

State of Maryland
Department of Health and Mental Hygiene
Laboratories Administration
1770 Ashland Avenue
Baltimore, MD 21205
ISO QA-SOP-TR 5.02



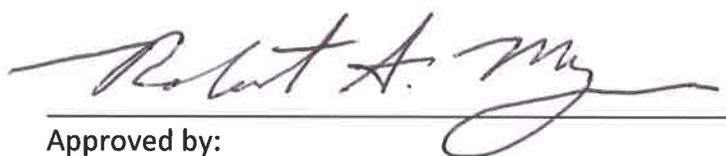
Chemical Hygiene Plan

Fifth Edition
April 2017

State of Maryland
Department of Health and Mental Hygiene
Laboratories Administration

Chemical Hygiene Plan

Review Sheet



Approved by:
Robert Myers, Ph.D.
Laboratory Director

04/07/17
Date



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4/3/2017
Date

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Revision History

Chemical Hygiene Plan

REVISION	COMMENTS	DATE
Original	United States Department of Labor, Occupation Safety and Health Administration mandated that all laboratories handling hazardous chemical must implement a written Chemical Hygiene Plan by January 31, 1991.	1/1/1991
Second Version	Chemical Hygiene Plan was revised and reformatted.	3/1/1994
Third Version	Chemical Hygiene Plan rewritten, updated, and reformatted.	7/1/2011 7/1/2012
Third Version	Chemical Hygiene Plan updated.	2/25/2013
Fourth Version	Chemical Hygiene Plan revised and updated for the 1770 Ashland Avenue facility, as well as labeled ISO QA-SOP-TR 5.02 .	11/30/2014, and 6/1/2015
4.1 Version	Chemical Hygiene Plan PPE revised and Appendix F revised.	5/1/2016
Fifth Version	Chemical Hygiene Plan revised and updated to include the State Maryland's new health care provider WorkPro and Occupational Medical Services (OMS) effective April 1, 2017.	4/1/2017

FOREWORD

On January 31, 1990, the Occupational Safety and Health Administration (OSHA) promulgated a final rule for occupational exposure to hazardous chemicals in the laboratory. Clinical and environmental laboratories differ from industrial operations in their use and handling of chemicals, therefore, OSHA has taken a different approach to ensure employee safety in these laboratories. The rule required all laboratories to implement a written "Chemical Hygiene Plan" for hazardous chemicals.

This document is the "Chemical Hygiene Plan" for the Maryland, Department of Health and Mental Hygiene, Laboratories Administration. All employees of the Laboratories Administration are required to maintain a copy for personal reference. It will require the cooperation of laboratory supervisors and their staff to make the plan a viable, working document for the safe use and handling of hazardous chemicals. A sincere concern for the welfare of employees must be demonstrated in the daily practice of our laboratory science. Supervisors have the primary responsibility for enforcing the "Chemical Hygiene Plan" in their respective laboratories. However, any employee who observes an unsafe practice is responsible for immediately advising the employee in a positive manner to help promote a change in behavior for the safety of everyone.

A genuine commitment of the Laboratories Administration to the "Chemical Hygiene Plan" is reflected in the actions already taken to enhance employee safety and in our resolve to dedicate the resources necessary for the success of this plan. The Laboratories Administration employs a full-time Safety and Security Officer who provides an ongoing safety training program. The services of a medical office are immediately available to the Laboratory. Safety devices and equipment to protect employees are provided where appropriate. This commitment is not sufficient to guarantee safety, without the comparable commitment of all Laboratories Administration employees.

Robert A. Myers, Ph.D.

Director,
Laboratories Administration

RM/2017

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I INTRODUCTION

a) PURPOSE

The general intent of the Chemical Hygiene Plan (CHP) for the State of Maryland Laboratories Administration is:

- i) To protect laboratory employees and others from health hazards associated with the use of, disposal of, and potential exposure to hazardous chemicals used within the Laboratories Administration. To adhere to guidelines defined in the United States Department of Labor, Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1200 Hazardous Communication and 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories.
- ii) To maximize employees awareness of chemicals used within the Laboratories Administration.
- iii) To ensure safety and minimize the effects, in the case of an accidental exposure.

b) POLICY STATEMENT

The Laboratories Administration has developed and implemented an effective written CHP, which sets forth procedures, equipment, personal protective equipment (PPE), and work practices that are capable of protecting employees from potential health hazards caused by hazardous chemicals in the laboratory.

All employees of the Laboratories Administration are required to maintain a copy for personal reference, and additional copies will be located in the Library and on the Laboratories Administration intranet.

The CHP will be reviewed annually by the Chemical Hygiene Steering Committee and updated as necessary. Employee health and safety work rules that are included in each laboratory's CHP must be reviewed annually.

c) GENERAL GUIDELINES

- i) Employees shall minimize their physical contact with all chemicals at all times. Direct inhalation of vapors and direct skin contact of chemicals should be avoided. Exposure to extremely hazardous chemicals for even short duration can be dangerous. Chronic long term exposure to chemicals of low to moderate toxicity should also be minimized.
- ii) Laboratory chemical fume hoods are local ventilation devices to prevent toxic, offensive or flammable vapors from entering the laboratory atmosphere. Chemical fume hoods are the first line of defense to keep hazardous chemicals

away from laboratory employees. Utilizing hoods properly will keep potentially hazardous vapors well below danger levels.

- iii) Do not underestimate risk. Even for substances of no known significant hazard, exposure should be minimized. For work with substances which present special hazards, special precautions should be taken (i.e. use of proper PPE, use of chemical fume hoods, etc.). Employees should assume that any chemical mixture will may produce a more toxic reaction than its most toxic component and that all substances of unknown toxicity are toxic.
- iv) Safety is too important to be left to others. Protect yourself. Protect your co-workers.

d) RESPONSIBILITIES

Chemical hygiene is important to all employees within the Laboratories Administration. A safe and healthy lab environment is the responsibility of every employee of the Laboratories Administration. To further this goal, responsibilities are described below:

- i) Laboratory Director
 - (1) Accepts the ultimate responsibility for safety and chemical hygiene within the Administration. He/she shall request funds in the budget for:
 - (a) Training and safety equipment,
 - (b) Medical consultations and treatment, and
 - (c) Disposal of chemical and hazardous waste.
 - (2) Designates employees who will serve as Chemical Hygiene Officer(s) and who will serve on the Laboratory Safety & Security Committee.
 - (3) Designates laboratory supervisor(s) who have overall responsibility for chemical hygiene within their respective laboratory sections.
 - (4) Advises the Safety & Security Officer or designees responsible for implementing the CHP according to OSHA standards.
- ii) Laboratory Safety & Security Officer (SSO)
 - (1) Serves as the Chemical Hygiene Officer by developing, implementing, and enforcing the CHP.
 - (2) Serves as the Chairperson for the Laboratory Safety & Security Committee.
 - (3) Coordinates air monitoring of any regulated chemicals as appropriate where there is reason to believe that exposure levels potentially exceed

the Permissible Exposure Limit (PEL) or the Short-term Exposure Limit (STEL).

- (4) Assists Division Chiefs and supervisors by defining hazardous operations, designating safe practices, selecting protective equipment, and guiding development of current and future chemical hygiene policies and practices.
- (5) Ensures appropriate PPE and medical examinations/evaluations are provided to employees working with hazardous chemicals outside of chemical containment equipment/device(s).
- (6) Provides a copy of the approved CHP for laboratory staff, electronically or hard copy.
- (7) Reviews and approves Standard Operating Procedures (SOPs) for proposed laboratory activities involving hazardous chemicals.
- (8) Ensures laboratory employees receive instructions and training in “good laboratory practices” and procedures for dealing with accidents involving chemical substances.
- (9) Ensures laboratory inspections are conducted at least annually to ensure compliance with the laboratory safety policies.
- (10) Tests all laboratory safety showers annually.
- (11) Assists the Radiation Safety Officer (RSO) in developing the Administration’s Radiation Safety Plan.
- (12) Documents and maintains compliance with all appropriate local, state, and federal safety related regulatory requirements.
- (13) Ensures laboratory employees are provided with annual safety training. The following training courses/components will be provided for laboratory staff according to the hazards of their job duties and responsibilities:
 - (a) Chemical Hygiene,
 - (b) Respiratory Protection,
 - (c) General Safety,
 - (d) PPE,
 - (e) Compressed Gases,
 - (f) Ventilation Fire Training, and
 - (g) “Right-to-Know”/Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS).

- (14) Investigates, corrects, and reports in writing to the Laboratory Director any significant safety issues pertaining to the operation and implementation of work practice controls and equipment.
- (15) Ensures proper disposal of hazardous and non-hazardous chemical waste.
- (16) Ensures ventilation guidelines are enforced and calibrations, ventilation measurements, and maintenance records are maintained.
- (17) Reviews the CHP annually and updates the plan as needed.
- (18) Identifies ways to improve the Chemical Hygiene Program.
- (19) Ensures chemicals are properly stored. Maintains and reports annually chemical inventories.
- (20) Ensures proper spill containment procedures and supplies are available for chemical spill cleanup.
- (21) Maintains employee safety and exposure records for at least thirty (30) years after employee's separation date.
- (22) Ensures current "Right-to-Know" information and/or MSDS/SDS materials are available to all employees.

iii) Division Chief

- (1) Accepts overall responsibility for safety and chemical hygiene within the division/ administrative units he/she supervises.

iv) Supervisors

- (1) Ensure that employees are familiar with and trained to follow the CHP.
- (2) Ensure that all Standard Operational Procedures (SOP) include the required PPE for all job tasks.
- (3) Develop and implement an emergency plan that includes procedures for ventilation failure, evacuation, medical care, reporting, and drills in accordance with the Laboratories Administration Emergency Evacuation Plan (Appendix I, References 6).
- (4) Consult with the SSO for current legal status of regulated chemicals and hazardous materials maintained in their laboratory.

- (5) Seek prior approval from the SSO for any new procedure which may involve using any new or unusual chemical or methodology.
 - (6) Maintain current chemical inventory and MSDS in their laboratory and updates them annually.
 - (7) Ensure chemical containers are labeled properly (i.e. date received, date expired, PPE required, and hazardous warning labels are visible).
 - (8) Ensure chemicals are segregated in a well ventilated area with local exhaust, such as snorkles.
 - (9) Ensure chemicals which are highly toxic or other chemicals whose containers cannot be resealed are in unbreakable secondary containers.
 - (10) Examine stored containers periodically (at least annually) for replacement, deterioration, and container integrity.
 - (11) Monitor procurement, use, and disposal of all chemicals used in their section.
- v) Safety & Security Committee Members
- (1) Inspect each laboratory on their floor quarterly and report the following to the SSO:
 - (a) Adequate supplies of PPE,
 - (b) Proper record keeping of chemical fume hood face velocities,
 - (c) Properly maintained waste storage containers and disposal containers,
 - (d) An orderly maintained laboratory environment, "clean space," and hallways,
 - (e) Adequately stocked spill kits and first aid kits,
 - (f) Expiration dates on fire extinguishers, and
 - (g) Proper water flow and alignment of eyewash stations.
- vi) Employee
- (1) Complies with the all safety related policies and procedures (i.e. CHP, *Laboratory Safety Manual*, and Divisional SOPs).
 - (2) Does not damage, move, or remove any safety equipment provided for use in the laboratory work environment.
 - (3) Understands and follows policies and procedures established by the Laboratories Administration.

- (4) Properly uses the required safety equipment and PPE necessary to perform each task assigned.
 - (5) Reports to the laboratory unit supervisor and/or SSO all information pertaining to every accident resulting in an exposure to toxic or hazardous chemicals.
 - (6) Does not smoke, eat, drink, chew gum, or apply cosmetics in areas where laboratory chemicals are present.
- vii) While the Laboratory Director, SSO, and Division Chiefs determine and implement policy, it is extremely important that lab supervisor (section and unit heads), as well as the individual lab employee (chemist, laboratory scientist, technician and assistant) understands his/her own responsibility. The success of the CHP depends on the cooperation and support of every laboratory employee.
- e) THE LABORATORY FACILITY
- i) The Laboratories Administration's Central Laboratory occupies floors 1-5, the Lower Level, and Penthouse of 1770 Ashland Avenues in Baltimore, Maryland. Floors 2-5 contain laboratories, the 1st Floor houses the administrative and support services offices, seminar rooms and training lab, computer training room, and the Lower Level comprises the chemical stockroom and waste room, centralized specimen and sample receiving, warehouse, maintenance shop, animal suite, and radiation laboratory. The 1770 was designed in 2010 specifically as a laboratory facility and has been occupied by the Laboratories Administration since April 2015.
 - ii) The air handling system of the building is a one-pass (non-recirculating) type. The air volume within 1770 is exchanged at the rate of least 6 times per hour. In addition, the laboratories are under negative pressure relative to the positive pressure hallways, hence flow of potentially contaminated air from laboratory into the building is minimized.
 - iii) Each laboratory floor is equipped with safety showers, eyewash stations, AED, fire extinguishers, and smoke detector systems. A fire alarm sounds when the building is to be evacuated. There is also an intercom (PA) system to transmit emergency messages. The employees are trained to shut down equipment quickly, close laboratory doors, and exit the building when the alarm sounds.
 - iv) Most laboratories contain sinks and chemical fume hoods. Many also contain other safety and ventilation devices, such as ventilated storage cabinets, acid-proof storage cabinets, snorkel hoods, chemical storage, and biological safety cabinets (BSC).

- v) The individual laboratories comprising the Laboratories Administration have specific functions and missions. Whether clinical or environmental, chemical or biological, they function as analytical laboratories with specifically defined roles.
- vi) The use of any laboratory for activities other than those designated by the Director of the Laboratories Administration is strictly forbidden. Unauthorized use of Laboratories Administration's facilities or supplies may result in progressive discipline for employees and will be treated accordingly.

II CHEMICAL HYGIENE PLAN

a) CHEMICAL SAFETY GENERAL RULES AND PRINCIPLES

For all laboratory employees working with chemicals the following rules apply:

Laboratory employees, by the very nature of their work place, may be exposed to a wide variety of potentially hazardous and toxic substances. A thorough knowledge of the nature of chemical hazards an employee may encounter in the work place is essential to employing safe laboratory techniques. Employee access to information about hazardous and toxic substances in the workplace is mandated by the Federal Government and Maryland State laws, including applicable Maryland Occupational Safety and Health (MOSH) Laws and "Right-To-Know" Law. (Appendix I-Reference 1, 7, Appendix A, and Appendix B).

- i) **Chemicals:**
All chemicals covered under the "Right-To-Know" regulations included but are not limited to cleaners, disinfectants, paints, stains, compressed gases, and typical laboratory chemicals.
- ii) **Class of Chemicals:**
Class of chemical is a group of chemicals with the same U.S. Department of Transportation (DOT) hazard classifications, similar properties, and requiring the same safety precautions (Appendix A). This list must be available to the SSO and to the employees.
- iii) **Hazardous Classifications:**
These hazardous classifications are defined as either a health hazard or a physical hazard.
 - (1) **Health Hazard**
A chemical having significant evidence, based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals, which are carcinogens, toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, and other agents which can damage the lungs, skin, eyes or mucous membranes.

- (a) Irritant: Contact causes minor, reversible damage to tissues.
- (b) Corrosive: Contact causes major, long-term damage to tissues.
- (c) Sensitizer: Overexposure causes extreme sensitivity to future minor exposures, sometimes requiring reassignment of the employee to an area where exposure cannot occur.
- (d) Highly Toxic: exposal dose of a few drops to one ounce (0.5 to 30 mL) will probably be fatal (LD-50 of 1-500 mg/Kg).
- (e) Moderately Toxic: exposal dose of one ounce to one pint (30 to 500 mL) will probably be fatal (LD-50 of 500-5000 mg/Kg).
- (f) Low Toxicity: exposal dose of one pint to one quart (500 to 1000 mL) will probably be fatal (LD-50 of 5-15 g/Kg).
- (g) Toxins: Overexposure impairs function or causes damage to specific organ tissues or systems, such as liver, kidneys, bone marrow, fetal development, blood pressure, nervous system, reproductive system, circulatory system, etc.
- (h) Select Carcinogens: Defined in the MOSH Standard and the CHP, these chemicals fit one of three basic categories:
 - (i) Known human carcinogens for which the volume of human exposure data is sufficient to prove that overexposure causes cancer in people.
 - (ii) Probable human carcinogens, for which insufficient human exposure data is available for proof, but human and animal exposure data indicate a strong likelihood that overexposure will cause cancer in humans.
 - (iii) Suspected human carcinogens, for which there is little or no human exposure date, but animal exposure data indicates a likelihood that overexposure will cause cancer in humans.
- (i) Ionizing Radiation Exposure: Defined by OSHA, federal regulations, and the CHP prohibit employee exposure to large doses of ionizing radiation (with reference to IARC volume 75(2000), Ex 1-12). Ionizing radiation exposure fits is three categories:
 - (i) Chronic exposure (continuous or intermittent) to low levels of ionizing radiation typically has delayed effects. Some of these effects may include genetic defects, cancer, pre-cancerous lesions, benign tumors, skin changes and congenital defects.
 - (ii) Acute exposures (i.e., one large dose or a series of doses for a short period of time) can cause both more immediate and delayed effects. The more immediate effects may include radiation sickness (e.g. hemorrhaging, anemia, loss of body fluids and

bacterial infections). Delayed effects of acute exposure may include genetic defects and cancer as along with sterility.

- (iii) Extremely high levels of exposure can result in death within hours, days, or weeks. A variety of cancers have been associated with exposure to ionizing radiation including leukemia, and cancers of the lung, stomach, esophagus, bone, thyroid, and the brain and nervous system. Exposure to ionizing radiation also may damage developing embryos and fetuses and may damage parental genetic material.

(2) Physical Hazards

- (a) Flammable: Chemicals which at near ambient temperatures can form an explosive mixture with air (Flash Point of $<50^{\circ}\text{C}$ or $<120^{\circ}\text{F}$).
- (b) Combustible: Chemicals which can form an explosive mixture with air only if they are heated first (Flash Point of $<50^{\circ}\text{C}$).
- (c) Compressed Gas: Chemicals which are under a pressure greater than 2.6 atmospheres ($>40\text{psig}$).
- (d) Oxidizer: Chemicals which can provide oxygen to allow combustion or explosion to take place in the absence of air.
- (e) Highly Reactive: Chemicals which can react violently and spontaneously by themselves or with air, water, or physical shock, including explosives, pyrophorics (air-reactives), organic peroxides, perchlorate salts, water-reactives, etc.
- (f) Cryogenics: Chemicals which are liquids or compressed gases that boil at a temperature below -160°C , used to obtain very low temperatures. Cryogenic material may also be considered corrosive, flammable, and/or reactive. Physical contact with cryogenics or related equipment may result in serious skin burn or permanent eye damage caused by liquid cryogen, i.e., liquid nitrogen. Liquid cryogenics warmed above their critical temperatures will generate high pressures that can cause a confining vessel to rupture or explode. Cryogenics can potentially create an oxygen deficient environment, because they have liquid-to-gas expansion ratios, generally greater than 700 to 1. A small spill may produce a large volume of gas that can displace air in a permitted confined area, creating oxygen deficiency.

iv) Chemical Inventory

Every laboratory within the Laboratories Administration is responsible for maintaining an accurate and current chemical inventory. Chemical inventory lists are part the Laboratories Administration's employees "Right-to-Know

Policy.” Each laboratory supervisor is responsible for submitting their chemical inventory lists electronically annually during the month of January to the SSO (Appendix H). The chemicals must be listed by scientific chemical name and common name. Inventories shall include known hazards and quantities on hand. Additions, deletions, and corrections to these lists should be made throughout the year, as they occur. Copies of the chemical inventory will be maintained in the laboratory with corresponding material safety data sheets (MSDS) stored in the same file/binder for employee reference.

- v) **Material Safety Data Sheets (MSDS)/ Safety Data Sheets (SDS)**
The SSO shall maintain all MSDS/SDS received with shipments of hazardous chemicals and ensure they are available to employees, designated representatives, or persons providing health care to employees. A file of available MSDS/SDS shall be maintained within each laboratory and on the Maryland’s Department of Health & Mental Hygiene (DHMH) intranet. Each laboratory will develop a file of MSDS/SDS(s) pertinent to their operation and consistent with the chemical inventory. The SSO shall provide information relating to hazardous chemicals when MSDS/SDS(s) are not available to employees, designated representatives, or persons providing health care to employee.

- vi) **Labeling**
 - (1) After a chemical or reagent is delivered to the requesting employee’s lab, the employee shall write the date received and their initials on each individual chemical or reagent container (e.g. “Rec’d J.S., 9/16/10”) prior to usage. Once the chemical or reagent container is opened, the date opened and initials of the employee who opened the container must be written on the container (e.g. “Opened T.M., 9/23/10”).
 - (2) Carefully read the label on any chemical before opening the container.
 - (3) Do not use a chemical or reagent without labels or with unreadable labels (Do not guess).
 - (4) Label all prepared solutions with the following information:
 - (a) Name of solution, concentration, and hazard;
 - (b) Date prepared;
 - (c) Name of preparer;
 - (d) Expiration dates (if applicable); and
 - (e) Required PPE.
 - (5) **Removal or Defacing Labels.** Labels on incoming reagents and chemicals are not to be removed or defaced. All containers of chemicals and reagents must be properly and clearly labeled.

vii) General Rules

(1) Smoking, Eating, or Drinking

- (a) Smoking is not allowed in any Maryland State buildings.
- (b) Employees may eat, drink, or chew gum only in designated areas. All laboratory employees must wash their hands and remove lab coats before entering eating areas.
- (c) Do not store food or beverages in laboratory storage areas or refrigerators. Laboratory glassware and utensils must not to be used for the preparation of food or drink.

(2) Avoid Routine Exposure

- (a) Develop and encourage safe work habits.
- (b) Minimize exposure to all chemicals.
- (c) Check exhausts devices before beginning any procedure which produces toxic vapors.

(3) Equipment and Glassware

- (a) Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware.
- (b) Use equipment and glassware only for its intended use.

(4) Pipetting - Never use mouth suction for pipetting or starting a siphon.

(5) Chemical Fume Hoods – Use chemical fume hoods for any operation which can result in a release of toxic vapors or dust.

(6) Personal Protection

- (a) Wear eye protection whenever chemicals are stored or handled.
- (b) Wear chemical resistant gloves when there is a potential for skin contact with toxic materials.
- (c) Wear lab coats whenever handling chemicals.

(7) Horseplay - Horseplay will not be tolerated. Practical jokes or other behavior which can confuse, startle, frighten or distract another worker will result in disciplinary action.

(8) Know the location and uses of safety devices:

- (a) Fire extinguisher,
- (b) Safety storage cabinets,
- (c) Safety apparel,
- (d) Chemical spill kits,
- (e) Emergency safety shower/eyewash stations,
- (f) MSDS/SDS, and

- (g) Emergency phones and numbers.
- (9) When setting up a new procedure, plan safety precautions before implementation. Seek approval and/or safety inspection from SSO if necessary.
- (10) Plan for emergencies (i.e. electrical outages) for attended and unattended operations.
- (11) Do not test chemicals or reagents by touch, smell, or taste.

III CHEMICAL PROCUREMENT

- a) Chemicals shall be ordered in limited quantities to prevent shelf expiration. Excessive stockpiles of unused chemicals are a potential safety hazard and can incur high costs for disposal.
- b) For all newly ordered chemicals or substances a copy of the MSDS/SDS is given to the SSO and the original remains in the laboratory.

IV CHEMICAL DISTRIBUTION

- a) Safe handling precautions must be taken to prevent spillage and breakage when chemicals are being delivered.
- b) Never accept any opened or unlabeled chemical or reagent container from the warehouse, chemical stockroom, or supplier. All chemicals must have a current MSDS available.
- c) Chemicals and reagents must be placed in a suitable transport container or bucket. Chemicals may also be delivered in their original packaged cartons (precautions having been taken to ensure package integrity and absence of leaks).
- d) Gas cylinders must be delivered using special compressed gas cylinder delivery trucks.
- e) Prior to a new chemical being received, the SSO shall be consulted for information regarding special handling, storage and disposal.

V CHEMICAL STORAGE

- a) Consult the MSDS/SDS for chemical compatibility and reactivity for chemical and reagent storage.
- b) Chemicals shall be ordered in the smallest practical amounts. Unusable, out-of-date, or expired chemicals must be disposed. Notify the SSO of all chemical/hazardous waste disposal needs.

- c) Avoid exposure to heat and direct sunlight when storing chemical and reagents.
- d) Do not store chemicals or reagents on laboratory bench or in chemical fume hoods. Chemicals and reagents must be stored in approved areas, such as flammable storage cabinets, acid and base cabinets, etc.
- e) At the time of the annual chemical inventory, examine containers carefully for leaks, corrosion and disintegrated or unreadable labels, and expiration dates. The SSO shall collect room/laboratory chemical inventories annually from supervisors using the Laboratories Administration Chemical Inventory Template (Appendix H).
- f) Secondary containers shall be used to store highly corrosive and previously opened chemicals.
- g) For more information pertaining to chemical storage consult the Laboratories Administration's *Laboratory Safety Manual*.

VI CHEMICAL AND HAZARDOUS WASTE DISPOSAL

The SSO will contact hazardous waste disposal firms to remove waste on a regular basis. No generated hazardous waste shall be held in storage for more than 180 days.

- a) Chemical/Hazardous Waste Disposal Regulations
 Strict federal, state, and local laws and regulations govern the disposition of "controlled hazardous substances" (CHS), a term used synonymously with "hazardous waste". The Laboratories Administration must comply with the regulations in the Code of Maryland Regulations (COMAR) 26.13.05, Disposal of Designated Hazardous Substances, which is promulgated under the authority of Health-Environmental Article, Title 7, Subtitle 2. These regulations are used in conjunction with the Federal Environmental Protection Agency (EPA) – administered program authorized under the Resource Conservation and Recovery Act (RCRA), 42 USC 6901 ET. seq. Violating any of these laws or regulations may subject the violator to criminal penalties. The regulations spell out hazardous waste characteristics. ANY unwanted chemical or hazardous waste should be considered potentially hazardous and handled as such. Questions concerning the disposal of chemical and hazardous waste shall be referred to the SSO.
- b) Chemical/Hazardous Waste Guidelines
 - i) No material considered hazardous may be put down a drain leading to the sewer system or into the routine trash collection system.
 - ii) Non-hazardous chemical wastes generated from laboratory analyses may be routed directly into the sanitary sewer with adequate flushing. Waste streams that are merely acidic or basic may be discharged into the sanitary sewer if they produce an effluent with a pH 5-12, as required by Baltimore City. The

Laboratories Administration utilizes an acid neutralizing tank to ensure pH levels meet EPA and Baltimore City requirements.

- iii) Chemical and hazardous waste generated as part of laboratory testing procedures must be collected in suitable, properly labeled and dated containers. All constituents and their approximate percent composition (waste profile) shall be noted on their labels. Periodic pick-up and disposal of these wastes must be arranged through the SSO. (Appendix G for examples).
 - iv) Excess, outdated or otherwise unwanted chemicals in their original containers shall be retained in the lab section until arrangements for their removal have been made through the SSO. If possible, excess and unwanted chemicals should be transferred to other laboratory sections able to use the chemicals to reduce waste.
 - v) All other chemical waste questions shall be referred to the SSO for evaluation and recommendation.
- c) Chemical and Hazardous Waste Management
- An effective waste management program for the Laboratories Administration will be based on the following principles:
- i) Selection of analytic methods and procedures, and scheduling of operations to minimize production of hazardous chemical wastes;
 - ii) Chemical supplies shall be ordered and stocked in quantities that will be used prior to the within expiration dates. Having dependable vendor sources from which emergency supplies can be obtained without having to overstock;
 - iii) Properly labeling and storing all chemicals in appropriate containers regardless of whether the chemicals are stocked on a shelf or in use; and
 - iv) Chemical and hazardous waste disposal shall be coordinated through the SSO so that it will be handled in a legal and environmental acceptable manner.
- d) Lab Procedures for Disposing of Chemical/Hazardous Wastes and Unwanted Chemicals
- i) The unit or section supervisor or designee must forward a "Generator's Inventory of Hazardous Waste Submitted for Removal" Form listing all materials requiring disposal to the SSO. Items listed on the form include the following: room number, chemical name and description, unit (container size and volume), and quantity (types and number of containers) (See Appendix F).
 - ii) For Large Containers/Drums (5, 15, 30 gallons, etc.) a "Waste Material Profile Sheet" must be completed and attached to any large container/drum (See Appendix G). Items listed on the form include the following: container start

date, initials of scientist or lab tech who began filling container, room number, waste method if applicable, percent concentration of chemical contents (i.e. 60-80% methanol, 20-40% water), and hazard code (i.e. flammable, toxin, poison, oxidizer, etc.)

- e) Chemical/Hazardous Removal and Pick-up
 - i) The SSO shall review each "Generator's Inventory of Hazardous Waste Submitted for Removal Form" to determine how wastes should be handled according to provisions of chemical hazardous waste laws.
 - ii) The SSO shall prepare a "Hazardous Waste Removal Profile" for the Laboratories Administration to be forwarded to a contracted or licensed hazardous materials disposal company.
 - iii) The SSO shall follow state procurement requirements to contact a licensed hazardous materials disposal company for chemical hazardous waste pick-up and disposal.
 - iv) The SSO shall schedule and monitor the hazardous waste pick-up.
- f) Hazardous Materials Disposal Company
The company's technical staff will arrange and conduct the actual packaging, labeling, manifesting, transportation and final disposal of the hazardous chemical wastes. They will also provide all regulatory documentation, including a set that must be forwarded to the Waste Management Administration of Maryland's Department of the Environment. Copies will be retained in the files of the Office of Laboratory Safety and Security. The SSO or another responsible agent of the Administration must sign these documents stating that the Laboratories Administration is the waste generator.

VII ENVIRONMENTAL MONITORING

- a) The ultimate goal of the Laboratories Administration is to eliminate chemical exposures and improve working conditions.
- b) Should an employee develop signs, symptoms or other evidence which might indicate a potential overexposure, environmental monitoring shall be scheduled through the SSO. The mechanism for this will be initiated by a complaint to the immediate supervisor. Each complaint must be brought promptly to the attention of the section head and Division Chief; and mandatory notification of Director and SSO, whom may arrange for a consultation with MOSH.
- c) Exposure monitoring data will be made available to employees in any laboratory which has been monitored. Such data will be made available to the individual or his/her representative.

VIII HOUSEKEEPING AND EQUIPMENT MAINTENANCE

- a) Housekeeping
 - i) General housekeeping in the laboratory tower and general maintenance is the responsibility of the Forest City (FC), telephone number 410-900-1040, and the Facility Manager, telephone extension 443-681-3818.
 - ii) FC is responsible for:
 - (1) Trash pick-up,
 - (2) Restroom cleaning,
 - (3) Floor cleaning (all public areas, but not lab spaces),
 - (4) Fire extinguishers, and
 - (5) Chemical fume hood exhaust fan maintenance.
 - iii) Before performing maintenance on the building, FC personnel must be made aware of the requirement not to contaminate laboratory air by locating potential emitting chemical sources adjacent to building air intakes.
 - iv) Laboratory employees are responsible for the following:
 - (1) Keep work areas clean and uncluttered;
 - (2) Clean work surfaces routinely at the end of each operation;
 - (3) Reagents and chemicals placed in proper storage areas at the end of each day; and
 - (4) Cleanup of laboratory spills.
 - v) Stairways, halls, and utility closets/wire rooms must not be used as storage areas by FC or by laboratory personnel.
 - vi) Access to exit and emergency equipment must never be blocked.
- b) Chemical Fume Hood and Chemical Fume Hood Maintenance
 - i) Kewaunee Scientific Corp., metal and NuAire Inc. polypropylene Variable Air Volume (VAV) chemical fume hoods are used throughout the Central Lab. VAV chemical fume hood maintains a constant face velocity regardless of sash position. To ensure accurate control of the average face velocity, VAV hoods incorporate a closed loop control system. The system continuously measures and adjusts the amount of air being exhausted to maintain the required average face velocity. VAV have been set to maintain an average face velocity of between 80-100 fpm.
 - ii) Chemical fume hoods are used to protect employees while they are working with any potentially hazardous chemicals or reagents. Records of daily chemical fume hood face velocity values shall be maintained by employees using the electronic face velocity meter mounted on each unit. Chemical fume hoods shall be checked daily for adequate face velocity of 80-120 fpm using the face velocity form to document measurements (Appendix C). Copies of

records shall be sent to the SSO annually. The SSO shall be contacted if a chemical fume hood is not functioning properly.

- iii) The SSO, or certified vendor, will verify all chemical fume hoods at least annually.

- iv) Proper chemical fume hood usage and maintenance requires the following:
 - (1) Chemical fume hoods shall not be used as a storage and disposal container.
 - (2) Do not block vents in the hood.
 - (3) Keep hazardous chemicals at least 6 inches from the edge of the hood's opening to reduce exposure.
 - (4) Do not use a hood unless face velocity meter is reading 80-120 fpm.
 - (5) Do not turn off the fume hood face velocity monitoring alarm, unless the fume hood is no longer in use. If the chemical fume hood is no longer in use, post signage to that effect.
 - (6) When working in the hood keep sash at 18 inches as indicated by hood label. This maximum hood opening will maintain the laminar air flow (i.e. prevent turbulent flow which may return fumes into the laboratory).
 - (7) If the face velocity meter alarms, check sash settings. Call the SSO at 443-681-3792 if alarm continues.
 - (8) If modifications are made to the ventilation system, the chemical fume hoods must be checked for proper functioning.
 - (9) When appropriate, use traps or scrubbers as a primary means of reducing toxic or noxious materials from being vented in the hood.
 - (10) Do not allow paper or other foreign material to enter exhaust ducts, since they can lodge in ducts and reduce efficiency.
 - (11) Never lean in the hood to work.
 - (12) Remove contaminated gloves and other protective gear inside the hood after handling toxic chemicals, if possible.
 - (13) Each chemical fume hood has a label associated with it indicating proper sash height at 18 inches.
 - (14) Always use the chemical fume hood for their designated operations (Appendix I--Reference 6 *Laboratory Safety Manual*).

- v) Other Equipment Maintenance
 - (1) Some laboratory equipment and instruments, such as freezers, refrigerators, ice makers, etc. are maintained and repaired by the Laboratories Administration's Maintenance Shop, 443-681-3794. Other pieces of equipment, such as autoclaves, centrifuges, etc. are serviced by vendor or other maintenance and repair technicians.
 - (2) Clean chemical residue and/or disinfect equipment before any maintenance personnel or technician make repairs.
 - (3) Equipment not in service must be clearly labeled noting the hazard.

IX PERSONAL PROTECTIVE EQUIPMENT (PPE)

- a) Guidelines for the PPE used within the Laboratories Administration are found in 29 CFR 1910.132.
- b) It is the duty of the supervisor to decide which special apparel is necessary to minimize chemical exposure while performing laboratory procedures. Supervisors must list the required PPE for all job tasks in their SOP. Supervisors should consult the SSO if they have any questions concerning proper PPE.
- c) The following are necessary features of the Laboratories Administration CHP to minimize chemical exposures:
 - i) Lab coats must be worn when working with or around chemicals, compressed gas, and cryogenic liquids.
 - ii) Laboratory aprons made of chemical resistant material are to be used with procedures where splashing of chemicals may occur.
 - iii) Gloves are worn for protection against many different chemicals, potential hazardous exposures. Some chemicals will "breakthrough" the glove material in a very short time. Therefore, glove selection is based on the specific chemical utilized and MSDS/SDS recommendations. The performance of gloves depends on their thickness and conditions of manufacture, as well as their material of construction. It is best to consult the manufacturers' glove selection guides. (Appendix J).
 - (1) When choosing the proper glove type, supervisors, managers, and Division Chief should be considered when writing their risk assessment:
 - (a) Chemical compatibility, does it meet manufacturers' and equipment manufactures' recommendations for glove use.
 - (b) Duration of use.
 - (c) Dexterity needed while wearing the gloves.
 - (d) Length of glove needed.
 - (e) Potential exposure hazard of chemical in use.
 - (f) Potential employee allergic reactions.
 - iv) Sleeve protectors can add protection for your arms above the reach of your gloves.
 - v) Eye Protection is necessary at all times when working with hazardous chemicals, compressed gases, and cryogenic liquids.
 - (1) Eye protection, glasses or face shields, shall meet the current edition of American National Standards Institute (ANSI) 87.1 standard.
 - (2) Prescription eyeglasses are not to be used in place of eye protection.
 - (3) Contact lenses are not recommended when working around or with chemicals even when wearing eye protection.

- vi) Some procedures may require special apparel not available in the laboratory. Consult with the SSO to meet these special needs.
- d) Each laboratory floor is equipped with emergency safety showers, eyewash stations, fire extinguishers and emergency phones. The location of these must be pointed out to each new or transfer employee by either the immediate supervisor or SSO. In addition, the building's fire alarm system and intercom for hazard alerts must be explained to a new employee or transfer.
- e) Signage - The Laboratories Administration provides floor plan location signs for:
 - i) Emergency Safety Showers,
 - ii) Eyewash Stations,
 - iii) Fire Extinguishers,
 - iv) First Aid Supplies and Automated External Defibrillators (AED),
 - v) Floor Plans, and
 - vi) Warning signs indicating location of hazardous chemicals, radiological hazards and biohazards.
- f) Radiation Safety and Training
Each employee assigned to the Radiation Section shall be provided information, monitoring equipment (TLD dosimeter) and comprehensive radiation safety training. Scientists in the Radiation Section are apprised of the hazards of radioactive chemicals present in their work area. Initial radiation safety training, conducted by the Radiation Safety Officer (RSO), will be given once an employee is assigned to the section and prior to new assignments involving different potential exposure scenarios. Refresher radiation safety training for all Radiation Section employees is provided annually (Appendix I, Reference 6, and *Laboratory Safety Manual* for more information regarding radiation safety, spills, and waste disposal).

X CHEMICAL SPILLS AND ACCIDENTS

- a) In the event of a chemical spill, or chemical spill related accident contact the SSO and lab supervisor immediately. Do not attempt to clean up spills without SSO and lab supervisor consultation, if the spill involves:
 - i) Unknown chemicals;
 - ii) Volatile, toxic or flammable substance(s); or
 - iii) The result of a chemical fire or explosion.

After the nature of the spill has been determined follow the procedures listed in the rest of this section.

- b) Chemical Spills Procedures

- i) Render First Aid: Attend to any person who may have been contaminated.
 - (1) If a liquid spill occurred over a large part of the body, use the nearest safety shower, quickly remove all contaminated clothing while under the safety shower. Every second counts and no time should be wasted because of modesty. Flood the affected body area with cold water for at least 15 min; resume if pain returns. Wash off all chemicals using soap and water. **DO NOT** use neutralizing chemicals, unguents or salves.
 - (a) A liquid spill may require the use of an absorbent, which may be a pre-packaged spill kit or commercially purchased spill cleanup kit; or any appropriate absorbent that will neutralize the chemical spill.
 - (b) If a liquid spill involves the eyes, use the nearest eyewash fountain for a minimum of 20 min. Pull the eyelids away from the eye and roll the eyeball up and down and from side-to-side to thoroughly wash the eye. Then seek medical attention.
 - (c) If a dry chemical spill occurs, brush as much of the dry chemical off your clothes and body as soon as possible. Wash your face and hands with an excess of water, and then with soap and water. Eyes should be washed as described in 'b', above. NOTE: Caustics, e.g. NaOH and KOH, are extremely difficult to completely wash off the skin and clothes as they, and all other caustic materials, react with the oils in the skin and can penetrate several layers of skin. Washing should continue until the soapy (slick) feeling is gone. Seek medical attention if necessary.
 - (i) A dry powder spill will require gloves and possibly a dust respirator if the powder becomes airborne. Wash the area with soap and water and allow to air dry.
- ii) Give Warnings: During a spill use the following warnings:
 - (1) Evacuate nonessential personnel from the spill area.
 - (2) If the spill material is flammable, turn off all ignition and heat sources.
 - (3) Inform your immediate supervisor and the SSO. They will recommend proper cleanup procedures and proper PPE.
- iii) Chemical Spill Cleanup Materials & Waste Considerations
 - (1) Appropriate cleanup supplies and equipment must be kept available in the event of a spill. These materials must be consistent with the hazards and quantities of the spilled substance. Cleanup supplies shall include neutralizing agents (e.g., sodium carbonate, sodium bisulfate) and absorbents (e.g., vermiculite, paper towels). Commercial spill cleanup

kits containing similar materials and instructions covering their use are recommended and should be available and located strategically around technical work areas to confine or contain a spill to the smallest area possible.

- (2) All materials generated from a spill should be considered hazardous wastes and handled appropriately.

iv) Specific Chemical Spill Cleanup Procedures

(1) Flammable Solvent Spill Cleanup Procedure:

- (a) Turn off all gas burners. Do NOT turn off or on any electrical equipment. Sparks from electric switches could start a fire.
- (b) Lay out spill control material if available, or toweling, vermiculite, or other dry absorbent material around the edge of the spill to keep it from spreading. Then absorb as much of the liquid as practical into appropriate absorbent. Place the wet absorbent material in a working fume hood and allow the solvent to evaporate. Be sure to follow the proper procedures for disposal of wastes.
- (c) Large spills or extremely toxic spill may result in a situation that cannot be mitigated may require the assistance of trained personnel and/or equipment to perform an effective and safe cleanup.
- (d) Some solvents are very toxic. **Avoid exposure.** Do not expose yourself or allow others to be exposed to those vapors. In such cases evacuate the room, close the doors and wait for the laboratory air circulation system to remove the vapors and dry up the spilled solvent.

(2) Nonflammable Spill Cleanup Procedures:

- (a) Acid spills
 - (i) Wear protective gloves and eye protection while pouring the contents of an acid-neutralizing spill kit, baking soda (NaHCO_3), or sodium sulfate (Na_2SO_4) around the edge of the spill to neutralize the acid. Continue to add the dry neutralizing material until most of the liquid has been absorbed.
 - (ii) Wait 10-15 min or until chemical neutralization is verified with pH paper. Wear rubber gloves and use a dustpan or a large scoop to pick up as much of the material as practical. Put the material in a plastic container for proper disposal.
 - (iii) While wearing gloves and using as many paper towels as needed, wipe the remaining material off the floor or bench. A wet mop or wet towels may then be used

to wash the surfaces. All towels should be well rinsed in running water before disposal or further cleaning.

(b) Alkali Spills

- (i) Wear protective gloves and eye protection while pouring dry absorbent material around the outer edge of the spill. The contents of a base neutralization kit, paper towels, or vermiculite may be used to absorb the liquid. **NOTE: DO NOT** add acids to concentrated or strong caustic spills. There may be violent chemical reactions and the spill will be spread over a wider area.
- (ii) When most of the liquid has been absorbed, scoop up the absorbing material and rinse it well with an excess of water before placing the absorbing material in a proper disposal container. **NOTE:** Caustics are difficult to wash out of absorbents, so continue the washing for several minutes.
- (iii) After most of the spilled liquid and absorbents have been removed, pour small amounts of dilute acetic acid (2-3%) or 0.1N (1%) hydrochloric acid on the spill area. Allow neutralization to be completed. Then, while still wearing rubber gloves and eye protection, mop or wipe up the liquid. Rinse the area with a wet mop or towels.

c) Chemical Related Accidents

- i) If job-related accidents or injuries occur in the lab:
 - (1) Shout a warning to co-workers, and if necessary, clear the work area.
 - (2) Apply first aid. Minor wounds should be cleaned with soap and water and bandaged.
 - (3) Immediately inform your supervisor and the SSO of the accident or incident.
 - (4) If the injury or illness is severe (life threatening) or deemed to require immediate emergency medical care:
 - (a) Call the Security emergency number 443-681-3795 give them complete and accurate information concerning the location and the nature of the problem. They will call 911 and Security personnel.
 - (b) An employee must stay with the injured or ill person until help arrives.
 - (5) For a less serious injury, but still requiring professional medical attention, follow these procedures:
 - (a) Make arrangements to transport the injured person to the State's designated health care facility, WorkPro and Occupational Medical Services (OMS) (Appendix I, Reference

6 *Laboratory Safety Manual*). A co-worker should drive the patient to the clinic. If available, a Maryland State car may be used. Check with the Lab's fleet manager, 443-681-3813.

- (b) File out "Employee First Report of Injury," Injured Workers Insurance Fund (IWIF) form. The AUTHORIZATION FOR EXAMINATION OR TREATMENT form must be signed. The form must be filled in completely and have the appropriate signatures, and must be returned to the SSO. An employee can obtain a copy of this form from the SSO. (Appendix I, References 6 *Laboratory Safety Manual* Appendix A. for a copy of the form.)

(6) Employees must report the following to the SSO:

- (a) All accidents,
- (b) All incidents resulting in damage to instruments, equipment, furnishings, buildings, and
- (c) All situations or conditions that have the potential for injury, hazard to health, or damage to property.

XI MEDICAL PROGRAM

- a) Medical surveillance of laboratory employees is not routinely scheduled. If potential occupational overexposures to hazardous chemicals are suspected, supervisor shall contact the laboratory SSO and refer to the Laboratory Safety Manual for appropriate "Employee First Report of Injury" documentation requirements. Medical consultation shall be provided by the State Physician and/or approved workers' compensation healthcare provider.
 - i) The Laboratories Administration shall provide the opportunity for a medical consultation under the following circumstances:
 - (1) Signs and symptoms associated with a hazardous chemical develop,
 - (2) Environmental monitoring reveals an exposure level routinely above the action level for an OSHA regulated substance, or
 - (3) An unconfined chemical release resulting in the potential for hazardous chemical exposure, which exceeds the STEL or the PEL.
 - ii) The Laboratories Administration will provide the following information to the treating healthcare provider and the employee, if available:
 - (1) The identities and MSDS(s) of the hazardous chemical(s),
 - (2) The circumstances and conditions under which the exposure occurred,
 - (3) Signs and symptoms of exposure; and
 - (4) Any quantitative or qualitative exposure data.
 - iii) The Director of the Laboratories Administration must receive a written opinion from the caring physician which includes:
 - (1) Recommendations for future medical follow-up,
 - (2) Results of the medical consultation,

- (3) A statement that the employee has been informed of the consultation and any medical condition that may require further examination or treatment, and
 - (4) Medical assessment relating only to the occupational exposure.
- iv) The Medical Program described above refers only to potential occupational chemical exposures in the laboratory. Employees requiring immediate or emergency medical attention will be treated at the designated hospital emergency room.

XII RECORDS

- a) The Laboratories Administration with the cooperation of DHMH's Office of Human Resources will establish and maintain employee's medical records. Medical records for all lab employees shall be preserved and maintained for at least the duration of employment plus thirty (30) years according to the Code of Federal Register, 29 CFR 1910.1020.
 - i) The following records must be maintained in the office of the SSO or in a secured-restricted storage area:
 - (1) First Report of Injury (Accident Reports) and medical consultation reports,
 - (2) Chemical Inventory and Disposal Records,
 - (3) MSDS, and
 - (4) Annual usage records for moderate to highly acute toxic chemicals (to be maintained by each employee monitored by the supervisor and transferred to the SSO).

XIII CHEMICAL HYGIENE TRAINING AND INFORMATION

- a) Applicability of MOSH Law "Right-To-Know Law"
Under MOSH rules, certain regulations and standards apply to analytical, educational or research and development laboratories. Law provisions include education and training programs (Appendix I, Reference 6, *Laboratory Safety Manual*)
 - i) Chemical Hygiene Education and Training Programs
Chemical Hygiene Training Program for the laboratories is comprised of these areas:
 - (1) Initial new employee orientation training conducted by the SSO;
 - (2) Laboratory section specific on-the-job-training conducted by the immediate supervisor for all new employees, and when implementing any new processes or test methods; and
 - (3) Annual review of the CHP by SSO and Chemical Hygiene Committee.
- b) Employer's Education and Training Responsibility
The Laboratories Administration will provide each employee with training and education designed to inform the employee of job specific duties.

- i) Provide new employee with copies the current *Laboratory Safety Manual* and CHP. New employees must receive their chemical hygiene training before they can work independently or unsupervised in the lab.
 - ii) Hazard communication methods used in the Laboratories Administration, including but limited to the following:
 - (1) CHP,
 - (2) Chemical inventory lists,
 - (3) MSDS/SDS,
 - (4) Appropriate signage and warning labels,
 - (5) Continuing education and safety workshops/seminars, and
 - (6) Contents of Title 29 CFR Part 1910 (Appendix I, Reference 1).
 - iii) Employee's "Right-To-Know"
 - (1) An employee or designated representative may request access to a chemical inventory list, the CHP, and any MSDS/SDS maintained by the Laboratories Administration.
 - (2) If the Laboratories Administration fails to comply with subsection "a", an employee requesting information or access to information about a "hazardous" chemical, may refuse to work with that hazardous chemical until information is provided.
 - iv) The Chemical Hygiene Committee will review the CHP and Chemical Hygiene Training Program annually.
- c) Chemical Hygiene Training Program
- i) New Employee Chemical Hygiene Training and Education
An employee's immediate supervisor must see that an employee has been made aware of the following prior to starting any new assignment:
 - (1) Nature of the hazardous chemicals encountered in the workplace, e.g., definitions of hazardous chemicals, and MSDS/SDS;
 - (2) Appropriate work practices regarding hazardous chemicals in the workplace, e.g., labeling and incompatibilities;
 - (3) Appropriate control programs regarding hazardous chemicals in the workplace, e.g., purchase, storage, waste disposal;
 - (4) Protective measures in the work place, e.g., PPE and safety equipment;
 - (5) Emergency procedures relating to hazardous chemicals in the workplace, e.g., spill cleanup procedures;
 - (6) Methods and observations that may be used to detect the presence or release of a hazardous chemical, e.g., environmental monitoring, visual appearances, or odor of hazardous chemicals etc.; and
 - (7) Location and availability of reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the lab, including but not limited to MSDS. This would include appropriate

handouts, posters and graphic materials, such as CDs, outline websites, and videos, if available.

- ii) Employees must receive chemical hygiene training by their immediate supervisor that will reinforce safety awareness and basic safety principles necessary to work within the lab section. Also, employees must receive additional training when:
 - (1) New safety materials and information is available.
 - (2) An employee may be required to take special precautions due to a special case or operation, such as equipment maintenance.
 - (3) A change in procedure or work assignment which potentially exposes an employee to different or increased exposure to hazards.

d) Training Techniques, Ideas, and Subject Matter

The following are some techniques and ideas that supervisors may use to conduct chemical hygiene and safety training programs:

- i) Conduct general safety and chemical hygiene training covering the laws and regulations, safety principles, basic policy, and operations used where employees, or a select group, such as a particular section, may be potentially exposed to a specific hazard or procedure.
- ii) Training may be conducted in a formal classroom setting or informally in a "bench level" session, as appropriate.
- iii) Training may be reinforced by posting additional information in work areas, as well as preparing and distributing pertinent handout materials.
- iv) Training may consist of lectures, informal discussion sessions, small groups, or one-on-one situations. Audiovisual aids, such as DVDs, web seminars, online courses, training CDs, and other graphic materials are valuable as training aids, but providing them alone does not constitute adequate training. All materials used must be approved and determined to meet the training requirements by the Division Chief or SSO.
- v) Refresher training topics for safety and chemical hygiene may include the following.
 - (1) Use and maintenance of protective equipment.
 - (2) Work practices - procedures to follow when handling materials, steps to minimize exposures, waste disposal procedures, ordering and storage practices.
 - (3) Engineering controls - ventilation, monitors, use of hoods and controlled environment areas, special storage facilities, etc.
 - (4) Spill control procedures and reporting.
 - (5) Fire protection and use of extinguishers, evacuation plans, and fire prevention.

- (6) Methods and observations that may be used to detect the presence or release of hazardous chemicals, infectious materials and other potential health hazards.
 - (7) Accident and incident reporting, first aid, CPR, emergency procedures in the workplace (including rights under workmen's compensation, etc.).
- vi) Training Assessment and Documentation
- A central training record should be maintained by the SSO, Quality Assure Officer (QAO), or Training Coordinator, as required by MOSH, EPA, MDE or other inspecting agency that requires safety training. Individual employee training records must be kept by supervisors and placed in an employee's permanent file, and should also be kept by the employee. At a minimum, the records should include the following:
- (1) Attendance (sign in sheet or individual record);
 - (2) The date and length of the training;
 - (3) Name and title of person presenting the training;
 - (4) The titles and/or references of training materials used;
 - (5) A brief outline, summary or lesson plan of training subject matter covered; and
 - (6) Training results, quizzes, tests, or certificate given for each session.
- vii) Efforts should be made to evaluate the effectiveness of the training program in meeting the objectives sought. This can be done in several ways:
- (1) Testing: written test, one-on-one oral evaluation with employee, or demonstration by employee of skill learned.
 - (2) Formal feedback on the training from recipients to determine what was most valuable and helpful and what seemed least helpful. This type of feedback will help when revisions and/or additions are made to the training.
- viii) Training is a necessary effort to provide all employees with a safe and healthful work place environment, free from potential chemical hazards capable of causing acute or chronic exposure to the Laboratories Administration's employees.

XIV APPENDICES

APPENDIX A

U.S. Department of Transportation (DOT) HAZARD CLASSIFICATION LIST

DOT Hazard Classes (Categories Based On Physical and Chemical Properties)

The U.S. hazardous material regulatory system is a risk-based system that focuses on identifying the hazard and reducing the likelihood of a hazardous material release. Under the DOT's Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180)³ hazardous materials are categorized by analysis and experience into hazard classes and packing groups. Each shipper is required to classify a material according to these hazard classes and packing groups and communicate the material's hazards. The shipper repetitively communicates the hazard through the use of package labels, shipping papers, and placards on transport vehicles.

The DOT has broad jurisdiction to regulate hazardous materials that are in transport, including the discretion to decide which materials shall be classified as "hazardous." These materials are placed in one of nine hazard classes based on their chemical and physical properties. The hazard classes may be further subdivided into divisions based on their characteristics. Additionally, some materials may be reclassified as combustible materials or "other regulated materials" (ORM-D) because of limited hazard during transport. These properties and characteristics are crucial in understanding the dynamics of a spill during a traffic incident. Therefore, it's important for response personnel to understand the hazard classes, their divisions, and reclassified materials:

- Class 1: Explosives
 - Division 1.1 Explosives with a mass explosion hazard
 - Division 1.2 Explosives with a projection hazard
 - Division 1.3 Explosives with predominantly a fire hazard
 - Division 1.4 Explosives with no significant blast hazard
 - Division 1.5 Very insensitive explosives
 - Division 1.6 Extremely insensitive explosive articles
- Class 2: Gases
 - Division 2.1 Flammable gases
 - Division 2.2 Nonflammable gases
 - Division 2.3 Poison gases
- Class 3: Flammable liquids.
 - Liquid material with a flash point of not more than 60° C (140° F), or any material in a liquid phase with a flash point at or above 37.8° C (100° F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging.
 - Combustible liquid
 - Any liquid that does not meet the definition of any other hazard class specified in the HMR and has a flash point above 60 °C (140 °F) and below 93 °C (200 °F);
 - A flammable liquid with a flash point at or above 38 °C (100 °F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid.
- Class 4: Flammable solids; spontaneously combustible materials; and materials that are dangerous when wet
 - Division 4.1 Flammable solids

- Division 4.2 Spontaneously combustible materials
 - Division 4.3 Materials that are dangerous when wet
- Class 5: Oxidizers and organic peroxides
 - Division 5.1 Oxidizers
 - Division 5.2 Organic peroxides
- Class 6: Poisons and etiologic materials
 - Division 6.1 Poisonous materials
 - Division 6.2 Etiologic (infectious) materials
- Class 7: Radioactive materials
 - A material that spontaneously gives off ionizing radiation where the activity concentration or total activity exceeds the values specified for certain radionuclide in the HMR.
- Class 8: Corrosives
 - A material, liquid, or solid that causes visible destruction or irreversible alteration to human skin; or a liquid that has a severe corrosion rate on steel or aluminum.
- Class 9: Miscellaneous
 - A material which presents a hazard during transport, but which is not included in any other hazard class (e.g., a hazardous substance or a hazardous waste).
- ORM-D: Other regulated material

A material which, although otherwise subjected to regulations, presents a limited hazard during transportation due to its form, quantity, and packaging.

APPENDIX B

U.S. Environmental Protection Agency (EPA) HAZARD CLASSIFICATION LIST

Classification of Chemical Waste

A chemical waste is considered to be a hazardous waste if it is specifically listed by the EPA or DEP as a hazardous waste or if it meets any of the four hazardous characteristics below. If a chemical waste is not on the EPA list of hazardous wastes, and does not meet any of the hazardous waste characteristics, it is a non-hazardous waste.

Ignitable

A liquid which has a flash point of less than 60°C (140°F) is an ignitable waste (e. g., Acetone, Methanol). A solid is an ignitable waste if it is capable of causing fire through friction or absorption of moisture, or can undergo spontaneous chemical change which can result in vigorous and persistent burning under standard temperature and pressure (e. g., Benzoyl Peroxide). A substance which is an ignitable compressed gas or oxidizer is an ignitable waste (e. g., Propane, Hydrogen Peroxide).

Corrosive

An aqueous solution which has a pH less than or equal to 2 or greater than or equal to 12.5 (e. g., Hydrochloric Acid, Ammonium Hydroxide), or is a liquid and corrodes steel at a rate greater than 6.35 mm per year at a test temperature of 55°C, is a corrosive waste.

Reactive

A reactive waste is a material that is normally unstable and undergoes violent chemical change without detonating, can react violently with water to form potentially explosive mixtures or can generate dangerous or possibly toxic gases, vapors or fumes in a quantity sufficient to present a danger to public safety, health or welfare or to the environment, a material that is capable of detonation or explosive decomposition or reaction at standard temperature and pressure is a reactive waste (e. g., Picric Acid, Potassium Cyanide, Lithium Aluminum Hydride).

Toxic

A waste that contains one of the constituents in concentrations equal to or greater than the values listed below is a toxic waste.

I) Table listing toxic waste materials and with their corresponding concentrations.

Material	Concentration (mg/L)
Metals	
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0
Zinc	500.0
Pesticides	
Endrin	0.02

Material	Concentration (mg/L)
Lindane	0.4
Methoxychlor	10.0
Toxaphene	0.5
2,4-D	10.0
Organics	
Benzene	0.5
Carbon Tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol	200.0
1,4-Dichlorobenzene	7.5
1,2-Dichlorobenzene	0.5
1,1-Dichlorobenzene	0.7
2,4-Dinitrotoluene	0.13
Heptachlor	0.008
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachloroethane	3.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Tetrachloroethylene	0.7
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
Vinyl Chloride	0.2

APPENDIX C

FORM FOR RECORDING FUME HOOD FACE VELOCITY READINGS

Hood No.: _____ Room: _____ Year: _____

Month	January		February		March		April		May		June		July		August		Sept.		Oct.		Nov.		Dec.	
	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.	Read	Int.
1																								
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30																								
31																								
Review																								

"Read": Face velocity meter reading fpm

"Int.": Initials of employee recording the face velocity reading

APPENDIX D

MEDICAL CONSULTATION REQUEST FORM

TO: LABORATORY DIRECTOR

FROM: SAFETY & SECURITY OFFICER DATE _____

INDIVIDUAL REFERRED

DIVISION/SECTION

EXPOSURE DATE

BRIEFLY DESCRIBE THE CIRCUMSTANCES OF EXPOSURE.

NAME THE CHEMICAL(S) IMPLICATED IN THE EXPOSURE.

LIST SIGNS, SYMPTOMS AND DURATION OF EXPOSURE

APPENDIX E

MEDICAL CONSULTATION FOLLOW-UP FORM

TO: LABORATORY DIRECTOR

FROM: SAFETY & SECURITY OFFICER

DATE _____

INDIVIDUAL REFERRED

DIVISION/SECTION

EXPOSURE DATE

DESIGNATED MEDICAL CONSULTANT

ACTIONS TAKEN BY DESIGNATED MEDICAL CONSULTANT

APPENDIX F

GENERATOR'S INVENTORY OF HAZARDOUS WASTE SUBMITTED FOR REMOVAL

NAME _____

DATE _____

SUPERVISOR NAME PRINT/SIGNATURE _____

ITEM #	RM #	CHEMICAL NAME/ITEM DESCRIPTION (no abbreviations, refer to your chemical inventory) **	HAZARD (eg: Flammable-F, Oxidizer-O, Irritant-I, Explosive-E, Corrosive-C, Toxic-T)	Container Size (eg: drum-15 gal, glass jar Liter, 500 mL flask etc.)	Volume (eg: grams, liters, gal, etc.)	QTY
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						

****Unknown chemical must be tested for acidity, pH, and ignitability and then supervisor and Division Chiefs must sign off for removal. All secondary containers must be labeled with chemical name, chemical profile, hazard, volume, start date, expiration date, and initials.**

THIS SECTION TO BE COMPLETED BY THE SAFETY OFFICER

DATE RECEIVED _____

STORAGE ROOM NUMBER _____

DATE REMOVED _____

APPENDIX G

WASTE MATERIAL PROFILE SHEET

Waste Material Profile Sheet	
Start Date:	
Initials of Employee:	
Waste Method:	
Hazard Code:	
Percent Concentration of Chemical Contents:	

APPENDIX I

REFERENCES

1. U.S. Department of Labor, Federal Register, 29 CFR 1910 et seq. (29 CFR 1910.1200 Hazardous Communication, Final Rule February 13, 1996; 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories, Final April 3, 2006; and 29 CFR 1910.132 Personal Protective Equipment, Final Rule November 15, 2007.)
2. U.S. Department of Transportation. 2011 Website, <http://www.dot.gov/>.
3. U.S. Department of Transportation, Federal Highway Administration, Office of Operations, "Traffic Incident of Management In Hazardous Materials Spills In Incident Clearance, DOT Hazard Classes," <http://ops.fhwa.dot.gov/publications/fhwahop08058/20.htm>
4. U.S. Environmental Protection Agency. 2011 Website, <http://www.epa.gov/>.
5. Division of Lab and Industry, Article 89, Subsections 32B 9d-g and 32M. 1986 Cumulative Supplement, Annotated Code of Maryland.
6. *Laboratory Safety Manual* (current issue)
7. Maryland Occupational Safety and Health (MOSH) at: www.dllr.state.md.us/labor/mosh.html
8. U.S. Department of Labor, Federal Register 29 CFR Part 1910.1450. Occupational Exposure to Hazardous Chemicals in Laboratories, Final rule January 31, 1990.
9. Prudent Practices for Handling Hazardous Chemicals in Laboratories. National Research Council, National Academy Press, 1981.
10. Michigan State University, chemical safety, selection and usage of chemically resistant gloves, <http://www.orcbs.msu.edu/>

APPENDIX J

Glove Compatibility Charts and Resources

Chemical Resistance of Glove Material

Protective gloves are not equally effective for every hazardous chemical. Some chemicals will "break through" the glove material in a very short time. Therefore, glove selection is based on the specific chemical utilized. The performance of gloves depends on their thickness and conditions of manufacture, as well as their material of construction. It is best to consult the manufacturers' glove selection guides. Here are select links to four (4) glove manufactures found at the Laboratories Administration:

- 1) Ansell Gloves Compatibility Chart http://www.ansellpro.com/download/Ansell_7thEditionChemicalResistanceGuide.pdf
- 2) MicroFlex Gloves Compatibility Chart
http://www.microflex.com/Products/~/_media/Files/Literature/Domestic%20Reference%20Materials/DOM_Reference_Chemical%20Resistance.ashx
- 3) Chemrest Chemical Guide
<http://www.showabestglove.com/site/chemrest/default.aspx>
- 4) Kimberly Clark Gloves Compatibility Chart
http://www.kcprofessional.com/us/download/Technical%20Data%20Sheets/K2365_09_01_SN_Chem_Guide_v11.pdf

Government and Other Manufacturer Glove Compatibility Selections Guides and/or Permeability Data

- 1) **National Institute for Occupational Safety and Health (NIOSH).**
Guide for Evaluating the Performance of Chemical Protective Clothing 90-109, link <http://www.cdc.gov/niosh/docs/90-109/>
- 2) **Ansell-Edmont** - Ansell Industrial, 1300 Walnut St., Coshocton, OH 43812.
From the AnsellPro.com home page, link to the **Chemical Resistance Guide: Permeation and Degradation Data**, http://www.ansellpro.com/download/Ansell_7thEditionChemicalResistanceGuide.pdf. Ansell's interactive chemical resistance and glove recommendations guide to nearly 200 industrial chemicals and mixtures. Links to toxicology information, for thousands of chemicals from the National Library of Medicine database, is also provided.
- 3) **Best Manufacturing Company** - 579 Edison Street, Menlo, GA 30731.
Comprehensive Guide to Chemical-Resistant Best® Gloves - Software package with a 200-plus chemical database is free for downloading. It will help you determine which of the 21 chemical-resistant glove materials, in varying thicknesses, to use for specific applications. These range from where contact with the chemical is brief or intermittent, to worst-possible-case situations, such as total immersion (a decidedly imprudent procedure). Supports Windows 3.1, 3.11, 95, or NT.
<http://www.bestglove.com/products/chemresist/chemresist.htm> This information is also available on the website, where you can search by chemical name, CAS number, and chemical class.
- 4) **Lab Safety Supply** - PO Box 1368, Janesville, WI 53547.
Chemical Protective Gloves, EZ Facts Document 191 - Provides general information about OSHA regulations, selection factors and criteria, and types of glove materials. For specific information you can e-mail technical support, techsvc@labsafety.com, or consult the chemical compatibility chart contained in their hard copy catalog. Find and html version of the fact sheet at: <http://www.labsafety.com/refinfo/ezfacts/ezf191.htm>.
- 5) **MAPA Professional** - 85 85 Innsbruck Drive, Buffalo, NY 14227.
Permeation, Degradation and Breakthrough Rates - for 111 chemicals against 5 polymeric materials, including their Stansolv® Nitrile and StanzoilÆ Neoprene gloves.
<http://www.mapaglove.com/ChemicalSearch.cfm?id=0>