Office of Environmental Health and Safety
Chemical/Biological Safety Section

CHEMICAL WASTE MANAGEMENT

(Revised 07/14/09)

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I. INTRODUCTION. Virginia Commonwealth University and Virginia Commonwealth Healthcare Systems (formerly MCVH), under the direction of the Office of Environmental Health and Safety (OEHS), have an established program to meet the university's and healthcare system's chemical waste management needs. The Chemical/Biological Safety Section (CBSS) of OEHS administers this program and makes every effort possible to handle and dispose of waste properly, to protect employee health, and to protect the environment. Disposal methods employed by CBSS meet or exceed regulatory requirements established by the Virginia Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA). The following information details VCU's chemical waste management program.

II. DEFINITIONS.

A. Acid: An inorganic or organic compound that (1) reacts with a base to form a salt; (2) gives rise to an excess of hydrogen ions in solution. Examples of common laboratory acids include: acetic acid, hydrochloric acid, and sulfuric acid.

B. Base: A compound that can ionize in solution and form hydroxide ions. Examples of "basic" compounds common in laboratories include: potassium hydroxide, sodium chloride, and sodium hydroxide.

C. CFR: United States Code of Federal Regulations.

D. Combustible Liquid: Any liquid having a flash point at or above 100° F and below 200° F.

E. Corrosive: Aqueous waste that has a pH less than or equal to 2.0 or greater than or equal to 12.5.

F. DEQ: Virginia Department of Environmental Quality.

G. DOT: U.S. Department of Transportation.

H. EPA: U.S. Environmental Protection Agency.

I. Flash Point: The minimum temperature at which a liquid gives off flammable vapors which when in contact with spark or flame will ignite.

J. Generator: Any person or entity whose acts or processes produce hazardous waste as identified or listed in 40 CFR Part 261.

K. Hazardous Waste: EPA regulations classify a waste as hazardous by either specifically including it on one of four lists or by defining four characteristics that the generator can use to determine whether a waste is hazardous. These characteristics are: corrosivity, ignitability, reactivity, and extraction procedure (EP) toxicity. The four lists containing hazardous materials and definitions of hazardous materials are found in 40 CFR Part 261, Subpart D:

1. Hazardous Wastes from Nonspecific Sources: includes spent solvents common in laboratory operations and the still bottoms from the recovery of these solvents.

2. Hazardous Wastes from Specific Sources: includes primarily industrial wastes not usually associated with laboratory operations.

3. Discarded Commercial Chemical Products.

4. Discarded Off-Specification Chemicals, Containers, and Spill Residues.

If a waste is not listed, it is still a hazardous waste if it meets any of the following four characteristics; these characteristics can be determined by specific tests cited applicable regulations (EPA maintains a list of "hazardous substances in 40 CFR Part 302):

1. Ignitability

2. Corrosivity

3. Reactivity

4. Extraction Procedure Toxicity

L. OEHS: Office of Environmental Health and Safety.

M. OSHA: Occupational Safety and Health Administration.

N. Oxidizer: Any substance which readily yields oxygen to stimulate the combustion of organic matter. Examples include chlorate, permanganate, inorganic peroxides, and nitrates.

O. RCRA: Resource Conservation and Recovery Act of 1976.

P. Reactive: Any waste that rapidly undergoes violent chemical change, may be explosive, or generate toxic fumes and vapors.

Q. TSD: Treatment, Storage, and Disposal Facility.

III. Purpose. Laboratories are responsible for only 0.1-1.0% of the total hazardous waste that is generated in the United States according to EPA estimates, but this comparatively low volume of waste is characterized by an enormously greater chemical diversity than industrial waste streams. In a university and hospital system such as VCU/VCUHS, chemical wastes are generated in operations of diverse magnitude and complexity and thus amounts and varieties of the wastes vary accordingly. As a generator of such wastes, the VCU community has moral and legal obligations to ensure wastes are handled and disposed of in ways that pose minimal potential harm to health and the environment. For these reasons, a chemical waste management program was established by OEHS to fulfill the following objectives:

A. Protecting the environment and preserving the health and safety of employees, students, patients, visitors, and the surrounding community.

B. Complying with applicable regulations.

C. Establishing laboratory practices for reducing types and quantities of hazardous wastes.

D. Educating the VCU community in the proper handling and disposal of hazardous wastes.

E. Demonstrate outstanding environmental stewardship to the surrounding community.

IV. REQUIREMENTS.

All work which uses chemical substances eventually produces chemical wastes. Those generating this waste have a moral and legal obligation to see that the waste is handled, transported, and disposed of in ways that minimize both short-term and long-term harm to health and the environment.

On November 19, 1980, the EPA adopted federal regulations creating a Hazardous Waste Management System under the authority of RCRA. These regulations are designed to provide "cradle-to-grave" management of hazardous wastes by imposing management requirements on generators and transporters of hazardous materials and upon owners and operators of treatment, storage, and disposal facilities.

In Virginia, the DEQ has the responsibility of enforcing the federal program. Under this program, all generators are required to ensure that wastes are properly identified and classified according to their hazards and that they undergo proper treatment, packaging, and disposal. Major regulatory amendments made in 1984 expand waste management requirements, ban land disposal of bulk liquid hazardous wastes, require regulation of underground storage tanks, and bring generators of smaller amounts of hazardous waste under the law's regulatory requirements. Sections of RCRA provide for criminal penalties and citizen suits against individuals who violate hazardous waste regulations. University employees acting outside the scope of their responsibilities by illegally disposing of hazardous waste can be held personally liable for legal remedies and consequences resulting from their actions.

V. WASTE MINIMIZATION. Chemical waste management requirements are constantly changing. Changes in technology, regulatory guidelines, rising costs of supplies, disposal, transportation, insurance, etc., make chemical waste management an extremely expensive process. Waste minimization is a fundamental method of reducing escalating disposal costs and burden to the environment. There are a number of ways in which those who generate chemical wastes can help in the chemical waste minimization effort. Some useful waste minimization practices include the following:

A. Reduce the amount of chemicals ordered to decrease chemical waste. One important aspect of a chemical waste management program is implementing the "less is better" concept.

This concept is directed at buying only quantities of materials that will be readily consumed. It may seem to be less expensive to buy chemicals in larger quantities but it is in fact more expensive if the cost of disposal is taken into consideration. It is therefore economically advantageous for VCU to purchase only quantities of chemicals which will be consumed in required processes.

B. Label all chemical waste containers appropriately. This is an extremely important point. In order for any wastes to be disposed of, the contents must be known along with an approximate percentage composition. Testing of unknown materials is very expensive and the cost for this will be borne by the department. When one considers the cost of testing an unknown and multiple it by hundreds of unknown wastes generated, the results are financially staggering.

C. Consolidate compatible chemical wastes. Disposal costs are reduced if fewer containers must be managed. For this reason, waste materials should be consolidated to the extent possible to reduce the number of containers to be disposed of. Great caution must be exercised to ensure that chemicals combined into a single container are compatible. If in doubt about consolidating materials, Appendix A contains a listing of incompatible chemicals or advice can be sought from OEHS by calling 828-1392.

D. Do not let wastes accumulate. Generally, OEHS accepts no more than 20 liters of liquid waste per appointment. Chemical wastes should not be allowed to accumulate in laboratories or work areas. Each laboratory or other area where hazardous wastes are created is required to establish and operate a satellite accumulation area (SAA) in accordance with guidance contained on the OEHS website. Once a waste container is full, it should be disposed of through OEHS within three days. Further guidance on SAAs can be obtained by calling 828-1392. Costs for disposal of hazardous wastes which are non-routine (e.g., laboratory cleanout) will be charged to the department.

E. Do not abandon laboratories with chemicals and hazardous wastes remaining. University policy dictates that departing researchers are responsible for coordinating with their departments to remove and/or recycle any materials remaining in the laboratory. Any removal/disposal activities conducted by OEHS following departure of a researcher or inactivation of a laboratory will be charged to the department.

F. Consult OEHS if a new research project is about to commence. Ideally, OEHS would be consulted during the planning phase of grant requests to ascertain the impact of the new research and resulting wastes. Some wastes are very difficult to dispose of (e.g., PCB) and allowance in the grant request may have to include funding for disposal of highly toxic and otherwise difficult to dispose of materials.

VI. GUIDELINES FOR THE INVESTIGATOR.

A. **PROPER WASTE IDENTIFICATION IS CRITICAL!** The generator must identify all chemical wastes before they will be accepted by OEHS for disposal. Laboratory glassware containing reaction mixtures of unknown nature and sometimes of unknown origin can pose

difficult disposal problems and may require costly analysis before removal and disposal. The generator (PI/department) is responsible for providing wastes of known composition or having the materials analyzed. Such materials can be a frequent occurrence in research laboratories, particularly in those having a high rate of personnel turnover. The disposal of an unlabeled "orphan" reaction mixture can sometimes be guided by knowledge of the chemistry that was being done by a former laboratory worker. **The responsibility to ensure that all chemical wastes are adequately identified before being offered to OEHS for disposal rests with the generator (PI/department).**

1. "Orphan" chemicals/reaction mixtures left by former laboratory workers/researchers are the most frequent source of unknowns. Investigators should label all stored reaction mixtures with the name and concentration of the chemical compound, date formed, the name of the investigator and a notebook reference. Laboratories are encouraged to institute a checkout procedure that requires departing workers and researchers to identify all reaction mixtures and unlabeled chemicals that they have not disposed of before leaving.

2. The potential consequences of incomplete or incorrect identification of hazardous wastes by the generator are serious and may include:

a. Selection of inappropriate waste treatment methods and disposal facilities with the potential for fire, violent chemical reactions, and environmental contamination.

b. Inappropriate emergency response to chemical exposures, spills, and fires.

c. Blending of incompatible wastes resulting in adulteration of large, bulked waste streams rendering them difficult and costly to treat and dispose of.

d. Mislabeling of recyclable materials.

e. Heavy fines, civil liability and penalties; restriction or termination of operating permits and access to waste treatment and disposal facilities.

3. The contents of all chemical waste containers are subject to analytical audit by the chemical safety staff, disposal contractors, regulatory agencies, and commercial facilities receiving wastes for treatment, recycling, or disposal.

B. **General Labeling Requirements.**

1. Labeling is a federal requirement of the Hazard Communication Standard and the Hazardous Chemicals in Laboratories Standard. Labels on any containers that were previously used to package other chemicals but will be used to bulk wastes should either be removed or completely defaced by placing a bold "XXX" across the original label prior to reuse.

2. If the waste is a mixture, apply a chemical waste tag available at the OEHS web page (Chemical waste label) to the container and identify the chemical waste constituents by proper

chemical name. Indicate the approximate quantity or concentration of each constituent. Avoid the use of obscure chemical acronyms and brand names on chemical waste identification tags.

3. When necessary to biologically decontaminate chemical wastes packaged in an autoclave bag, the bag may remain chemically contaminated with a hazardous material after autoclaving and must be managed as chemical waste. In this situation, OEHS will accept the waste packaged in autoclave bags provided the generator certifies that the biological agent has been inactivated and all biohazard-warning symbols have been removed from the bag or defaced.

C. **SPECIAL CHEMICAL WASTES.**

1. Temperature Sensitive Wastes. Certain nitrosoguanidines, nitrosoureas, and organic peroxides are examples of chemicals that are unstable, generate pressure, or may otherwise become hazardous at room temperature following prior rapid temperature changes. These compounds must be maintained by the investigator at a safe temperature until they are accepted by OEHS for disposal. Temperature sensitive wastes should be managed separately and not mixed with other non-temperature sensitive chemicals.

2. Explosive or Highly Reactive Wastes. Examples of highly reactive chemicals encountered in typical laboratories include azides, peroxides, and picric acid. For your own safety, please be aware of the following points:

a. Containers of highly reactive wastes should not be commingled with other chemical waste containers. They must always be managed separately. When contemplating disposal of a highly reactive waste, contact OEHS for advice before handling or moving the material.

b. Pending removal from the work area, store explosive materials in appropriate non-combustible cushioning material. Do not place metal-sensitive compounds such as picric acid in metal containers or wrap containers in aluminum foil.

c. Certain chemicals such as dinitrophenol hydrazide, picric acid, and other poly-nitrocompounds may become shock sensitive and dangerous to handle if allowed to dry out. Keep these chemicals in liquid form, not allowing them to dry out during storage. If a container of this material has dried out, do not attempt to touch it, open it, or add water. CLEAR ALL PERSONNEL FROM THE AREA AND CALL OEHS FOR EMERGENCY ASSISTANCE at 828-9834.

3. Peroxide-Forming Chemicals.

a. Alkali metals, ethers, olefins, dienes, and vinyl-halides are examples of chemicals that are prone to form peroxides when exposed to air over time. The peroxides are sensitive to heat, friction, impact, and light and are among the most hazardous chemicals encountered in the laboratory. Some of these peroxides can be extremely shock sensitive and violently explosive, and as such, require special care when handling. Inventories of peroxide-forming chemicals must be minimized and managed carefully. Indicate the date of purchase or receipt and the date

opened on all containers of these chemicals. This information is necessary to meet safety, transportation, and waste treatment facilities requirements.

b. Opened containers of peroxide-forming chemicals should be tested for peroxide formation or be discarded as chemical waste within three to six months of opening depending upon the reactivity of the compound. If a significant degree of peroxide formation in a prone chemical is indicated by analytic results or by the formation of crystals in the container, do not attempt to move it. Clear personnel from the area and call OEHS for emergency assistance at 828-9834.

c. Degree of peroxide formation is greatly influenced by the passage of time. Researchers should only order sufficient quantities of peroxide-forming materials as can be reasonably consumed. Hence, control of peroxide formation is a function of effective inventory management. If, due to poor inventory management or laboratory hygiene practices, materials become highly hazardous, the generator (PI/department) will be liable for the cost of disposal.

4. Dioxin Group Chemicals. Chlorinated phenols and phenoxyacetic acids, chemicals derived from these compounds, and wastes containing any detectable concentration of chlorinated dibenzo-p-dioxins or chlorinated dibenzofurans are included in this group. Wastes containing dioxins are difficult and costly to treat and dispose of due to regulatory restrictions and unavailability of permitted disposal facilities. Presently, there are no commercial facilities in the United States accepting dioxin waste. For this reason, researchers contemplating the use of dioxin-containing compounds should also program for the long-term storage costs associated with holding these wastes offsite until disposal means become available.

5. Compressed Gas Cylinders. Compressed gas cylinders (both empty and full) present unique problems as components of the chemical waste stream. The disposal cost of empty gas cylinders far exceeds their acquisition costs. All laboratories using compressed gas cylinders should make arrangements with the supplier or vendor to return/recycle the cylinders when they are no longer needed. All future purchases of compressed gas cylinders should be coordinated with companies or vendors with return policies. Given the exorbitant cost of disposing of cylinders when “return policy vendors” are available makes it incumbent upon cylinder users to bear some of the financial burden for their disposal if not recycled. In any case, disposal/recycling of cylinders should be coordinated through OEHS.

D. **RESTRICTIONS ON ACCEPTING CHEMICAL WASTE**. Presently, CBSS is not accepting the following waste materials:

1. Needles and broken glass (except mercury-containing materials by arrangement). Uncontaminated sharps and broken glass should be placed into a “sharps container” and disposed of through Environmental Services (828-9444).

2. Uranyl compounds (these compounds are classified as radioactive wastes and will be disposed of through the Radiation Safety Office (828-9131).

3. Infectious waste material (see appropriate guidelines for disposing of infectious wastes elsewhere on the OEHS webpage).

VII. WASTE MANAGEMENT PROTOCOLS.

A. Office of Environmental Health and Safety. The CBSS of OEHS administers the chemical waste management program. OEHS adheres to the objectives listed in Section III of this program and makes every effort to handle and dispose of wastes in accordance with applicable regulations and sound environmental stewardship.

1. Waste Disposal Protocol. Protocols have been developed which instruct in step-by-step fashion how chemical waste is to be disposed of on both campuses of the university. These protocols are contained in Section XIV (medical campus) and Section XV (academic campus) of this document.

2. Segregation/Classification. After chemical waste has been received by CBSS, the process of segregation/classification occurs. Chemicals are physically separated according to hazard category (e.g., flammables, toxins, oxidizing agents, reducing agents, water-reactive chemicals, pyrophoric materials, etc.). These wastes are then further segregated in the chemical waste storage facility pending contractor removal.

3. Bulk Flammable Liquids. Flammable liquids which exhibit certain characteristics for incineration purposes are combined into 55-gallon drums. Bulking high-BTU materials reduces disposal cost. A sample of the requiring liquid is tested by a laboratory for BTU value, chlorine content, percent water content, specific gravity, and percent ash content. This testing ensures the materials are suitable for incineration. Xylene, toluene, and methanol are examples of flammable liquids that are bulked for incineration purposes.

4. Waste Oil. All uncontaminated waste oils are placed into bulk oil drums which are then collected by the contractor. Waste oil is recycled or used in heat recovery processes. The university has an oil-burning heater which is permitted to burn uncontaminated motor oil. Products meeting specification for burning in this heater are disposed of with two benefits for the university: lowered heating fuel cost and lowered waste disposal cost.

5. Labeling. Labeling is an essential element in maintaining the inventory and tracking system of a chemical waste management program. Each waste drum is specifically labeled according to the hazard class of waste it contains. A hazardous waste label, which gives details such as the generator name, generator locations, EPA identification number, manifest document number, etc., is also required for each drum.

6. Drum Content Sheets. For each lab pack (open head waste disposal drum) that is filled and closed, there must be a “content sheet” which corresponds to that particular drum. The content sheet includes a waste description and the quantity of each laboratory material which is placed into that drum. A copy of this content sheet follows the drum to its final disposal destination. Although specific content sheets are not used for bulk flammable liquids, an inventory of type and quantity of waste is kept by OEHS.

B. Hazardous Waste Manifests. The ultimate tool in fulfilling the "cradle-to-grave" tracking system to follow generated wastes to their disposal site is the Hazardous Waste Manifest (manifest). The manifest documents all wastes leaving VCU and identifies the transporter, and the waste disposal facility. The generator's name, generator EPA identification number, quantity of material, DOT (Department of Transportation) number, hazard class, shipping name and identification numbers, and signature of the generator representative are some of the items that are required on a hazardous waste manifest. A manifest accompanies all waste to the TSD facilities and a copy is signed and returned to the generator upon receipt of the waste. This process enables VCU to keep track of wastes and to ensure that all wastes have been properly delivered to the disposal or treatment site. The manifesting process is a cooperating effort among VCU, the hazardous waste broker, and the TSD facility.

C. Transportation. 49 CFR contains the requirements for transportation of hazardous wastes. Approved materials, containers, and appropriate labels are some of the items specified in these regulations. No waste can be placed onto a transport vehicle until drums are labeled and the hazardous waste manifest has been completed. Hazardous waste is removed from VCU via a contractor.

D. Chemical Waste Treatment Methods. Chemical Wastes generated by the university/hospital community ultimately arrive at federally-approved treatment sites where the wastes may be treated prior to disposal. The various classes of chemical wastes require different handling procedures and some treatment methods include:

1. Non-Chlorinated Solvents. Non-chlorinated solvents are processed to reclaim the solvents in as high a purity as is technically possible. The initial process involves passing the solvent over and through various filters to eliminate solid particles from the waste solvent. Next, the solution is placed in a distillation process where the waste system is distilled and the distillate collected. This reclaimed solvent is usually 80-100 percent pure and is sold to cement kilns for heat recovery.

2. Chlorinated Solvents. Chlorinated solvents are handled in the same manner as outlined above but are handled by equipment which is kept separate from that used to reclaim the non-chlorinated solvent.

3. Organic Acids. Organic acids are treated on an individual basis whereby the acids are collected in a reaction vessel and an alkaline solution is slowly introduced into the tank. The alkaline solution used is either waste alkaline liquid that have been give prior approval for use in the neutralization process or virgin alkaline liquids. Once enough alkaline solution has been added to the vessel to bring about desired neutralization at a pH of approximately 7.0, the solution is tested to ensure that discharge proceeds in accordance with all EPA regulations (including the land disposal restriction under 40 CFR 268.32).

4. Inorganic Acids. Inorganic acids are neutralized in the same manner outlined above except that inorganic acids can be handled in bulk rather than on an individual basis.

5. Oxidizers. Oxidizers are treated in individual reaction vessels with sodium bisulfate or similar compounds to neutralize this type waste.

6. Inorganic Salts. Inorganic salts and certain organic salts such as salts of cadmium, lead, copper, and nickel are also effectively neutralized in separate reaction vessels with the effluent being tested to assure proper treatment prior to discharge.

7. Cyanides. Solid cyanide compounds are tested for leaching using a 24-hour extraction process and a representative sample of the waste solid. Once the material passes the extraction tests and proves no leaching will occur, the solids are then collected and readied for disposal in a landfill certified by a state in which the landfill is located and the federal EPA. All liquid cyanide compounds are introduced into individual reaction vessels where they are effectively neutralized by approved methods, and the effluent is tested to ensure desired neutralization prior to disposal.

8. Flammable Solids. Flammable solids, except for air- and water-reactive materials, are combined with stabilizing compounds which produce a concrete-like solid. Once tested and approved, this material is then shipped to a landfill certified to accept such materials. All water reactive and air reactive materials are handled on an individual basis. Once tested to determine reactivity and special handling procedures, these compounds are transported to federally approved sites where the compounds are detonated.

VIII. MANAGING ALDEHYDE-BASED WASTE.

A. Within some departmental laboratories high-level disinfectants containing formaldehyde and glutaraldehyde are used to preserve and sterilize materials and medical instruments. Because of various EPA disposal restrictions, large quantity users (i.e., used for cold sterilization of instruments or used for tissue fixing) of aldehyde-based products must first neutralize the liquid prior to disposing of the product via the sanitary sewer. Departments can properly treat up to ten percent formalin (3.75% formaldehyde) or up to four percent glutaraldehyde solutions with a product such as Formalex® or similar products. These products can convert aldehydes into a non-toxic solution suitable for disposal into the sanitary sewer. For additional information concerning these products, contact OEHS. Please note that no additional requirements are necessary for small quantity users (usually less than one gallon) such as those departments using aldehyde-based solutions for tabletop disinfectants or cold sterilization.

B. Chemical spills of aldehyde-based products can also be treated using a spill kit. *Departments regularly using aldehyde products should purchase and maintain spill kits.* For additional information, please contact OEHS.

IX. PERSONAL PROTECTIVE EQUIPMENT. Engineering and administrative controls of hazardous exposures in the workplace are most effective in controlling and limiting personal exposure to hazardous materials. In some circumstances, it is not practical to employ engineering and/or administrative controls. In these circumstances, personal protective equipment is used to control hazardous exposures. A variety of specialized clothing and equipment is commercially available for use in the laboratory. The proper use of these items will

minimize or eliminate exposures to the hazards associated with many laboratory operations. The protective equipment available for laboratory protection ranges from full body suits to partial body protection, such as gloves and boots. It is important to "fit the PPE to the hazard." Every laboratory worker and supervisor should be familiar with the location and proper use of available protective apparel, available safety equipment, and emergency procedures. Instruction of laboratory personnel in the proper use of such equipment and procedures is the responsibility of the PI or laboratory manager. The Office of Environmental Health and Safety will assist the PI as required with the selection and employment of protective equipment. Laboratory personnel handling hazardous wastes or transporting hazardous chemicals to OEHS for disposal should utilize the following PPE depending upon the nature of the waste being handled:

A. Eye Protection. Safety glasses, face shields, and/or goggles meeting American National Standards Institute specifications should be used when working around hazardous chemicals. Regular eyeglasses are not acceptable for eye protection when working in the laboratory or around hazardous materials which could damage the eyes.

B. Clothing and Footwear. When transporting or receiving chemical waste, a laboratory coat and disposable gloves are to be worn at all times; however, more specialized "heavy duty" gloves and protective clothing might be necessary when handling corrosives or other toxic chemicals. Closed-toes shoes must be worn at all times when working in laboratories and other areas where chemicals are stored or used. More extensive foot protection than afforded by "street shoes" may be required when performing some tasks.

C. Respiratory Protection Equipment. Several types of non-emergency respirators are available for protection in atmospheres that are not immediately dangerous to life or health (i.e., an atmosphere which would quickly disable a person to the point that self-rescue was not possible) but could be detrimental after prolonged or repeated exposure. The choice of appropriate respirator use in a given situation will depend upon the type of contaminant and its estimated or measures concentration, known exposure limits, and hazardous properties (e.g., eye irritation or skin absorption). The Office of Environmental Health and Safety will provide guidance to individual laboratories in the selection and maintenance of respirators. Prior to an employee being issued a negative pressure respirator, the employee must have completed a physical (contact Employee Health) and must be fit tested (contact OEHS).

1. Dust, Mist, and Fume Respirators. These respirators can only be used for protection against particular (or classes of) dusts, mists, and fumes specified by the manufacturer.

2. Chemical Cartridge Respirator. These respirators are commonly known as the familiar half-face piece respirators. These respirators can be used only for protection against particular gasses or individual classes of gasses as specified by the manufacturer and cannot be used at contaminant concentrations above that which is specified on the cartridge. All respirators must be fit tested individually by OEHS to assure a proper seal. Each person should have his/her own respirator whenever possible. Organizations requiring their employees to utilize respirators must have a respiratory protection program, an example of which can be obtained from OEHS.

D. Gloves. Impervious gloves are a primary means of protecting oneself from dermal exposure to chemicals when working in the laboratory. Further information on glove materials and selection can be found in Appendix B of this document. Typically, glove materials will include disposable gloves (latex or nitrile), neoprene, polyvinyl chloride, polyvinyl alcohol, butyl rubber, and some less common materials. Nature of the chemical to be protected against determines the best glove material; therefore, OEHS should be contacted to advise of the most effective glove material in a given situation.

X. PROPER TRANSPORTATION PRACTICES. All wastes which are being transported to Sanger Hall for disposal should be in containers appropriate for the material. In particular, these containers should be break resistant. For example, a glass container of liquid should be transported in a non-breakable container which will serve to contain the liquid in the event the glass container should break. Only freight elevators are to be used when transporting hazardous wastes.

XI. DISPOSAL COST. Because of constraints being placed on chemical waste disposal at the national level, the cost of acceptable disposal methods is increasing dramatically. The cost of disposing of the chemical wastes generated at VCU changes on an annual basis. The CBSS must be contacted to conduct a walk-through prior to laboratory cleanouts. We will provide an estimate for and coordinate the removal and disposal of hazardous chemical waste. The laboratory and/or the generating department are responsible for disposal costs of lab cleanouts to include labor cost. Additionally, the cost of disposing of expired ethers will be borne by the department. With the escalating cost of disposing of compressed gas cylinders, recycling is strongly encouraged. Currently, OEHS has some funds to dispose of compressed gas cylinders but declining budgets make shift disposal cost entirely to departments. Every attempt must be made to procure compressed gas cylinders from vendors who have a return policy. The cost to dispose of compressed gas cylinders is exorbitant and in most cases unnecessary. Contact OEHS prior to procuring compressed gasses to obtain recommendations on vendors with a return cylinder policy.

XII. Chemical Spill Emergency Response Plan.

A. Each area or department of VCU or VCUHS must be prepared to handle a spill of chemicals widely or routinely used within that department. Please note that pre-packaged emergency spill kits are available to handle small spills of solvents, biologicals, and corrosives. These spill kits can and should be purchased through a local laboratory safety supply company. Contact OEHS for advice if you are uncertain of your needs.

B. Report any spill of hazardous materials immediately by calling the **RADIATION/ CHEMICAL EMERGENCY LINE** at 828-9834. Properly protected and trained personnel will be available to evaluate and cleanup the spill. Do not call housekeeping to manage situations that they are not properly trained to handle. If a spill does occur, the following procedures may be used but should be tailored to individual needs:

1. Attend to any persons who may have become contaminated. Chemical splashes to the eyes must be treated immediately. If the person is in distress, take them to Employee Health or if the situation warrants, call 911 for assistance.

2. Notify persons in the immediate area of the spill.

3. Evacuate all nonessential personnel from the spill area.

4. Refer to the appropriate material safety data sheet and if the spilled material is flammable, turn off ignition and heat sources.

5. Avoid breathing vapors of the spilled material; if necessary use an appropriate respirator.

6. Leave on or establish exhaust ventilation if it is safe to do so. If it is not safe to use powered equipment (fans, ventilators, etc.) consider establishing natural ventilation to dilute vapors. Only do this if the vapors will not affect other occupied spaces.

7. Secure the supplies and equipment necessary for the cleanup. Most small liquid spills (<100 ml) can be absorbed with paper towels, sand, or other appropriate absorbent.

8. During the cleanup operation, use appropriate PPE.

9. Contact OEHS if a regulated substance is involved. Regulated refers to those materials meeting regulatory requirements to qualify as hazardous materials. If in doubt, contact OEHS for advice.

10. After cleanup of chemical spills, all materials to include any paper towels used in the cleanup must be disposed of as hazardous waste. Particular care should be exercised in handling the absorbent materials used in the cleanup of flammable liquids to protect against further fire hazards.

XIII. TRAINING. The OEHS staff is trained in proper waste segregation, evaluation, packing, regulations, personal protection, etc., annually. We will provide departmental training related to our chemical waste management program upon request.

XIV. WASTE PROTOCOL FOR THE MEDICAL CAMPUS.

A. Hazardous waste and outdated chemicals will be accepted for processing on an appointment-only basis on Tuesday and Thursday of each week from 9:00 to 9:30 AM at the Sanger Hall loading dock. Chemical wastes will be accepted in properly sealed disposable bottles and containers. Generally, containers for hazardous waste will not be returned to the generator unless prior arrangements have been made with CBSS. Containers sealed with parafilm, tape, etc., will not be accepted. Radioactive materials will not be accepted for disposal by CBSS. For disposal of radioactive materials, please contact Radiation Safety at 828-9131.

B. Due to the large volume of materials received for disposal, no more than five containers or 20 liters of waste will be accepted per appointment per investigator without prior approval.

C. Disposal costs for expired ethers will be borne by the department or PI. Ethers should be turned in for disposal prior to expiration to avoid exorbitant disposal costs.

D. Compressed gas cylinders should be procured from vendors with a cylinder return or recycling program. Disposal of expended compressed gas cylinders can be quite expensive, particularly for corrosive or toxic gasses. Presently CBSS is accepting cylinders for disposal provided the contents are known. Disposal costs for cylinders containing unknown gasses will be borne by the generating department or PI. Contact CBSS for further information or assistance.

E. Each container of hazardous waste must be labeled with the following information (chemical waste labels):

1. Contents (full chemical and common name, no abbreviations)

2. Percentage by constituent

3. Name of investigator

4. Date

F. The hazardous waste disposal form http://www.vcu.edu/oehs/chemical/wastedisposal.doc must accompany all waste to be disposed through CBSS. The document must be complete and signed by the individual responsible for generating the particular waste or having knowledge of the source and identity of the waste.

G. Waste should be transported in protected containers. For example, a glass container of liquid should be transported in a non-breakable container or on a cart which will serve to contain the fluid should the inner container break or leak.

H. Waste should be transported on freight elevators only, never passenger elevators.

I. Any uncontrolled spills or releases of hazardous chemicals should be reported immediately to OEHS by calling the Radiation/Chemical Emergency Line at 828-9834.

XV. WASTE PROTOCOL FOR THE ACADMEIC CAMPUS.

A. Chemical waste generated by the Chemistry department on the Academic Campus is to be taken to Oliver Hall, Room 3054, Chemistry Department Stockroom, for disposal.

B. All other buildings and departments on the Academic Campus must schedule an appointment at 828-1392. Appointments will be accepted on Tuesday and Thursday at 11:00

AM at the Oliver Hall loading dock. Chemical wastes will be accepted in properly sealed disposable bottles and containers. Generally, containers for hazardous waste will not be returned to the generator unless prior arrangements have been made with CBSS. Containers sealed with parafilm, tape, etc., will not be accepted. Radioactive materials will not be accepted for disposal by CBSS. For disposal of radioactive materials, please contact Radiation Safety at 828-9131. Information contained in paragraphs XIV B-I above are applicable to chemical waste disposal on the Academic Campus.