20. Visitors are not permitted in the labs during times when experimental work or handling of chemicals is in progress. Visitors are not permitted in the prep rooms, receiving areas, or storage facilities.

21. Custodians assigned to chemistry laboratories are to be trained in chemical hygiene, spill containment, and reading and understanding chemical labels and are required to attend the biannual CHP retraining session.

BASIC RULES AND PROCEDURES FOR WORKING WITH CHEMICALS

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.
- Ingestion: Encourage the victim to drink large amounts of water.
- Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.
- Clean-up: Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal. See recommendations.

(b) Avoidance of "routine" exposure: Develop and encourage safe habits; avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals. Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices. Inspect gloves and test glove boxes before

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

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

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

The storage, handling, or consumption of food or beverages and application of cosmetics in storage areas, refrigerators, glassware, or utensils which are also used for laboratory operations is strictly forbidden.

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

(f) **Exiting:** Wash areas of exposed skin with warm, soapy water well before leaving the laboratory.

(g) **Horseplay:** Practical jokes or other behavior which might confuse, startle, or distract another worker are forbidden.

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

(i) **Personal apparel:** Confine long hair and loose clothing. Wear shoes at all times in the laboratory, but do not wear sandals, perforated shoes, or sneakers. Watches, rings, bracelets, jewelry, scarves on the head or elsewhere, or any other items are to be removed from wrists and fingers.

(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.

(k) **Personal protection:** Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled. Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls, inspecting the respirator before use. Those individuals using respirators must be "fit tested," cleared for their use, and medical monitored by West Virginia University. See the CHO for further details.

Use any other protective and emergency apparel and equipment as appropriate. Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken.

Remove laboratory coats immediately on significant contamination.

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

(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.

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

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.

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

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

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

Deposit chemical waste in appropriate labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.

Do not discharge to the sewer concentrated acids or bases; highly toxic, malodorous, or lachrymatory substances, 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.

(q) **Working alone:** Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous. Students must never work alone in the laboratory or preparation room during procedures where chemicals are used or handled.

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.

(b) **Embryotoxins (examples: organomercurials, lead compounds, formamide):** If you are a woman of childbearing age, handle these substances only in a hood for which 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: diisopropylflurophosphate, hydrofluoric acid, hydrogen cyanide

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

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

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

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

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

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

   (f) Prevention of spills and accidents: Be prepared for accidents and spills. Assure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity.

   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.

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

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

   Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles).

4. **Work with Chemicals of High Chronic Toxicity**
Examples: dimethylmercury and nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, other human carcinogens or substances with high carcinogenic potency in animals

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).

(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. Each laboratory must have a designated area for the handling of these materials. This area must be clearly marked with a sign that says "Designated Area."

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

(c) Non-Contamination/Decontamination: Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the controlled area before normal work is resumed there.

(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.

(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.

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

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

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

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

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

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

(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.

5. **Animal Work with Chemicals of High Chronic Toxicity**

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

   (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.

   (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).

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

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

Safety Recommendations

The above recommendations do not include those which are directed primarily toward prevention of physical injury rather than to exposure. However, failure of precautions against injury will often have the secondary effect of causing toxic exposures. Therefore, to obtain a list of reference materials available for your use in the Safety Office, send a memo to the CHO.

Common Peroxide Forming Chemicals

List A

Severe peroxide hazard on storage with exposure to air. Discard within three (3) months.

Diisopropyl ether (isopropyl ether)
Divinylacetylene (DVA)
Potassium metal (except submerged in mineral oil)
Potassium amide
Sodium amide (sodamide)
Vinylidene chloride (1,1-dichloroethylene)

Diethyl ether cannot be stored for longer than one (1) calendar year from its receiving date. After that time it must be discarded regardless of its peroxide content.

List B

Peroxide hazard on concentration; do not distill or evaporate without first testing for the presence of peroxides. Discard or test for peroxides every six (6) months.

Acetaldehyde diethyl acetal (acetal)
Cumene (isopropylbenzene)
Cyclohexene
Cyclopentene
Decalin (decahydronaphthalene)
Diacetylene (butadiene)
Dicyclopentadiene
Diethyl ether (ether)
Diethylene glycol dimethyl ethers (glyme)
Ethylene glycol ether acetates
Ethylene glycol monoethers (cellosolves)
Furan
Methylacetylene
Methyl cyclopentane
Methyl isobutyl ketone
Tetrahydrofuran (THF)
Tetralin (tetrahydronaphthalene)
Vinyl ethers

List C

Hazard of rapid polymerization initiated by internally former peroxides.

(a) Normal liquids; discard or test for peroxides after six (6) months.

Chloroprene (2-chloro-1, 3-butadiene)
Styrene
Vinyl acetate
Vinylpyridine

(b) Normal gases; discard after twelve (12) months.

Butadiene
Tetrafluoroethylene (TFE)
Vinylacetylene (MVA)
Vinyl chloride

Common Reactive Chemicals

Violent fires and/or explosions are the hazards associated with the following reactive chemicals. They should be kept in segregated storage if possible.

Ammonium nitrate
Benzoyl peroxide
Tert-Butyl hydroperoxide
Calcium hydride
Potassium
Chromium trioxide
Diethylaluminum hydride
m-dinitrobenzene

Divinylbenzene
Hydrazine
Hydrazine chlorate
Conc. Hygrogen peroxide
Lauroyl peroxide
Magnesium perchlorate
Nitromethane
2-nitropropane
p-nitrotoluene
Phosphorus (red)
Picric acid (hydrate)
Trinitrotoluene

Ammonium perchlorate
2-Butanone peroxide
Tert-Butyl peroxide
Cesium
Chromic nitrate
Diborane
Dimethyl phosphine
p-dinitrobenzene
Germane
Hydrazine hydrate
Hydrazine chlorite
Hydroxylammonium nitrate
Lithium acetylide
Mercury (I) perchlorate
Nitroethane
o-nitrotoluene
any peroxides
Phosphorus (yellow)
Picric acid (anhydrous)
Trinitrobenzene

SPECIFIC CHEMICAL HAZARDS THAT FREQUENTLY LEAD TO FIRES OR EXPLOSIONS

Acetylenic compounds are explosive in mixtures of 2.5-8.0% with air. At pressures of 2 or more atmospheres, acetylene (C_2H_2) subjected to an electrical discharge or high temperature decomposes with explosive violence. Dry acetylides detonate on receiving the slightest shock.

Aluminum chloride ($AlCl_3$) should be considered a potentially dangerous material. If moisture is present, there may be sufficient decomposition (to give hydrogen chloride [HCl]) to build up considerable pressure. If a bottle is to be opened after long standing, it should be completely enclosed in a heavy towel.
Ammonia (NH_3) reacts with iodine to give nitrogen triiodide, which is explosive, and with hypochlorites to give chlorine. Mixtures of NH_3 and organic halides sometimes react violently when heated under pressure.

Dry benzoyl peroxide $(C_6H_5CO_2)_2$ is easily ignited and sensitive to shock. It decomposes spontaneously at temperatures above 50 degrees C. It is reported to be desensitized by addition of 20% water.

Carbon disulfide (CS_2) is both very toxic and very flammable; mixed with air, its vapors can be ignited by a steam bath or pipe, a hot plate, or a glowing light bulb.

Chlorine (Cl_2) may react violently with hydrogen (H_2) or with hydrocarbons when exposed to sunlight.

Chromium trioxide-pyridine complex ($CrO_3 \cdot C_5H_5N$) may explode if the CrO_3 concentration is too high. The complex should be prepared by addition of CrO_3 to excess C_5H_5N.

Diazomethane (CH_2N_2) and related compounds should be treated with extreme caution. They are very toxic, and the pure gases and liquids explode readily. Solutions in ether are safer from this standpoint.

Dimethyl sulfoxide [$(CH_3)_2SO$] decomposes violently on contact with a wide variety of active halogen compounds. Explosions from contact with active metal hydrides have been reported. Its toxicity is still unknown, but it does penetrate and carry dissolved substances through the skin membrane.

Dry ice should not be kept in a container that is not designed to withstand pressure. Containers of other substances stored over dry ice for extended periods generally absorb carbon dioxide (CO_2) unless they have been sealed with care. When such containers are removed from storage and allowed to come rapidly to room temperature, the carbon dioxide may develop sufficient pressure to burst the container with explosive violence. On removal of such containers from storage, the stopper should be loosened or the container itself should be wrapped in towels and kept behind a shield. Dry ice can produce serious burns (this is also true for all types of cooling baths).

Drying agents – Ascarite should not be mixed with phosphorus pentoxide (P_2O_5) because the mixture may explode if it is warmed with a trace of water. Because the cobalt salts used as moisture indicators in some drying agents may be extracted by some organic solvents, the use of these drying agents should be restricted to gases.

Diethyl, diisopropyl, and other ethers (particularly the branched-chain type) sometimes explode during heating or refluxing because of the presence of peroxides. Ferrous salts or sodium bisulfite can be used to decompose these peroxides, and passage over basic active alumina will remove most of the peroxidic material. All ether over the expiration must be disposed through the CHO.

Ethylene oxide (C_2H_4O) has been known to explode when heated in a closed vessel. Experiments using ethylene oxide under pressure should be carried out behind suitable barricades.

Halogenated compounds – Chloroform ($CHCl_3$), carbon tetrachloride (CCl_4), and other halogenated solvents should not be dried with sodium, potassium, or other active metal; violent explosions are usually the result of such attempts. Many halogenated compounds are toxic.

Hydrogen peroxide (H_2O_2) stronger than 3% can be dangerous in contact with the skin; it may cause severe burns. Thirty percent may decompose violently if contaminated with iron, copper, chromium, or other metals or their salts.

Liquid-nitrogen-cooled traps open to the atmosphere rapidly condense liquid air. Then, when the coolant is removed, an explosive pressure buildup occurs, usually with enough force to shatter glass equipment. Hence, only sealed or evacuated equipment should be so cooled.

Lithium aluminum hydride ($LiAlH_4$) should not be used to dry methyl ethers or tetrahydrofuran; fires from this are very common. The products of its reaction with carbon dioxide have been reported to be explosive. Carbon dioxide or bicarbonate

extinguishers should not be used against $LiAlH_4$ fires which should be smothered with sand or some other inert substance.

Oxygen tanks – Serious explosions have resulted from contact between oil and high-pressure oxygen. Oil should not be used on connections to an oxygen cylinder.

Ozone (O_3) is a highly reactive and toxic gas. It is formed by the action of ultraviolet light on oxygen (air) and, therefore, certain ultraviolet sources may require venting to the exhaust hood.

Palladium or platinum on carbon, platinum oxide, Raney nickel, and other catalysts should be filtered from catalytic hydrogenation reaction mixtures carefully. The recovered catalyst is usually saturated with hydrogen and highly reactive and, thus, will enflame spontaneously on exposure to air. Particularly in large-scale reactions, the filter cake should not be allowed to become dry. The funnel containing the still-moist catalyst filter cake should be put into a water bath immediately after completion of the filtration.

Another hazard in working with such catalysts is the danger of explosion if additional catalyst is added to a flask in which hydrogen is present.

Parr bomb calorimeters used for hydrogenations have been known to explode. They should be handled with care behind shields, and the operator should wear goggles.

Perchlorates – The use of perchlorates should be avoided wherever possible. Perchlorates should not be used as drying agents if there is a possibility of contact with organic compounds or in proximity to a dehydrating acid strong enough to concentrate the perchloric acid ($HClO_4$) to more than 70% strength (e.g., in a drying train that has a bubble counter containing sulfuric acid). Safer drying agents should be used.

Seventy percent $HClO_4$ can be boiled safely at approximately 200 degrees C, but contact of the boiling undiluted acid or the hot vapor with organic matter, or even easily oxidized inorganic matter (such as compounds of trivalent antimony), will lead to serious explosions. Oxidizable substances must never be allowed to contact $HClO_4$. Beaker tongs, rather than rubber gloves, should be used when handling fuming $HClO_4$. Perchloric acid evaporations should be carried out in a hood that has a good draft. Frequent (weekly) washing out of the hood and ventilator ducts with water is necessary to avoid danger of spontaneous combustion or explosion if this acid is in common use.

Permanganates are explosive when treated with sulfuric acid. When both compounds are used in an absorption train, an empty trap should be placed between them.

Peroxides (inorganic), when mixed with combustible materials, barium, sodium, and potassium peroxides, form explosives that ignite easily.

Phosphorus (P) (red and white) forms explosive mixtures with oxidizing agents. White P should be stored under water because it is spontaneously flammable in air. The reaction of P with aqueous hydroxides gives phosphine, which may ignite spontaneously in air or explode.

Phosphorus trichloride (PCl_3) reacts with water to form phosphorous acid, which decomposes on heating to form phosphine, which may ignite spontaneously or explode.

Care should be taken in opening containers of PCl_3, and samples that have been exposed to moisture should not be heated without adequate shielding to protect the operator.

Potassium (K) is in general more reactive than sodium; it ignites quickly on exposure to humid air and, therefore, should be handled under the surface of a hydrocarbon solvent such as mineral oil or toluene (see Sodium).

Residues from vacuum distillations (for example, ethyl palmitate) have been known to explode when the still was vented to the air before the residue was cool. Such explosions can be avoided by venting the still pot with nitrogen, by cooling it before venting, or by restoring the pressure slowly.

Sodium (Na) should be stored in a closed container under kerosene, toluene, or mineral oil. Scraps of Na or K should be destroyed by reaction with n-butyl alcohol. Contact with water should be avoided because Na reacts violently with water to form H_2 with evolution of sufficient heat to cause ignition. Neither carbon dioxide nor bicarbonate nor carbon tetrachloride fire extinguishers should be used on alkali metal fires.

Sulfuric acid (H_2SO_4) should be avoided, if possible, as a drying agent indesiccator. If it must be used, glass beads should be placed in it to help prevent splashing when the desiccator is moved. The use of sulfuric acid in melting point baths should be avoided. (Silicone oil should be used.) To dilute sulfuric acid, add the acid slowly to cold water.

Trichloroethylene (ClCCHCl) reacts under a variety of conditions with potassium or sodium hydroxide to form dichloroacetylene, which ignites spontaneously in air and detonates readily even at dry-ice temperatures. The compound itself is highly toxic, and suitable precautions should be taken when it is used as a degreasing solvent.

Incompatible Chemicals

When transporting, storing, using, or disposing of any substance, utmost care must be exercised to ensure that the substance cannot accidentally come in contact with another with which it is incompatible. Such contact could result in a serious explosion or the formation of substances that are highly toxic or flammable or both.

For more information on the toxic nature of chemicals, proper use of chemicals, safe and proper storage and disposal, call the Chemical Hygiene Office.

Appendix I
(revised 7/18/13)

Site-Specific Additions to the Chemical Hygiene Plan for Potomac State College

Section A

Pesticide-Herbicide Spraying Procedure Used During Campus Visitations by K-12 and Day Care Centers Visitors

During any visitation to Potomac State College by students/staff of Kindergarten through 12th grade (K-12) and/or Day Care Centers (DCC), pesticide applications on the Potomac State College campus will be regulated under the following procedures. Visits include, but are not limited to, plays, seminars, workshops, campus tours, and athletic events that are specifically for K-12/DCC or to which such a group has been specifically invited.

- **All** pesticide applications must be in compliance with all state and federal regulations.
- **Any** person(s) applying pesticides on Potomac State College's campus must be a certified commercial pesticide applicator or a certified public pesticide applicator or a registered technician under the supervision of a certified pesticide applicator.
- **All** notifications must be sent by electronic or written means.
- **No** K-12/DCC persons may be invited to be on campus during a pesticide application or the subsequent restricted entry interval unless the situation is handled under **EXCEPTIONS**.
- Under ordinary circumstances, a pesticide application will not be scheduled if it conflicts with a scheduled event involving K-12/DCC persons.
- Any certified pesticide applicator has the authority to request any individual to leave an area that has been posted for the purposes of a pesticide treatment. If the individual fails to comply with this request, the certified pesticide applicator may have Campus Police remove the individual.
- The Senior Pesticide Applicator (SPA) must notify the campus community no less than 48 hours in advance of an intended application of pesticides. The notification is to include area(s) to be treated, date(s) of application, and a request for notifications to be sent to the SPA from the campus community of any scheduled visits by K-12/DCC that would coincide with those dates.
- Any sponsor, host, coordinator, director, or any other person that is responsible for a visit or the scheduling of a visit by persons associated with K-12 or Day Care Centers is responsible for notifying the SPA that their planned visit will coincide with the intended pesticide application date(s). Such notification must be sent to the SPA within 24 hours of the posted notification of intent to apply pesticides.
- If there are no conflicts with scheduled K-12/DCC events, the SPA must notify the campus community at least 24 hours prior to the application. This notification must include the area(s) and date(s) of application.
- On the date(s) of application, the SPA or other applicator, including outside contractors, must post signs in accordance with state and federal laws. These

signs must state the materials being used, date and time of application, the re-entry period, and emergency contact information. The signs must be removed within 48 hours of the expiration of the re-entry interval.

- The SPA must post a log sheet of all pesticide applications on campus including applications made by outside contractors and other certified applicators. This log sheet must state materials applied, dates and times of application, amount of material used, areas treated, and applicator information and any other information as required by law. This log sheet will be available on the Safety Board at the Maintenance Building. A copy of MSDS and specimen labels for all materials used will be available at this location.
- In the event that a scheduled application of pesticides is canceled, the SPA must notify the campus community immediately.
- Persons hiring outside contractors are responsible for alerting those contractors to these procedures and providing the SPA the information to complete the log sheet as outlined above.
- Outside contractors and certified applicators working for Potomac State College are responsible for submitting a log of their activities on campus to the SPA by the last working day of the month in which they have applied pesticides to campus.
- These procedures are to supplement any other applicable state and federal regulations and in no way may replace or superseded them.

EXCEPTIONS

All **EXCEPTIONS** are to be approved by the CHO and the SPA at least 24 hours in advance.

EXCEPTION: As allowed by legislative rule 61-12J-9.1, pesticides may be applied to a localized area of infestation when students, children or school, child care center, or family child care facility employees are present if the infestation causes an imminent threat of bodily harm.

EXCEPTION: As allowed by legislative rule 61-12J-4.9, areas of schools, including but not limited to greenhouses, nursery plots, or agricultural field plantings used for vocational agricultural plots or research, are exempt from the requirements of this rule. These areas must be posted and a log kept as to materials used, amount of materials used, time of application, applicator information, and any other information that may be required by law.

EXCEPTION: Certain materials and methods as specifically stated by legislative rule 61-12J-7.1.b.2-3 are exempt.

EXCEPTION: With prior approval of the CHO and the SPA, areas may be treated with pesticide during a K-12/DCC visit providing the area can be restricted to those persons and there is no threat of pesticides coming into contact with those persons through any means and it is not reasonably possible to postpone the application.