Author:	Michael Heminuk	Revision #:	2
Approved By:	Ronnie Keeter	Date Revised:	February 2022

SAFETY POLICY & PROCEDURE

Exposure to Hazardous Chemicals in Laboratories

SPP# 1910.145

Quick Reference

Contents

1.0 Purpose

The purpose of this safety policy and procedure is to protect North Carolina Department of Transportation (NCDOT) employees who use hazardous chemicals in laboratories.

2.0 Scope and Applicability

NCDOT laboratory employees may handle a variety of hazardous chemicals in their daily activities. Due to their frequent contact with chemicals, overexposure to chemicals may occur if the proper safeguards are not in place and if the proper precautions are not followed.

This safety policy and procedure presents a Chemical Hygiene program to protect NCDOT laboratory employees. It includes provisions for training and presents discussions on permissible exposure levels and employee exposure determination. A model Chemical HygienePlan that can be used by all NCDOT laboratories is also presented. Medical, hazard identification, respirator, and recordkeeping requirements are also presented.

This document also details the areas of responsibility for managers/unit heads, supervisors, Chemical Hygiene Officers, employees, and Safety and Risk Management within NCDOT.

This safety policy and procedure affects all the Materials and Tests laboratories that handle hazardous chemicals. Any other laboratory within NCDOT that handles hazardous chemicals is also affected by this safety policy and procedure.

3.0 Reference

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry 29 CFR 1910.1450.

4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or thepublic.

Therefore, NCDOT laboratory employees who handle hazardous chemicals will not handle such chemicals until they have been trained in NCDOT's Chemical Hygiene program. When hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Exposure to Hazardous Chemicals in Laboratories will be implemented. These measures will be implemented to minimize hazards in order to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure Exposure to Hazardous Chemicals in Laboratories. It is also the responsibility of each NCDOT employee to report immediately unsafe conditions to his or her supervisor. Specific responsibilities are found in Section 6.3.

6.0 Procedure

6.1 Definitions

Action Level
A concentration for a specific substance, calculated as an eight (8)-hour time- weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Chemical Hygiene Officer
A written program which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.

Combustible Liquid
Any liquid having a flashpoint at or above 100^0F (37.8 ^{0}C), but below 200^0F (93.3^0C) except any mixture having components with flashpoints of 200^0F (93.3^0C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

Compressed Gas

- A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at70°F (21.1°C).
- A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C).
- A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C).

Explosive
A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure or high temperature.

Flammable Aerosol
An aerosol that yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.

Flammable Gas
A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less.

Flammable Liquid
Any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C), or higher, the total of which make up 99 percent or more of the total volume of the mixture

Flammable Solid
A solid, other than a blasting agent or explosive, that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.

Flashpoint
The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested.

Hazardous Chemical
A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

Laboratory
A facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory Scale
Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

Laboratory-Type Hood
A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosed on the remaining side, constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Laboratory Use of Hazardous Chemicals
Handling or use of such chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a "laboratory scale".
- Multiple chemical procedures or chemicals being used.
- The procedures involved are not part of a production process, nor in any way simulate a production process.
- Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Medical Consultation
A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Oxidizer
A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

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

Protective Laboratory Practices and Equipment

Those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Unstable (Reactive)

A chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperatures, or in contact with certain other chemicals.

Water-Reactive

A chemical that reacts with water to release a gas that is either flammable or presents ahealth hazard.

6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- Permissible Exposure Level
- Employee Exposure Determination
- Chemical Hygiene Plan
- Medical Requirements
- Hazard Identification
- Respirators
- Recordkeeping

6.2.1 Training

Employees who handle hazardous chemicals in laboratories will be trained in:

- 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.”).
- The physical and health hazards of chemicals in the work area
- The measures employees can take to protect themselves from these hazards, including specific procedures the employee can take to protect themselves from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used

Additionally, affected employees will be trained on applicable details of NCDOT’s written Chemical Hygiene Plan.

Employees must also be informed of:

- The location and availability of their laboratory’s Chemical Hygiene Plan.
- The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard.

- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
- 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, Safety Data Sheets received from the chemical supplier.

Employees shall be trained at the time of initial assignment to 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 at the discretion of the supervisor.

6.2.2 Permissible Exposure Levels

Employees' exposures to any of hazardous chemicals shall not exceed the permissibleexposure level as specified in OSHA's Z tables.

6.2.3 Employee Exposure Determination

Employee exposure monitoring will consist of initial and periodic monitoring**.**

Initial monitoring will be conducted if there is suspicion that the exposure levels for a particular substance regularly exceeds the action (or in the absence of an action level, the PEL).

Periodic monitoring shall be conducted if the initial monitoring discloses employee exposure over the action level. The frequency of periodic monitoring will be based on the OSHA Z tables requirements for the subject

6.2.4 Chemical Hygiene Plan

A chemical hygiene plan must be in place for all laboratories that use and handle hazardous chemicals. Appendix A presents a model chemical hygiene plan that canbe used by any NCDOT laboratory. The goals of a chemical hygiene plan are to:

- Protect employees from health hazards associated with hazardous chemicals in that laboratory
- Keep exposures below the limits specified in the OSHA Z tables

This Chemical Hygiene Plan will be available to employees and it shall include each of the following elements:

- Standard operating procedures to be followed when laboratory work involves the use of hazardous chemicals
- Criteria 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
- A requirement that fume hoods and other protective equipment need to be functioning properly
- Provisions for employee information and training

- Provisions for medical consultation and medical examinations
- Designation of a Chemical Hygiene Officer
- Provisions for additional employee protection for work with particularly hazardous substances. These include select carcinogens, reproductive toxins andsubstances which have a high degree of acute toxicity. Special consideration shall be given to the following provisions which shall be included where appropriate:
    - Establishment of a designated area
    - Use of containment devices such as fume hoods or gloveboxes
    - Procedures for safe removal of contaminated waste
    - Decontamination procedures

The Chemical Hygiene Plan shall be reviewed and evaluated at least annually and updated as necessary.

6.2.5 Medical Requirements

Employees who work with hazardous chemicals will be provided an opportunity to receive medical examinations and/or consultation including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

- Whenever an employee develops signs or symptoms associated with an exposure to hazardous chemicals in the laboratory
- Where exposure monitoring reveals an exposure level routinely above the action levels (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements
- Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

The following information shall be provided to the physician:

- The identity of the hazardous chemical(s) to which the employee may have been exposed
- A description of the conditions under which the employee was exposed to chemicals
- A description of the signs and symptoms of exposure that the employee is experiencing

Upon completion of the medical examination or consultation, the NCDOT laboratory shall obtain a written opinion from the examining physician which shall include the following:

- Any recommendation for further medical follow-up.

- The results of the medical examination and any associated tests.
- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace.
- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure. See SPP# 1910.20, Access to Medical Records for related information.

6.2.6 Hazard Identification

Labels on incoming containers of hazardous chemicals must not be removed or defaced.

Additionally, Safety Data Sheets (SDS) that are received with incoming shipments of hazardous chemicals must be readily accessible to laboratory employees.

6.2.7 Respirators

If respirators are required to maintain exposures below the PEL, they shall be selected and used per NCDOT's Respiratory Program and SPP# 1910.134, Respiratory Protection.

6.2.8 Recordkeeping

Accurate records of employee exposures and any medical consultation and examination shall be maintained in the employee's file.

7.0 Specific Responsibilities

7.1 Managers / Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase of laboratory equipment and supplies to ensure compliance with this safety policy and procedure. They will be also responsible for identifying the employees affected by this safety policy and procedure. Managers/Unit Heads will obtain and coordinate the required training for the affected employees.

Managers/Unit Heads will designate a Chemical Hygiene Officer to oversee implementation of their facility's Chemical Hygiene Plan.

Managers/Unit Heads will also ensure compliance with safety policy and procedure through their auditing process.

7.2 Laboratory Supervisors

Laboratory supervisors will ensure that laboratory employees follow safe laboratory work practices as outlined in NCDOT's model Chemical Hygiene Plan. The laboratory supervisor will provide laboratory employees information and training about the hazards of chemicals in

their work area. Additionally, laboratory supervisors will ensure that laboratory employees are provided with PPE as necessary for their job.

Laboratory supervisors will ensure that all chemical containers are labeled and that Safety Data Sheets (SDS) are readily accessible for the hazardous chemicals in their laboratory.

7.3 Laboratory Employees

Employees shall be responsible for recognizing possible exposures by odor, mucous membrane irritation, headaches, nausea, visible dust emissions, and vapors. Employees are to follow work practices for the process, use PPE as required, activate engineering controlswhen necessary, and report suspicious circumstances to their supervisors.

7.4 Safety & Risk Management

Safety and Risk Management will provide prompt assistance to managers/unit heads, supervisors, or others as applicable on any matter concerning this safety policy and procedure. Additionally, Safety and Risk Management will assist in the developing or securing of required training.

Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

APPENDIX A: Model NCDOT Chemical Hygiene Plan

Chemical Hygiene Plan for

Laboratory _____ Division/Unit _____
Location _____ Date _____

Chemical Hygiene Officer

_____ _____
Name Title

_____ _____
Telephone Number Mailing Address

This Chemical Hygiene Plan includes the following components :

- Basic Rules and Procedures for Laboratory work with Chemicals
- Chemical Procurement, Distribution, and Storage
- Housekeeping, Maintenance, and Inspections
- Medical Program
- Protective Apparel and Equipment
- Records
- Signs and Labels
- Spills and Accidents
- Training and Information Program
- Waste Disposal

Basic Rules and Procedures for Laboratory Work with Chemicals

Accidental Exposure and Spills

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

Ingestion:
Encourage the victim to drink large amounts of water unless the SDS advises otherwise.

Skin Contacts:
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.

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.

APPENDIX A: Model NCDOT Chemical Hygiene Plan (Continued) 2

Basic Rules and Procedures for Laboratory Work with Chemicals (Continued)

Inspect gloves and test glove boxes before use. Do not allow release of toxic substances since rooms have contained recirculated atmospheres.

Choice of chemicals

Use only those chemicals for which the design of the available ventilation system is appropriate.

Eating, smoking, etc.

Employees shall not eat, drink, smoke, chew gum , or apply of cosmetics in areas where laboratory chemicals are present. Wash hands before conducting these activities.
Employees shall not store, handle, or consume food or beverages in storage areas, refrigerators, or in glassware or utensils which are also used for laboratory operations.

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 designed purpose.

Exiting

Wash areas of exposed skin thoroughly before leaving the laboratory.

Horseplay

Employees shall not engage in practical jokes or other behavior which might confuse, startle or distract another worker.

Mouth suction

Do not use mouth suction for pipetting or starting a siphon.

Personal apparel

Confine long hair and loose clothing. Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers.

Personal housekeeping

Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored. Clean up the work area on completion of an operation or at the end of each day.

Personal protection

Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled. Use IR - UV protective eye wear for loading and unloading the muffle furnace.

Wear appropriate gloves when the potential for contact with toxic materials exists. Inspect the gloves before each use. Wash them before removal and replace them periodically.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls or inspecting the respirator before use.

Basic Rules and Procedures for Laboratory Work with Chemicals (Continued)

Personal Protection (Continued)
Use any other protective and emergency apparel and equipment as appropriate.
Avoid use of contact lenses in the laboratory unless necessary. If they are used, inform supervisor so special precautions can be taken. Remove laboratory coats immediately onsignificant contamination.

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

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.

Use of Hood
Use the hood for operations which might result in release of toxic chemical vapors or dust.
As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with TLV of less than 50 PPM.

Confirm adequate hood performance before use. Keep hood closed at all times except when adjustments within the hood are being made. Keep materials stored in hoods to a minimum and do not allow them to block vents or air flow. Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."

Vigilance
Be alert to unsafe conditions and see that they are corrected when detected.

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.

Do not discharge to the sewer concentrate acids or bases, highly toxic, malodorous, or lachrymatory substances or any substances which might interfere with the biological activity ofwastewater treatment plants, create fire or explosion hazards, cause structural damage, or obstruct flow.

Working Alone
Avoid working alone in a building, do not work alone in a laboratory if the procedures being conducted are hazardous.

Chemical Procurement, Distribution, and Storage

Procurement

Yes	No	
☐	☐	Is information available to employees on proper handling, storage, and disposal on substances when they are received? If not, list the measures to ensure information will be made available to employees.

_____

_____

No containers should be accepted without adequate identifying labels.

Stockrooms/Storerooms

Yes	No	
☐	☐	Are toxic substances segregated in well-identified areas with local exhaust ventilation?
☐	☐	Are highly toxic chemicals whose containers have been opened in unbreakable secondary containers?

Stored chemicals should be examined at least annually for replacement, deterioration, and container integrity. Additionally, stockrooms/storerooms should not be used as preparation or repacking areas.

Distribution

When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible.

Laboratory Storage

Yes	No	
☐	☐	Are chemicals that are stored in the laboratory in small as possible quantities?
☐	☐	Are periodic inventories conducted with unneeded items discarded or returned to the stockroom/storeroom?

If laboratory storage is permitted, do not store chemicals on bench tops and in hoods. Also, exposure to heat or direct sunlight should be avoided.

Environmental Monitoring

Yes	No	
☐	☐	Is a highly toxic substance stored or used 3 times a week or more?
☐	☐	Are the laboratory hoods or other ventilation devices being tested or redesigned?

If any of the environmental monitoring questions were unanswered "yes," monitoring ofairborne concentrations may be required.

Housekeeping, Maintenance, and Inspections

Cleaning

Floors shall be cleaned regularly.

Inspections

Yes No

☐ ☐ Are formal housekeeping and chemical hygiene inspections conducted quarterly(laboratories with frequent personnel changes) or semiannually?

Informal housekeeping inspections shall be performed continually.

Maintenance

Yes	No	
☐	☐	Are eye wash fountains inspected every 3 months?
☐	☐	Are respirators routinely inspected by the laboratory supervisor?
☐	☐	Are procedures in place to prevent the start-up of out-of-service equipment?

All other safety equipment should be regularly inspected.

Passageways

Yes No

☐ ☐ Are all accesses to exits, emergency equipment, and utility controls not blocked?

Stairways and hallways should not be used as storage areas.

Medical Program

Routine Surveillance

Yes No

☐ ☐ Are any employees regularly and frequently handling toxicologically significant quantities of a chemical? If yes, those employees should consulta qualified physician to determine whether a regular schedule of medical surveillance is required?

First Aid

Employees trained in first aid should be available during all working hours.

Protective Apparel and Equipment

Yes	No	
☐	☐	Is protective clothing available and compatible with the degree of required protection

Are these items in place?

Yes	No	
☐	☐	Early accessible drench-type safety shower?
☐	☐	An eyewash fountain accessible?
☐	☐	A fire extinguisher present?
☐	☐	Is respiratory protection available?
☐	☐	Are a fire alarm and emergency phone nearby?

Records

Accident records should be written and maintained. These records are maintained by_____and kept at_____(location).

Yes	No	
☐	☐	Are high risk substances used at this laboratory? If so, document the inventory and usage of these substances.

Signs and Labels

The following signs and labels should be posted in this laboratory:

- Emergency telephone numbers of emergency personnel/facilities, supervisors, andlaboratory workers
- Identity labels, showing contents of containers (including waste receptacles) andassociated hazards
- Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted
- Warnings at areas or equipment where special or unusual hazards exist

Spills and Accidents

Yes	No	
☐	☐	Is a written Emergency Action Plan in place? (See SPP 1910.38) It should be included procedures for ventilation failure, medical care, and drills.
☐	☐	Is alarm system in place and operable in all parts of the laboratory facility?
☐	☐	Does it include prevention, containment, cleanup, and reporting provisions?

Training and Information Program

Yes	No	
☐	☐	Are all employees informed about the work in the laboratory, its risks, and what to do if an accident occurs?

Emergency and Personal Protection

Yes	No	
☐	☐	Do employees know the location and use of available protective clothing and equipment?
☐	☐	Are some of the employees trained in the proper use of the emergency equipment procedures?
☐	☐	Do the stockroom/storeroom employees know about the hazards and compatible protective clothing associated with the chemical substances they handle?

Literature/Consultation

Yes	No	
☐	☐	Are literature and consulting advice concerning chemical hygiene available to laboratory employees?

Waste Disposal

Content

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.

Waste Disposal (Continued)

Discarding Chemical Stocks

Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened. Before an employee's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage.

Frequency of Disposal

Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals.

Method of Disposal

Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste.

Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.

Hood should not be used as a means of disposal for volatile chemicals
Disposal by recycling or chemical decontamination should be used when possible.