Division of Air Quality

Chemical Hygiene Plan

Ambient Monitoring Section
4403 Reedy Creek Road
and
2728 Capital Boulevard
Raleigh, North Carolina

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Table of Contents

Introduction

The Division of Air Quality is dedicated to insuring the safety and well being of its employees. The Chemical Hygiene Plan has been written for the Ambient Monitoring Branch Hydrocarbon and Particulate Matter Laboratories and establishes laboratory procedures and practices that will insure that all laboratory workers, and others who may enter the laboratory setting, are protected from all potentially hazardous substances associated with laboratory operations. The Chemical Hygiene Plan developed herein establishes overall organization and supervisory responsibilities to provide a safe working environment, but the ultimate responsibility for safety rests with the person actively performing the work.

The Ambient Monitoring Branch is responsible for the assessment of criteria pollutants in the ambient air and the measurement of precursors of criteria pollutants. The Branch uses primarily traditional methods to gather information to support permit actions, attainment designations, and state implementation plan development. The Branch provides analytical support to the Division of Air Quality with the operation of the Ambient Monitoring Branch Hydrocarbon Laboratory located at 4403 Reedy Creek Road in Raleigh and the Ambient Monitoring Branch Particulate Matter Laboratory located at 2728 Capital Boulevard in Raleigh.

The Chemical Hygiene Plan is to comply with the Occupational Safety and Health Act, 29 CFR 1910.1450, to provide a written plan, which is capable of:

- Protecting employees from health hazards associated with hazardous chemicals in that laboratory; and
- Keeping exposures below the limits specified in the OSHA standard.

The Chemical Hygiene Plan shall be readily available to employees. Division of Air Quality will provide the employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area. This information will be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations.

Chemical Hygiene Responsibilities

Director – Division Air Quality, has ultimate responsibility for chemical hygiene with the division and must, with other administrators, provide continuing support for the division's chemical hygiene program.

Chief – Ambient Monitoring Branch is responsible for chemical hygiene at the Reedy Creek and Parker Lincoln Laboratories.

Supervisor – Projects and Procedures Branch has overall responsibility for chemical hygiene procedures in the laboratory including procedures to:

- Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided;
- Provide for regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;
- Determine the required levels of protective apparel and equipment; and
- Ensure that facilities and training for use of any material being ordered are adequate.

Chemical Hygiene Officer, appointed by the Supervisor – Projects and Procedures Branch, who must:

- Work with the supervisor and other employees to develop and implement appropriate chemical hygiene practices;
- Monitor procurement, use, and disposal of chemicals used in the lab;
- Conduct appropriate chemical hygiene inspections (formal or informal); and
- Seek ways to improve the chemical hygiene program.

Laboratory Workers, who are responsible for:

- Planning and conducting each operation in accordance with the DAQ chemical hygiene procedures; and
- Develop good personal chemical hygiene habits.

Chemical Laboratory Facility Design Requirements

This section lists facility requirements that should be incorporated in the design, layout, and operation of the Ambient Monitoring Laboratories.

General Facility Design:

The laboratory facilities should have:

- An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air. The air for the Particulate Matter laboratory must be purified of dust and maintained within narrow temperature and humidity limits.
- The hydrocarbon laboratory requires an adequate, well-ventilated storeroom for storing helium and nitrogen cylinders.
- The hydrocarbon laboratory requires a laboratory fume hood for cleaning equipment in methanol and a sink.
- The hydrocarbon laboratory requires an eyewash and safety shower. The Particulate Matter laboratory requires only a personal eyewash station.
- The hydrocarbon laboratory requires other safety equipment including:
  - Fire extinguisher;
  - Fire blanket;
  - Escape air pack;
  - Solvent/chemical storage cabinets;
  - Chemical spill kits;
  - First aid kit; and
  - Emergency phone numbers.

Maintenance:

Chemical-hygiene-related equipment (laboratory fume hoods, safety shower, eyewash, and ventilation systems) should be continually appraised for efficiency.

- Laboratory fume hoods must be certified annually using ASHRAE Standard 110.1995, Method of Testing Performance of Laboratory Fume Hoods.
- Safety showers and eyewashes shall be inspected monthly to verify access is clear. They shall be activated quarterly in accordance with ANSI Z358.1-1990, American National Standard for Emergency Eyewash and Shower Equipment, to assure adequate and clean water supply.

Ventilation Systems:

- *General laboratory ventilation* – This system should provide a source of air for breathing and for input to local ventilation devices. It should not be relied on for protection from toxic substances released into the laboratory. General ventilation is to ensure that laboratory air is continually replaced which will prevent an increase of air concentrations of toxic substances during the working day and provide a direct air flow into the laboratory from non-laboratory areas.

- *Laboratory fume hoods* – A laboratory fume hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals. Each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use.
- *Local exhaust ventilation* – Local exhaust ventilation is achieved by a rigid or flexible duct with the intake placed as close as possible to a point of known release.
- *Other local ventilation devices* – Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed. Each canopy hood and snorkel should have a separate exhaust duct. Canopy hoods seldom provide the control expected and should be used with caution.
- *Modifications* – Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.
- *Performance* – Rate: 4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control.
- *Quality* – General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas; airflow into and within the hood should not be excessively turbulent; hood face velocity should be adequate (typically 60 – 100 lfm).

Eyewash and Safety Showers:
Eyewash and safety showers will be in or near proximity to work areas where employees may be exposed to injurious corrosive materials. They should be positioned no more than 100 feet from workstations. The physical layout of the workplace with specific attention to obstructions such as machine and equipment must be considered in locating eyewash stations. The employee (who may be partly blinded by chemicals in the eye) must be able to reach and use the eyewash and safety shower equipment within 10 seconds.

Safety shower should be attached to a water supply capable of delivering a minimum of 30 gallons of clean water per minute and should be installed in accordance with ANSI Z358.1-1990. Eyewashes should be available either as an installed device or as a portable saline solution bottle designated specifically as “Eyewash”. These solutions should be replaced on or before their printed expiration dates.

General Principles and Basic Rules For Working with Laboratory Chemicals

The following rules apply to all laboratory work. The supervisor of laboratory workers shall develop specific standard operating procedures (SOPs) to cover the circumstances specific to each individual laboratory operation beyond those general guidelines that follow. All laboratory workers should know and follow the rules and procedures outlined in this plan.

1. General Principles for Work with Laboratory Chemicals

- *It is prudent to minimize all chemical exposures*: Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Skin contact with chemicals should be avoided as a cardinal rule.
- *Avoid underestimation of risk*: Even for substances of no known significant hazard, exposure should be minimized; for work with substances, which present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
- *Provide adequate ventilation*: The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices.
- *Observe the PELs, TLVs*: The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded.

2. General Safety Rules

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

Accident and spills:

Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.

Ingestion: Encourage the victim to drink large amounts of water. Follow instructions if any in the MSDS for first aid in case of ingestion. If no instructions are available, consult the Poison Control Center at 800-848-6946 and follow their recommended action. Seek medical attention.

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

Clean-up: Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal techniques.

Vigilance: DAQ employees are responsible for their own health and safety as well as the health and safety of others. Be alert to unsafe conditions and see that they are corrected or reported when detected.

Avoidance of "routine" exposure: Develop and encourage safe habits; avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals. Vent apparatus, which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices. Use only those chemicals for which the quality of the available ventilation system is appropriate.

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

Laboratory fume hoods: All volatile materials must be opened and used inside a certified laboratory fume hood. All work that is a potential source of contamination must be performed at least 6 inches inside the face of the hood. Work with the sash closed as far as possible. DO NOT put your head in the fume hood when contaminants are being generated. Fume hoods should not be used for storage. Excessive equipment or chemicals stored inside a hood obstruct the airflow and decrease the effectiveness of the hood.

Mouth suction or pipetting: Do not use mouth suction or pipetting for pipetting or starting a siphon. When pipetting, laboratory personnel must use a bulb, piston, or other mechanical device. Using a mechanical device prevents the potential of direct ingestion of hazardous chemicals.

Direct inhalation: Do not inhale fumes from any chemical container directly or deeply. If checking for odors is necessary, gently and carefully waft the vapors toward the nose.

Personal hygiene and protection: Confine long hair and loose clothing. Wear shoes at all times in the laboratory but do not wear sandals or other perforated shoes. Wearing of appropriate safety shoes and other apparel is required when performing hazardous or potentially hazardous duties such as cryogen tank replacement, gas cylinders, and equipment moving. Sandals, perforated shoes, and canvas shoes are prohibited from lab areas where chemicals or heavy equipment are handled. Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored. Clean up the work area on completion of an operation or at the end of each day.

Assure that all persons, including visitors, where chemicals are stored or handled, wear appropriate eye protection.

Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically. Use any other protective and emergency apparel and equipment as appropriate. Wash hands with lukewarm water and microbial soap immediately following the removal of gloves and other protective equipment. This is especially important before leaving the laboratory. Never wash with solvent or other chemicals that may cause adverse effects.

Avoid use of contact lenses in laboratories where chemicals are handled unless necessary; if they are used, inform supervisor so special precautions can be taken. Remove laboratory coats and other garments immediately on significant contamination.

Appropriate behavior: Avoid practical jokes or horseplay, which might confuse, startle or distract another worker. This behavior leads to accidents and injuries.

Eating, smoking, etc.: Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are used; wash hands before conducting these activities. Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils, which are also used for laboratory operations.

Working alone: Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous. If working alone is necessary, be sure to inform supervisor and/or security personnel, and take precautions to ensure personal safety after hours.

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

Refrigerators: Food must never be placed in a refrigerator or freezer used for storing chemicals or biological agents. All refrigerators must be marked either “FOOD ONLY” or “CHEMICALS ONLY”. No food or drink may be stored in a refrigerator used to store hazardous materials.

Waste disposal: Assure that the plan for each laboratory operation includes plans and training for waste disposal. Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (See Section 10, page 14).

Do not discharge to the sewer concentrated acids, bases or highly toxic or volatile substances, which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow.

3. Chemical Procurement, Distribution, Storage

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

Storerooms: Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Chemicals, which are highly toxic, should be in unbreakable secondary containers. Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, container integrity, and/or expiration date.

Distribution: When chemicals are hand carried, the container should be placed in a secondary container.

Laboratory storage: Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to storage cabinets or storeroom.

Chemical inventory and Material Safety Data Sheets: An inventory of all the chemicals used and stored in the laboratory must be maintained. Chemical inventories should be filed at the front of the MSDS binders. Electronic databases of MSDS forms and the chemical inventory are also acceptable if hardcopies of these are readily available.

4. Housekeeping, Maintenance, and Inspections

Cleaning: All working surfaces (floors, benches, counters, etc.) should remain orderly and unobstructed throughout the day. Maintaining a clean work area promotes safety and health as well as an efficient work area.

Inspections: Formal housekeeping and chemical hygiene inspections should be held at least quarterly; informal inspections should be continual. (See Appendix N for the inspection form.) Inspection reports will be completed and maintained on file at the laboratory.

Equipment Inspections: Eye wash bottles should be inspected monthly and replaced at expiration. The supervisor of laboratory personnel should periodically inspect respirators for routine use. Other safety equipment should be inspected regularly. (e.g., every 3-6 months).

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

5. Medical Program

Compliance with regulations: All laboratory personnel will be included in the division's medical surveillance program. Annual medical examinations will be conducted to determine any affects to exposures to chemical and physical hazards.

First aid/CPR: All laboratory personnel are encouraged to take first aid/CPR training upon initial assignment and a CPR refresher annually.

6. Protective Apparel and Equipment

These should include for each laboratory:

- Protective apparel compatible with the required degree of protection for substances being handled;
  - Laboratory protective clothing
  - Eye protection (safety glasses, face shields, and chemical safety goggles)
  - Chemical impervious gloves
  - Protective aprons
  - Safety shoes
- An easily accessible drench-type safety shower;
- An eyewash fountain or portable bottle;
- A fire extinguisher;
- Respiratory protection, fire alarm and telephone for emergency use should be available nearby; and
- Other items designated by the supervisor of laboratory personnel.

7. Signs and Labels

All hazardous materials entering the laboratory are required to have a Material Safety Data Sheet (MSDS). All MSDSs are retained on file in a bookcase at the entrance to the laboratory or on a MSDS database on a centrally located personal computer.

The number for reporting emergencies (chemical spills, fires, etc.) at the laboratory is 9-911. This number should be displayed. Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers should also be readily available.

Identity labels, showing contents of containers (including waste receptacles) and associated hazards, must be on all containers and cylinders.

Location signs for safety showers, eyewash stations, safety equipment, first aid equipment, exits, and areas where food and beverage consumption and storage are not permitted need to be displayed.

Warning signs at areas or equipment where special or unusual hazards exist.

8. Spills and Accidents

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

There should be an alarm system to alert people in all parts of the facility.

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

All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit.

9. Information and Training Program

All laboratory employees must attend an initial orientation session to assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs.

Every laboratory worker should know the location and proper use of available protective apparel and equipment.

> Note: All personnel of the laboratory should be trained in the proper use of emergency equipment and procedures. Such training as well as first aid instruction should be available to and encouraged for everyone who might need it.

All personnel receiving equipment and supplies should know about the hazards, handling equipment, protective apparel, and relevant regulations. The training and education program should be a regular, continuing activity – not simply an annual presentation.

Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources.

10. Waste Disposal Program

All employees must be familiarized with proper waste disposal to assure that minimal harm to people and the environment will result from the disposal of waste laboratory chemicals.

The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations. Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened.

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

Waste should be removed from laboratories to a central waste storage area as needed and from the central waste storage area at regular intervals. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.

Hoods should not be used as a means of disposal for volatile chemicals.

Disposal by recycling or chemical decontamination should be used when possible.

Appendix A
Safety Guidelines for
Use of Fume Hoods

General:
The laboratory fume hood is the major protective device available to laboratory workers. It is designed to capture chemicals that escape from their containers or apparatus and to remove them from the laboratory environment before they can be inhaled. Characteristics to be considered in requiring fume hood use are physical state, volatility, toxicity, flammability, eye and skin irritation, odor, and the potential for producing aerosols.

A laboratory fume hood with 2.5 linear feet of hood space per person should be provided for every 2-workers if they spend most of their time working with chemicals. Each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use.

A fume hood should be used if a proposed chemical procedure exhibits any one of these characteristics to a degree that:

- All volatile materials must be opened and used inside a certified laboratory fume hood.
- All work that is a potential source of contamination must be performed at least 6 inches inside the face of the hood.
- Work with the sash closed as far as possible. DO NOT put your head in the fume hood when contaminants are being generated.
- Fume hoods should not be used for storage. Excessive equipment or chemicals stored inside a hood obstruct the airflow and reduce the effectiveness of the hood.
- Laboratory fume hoods must be certified annually using ASHRAE Standard 110.1995, Method of Testing Performance of Laboratory Fume Hoods.

Appendix B
Safety Guideline for
Use of Personal Protective Equipment

General:

Lab coats or other similar clothing protectors are strongly encouraged for all laboratory personnel. Lab coats are required when working with specific carcinogens, reproductive toxins, high acute toxicity substances, strong acids and bases, and any substance on the OSHA PEL list carrying a "skin" notation.

Eye Protection:
Eye protection is required for all personnel and any visitors whose eyes may be exposed to chemical or physical hazards. Side shields on safety spectacles provide some protection against splashed chemicals or flying particles, but goggles or face shields are necessary when there is a greater than average danger of eye contact.

Face shields – A face shield must be worn when dispensing or transferring cryogenic materials. Face shields should also be worn when working with corrosive materials in considerable quantities.

Hand Protection:
Appropriate gloves must be worn where there is a potential for skin absorption, severe abrasion, cuts, or lacerations, punctures, chemical burns, thermal burns, or temperature extremes. They must also be worn where there is a reasonable anticipated contact with chemicals.

Hearing Protection:
Ear protectors (ear muffs or ear plugs) must be worn at any time employees are exposed to 90 dBA or greater. OSHA requires hearing protection when this level is exposed for an 8-hour time-weighted average. It is DAQ's guideline to provide ear protectors at the action level.

Respiratory Protection:
The most effective way to protect employees from airborne contaminants is to minimize the amount or extent of exposure to hazardous chemicals. Respirators will be used in the laboratory ONLY when engineering controls cannot control exposures. Emergency escape air supplies will be located in lab areas where potential asphyxiation harzards could exist.

Appendix C
Controlling Chemical Exposures

There are three major routes for a chemical to enter the body: inhalation, skin and eye contact, and ingestion. Types of controls for prevention of these various routes of entry include: good work practices, engineering controls, personal protective equipment, and administrative controls. Personal protective equipment must be used in conjunction with, not as a substitute for engineering controls and /or good work practices. All areas using personal protective equipment shall adhere to the Occupational Safety and Health Administration (OSHA) 1910.132, Personal Protective Equipment Standard, available through the DAQ safety consultant.

Each route of entry can be controlled by a number of means, as explained below.

Inhalation Hazards

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. To avoid significant inhalation exposures, engineering controls such as substituting a less volatile or a less toxic chemical or substituting a liquid or solid chemical for a gaseous one are the best means of control. If substitution is not practical, ventilation should be used to lessen the chance of overexposure. The use of well-functioning local exhaust ventilation, such as fume hoods, vented glove boxes and other local exhaust systems, is often required to minimize exposure to hazardous substances. Biological safety cabinets are generally vented directly back into the laboratory and do NOT filter chemical vapors. Dilution ventilation may be used to reduce exposure to non-hazardous nuisance odors. For extremely toxic chemicals such as those classified as poison gases by State or Federal Department of Transportation (e.g., arsine, phosgene) the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter controls may be required.

If both substitution and engineering controls are unavailable, the use of personal protective equipment may be required to reduce inhalation exposures. Respiratory protection from dust masks to self-contained breathing apparatus may be used to this end. If laboratory employees wear respirators, requirements of the OSHA Respirator Standard (1910.134) must be met. This Standard requires training on the proper use of respirators; medical surveillance to ensure the user is capable of wearing a respirator; and fit testing to ensure that the respirator fits properly. A lab worker or his/her supervisor should contact the Chemical Hygiene Officer in the event that respiratory protection is used to control exposures to hazardous chemicals.

Finally, administrative controls can be used to reduce the risk of overexposure to hazardous chemicals. Some examples of administrative controls include:

1. Minimizing exposure time for individual employees;
2. Restricted access to an area where a hazardous chemical is used;

3. Allowing a process that emanates nuisance odors to be done only after typical office hours, when most of the staff in the building have gone home;
4. Proper signage on lab doors to indicate special hazards within, a list of lab supervisor and occupants of the lab who should be contacted in the event of an emergency and appropriate telephone numbers; and
5. Restricting direct inhalation of chemicals by issuing directives which state that only under limited circumstances are chemicals to be intentionally inhaled.

Skin/eye contact hazards

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls include substitution and appropriate ventilation as described above in inhalation hazards. The more obvious means of preventing skin and eye contact is the wearing of personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment as appropriate to the hazard. Since the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult appropriate references to ascertain that the protective equipment material is resistant to the chemical being protected against.

Administrative controls to reduce skin/eye contact include:

1. Enforcement of polices pertaining to skin and eye protection; and
2. Discarding or repairing cracked or broken glassware.

Ingestion Hazards

Ingestion of chemicals is the least common route of entry into the body. However, a laboratory worker can easily ingest chemicals into the body via contaminated hands if they are not washed before eating, smoking or sticking part of the hand or a writing tool that has been in contaminated hands into the mouth. Some controls for preventing this route of exposure include engineering controls, such as isolating the hazardous substance so minimal contact is required (e.g., glove box use), personal protective equipment such as the wearing of gloves, and administrative controls such as forbidding mouth pipetting, encouraging good personal hygiene, and designating a well-marked non-chemical area where eating, drinking and applying cosmetics is permitted.

The DAQ Safety Consultant may conduct exposure evaluations for any suspected overexposure to substances regulated by OSHA and/or ACGIH TLVs. Note: ACGIH TLV is “American Conference of Governmental Industrial Hygienists Threshold Limit Value”. The DAQ Safety Consultant will keep records of exposure evaluations.

Appendix D
Compressed Gas Cylinders
Storage and Handling

General Hazard:
The hazards associated with compressed gases include oxygen displacement, explosion hazards, toxic effect of some gases, as well as the physical hazards of a ruptured cylinder. There are almost 200 different types of materials in gas cylinders including atmospheric gases, fuel gases, refrigerant gases, poison gases, and miscellaneous gases.

OSHA has regulations governing the use of compressed gases. The inspection of gas cylinders is discussed in OSHA 1910.101, Compressed Gases.

Inspection:
Gas cylinders should be properly secured at all times to prevent tipping, falling or rolling. They can be secured with straps or chains connected upright to a wall bracket, cylinder hand truck, cylinder rack, or by use of a cylinder stand or other fixed surface.

Cylinders should be stored in a cool, dry, well-ventilated, fire-resistant area away from sparks, flames or any other source of heat or ignition in accordance with federal, state, and local regulations. Cylinders should be stored so that they are protected from direct rays of the sun.

A cylinder storage area should be located in an area where the cylinders will not be knocked over or damaged by moving or falling objects or by pedestrian or vehicular traffic. When a cylinder is not being used for an extended period, the regulator should be removed, the valve closed, and the valve protector secured, and the cylinder tagged. Partially used cylinders will be tagged as such with an indication of the approximate amount (psig) remaining.

All gas cylinder storage must be prominently marked with the hazard class or the name of the gasses stored, such as Flammable Gas Storage Area, and “No Smoking” signs posted where necessary.

Where gases of different types are stored at the same location, cylinder (empty or full) should be grouped by type of gas.

Handling:
Be sure to close all cylinder valves when not in use. The valves of empty cylinders should also be closed.

Always use a suitable hand truck or similar device to remove the cylinder. Gas cylinders must be firmly secured for transporting and unloading. DO NOT roll or drag a cylinder to move it or allow cylinders to strike each other or any other surface violently. The gas cylinder should be secured to the cylinder truck or cart by strap or chains.

Regulators should be removed and valve protection caps should be secured before moving cylinders. Cylinder valves should be closed before moving cylinders.

It is also important to select the proper regulator for use with each gas cylinder. Lubricant should not be used on gas cylinder regulators. Do not tamper with or attempt to repair a gas cylinder regulator.

Consult the appropriate MSDS for detailed information on the chemical contained in the gas cylinder. Specific chemical handling and storage precautions will be outlined in the MSDS. The MSDS will also have specifications for appropriate personal protective equipment for worker protection.

Appendix E
Chemical and Liquid Resistant Gloves

Butyl Rubber Gloves:
Provide protection from nitric acid, sulfuric acid, hydrofluoric acid, red fuming nitric acid, rocket fuels, and peroxide. These gloves have a high impermeability to gases, chemicals, and water vapor, and resistance to oxidation and ozone attack. They have high abrasion resistance and remain flexible at low temperatures.

Natural Latex or Rubber Gloves:
Provide protection from most water solutions of acids, alkalis, salts, and ketones. Additionally, they are resistant to abrasions occurring in sandblasting, grinding, and polishing. These gloves have excellent wearing qualities, pliability, and comfort and are a good general-purpose glove.

Neoprene Gloves:
Provide good protection from hydraulic fluids, gasoline, alcohols, organic acids, and alkalis. They have good pliability and finger dexterity, high density and tensile strength, plus high tear resistance.

Nitrile Rubber Gloves:
Provide protection from chlorinated solvents (trichloroethylene, perchloroethylene). They are intended for jobs requiring dexterity and sensitivity, yet they stand up under mechanical use even after prolonged exposure to substances that cause other glove materials to deteriorate. They also resist abrasion, puncturing, snagging, and tearing.

Kevlar:
Provides protection against heat and cold. Kevlar is a synthetic material and is used by a variety of manufacturers in their gloves. Gloves made of Kevlar material are cut and abrasion resistant and wear well.

Zetex:
Provides protection against heat and cold. It is also a synthetic material and is used by several manufacturers in their gloves. Gloves made of Zetex material are cut and abrasion resistant and also withstand diluted acids (except hydrofluoric, alkalis, and solvents).

Appendix F
Material and Safety Data Sheets

Material and safety data sheets used in the Ambient Monitoring Laboratories are kept in binders in the laboratory and/or office area.

Appendix G
29 CFR 1910.1450(e)
OSHA Requirement for Chemical Hygiene Plan

1910.1450(e) Chemical Hygiene Plan
General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

(e)(1) Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan, which is:

(e)(1)(i) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(e)(1)(ii) Capable of keeping exposures below the limits specified in paragraph (c) of this section.

(e)(2) The Chemical Hygiene Plan shall be readily available to employees, employee representatives, and, upon request, to the Assistant Secretary.

(e)(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(e)(3)(i) Standard operation procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(e)(3)(ii) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(e)(3)(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

(e)(3)(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section;

(e)(3)(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(e)(3)(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

(e)(3)(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

(e)(3)(viii) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances, which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions, which shall be included where appropriate:

(e)(3)(viii)(A) Establishment of a designated area;

(e)(3)(viii)(B) Use of containment devices such as fume hoods or glove boxes;

(e)(3)(viii)(C) Procedures for safe removal of contaminated wastes; and

(e)(3)(viii)(D) Decontamination procedures.

(e)(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f) Employee Information and Training.

(f)(1) The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

(f)(2) Such information shall be provided at the time of an employee's initial assignment t a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

(f)(3) Information. Employees shall be informed of:

(f)(3)(i) The contents of this standard and its appendices, which shall be made available to employees;

(f)(3)(ii) The location and availability of the employer's Chemical Hygiene Plan;

(f)(3)(iii) The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

(f)(3)(iv) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(f)(3)(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

(f)(4) Training.

(f)(4)(i) Employee training shall include:

(f)(4)(i)(A) Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(f)(4)(i)(B) The physical and health hazards of chemicals in the work area; and

(f)(4)(i)(C) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(f)(4)(ii) The employee shall be trained on the applicable details of the employers written Chemical Hygiene Plan.

Appendix H
Ambient Monitoring Branch
Laboratory Safety Inspection Form

Date: _____ Reviewed by: _____

Inspected by: _____ Signature: _____

Note: Only items in non-compliance are checked. This inspection form only addresses chemical safety, chemical hygiene, and laboratory safety. This report does not address biological safety, radiation, or hazardous waste.

General

1. Door signage
_____ Names and phone numbers
_____ Hazards listed
_____ Dated within last year
2. OSHA Lab Standard
_____ Chemical Hygiene Plan
_____ MSDS available
3. Electrical
_____ Circuits properly loaded
_____ No cords across aisles
_____ Plugs are grounded
4. Other
_____ Housekeeping satisfactory
_____ Equipment is guarded
_____ No smoking, eating, drinking, or cosmetic application
_____ Exits are marked
_____ Aisles/exits are unobstructed

Emergency/Safety Equipment

5. Fire Extinguishers
_____ Available
_____ Unobstructed
_____ Mounted properly
_____ Current Hydrotest
6. Personal Safety Equipment
_____ Eye wash available
_____ Flushed weekly
_____ Deluge shower
_____ Tested monthly
_____ First aid kit stocked
7. Personal Protection
_____ Gloves
_____ Aprons
_____ Respirator
_____ Respirator users trained
_____ Lab Coat
_____ Goggles/face shield
8. Hoods
_____Used for all work forming toxic fumes
_____ Housekeeping O.K.
_____ Certified

Chemical Handling

9. Refrigerator
_____ No food
_____ Flammables in explosion-proof unit
10. Chemical Storage
_____ In cabinets or shelves
_____ By compatibility
_____ All containers labeled
_____ No excess of flammables
_____ Peroxides dated
_____ Secondary container for corrosives, Hg
11. Cylinders
_____ Secured
_____ No extremely toxic, explosive, pyrophoric
_____ If so, detection system
12. Other
_____ No mouth pipetting
_____ Spill Clean up kit

Comments:

_____

_____

_____

_____

_____

Appendix I
Chemical Hygiene Plan

Department of Environment and Natural Resources
Division of Air Quality

Employee Laboratory Safety Training Record

The Division of Air Quality Chemical Hygiene Plan requires that the supervisor of laboratory workers train their employees on the following topics:

The location and availability of the Occupation Safety and Health Administration (OSHA) Lab Standard, UIUC Model Chemical Hygiene Plan, chemical safety reference materials (including Material Safety Data Sheets), and OSHA Permissible Exposure Limits (PELS) if available;

Location and availability of the signs and symptoms associated with exposure to the hazardous chemicals with which employees work;

Detection methods and observations that may be used to detect the presence or release of a hazardous chemical in the lab, e.g., odor, monitoring equipment or visual appearance;

The physical and health hazards of the chemicals with which employees work; and

Work practices, personal protective equipment and emergency procedures to be used to ensure protection from overexposure to the hazardous chemicals with which employees work.

In addition to the training given by the lab supervisor, it is the employee's responsibility to request information and training when unsure how to handle a hazardous chemical or procedure and to follow all health and safety rules while working in the lab.

After you receive training from the laboratory supervisor, please complete this form and return it to your department office where it will be kept in your personnel file. Please feel free to write any comments or notes on the back of this page indicating the type of training you have received.

_____
(Employee's name – print)

_____
(Social Security Number)

_____
(Employee's signature)

_____
(Date)

_____
(Supervisor's name – print)