

# Clemson University Chemical Hygiene Plan



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## I. Introduction

The Clemson University Chemical Hygiene Plan (CHP) is a requirement of the Occupational Safety and Health Administration's (OSHA) standard on *Exposure to Hazardous Chemicals in Laboratories*, aka the OSHA Lab Standard (29 CFR 1910.1450). The CHP outlines the policies, practices, and procedures to be observed by employees at Clemson University where the OSHA Lab Standard applies. This document is intended to be used in conjunction with the [Clemson University Laboratory Safety Manual](#) and [Hazardous Waste Management Manual](#), which provide detailed information with regard to chemical and lab safety.

## II. Scope

The CHP applies to those Clemson laboratories that meet the criteria of the Lab Standard as outlined in this section. Any questions about applicability should be directed to the [Chemical Hygiene Officer / Chemical and Lab Safety Manger](#).

### **Occupational Exposure to Hazardous Chemicals in Laboratories (OSHA 29 CFR 1910.1450) – OSHA “Lab Standard”**

The OSHA Lab Standard applies to Clemson Laboratories that meet the criteria below.

The CHP applies to all Clemson University personnel engaged in the *laboratory use of hazardous chemicals*. The laboratory use of hazardous chemicals means handling or use of such chemicals to which all of the following conditions are met:

- 1) Chemical manipulations are carried out on a “laboratory scale<sup>1</sup>;”
- 2) Multiple chemical procedures or chemicals are used;
- 3) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- 4) “Protective laboratory practices and equipment” are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

This standard applies to all laboratories that use hazardous chemicals in accordance with the definitions of laboratory use and laboratory scale. Where this standard applies it supersedes the provisions of all other standards in 29 CFR, part 1910, subpart Z, except in specific instances identified by this standard. For laboratories covered by this standard, the obligation to maintain employee exposures at or below the permissible exposure limits (PELs) specified in 29 CFR, part 1910, subpart Z is retained.

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<sup>1</sup> Laboratory scale means 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.

Departments and principal investigators (PIs) engaged in laboratory work whose hazards are not sufficiently covered in this document and the Lab Safety Manual must add their own sections as appropriate (e.g. standard operating procedures, emergency procedures, identifying activities requiring prior approval, etc.).

Laboratories that do not meet these criteria are subject to the requirements of the Hazard Communication Standard (29 CFR 1910.1200). OES can assist in evaluation to determine the relevant applicable standards.

Although not explicitly covered by the OSHA standard, undergraduate students working with hazardous chemicals in teaching or research laboratories are expected to practice good chemical hygiene at all times. Clemson University prioritizes the safety of it's students and the elements of this plan may be used as a guide to ensure their safety when working with hazardous chemicals.

### **III. Roles and responsibilities**

#### **University president**

The university president has ultimate responsibility for the overall safety within Clemson University and must, with other administrators, provide continuing support for institutional health and safety programs.

#### **Chemical Hygiene Officer (CHO):**

- Work with administration, principal investigators, staff, and other employees to develop and implement appropriate lab safety policies, procedures, engineering controls, training, etc.
- Conduct inspections / audits of laboratories where hazardous materials are used to assess hazards in the labs and convey findings and recommendations to lab personnel.
- Assist laboratory personnel in assessment and selection of Personal Protective Equipment (PPE).
- Provide technical expertise to help researchers develop Standard Operating Procedures (SOPs) for laboratory operations for particularly high-hazard operations that might include explosives, select carcinogens, highly reactive materials, etc.
- Develop and maintain a chemical and laboratory safety training program.
- Review reports of lab accidents, incidents, chemical spills, and near misses and make recommendations to help reduce these events.
- Conduct in-lab training and encourage the use of self-inspections.
- Participate in the review of new construction and laboratory renovations and provide technical assistance to University Facilities.
- Assist with the close-out process for laboratories.

- Understand the current legal requirements concerning regulated substances.
- Review and, if necessary, update or revise the Chemical Hygiene Plan annually.

**Department chair / director:**

- Work with the CHO, administrators, PIs, staff, and other employees to develop and implement appropriate chemical hygiene practices and policies.
- Ensure that appropriate lab audits are conducted.
- Work with CHO and PIs to develop precautions and ensure adequate controls are present for research being conducted.
- Ensure the proper function and maintenance of emergency equipment such as eye / facewash, eyewash / shower units, spill response equipment, fire extinguishers, etc.,
- Ensure that policies and regulations are enforced.

\*For more efficient implementation of the CHP, department heads should select one or more individuals to serve as departmental safety coordinators. Department safety committees can also assume these responsibilities.

**Principal Investigator (PI) / lab supervisor:**

- Work with the CHO, administrators, PIs, staff, and other employees to develop and implement appropriate chemical hygiene practices and policies.
- Ensure that workers know and follow the chemical and lab safety policies and procedures.
- Conduct hazard assessments and determine the required levels of PPE for lab workers beyond minimum requirements established by OES.
- Ensure that appropriate engineering controls are available and in working order and that appropriate training for use has been provided.
- Provide regular, lab safety and housekeeping inspections including routine inspections of emergency equipment.
- Know the current legal requirements concerning regulated substances if they are used in their research. OES is available for assistance with information and resources.
- Ensure that lab personnel have access to, understand, and are able to comply with the information provided on Safety Data Sheets (SDS) and other sources of information on the hazards of lab chemicals.
- Ensure that facilities and training are adequate for all research conducted and materials being used.
- Ensure the proper function and maintenance of emergency equipment such as eye / facewash, eyewash / shower units, spill response equipment, fire extinguishers, etc.,
- Report all laboratory incidents / accidents to OES. Ensure that an incident report form is submitted to OES (and Risk Services if applicable) for all laboratory incidents / accidents.

- Ensure that they and their employees have received all required OES training based on the nature of the research conducted.
- Develop and implement any training specific to hazards associated with the research being conducted. All training should be formalized and documented.
- Determine criteria for lab procedures that require prior PI approval to perform.

### **Lab researcher / employee:**

- Review and understand the contents of the OSHA Lab Standard, Clemson CHP, and Clemson Laboratory Safety manual. CHP acknowledgement form should be signed and maintained by lab PI / supervisor (paper or electronic)
- Complete required OES and lab-specific training (on-line or in person).
- Use work practices, controls, and PPE required for safe performance of their job.
- Plan and conduct each experiment / process in accordance with the lab specific rules and prudent chemical safety practices.
- Know the location of and how to use emergency equipment.
- Inform their supervisors of incidents / accidents and conditions or work practices they believe to be a hazard to their safety or health or to the safety or health of others. An incident report form shall be submitted to OES (and Risk Services if applicable) for all laboratory incidents / accidents.
- Understand how to access and interpret SDS (and other relevant information sources) for chemicals used.

## **IV. Employee information and training**

Departments and PIs must provide employees with information and training to ensure that they are aware of the hazards of chemicals present in their work area and the steps they should take to protect themselves from these hazards. Training may take the form of individual instruction, group seminars, audio-visual presentations, handout material, or any combination of the above. However, the training must include the specific hazards associated with the chemicals in the work area when generic training is insufficient (e.g., extremely toxic materials, carcinogens, reproductive hazards). Training should be formalized and documented. Such information and training must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignment involving new exposure situations.

### **Information.**

Information provided by departments / PIs to employees must include:

1. The contents of the OSHA standard [29 CFR 1910.1450](#) and its appendices which shall be available to employees;
2. The location and availability of the Clemson University Chemical Hygiene Plan and Lab Safety Manual;
3. The permissible exposure limits for OSHA regulated substances or published exposure limits for other hazardous chemicals where there is no applicable OSHA standard (available from SDSs or OES);
4. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory (available from SDS);
5. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory (i.e., SDS and other sources of information). Also, see applicable sections of the Lab Safety Manual.

### **Hazard identification**

PIs are responsible for ensuring that all lab personnel are made aware of and understand the physical and health hazards of the chemicals that are used and stored in the lab. Numerous sources of information are available on chemical hazards including chemical labels, SDS, online resources, etc. Chapter IV of the Lab Safety Manual discusses identification of chemical hazards. Chemicals developed in the lab shall also be evaluated for their physical and health hazards. OES can assist in this evaluation upon request.

### **Training.**

**Training provided by OES:** OES offers online Chemical Hygiene and Lab Safety Training via the [OES website / SciShield](#). In-person training is also available upon [request](#) for general chemical and lab safety or specific topics.

**Department / PI training:** Training provided by departments / PIs to employees must include:

1. The physical and health hazards of chemicals in the work area;
2. Methods and observations that may be used to detect the presence or release of a hazardous chemical (i.e., monitoring conducted by continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
3. The measures employees can take to protect themselves from these hazards such as appropriate work practices (administrative controls), engineering controls, emergency procedures, PPE, etc.;
4. Any lab specific hazards (i.e. chemicals, instrumentation, processes / procedures, etc.) beyond the general scope of the Lab Safety Manual and OES training.
5. The applicable details of the CHP and Lab Safety Manual.

**Documentation:** All department chairs, PIs, staff, researchers, and other employees shall indicate that they have read, understand, and agree to abide by the criteria of the CHP by signing the CHP Acknowledgement Form. This should be maintained in each lab either as a paper copy or electronically. Records shall be maintained for any department or lab-specific training. All training sessions conducted by OES (online or in-person) will be documented via the SciShield database.

## **V. Medical examinations and consultations**

All employees who work with hazardous chemicals must be provided the opportunity to receive a medical evaluation / examination, including any follow-up examinations that the physician determines to be necessary, under the following circumstances:

1. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee must be provided an opportunity to receive an appropriate examination;
2. Where exposure monitoring reveals an exposure level routinely above the action level (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, medical surveillance shall be established for the affected employee as prescribed by the particular standard;
3. 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, the affected employee shall be provided an opportunity for a medical consultation. Such consultations shall be for the purpose of determining the need for a medical examination.

All required medical examinations and consultations must be performed by or under the direct supervision of a licensed physician through the Redfern Health Center or Joseph F. Sullivan Center clinic. Medical examinations and consultations must be provided at no cost to the employee. If medical examinations are required outside of normal hours of operation for Redfern / Sullivan Center, employees should be taken to a local Urgent Care facility or an area hospital emergency room. For emergencies call 911.

## **VI. Exposure limits**

For laboratory uses of hazardous substances, departments must ensure that laboratory employees' exposures to such substances do not exceed either the permissible exposure limits (PELs) specified in [29 CFR 1910, subpart Z](#), which are set by the Occupational Safety and Health Administration (OSHA), or the Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH), whichever is lower. OES can conduct evaluations upon request or following a potential or actual exposure.

Whenever employee exposures exceed the action level (or in the absence of an action level, the lower of the PEL or TLV), the department must implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices. Exposures to extremely toxic materials, select carcinogens, and reproductive toxins must be maintained as low as reasonably achievable.

## **VII. Engineering controls and employee protection**

The primary engineering control in the chemical laboratory is the chemical fume hood, although numerous other controls are used (snorkels, ventilated enclosures, etc.). Together with properly functioning laboratory ventilation, these systems work to contain and exhaust harmful contaminants while providing fresh air to lab spaces. The need for particular engineering controls will be dependent on the nature of the research conducted. OES will evaluate the need for engineering controls and assist in selection and proper installation of these devices.

### **Chemical fume hoods**

Chemical fume hoods are an important engineering control to limit /prevent exposure to laboratory chemicals. Chemical hood commissioning and annual testing are the responsibility of OES. As hoods are tested annually, a sticker will be placed on each hood to indicate whether the hood passed or failed testing requirements. Hoods that pass inspection will have a sticker showing the test date, average face velocity rates, and inspector initials. If the hood fails inspection, a Failed / Out of Service notice will be posted. Hoods that fail must be repaired and re-tested before further use is allowed. The CHO is responsible for reporting and scheduling hoods for repair (submitting work order to University Facilities). Once repairs have been made, OES will re-test the hood.

If you determine that a hood in your lab is not functioning properly, contact OES for an evaluation and placement of work order if necessary.

Chemical hoods should be equipped with a continuous monitoring device. Hood users should check to ensure the device is functioning before using the hood. If the monitor / alarm is not functional, OES should be contacted to schedule repair or calibration.



Information and training on the proper use of a chemical hood is provided in the Lab Safety Manual and online Lab Safety and Chemical Hygiene Training. In person fume hood training can also be provided by OES upon request.

### **Personal Protective Equipment (PPE)**

The selection of PPE (i.e., safety glasses, goggles, lab coats, gloves, etc.) used in the lab is the responsibility of the PI or department chair. General guidance for the selection and use of PPE is provided in the Lab Safety Manual. The CHO is available to provide technical assistance upon request. It is the responsibility of the user to ensure that their personal protective equipment is selected properly, maintained, and disposed of properly.

### **Emergency equipment**

The proper function and maintenance of emergency equipment such as eye / facewash, eyewash / shower units, spill response equipment, fire extinguishers, etc., is the responsibility of the Department Chair and the PI. Emergency equipment should be inspected and tested as indicated in the Lab Safety Manual. OES can assist in evaluation of the necessity for specific emergency equipment as well as provide training on test protocols. OES should be notified if any deficiencies are identified with emergency equipment. All lab personnel should be aware of the location and proper use of all emergency equipment and materials.

## **VIII. Laboratory inspection program**

The purpose of the laboratory inspection program is to assist faculty and staff in ensuring regulatory compliance and safety of laboratories in support of the research and teaching mission of Clemson University. This program supports researchers by providing guidance and oversight in regulatory compliance, prudent safety practices, and risk minimization strategies towards the university's goal of high-quality, efficient, and ethical scientific research.

This program covers the inspections of Clemson research and teaching labs that fall under the criteria of the OSHA Lab Standard. This program will help ensure researchers and staff comply with all applicable regulations and maintain a safe work environment via annual lab inspections performed by OES staff. OES staff will identify areas of concern and assist lab staff in remediation and risk minimization strategies.

Lab inspections will be conducted on an annual basis at a minimum. Inspections may be conducted more frequently based on the specific hazards of the research being conducted. Inspection criteria can be viewed via the SciShield inspection module. PIs and lab personnel are encouraged to conduct periodic self-inspections to help identify lab safety / compliance concerns. OES can provide evaluations for specific procedures and processes upon request.

## **IX. Standard Operating Procedures (SOPs)**

Laboratory safety procedures for general laboratory operations can be found in the Laboratory Safety Manual and Chemical Hygiene Plan. However, protocols for specific laboratory operations must be provided by lab PIs / personnel. PIs / supervisors will develop written standard operating procedures for work involving extremely toxic chemicals, select carcinogens, and reproductive toxins, or other chemicals / procedures that present increased hazards. SOPs must include (but not limited to) the following provisions where appropriate:

1. Establishment of a designated work area;
2. Use of containment devices such as chemical hoods, glove boxes, local ventilation, barricades, etc.;
3. Procedures for safe collection of contaminated waste; and
4. Decontamination procedures.

OES will assist laboratory personnel in developing general and process-specific SOPs for chemical use in laboratories. Due to the diversity of research and the number of labs involved, it will be the responsibility of each laboratory PI to ensure that their practices and procedures are adequate to protect their workers who use hazardous chemicals. Written SOPs shall be maintained by the PI and understood by all lab personnel. SOPs should be reviewed on a regular basis and updated as necessary.

## **X. Use of respirators (Respiratory Protection Program)**

The use of engineering controls such as chemical hoods and other containment devices should be used whenever possible to prevent inhalation exposure to hazardous chemicals. Therefore, it is not normally necessary to use respirators in laboratory operations. However, if a lab operation is being conducted where lab personnel believe they need a respirator for protection, the OES should be contacted to conduct a workplace assessment. If the OES recommends respiratory protection, the individual or individuals will need to comply with the University Respiratory Protection Program.

Where the use of respirators is necessary to maintain exposure below permissible exposure limits (PELs) or Threshold Value Limits (TLVs), whichever is lower, Clemson must provide, at no cost to the employee, the proper respiratory protective equipment. Respirators must be selected and used in accordance with the requirements of the Clemson University Respiratory Protection Program. Respirator users must be enrolled in the University Medical Surveillance Program and must be fit tested for the respirator they are assigned. To obtain more information on the Respirator Program visit the OES website – [Respiratory Protection](#).

## **XI. Special hazards requiring approval or additional measures**

Some processes that utilize particular chemicals or procedures may require approval, additional training, or consultation from OES. These include, but is not limited to:

- Use of toxic or highly toxic gases;
- Use of hydrofluoric acid (HF);
- Use of perchloric acid;
- Research on highly energetic materials;
- Use of PFAS (i.e. PFOA, PFOS, GenX, etc.);
- Use of PCBs;
- Activities identified as requiring Committee approval (i.e. IBC, RSC, IRB, IACUC, etc.);
- Activities requiring respiratory protection.

If uncertain about the need for approval or additional training / resources, contact OES.

Other research activities that require "employer approval" will occur at the local level (e.g., PI, lab supervisor, department chair, etc.). The CHO can assist department personnel and PIs in determining if such approval is warranted and prudent.

## **XII. Annual review**

The Chemical Hygiene Plan will be reviewed annually by the CHO to identify any deficiencies and revised as necessary to reflect findings and new guidance or information.

## **XIII. Resources**

[Occupational Exposure to Hazardous Chemicals in Laboratories \(OSHA Lab Standard; 29 CFR 1910.1450\)](#)

[Clemson University Laboratory Safety Manual](#)

[Clemson SciShield login / training](#)

[Prudent Practices in the Laboratory \(via Clemson library login\)](#)