



**CHEMICAL HYGIENE PLAN
AND
HAZARD COMMUNICATION PLAN**

**Occupational Exposures to Hazardous Chemicals in Laboratories
(9/16)**



**The Office of the Vice President for Research
Environmental Health & Safety
(Research Compliance Services)**

Detailed Safety Information available on
Environmental Health and Safety Homepage
<http://wp.research.uh.uconn.edu/rcs/ehs/>

An electronic copy of this plan is distributed to all P.I.'s.

SAFETY INFORMATION

(Fire, Police, Accident, Spill, Medical)
Campus Locations Dial "7777"
Off Campus Dial "911"

Other Health and Safety Numbers

Environmental Health and Safety Chemical Hygiene Officer Radiation Safety Officer Biological Safety Officer	2723
Radiation Safety	2250
Clinical Engineering	2964
CT Poison Control Center (24 hrs)	3456
Emergency Department	2588
Employee Health Service	2893
Environmental Operations Center (24 hrs)	2338
Epidemiology (Infection Control, Hospital)	4376
Facilities Development & Operations	2125
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(9/16)

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I have read and revised this Chemical Hygiene Plan and approve its distribution.

_____ Date: _____
Steven Jacobs
Interim Director, Research Safety
Chemical Hygiene Officer

CHEMICAL HYGIENE PLAN (CHP)

1.0 INTRODUCTION

1.1 The OSHA Laboratory Standard

On January 31, 1990, the Department of Labor published in the Federal Register an amendment to 29 CFR 1910, Subpart Z, identified as Section 1910.1450. The title of the amendment is "Occupational Exposure to Hazardous Chemicals in the laboratory," but it is better known as the "Laboratory Standard." The full context of this standard is provided in Appendix A.

The effective date of the standard was May 1, 1990. The Occupational Safety and Health Standard mandates certain safety actions that must be taken to protect employees from chemical hazards in laboratories. A part of the standard requires the development by the employer of this Chemical Hygiene Plan (CHP).

An updated nonbinding, non-regulatory guidance document can be found at <https://www.osha.gov/Publications/laboratory/OSHA3404laboratory-safety-guidance.pdf>

1.2 Role of the Chemical Hygiene Plan (CHP)

This Chemical Hygiene Plan (CHP) has been formulated and implemented by UConn Health in order to outline specific work practices and procedures which are necessary so that personnel are protected from the hazards of chemicals used in laboratory activities. Additionally, the OSHA "Laboratory Standard" exempts laboratory operations from many regulations under 29 CFR 1910 Subpart Z. For example, the Laboratory Standard normally supersedes other OSHA chemical requirements except for the specific permissible exposure limit. Where chemical permissible exposure levels (PELs) and action levels (ALs) are routinely exceeded the monitoring and medical surveillance parts of the OSHA Subpart Z standard apply. Where a general OSHA standard has been written to specifically cover a laboratory activity, those specific provisions do apply.

The focus of the OSHA Laboratory Standard and this Chemical Hygiene Plan is on chemical safety. Other UConn Health Guidelines and Policies cover work with potentially infectious agents, radioactive materials, chemicals and regulated medical waste disposal, hazardous materials contingency plan; etc. These policies and guidelines are listed in Appendix C and are available for review in Environmental Health and Safety or on Environmental Health and Safety's homepage. Fire safety is a critical consideration for laboratory activities and our Fire Department personnel provide technical expertise on such issues and assist all functions enforcing fire safety regulations and codes.

1.3 Chemical Hygiene Plan Coverage and Availability

All UConn Health laboratory activities are covered by this Chemical Hygiene Plan. Electronic copies of this Chemical Hygiene Plan are mailed electronically to all laboratories. This plan also may be accessed by computer through Environmental Health and Safety's homepage. See Section 2.0 for instructions on accessing this homepage.

1.4 Change in MSDS Chemical Hazard Summary Sheets

All regulating bodies in the United States are participating in a program known as GHS (Globally Harmonized System) for providing chemical safety information for chemicals. The intent of this program is to yield a uniform worldwide system for chemical hazard summaries. Therefore, the current MSDS system is being replaced by an SDS (Safety Data Sheets) system. Environmental Health and Safety has provided training on this new system prior to January 1, 2014. Please contact Environmental Health and Safety with any questions concerning this change.

2.0 ENVIRONMENTAL HEALTH AND SAFETY

2.1 Organization and Duties

The UConn Health Environmental Health and Safety (EHS) is the department assigned to ensure institutional worker safety and regulatory compliance in the handling and disposal of hazardous materials, physical hazards and biological hazards. Environmental Health and Safety is further divided into two Offices, Environmental Health and Safety (EHS) and the Radiation Safety Office (RSO). Environmental Health and Safety is managed by the Interim Director, who also acts as the Chemical Hygiene Officer as well as the EPA Emergency Coordinator. Chemical, physical and biological safety is generally handled by the EHSO. Radiological safety is generally handled by the RSO. The Institutional Biological Safety Officer (BSO) is also part of Environmental Health and Safety.

Environmental Health and Safety maintains a web site where important information such as SDS's, annual bloodborne pathogen annual refresher training, PPE information, respirator program and other related information may be obtained relating to the various programs for which this Office is responsible. To access this site,

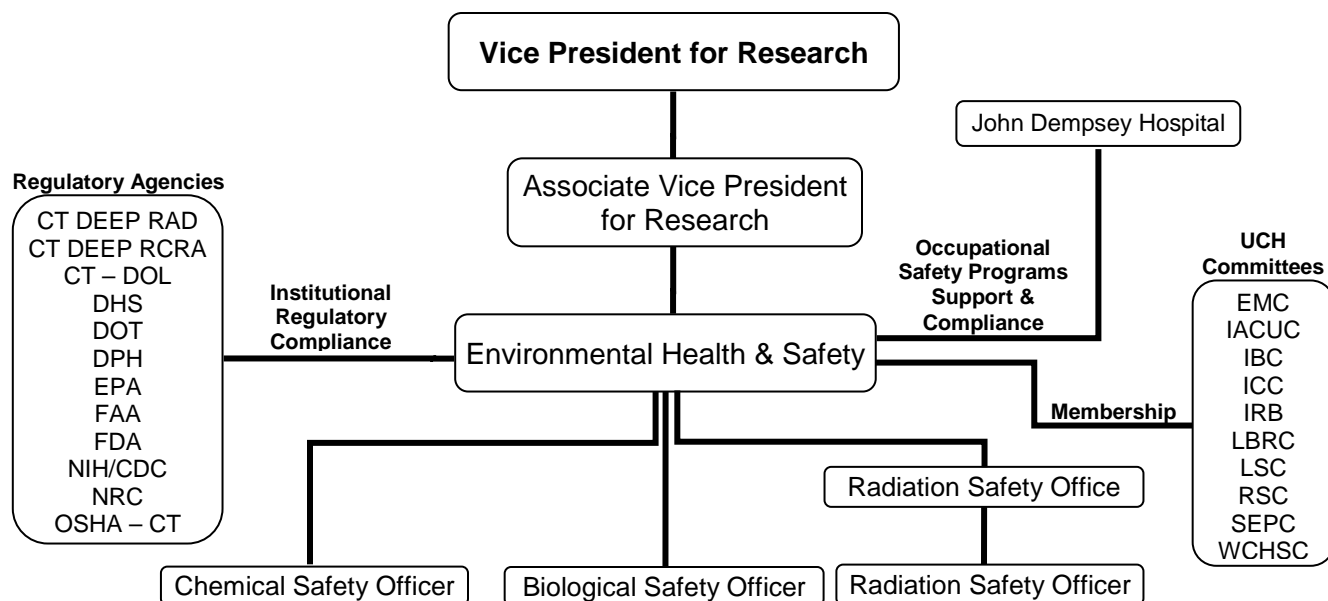
Go to UConn Health homepage, <http://wp.research.uh.uconn.edu/rcs/ehs/>

The phone numbers are:

x2250/x2723 – Environmental Health and Safety

2.2 Policy Setting committees, Regulatory Agencies and Institutional Interrelationships

The following chart provides the organizational structure that relates to Environmental Health and Safety activities to other functional areas of the UConn Health.



Committees

- EMC** – Environmental Management Committee
- IACUC** – Institutional Animal Care and Use Committee
- IBC** – Institutional Biosafety Committee
- ICC** – Infection Control Committee
- IRB** – Institutional Review Board
- LBRC** – Labor/Management Committee
- LSC** – Laser Safety Committee
- RSC** – Radiation Safety Committee
- SEPC** – UConn Health Safety and Emergency Preparedness Committee
- WCHSC** – Worker’s Compensation Health & Safety Committee

Regulatory Agencies

- CT DEEP RAD** – Connecticut Department of Energy & Environmental Protection Radiation Division
- CT DEEP RCRA** – Connecticut Department of Energy & Environmental Protection Resource Conservation & Recovery Act
- CT - DOL** – Connecticut Department of Labor
- DOT** – Department of Transportation
- DPH** – Department of Public Health
- DHS** – Department of Homeland Security
- EPA** – Environmental Protection Agency
- FAA** – Federal Aviation Administration
- FDA** – Food and Drug Administration
- NIH/CDC** – National Institutes of Health/Centers for Disease Control
- NRC** – Nuclear Regulatory Commission
- OSHA – CT** – Occupational Safety and Health Agency – Connecticut
- USDA** – United States Department of Agriculture

3.0 DESCRIPTION OF COVERED LABORATORY ACTIVITIES

3.1 OSHA Laboratory Definitions

The OSHA Laboratory Standard applies to all employers engaged in the laboratory and/or clinical use of hazardous chemicals. Laboratory and/or clinical use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met. OSHA defines a laboratory in 1910.1450(b) as a facility where "laboratory use of hazardous chemicals" occurs.

- Chemical manipulations are carried out on a "laboratory scale". 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. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.
- Multiple chemical procedures or chemicals are used;
- The procedures involved are not part of a production process, nor in any way simulate a production process; and
- "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

3.2 UConn Health Application of OSHA Definitions

UConn Health laboratory activities covered by the OSHA Laboratory Standard and this Chemical Hygiene Plan (CHP) include research, as well as hospital and clinical laboratories using hazardous chemicals or substances. The OSHA Laboratory Standard and this CHP do not apply to the use of hazardous chemicals which do not meet the definition of laboratory use or the laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of conditions that might result in no exposure include:

- Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and
- Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

4.0 INDIVIDUAL RESPONSIBILITIES ASSIGNED BY THE CHEMICAL HYGIENE PLAN (CHP)

4.1 General Safety and Chemical Hygiene Responsibilities

- 4.1.1 The Vice President for Research in collaboration with the Associate Vice President for Research Compliance have ultimate responsibility for supporting safety and chemical hygiene programs within UConn Health and provides continuing support of institutional safety and chemical hygiene efforts.
- 4.1.2 The Deans, Hospital Director and Vice President Operations, Chief Administrative Officer, and Chief Financial Officer have ultimate responsibilities for supporting safety and chemical hygiene issues within their activities and provide continuing support and enforcement of institutional safety and chemical hygiene efforts. All activities are

encouraged to establish policies so that safety is considered as a component of each individual's performance evaluation.

4.1.3 The principal investigator (PI) in a research laboratory or the laboratory supervisor/director of other laboratory activities is responsible for making this Chemical Hygiene Plan readily available to their employees and for the enforcement of the requirements of this Chemical Hygiene Plan, UConn Health Safety Policies/Guidelines and applicable Occupational Safety and Health Administration (OSHA) regulations. See also 4.1.6. The PI is primarily responsible for instructing staff on laboratory procedures, precautions and safety information.

4.1.4 The Chemical Hygiene Officer (CHO) for UConn Health is the Interim Director of Environmental Health and Safety. The CHO must:

- A. Provide technical guidance during the development, implementation and annual review of the Chemical Hygiene Plan;
- B. Work with administrators, faculty, staff, other employees and various committees to develop and implement appropriate safety and chemical hygiene policies and practices;
- C. Monitor procurement, use and disposal of chemicals used in the laboratories;
- D. Conduct appropriate laboratory safety monitoring, surveys and audits;
- E. Provide technical assistance to principal investigators, supervisors and employees as they discharge their responsibilities to develop adequate safety precautions, maintain facilities and enforce C.H.P. requirements;
- F. Remain current on developing regulatory issues concerning the use of hazardous chemicals in the laboratory;
- G. Assist Senior Administration (Fire Chief, Police Chief) and Facilities Development & Operations personnel on issues related to fire safety, disaster preparedness and emergency response (e.g. spills);
- H. Coordinate safety issues needing occupational medicine input with Employee Health Service;
- I. Seek ways to improve the chemical hygiene program;
- J. Serve as Facility Emergency Coordinator as required by the Environmental Protection Agency and the Connecticut Department of Energy & Environmental Protection and serve as an institutional representative on the Farmington Local Emergency Planning Committee meetings;
- K. Determine the need for employee exposure determinations and accomplish required exposure determinations; notify employees of any monitoring results within 15 working days after the receipt of the results; and maintain appropriate records of such monitoring;
- L. Provide on a monthly basis laboratory safety training sessions (and keep a list of attendees) that supplement specific safety training provided by the PI or laboratory

supervisor (personnel newly assigned to a laboratory must promptly complete such a laboratory safety training session);

M. Coordinate the Safety Data Sheet (SDS) program; and

N. Maintain for UConn Health the OSHA log of occupational accidents and illnesses.

4.1.5 UConn Health Safety Oversight Committees

UConn Health has established several Committees that provide oversight and policy development regarding the safety of staff, faculty and students. The Chemical Hygiene Officer, in addition to other staff of Environmental Health and Safety, are members of these Committees. These Committees include the Labor Management Committee, Institutional Biosafety Committee, Animal Care Committee, Radiation Safety Committee, Health System Safety and Emergency Preparedness Committee, Infection Control Committee and Workers Compensation Health and Safety Committee. See Section 2.2 for more information.

4.1.6 The principal investigator (PI) of a research laboratory or laboratory supervisor/director of other laboratory activities has direct and overall responsibility for safety and chemical hygiene in the laboratory including the responsibility to (See also 4.1.3):

A. Ensure that personnel in their laboratory know the potential hazards and are instructed in proper laboratory procedures;

B. Ensure that workers know and follow safety and chemical hygiene plan procedures; that protective equipment is available, in working order and appropriately used (NOTE: Only permitted the use of respirators as laboratory PPE is after all other options have been exhausted. Engineering controls are the preferred method of protection against inhalation hazards. If applicable Environmental Health and Safety must select any respirator used for chemical protection and train and fit test the employee in accordance with UCONN Health guidelines); and schedule and ensure that appropriate safety training has been completed;

C. Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment that is not inspected by UConn Health's Fire Department (Fire Extinguishers) or Facilities Development & Operations (Chemical Hoods and Safety Showers);

D. Be familiar with UConn Health policies concerning hazardous materials, hazardous waste management, chemical inventory, NFPA storage limits;

E. Ensure that proper facilities (space, equipment, fume hoods, etc.) and training for use of any hazardous materials being ordered are adequate;

F. Assist the CHO in the discharge of his/her responsibilities;

G. For chemicals developed in the laboratory take action as required by Section 4.3; and

H. The roles and responsibilities assigned when agreeing to be a student/host sponsor.

- I. Review with staff the potential safety and security hazards prior to staff working alone and develop (if necessary based on risk) a means and frequency of communication. See Section 5.1.10.

4.1.7 Employee Health Service (x2893) provides, under the direction of a licensed physician, required occupational medicine support to employees (at no cost to the employee and without loss of pay) in accordance with OSHA regulations and this Chemical Hygiene Plan. All employees who work with hazardous chemicals will be provided an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

- A. 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 shall be provided an opportunity to receive an appropriate medical examination.
- B. Where monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the permissible exposure level) 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.
- C. 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 consultation shall be for the purpose of determining the need for a medical examination. The employee, employee's supervisor and/or representatives of Environmental Health and Safety will direct the employee to Employee Health Service or Emergency Department, and:
 - Identify the hazardous chemical(s) to which the employee may have been exposed;
 - Describe the conditions under which the exposure occurred including quantitative exposure data, if available; and,
 - Describe the signs and symptoms of exposure that the employee is experiencing, if any.

The Employee Health Service will provide to the employee for any examination/consultation required under the Laboratory Standard a written report that includes:

- 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 chemical found in the work place; and
- 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.

Employee Health Service will provide to the employee's supervisor and Environmental Health and Safety any additional information they need to discharge

their responsibilities. Such additional information shall not reveal specific findings of diagnoses unrelated to occupational exposure.

- 4.1.8 Facilities Development & Operations supports the Chemical Hygiene Plan by proper maintenance and operation of laboratory facilities and the prompt collection of trash, glassware and regulated medical waste containers from the laboratories. Additionally, Facilities Development & Operations must:
- A. Keep laboratory users, Environmental Health and Safety and the Fire Department informed of any actions that could impact laboratory safety (utility loss, contractor activities, etc.);
 - B. Routinely verify proper operation of engineering controls and emergency systems provided for laboratory operations; promptly respond when the adequacy of such systems are questioned; and notify users, Environmental Health and Safety, and/or the Fire Department immediately (or in advance) when such systems must be shut down, or otherwise are not operating properly;
 - C. In the modification, alteration or construction of any laboratory, and prior to initiation of the project, have the preliminary laboratory design approved in writing by representatives of the Fire Department and Environmental Health and Safety;
 - D. Require that their personnel working in laboratory areas coordinate their activities with laboratory personnel and follow established safety procedures;
 - E. Require contractors to be briefed on laboratory safety prior to their start of any work in, or adjacent to, laboratories that pose an exposure risk, and enforce contractor compliance with UConn Health safety rules, and
 - F. Clean floors on a regular basis.
- 4.1.9 The Fire Department, under the direction of UConn Health's Deputy Fire Chief, is responsible for fire safety and emergency response.
- 4.1.10 UConn Health's Radiation Safety Officer is responsible for Radiation Safety.
- 4.1.11 Human Resources provides assistance in identifying employees needing safety training. Human Resources, is also responsible for receiving employee accident reports (x4589).
- 4.1.12 Purchasing supports UConn Health's written Hazard Communication Policy and assists in the identification of Department of Homeland Security chemicals when ordered and assists with the chemical inventory program. In accordance with the policy, Purchasing establishes procedures so that Safety Data Sheets (SDSs) are received by Environmental Health and Safety for items obtained through Purchasing or the Warehouse. Personnel in Purchasing that receive and transport chemicals must complete prescribed safety training and DOT classes, and strictly conform to safety practices during the receipt, delivery and storage of chemicals including compressed gases. The Purchasing Department must verify that any request for a compressed gas designated as a Department of Transportation (DOT) "Poison" has been approved by Environmental Health and Safety prior to ordering. The Warehouse stocks laboratory safety items for users, as recommended by Environmental Health and Safety. Property Administration coordinates their laboratory activities with the laboratory user and, as appropriate, Environmental Health and Safety.

4.2 Responsibilities of Each Laboratory Employee

Laboratory workers are responsible for:

- Knowing the hazardous properties of the chemicals they use so that proper safety precautions can be determined and followed;
- Planning and conducting routine safety audits on a continuing basis of each laboratory chemical activity in accordance with this institutional Chemical Hygiene Plan;
- Plan and prepare proper safety and notification procedures when working alone;
- Developing good personal chemical hygiene habits;
- Promptly completing required safety training sessions;
- Maintaining the integrity of chemical labels and labeling secondary containers, as required by the CHP, so the identity of the contents is readily known;
- Providing Environmental Health and Safety a copy of any Safety Data Sheet (SDS) received with a chemical;
- Properly storing chemicals so that compounds are properly segregated, and the potential for spills is minimized;
- Disposal of chemical, radioactive and medical wastes in accordance with UConn Health Policies (See 5.1.1 Q and Appendix C);
- Reporting promptly an occupational injury or illness to Human Resources (x4589) and, as indicated, obtaining medical services from Employee Health Service (x2893);
- Knowing the location and operation of emergency equipment such as eyewashes, safety showers, etc. and routinely flushing eye washes;
- Knowing emergency reporting (Dial "7777") and evacuation procedures;
- Reporting other laboratory safety issues or concerns to their supervisor and, as appropriate, Environmental Health and Safety, Employee Health Service, Public Safety or Facilities Development & Operations.
- Consulting Environmental Health and Safety prior to shipping chemicals/radioactive materials and/or biological materials from the UConn Health.

4.3 Responsibilities for UConn Health Developed Laboratory Chemicals

The principal investigator/laboratory supervisor for a chemical developed in their laboratory will:

- A. If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, determine in consultation with Environmental Health and Safety if it is a hazardous chemical as defined in Appendix A. If the chemical is determined to be hazardous, provide appropriate training to employees on the hazards and the safety procedures to be followed.
- B. If the chemical produced is a byproduct whose composition is not known, assume that the substance is hazardous and implement procedures required by this C.H.P.
- C. If the chemical substance is produced for another user outside of the laboratory, comply with the Hazard Communication Standard (29 CFR 1910.1200, see Appendix G) and prepare the required Safety Data Sheet (SDS) and label. Environmental Health and Safety will provide assistance and must approve any SDS and ensure proper labeling and packing for shipment.

- D. There may be requirements for registering a new chemical substance with the Environmental Protection Agency. Call Environmental Health and Safety for guidance for compliance with EPA regulations.

5. CHEMICAL HYGIENE PLAN

5.1 General Standard Operating Procedures

5.1.1 General Rules

The following general procedures should be followed by all employees for laboratory work with chemicals:

A. Accidents and spills:

For non-emergency accidents, visit Employee Health Service (x2893) during normal working hours (8:30AM–12:00PM, 1:00–4:00PM) or the JDH Emergency Department (x2588) after hours.

For emergency assistance always dial "7777". For minor spills, call Environmental Health and Safety (x2723).

Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (see also 5.1.6).

Ingestion: Contact the Connecticut Poison Control Center (ext. 4346) to determine initial actions and seek medical attention.

Skin Contact: Promptly flush the affected area with copious amounts of water and remove any contaminated clothing. Seek medical attention (see also 5.1.6).

Cleanup: Promptly clean up small chemical spills occurring on a prepared surface for such an event, when appropriate expertise, protective apparel, equipment and proper disposal resources are available to safely accomplish the task, call Environmental Health and Safety. For larger spills (i.e., cannot be immediately controlled and/or absorbed) emergency assistance dial "7777" and report the incident to the Public Safety Dispatcher.

B. Avoidance of "routine" exposure:

Avoid unnecessary exposure to chemicals by any route. Work with chemicals should be routinely done in a chemical fume hood.

Skin contact with chemicals should be avoided as a cardinal rule. Appropriate protective gloves must be readily available and worn when chemical contact is possible.

Unless part of an approved protocol, do not smell or taste chemicals. Apparatus which may discharge toxic vapors/gases (vacuum pumps, distillation columns, etc.) should be vented into local exhaust hoods.

Inspect protective gloves for tears, pinholes, etc. before use.

The Permissible Exposure Limits (PELs) of OSHA and the Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists should not be exceeded. Environmental Health and Safety can provide information on any established PELs and/or TLVs and determine if potential exposure are approaching these limits.

Prevent or minimize the release of toxic substances in cold rooms and warm rooms, since these rooms have contained recirculated atmospheres (no exhaust).

Prevent or minimize the release of toxic vapors and gases into biological safety cabinets since these exhaust air directly to the laboratory through only a particulate filter that does not absorb chemical vapors or gases.

C. Choice of chemicals:

Order only the amount needed and avoid accumulating chemicals – minimize onsite generation. Call Environmental Health and Safety to remove expired chemicals.

Before a substance is received, information on proper handling, storage and disposal should be known by the user. No laboratory chemical should be accepted without a label that identifies the chemical's name. Consult the SDS for the chemical prior to use.

Use only those chemicals and/or quantities of chemicals for which the capacity of the available engineering controls (e.g. chemical hood and ventilation system) is within design parameters.

Assume that all substances of unknown toxicity are toxic and minimize exposure to such substances as much as possible (see also 5.2.1).

Order, use and store the minimum quantity of hazardous material needed for work. Substitute safety environmental friendly chemicals if possible. (Forward the SDS to Environmental Health and Safety, MC1514).

Date all time sensitive material upon arrival (i.e., peroxide formers).

D. Eating, smoking, etc.:

Smoking is not permitted on the UConn Health campus. OSHA forbids eating or drinking in laboratory areas where laboratory chemicals are used or stored; hands should be washed before conducting these activities.

Storage, handling or consumption of food and beverages in glassware, utensils, refrigerators, etc. which are also used for laboratory operations is strictly forbidden.

E. 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; consider shielding or wrapping them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose. Do not use oversized glassware, flasks, etc. for your work. If laboratory work

involves pressurized systems (i.e., heating a chemical in a non-ventilated container) contact Environmental Health and Safety prior to initiation of the work.

F. Personal Hygiene:

Wash areas of exposed skin promptly and thoroughly if chemical contact is suspected. Contact the Employee Health Service (x2893) for concerns about exposure.

G. Horseplay:

Avoid practical jokes or other behavior which might confuse, startle or distract another worker.

H. Mouth suction:

Do not use mouth suction for pipetting or starting a siphon. Mouth pipetting is strictly forbidden.

I. Personal apparel:

Wear shoes at all times in the laboratory; the wearing of sandals, perforated or open-toed shoes should be avoided because of the reduced protection afforded in case of a spill. Proper attire must be determined by the P.I. based on the tasks being performed (hazard assessment). Long pants, closed low heeled shoes and hair pulled back is strongly recommended.

J. Personal housekeeping:

Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored. The work area should be cleaned on completion of an operation or at the end of the day.

K. Personal protection:

UConn Health has implemented, as required by 29CFR1910.132, 138, a formal policy on the "Selection and Use of Personal Protective Equipment (PPE)", the full text of which is available on Environmental Health and Safety homepage. (See Section 2.0)

General procedures for personal protection include:

Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled and the potential for eye injury exists.

Wear appropriate gloves when the potential for contact with toxic materials exists. (See Section 5.1.3.6) The style of glove and type of material needed should be selected based on type of chemical(s), quantities to be used, potential for contact,

permeation of the chemical through the glove and degradation of the glove by the material, etc. (See Section 5.1.3B for glove selection guidelines) Environmental Health and Safety has information which may be helpful in the selection of suitable gloves. The gloves should be inspected for tears and pinholes before each use. For gloves that will be reused, wash them before removal and replace them periodically. Hands should be washed promptly after removing gloves. Gloves should be worn only in the chemical use area and not in elevators, hallways, etc. Gloves should be removed when picking up a telephone or using equipment others touch bare-handed.

When airborne concentrations of chemicals are or could be of concern, consult Environmental Health and Safety.

Use appropriate personal protective equipment as prescribed by this Chemical Hygiene Plan.

Wear chemical safety goggles when the potential for eye injury exists because of chemical contact. Such covering safety eyewear is equally important to the wearer of contact lenses (See also paragraph 5.1.3 A).

The user should keep personal protective items clean. In case the user knows or suspects that the item has become contaminated, it should be promptly removed from service and cleaned prior to reuse. Any skin area that may have become contaminated should be promptly and thoroughly washed.

All personal protective equipment, including gloves, must be removed prior to leaving the laboratory and entering a public area (elevator).

L. Planning:

Seek information and advice about hazards. Plan appropriate protective procedures; plan positioning of equipment before beginning any new operation. Know what to do to prevent an accident and what to do if an accident occurs. Environmental Health and Safety can provide valuable assistance in planning for work with hazardous materials.

M. Unattended operations:

Unattended operations that could be hazardous should be avoided. When such operations must be conducted the need for the following precautions should be considered: leave lights on; place an appropriate sign on the door that includes the names(s) and phone number(s) of personnel that can be contacted in an emergency; and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water, ventilation, electrical power, etc.). Be especially careful of unattended operations involving a heat and/or electrical source (i.e., burners, hot plates, etc.). Review the Working Alone Policy (see 5.1.10) and comply with it.

N. Use of Laboratory Fume Hood:

A chemical hood must be used for operations which might result in significant release (e.g. above the OSHA permissible exposure level) of toxic chemical gases, vapors or dusts.

As a rule of thumb, consider the use of a hood or other local ventilation device when working with any appreciably volatile substance. Contact Environmental Health and Safety for guidance.

Adequate hood performance should be confirmed before use. This can be done by checking the Vaneometer, warning light or checking with a piece of tissue. For the best chemical hood performance the user should keep the work area five or six inches behind the plane of the sash, keep the hood sash closed except when adjustments within the hood are being made, keep materials stored in hoods to a minimum so as not to limit its use in an emergency and do not allow such items to block or interfere with airflow. Chemical fume hoods are not to be used for storage of equipment or supplies. If you suspect that the hood is not working properly, contact Facilities Development & Operations (x 2125). Environmental Health and Safety inspects fume hoods and biological safety cabinets (tissue culture hoods) yearly.

O. Chemical Distribution:

Within UConn Health hand-carried chemicals should be delivered in the DOT shipping container they arrived in or a secondary container that would provide added containment in case of a spill. Shipments of chemicals from UConn Health must conform to Department of Transportation (DOT) requirements. Laboratory workers must consult Receiving and/or Environmental Health and Safety prior to making such shipments. Laboratories should maintain a minimum inventory of chemicals at all times.

P. Vigilance:

Be alert to unsafe conditions and see that they are corrected or reported to the supervisor/PI when detected. Contact Environmental Health and Safety (x2723) if suspect individuals or activities are suspected.

Q. Chemical Waste Disposal:

1. A label indicating "Hazardous Waste" and the full chemical name (not chemical formula or symbol) and % concentration(s) of each constituent must be placed on each container of chemical waste by the user. Waste containers must be capped when not being filled and stored in secondary containment. Proper segregation by hazard class is mandatory.
2. To schedule a chemical waste pick up, please complete the "Inventory for Chemical Waste Container" form located under "Forms" on the Environmental Health and Safety's website and forward to the email address provided or fax to x3826. Any questions or to schedule a large volume pick up, call x2723 for assistance.
3. Do not discharge to the sewer flammable liquids, hazardous chemicals, metals, acids or bases (unless the pH has been adjusted to a range from 6 to 10 and heavy metals are not present), toxic, malodorous, or lachrymatory substances or any substances which might interfere with the biological activity of the

wastewater treatment plant, create fire or explosive hazards, cause structural damage or obstruct flow.

4. Those interested in additional chemical waste disposal information should contact Environmental Health and Safety for a copy of the UConn Health's Guidelines for the Disposal of Chemical Waste or obtain this information from Environmental Health and Safety's homepage (see Section 2.0).
5. The EPA mandates that waste containers must be kept/maintained in the area in which they are generated. Waste can not be transported across the hall or to another area not in a direct line of sight from the point of generation.
6. You may not accumulate greater than 55 gallons of each type of hazardous waste in your waste storage area.

R. Prior to the termination of employment:

At UConn Health, advanced notification to Environmental Health and Safety is prudent in order to dispose of any procedure specific/unusable chemicals prior to departure. Do not take/transport any hazardous chemicals, radioactive materials and/or biological material with you without contacting Environmental Health and Safety. Doing such could result in violations of Federal and State law.

Prudent clinical and laboratory safety practices as well as appropriate work place ethics must be followed at all times. Minors aged 16 and 17 years old may be permitted in the workplace if arranged through approved UConn Health sponsored educational programs and approved in advance by Human Resources and/or the Connecticut Department of Labor. Minors less than 15 years of age are not permitted in areas of potential exposures to hazardous materials or physical hazards. Prior to permitting any minor in the workplace, contact Human Resources or Environmental Health and Safety. It should be noted that no minor may receive compensation without prior approval of the Connecticut Department of Labor and an inspection of the area by the DOL.

5.1.2 Personal Hygiene

- A. If a hazardous chemical has contacted the skin the area should be washed promptly.
- B. Avoid inhalation of chemicals; do not "sniff" to test chemicals.
- C. Do not use mouth suction to pipette anything; use mechanical suction devices.
- D. Wash well with soap and water if chemical contact is suspected.
- E. Smoking is not permitted on UConn Health campus. Eating or drinking in laboratory areas where laboratory chemicals, radioactive materials or biological materials are used or stored is forbidden.
- F. Wash hands prior to leaving the laboratory.

5.1.3 Protective Clothing and Equipment – Disposable Glove Selection

- A. Eye protection worn when working with chemicals must meet the requirements of the American National Standards Institute (ANSI) Z87.1. This means that chemical safety goggles available from the Warehouse should be worn whenever there is a potential for chemical contact such as a liquid splash. When working with more than 10 mL of a corrosive liquid, a face shield should also be worn. These are also available from the Warehouse. Covering safety eyewear is equally important to the wearer of contact lenses. Additionally, employees are encouraged to inform their supervisors when contact lenses are worn, and medical personnel treating the individual in case of chemical contact, so that proper eye irrigation can be provided. For general laboratory work without the potential for chemical contact or splash, the routine use of goggles or safety glasses with side shields should be considered.
- B. **Disposable Glove Selection** is of utmost importance to ensure your personal safety when working with acids, bases, organic compounds and other chemicals and agents that should not come in contact with the skin. Direct chemical contact with the skin can cause severe burns and tissue destruction. In addition, materials deposited on the intact skin surface will permeate the skin with time and enter the circulatory system. The use of latex disposable exam gloves is discouraged because of potential latex allergies, may not be sufficient to inhibit chemical passage and can rip/tear easily. UConn Health recommends and stocks nitrile medical exam gloves for routine handling of hazardous materials, including biological, chemical and radioactive.

Protective gloves are rated by breakthrough time or the time it takes to detect a chemical on the inside of a glove if the chemical is deposited on the outer surface and is dependent upon composition and glove thickness. Gloves are supplied in various thicknesses, and in general, the thicker the glove the more resistant to chemical passage but the tactile ability to manipulate items lessens. Breakthrough times for nitrile medical exam gloves (4- 6 mils thick, or 0.1 mm- 0.15 mm) are provided below but **you should remove a glove immediately if contamination occurs**. If more than an incidental exposure is anticipated or an additional margin of safety is desired, two pairs of gloves should be worn. The gloves provided for routine laboratory and clinical operations are not intended for immersion type exposures. The intent is to protect from incidental splashes/droplets that this would be noticed and the glove immediately removed. Any anticipated exposures other than this should not be done without first contacting Environmental Health and Safety. Radioactive materials in of themselves would penetrate depending on the chemical form- ie: tritiated toluene would penetrate as toluene would. However, gloves provide minimum protection from the radiation emitted from most radioactive materials- the radiation penetrates the glove to the skin and not the compound itself. Provided gloves are intact, biological materials would not penetrate unless associated with a chemical that would penetrate and/or degrade the glove. The following table lists the general protective characteristics of unused and intact nitrile gloves, but keep in mind that **contamination on the outside of a glove requires immediate removal regardless of the rating given below**.

Nitrile Glove Class

- 0 - Safest for unlimited exposure, little to no breakthrough
- 1 - Next best for unlimited exposure, very low breakthrough
- 2 - Good for limited exposure, change when exposed
- 3 - Not for heavy exposure, change quickly when exposed
- 4 - Splashes only, change immediately when exposed
- 5 - Not recommended, may not provide protection

CHEMICAL	CLASS	Hold Up time, BT min
ACETALDEHYDE	5	0.3
ACETIC ACID	3	15.2
ACETONE	5	1
ACETONITRILE	5	3.3
ACRYLAMIDE	0	126.3
AMMONIUM ACETATE	0	160
AMMONIUM HYDROXIDE	2	51.3
BENZALDEHYDE	3	7.3
BENZENE	4	4.2
BUTANOL	0	126.3
BUTYL CHLORIDE	5	3
CARBON TETRACHLORIDE	3	61.1
CHLOROFORM	5	1.3
CHROMIC ACID	0	40
CITRIC ACID	0	160
CYCLOHEXANONE	4	15.8
DIMETHYL FORMAMIDE	5	2.4
DIMETHYL SULFOXIDE	3	15
DIMETHYLAMINO ETHANOL	0	150
ETHANOL	4	59.2
ETHANOLAMINE	3	46.4
ETHYL ACETATE	4	7.9
ETHYL ETHER	5	3.9
FORMALIN	0	128.6
FORMIC ACID	4	8.7
GLUTARALDEHYDE	0	126.3
GLYCEROL	0	160
HEPTANE	0	126.3
HYDRAZINE	0	133.3
HYDROCHLORIC ACID	0	160
HYDROFLUORIC ACID	3	15.8
HYDROGEN PEROXIDE	0	160
LACTIC ACID	0	160
METHANOL	3	7.4
METHYL ETHYL KETONE	5	1.3
METHYL METHACRYLATE	4	5

METHYLENE CHLORIDE	5	0.3
NITRIC ACID	0	137.1
OXALIC ACID	0	160
PENTANE	4	38.2
PERCHLORIC ACID	0	94.7
PHENOL	4	8.6
PHOSPHORIC ACID	0	160
PICRIC ACID	2	27
POTASSIUM HYDROXIDE	0	160
PROPIONIC ACID		37.5
PYRIDINE	5	2.4
SODIUM HYDROXIDE	0	160
SODIUM THIOSULFATE	0	160
SULFURIC ACID	3	47.4
TOLUENE	4	1.7
TRICHLOROACETIC ACID	0	160
XYLENE	4	10.8

- C. A laboratory coat should be worn while conducting laboratory activities when contamination is possible in order to reduce the potential for chemical contact and to protect street clothing. When significant potential for liquid contact exists, the use of safety goggles, impervious gloves and an impervious apron over the laboratory coat must be considered. A fire resistant lab coat must be worn in situations where a violent chemical reaction/heat is possible (Sec 5.2.9).
- D. When working with allergenic, sensitizing, or toxic chemicals, gloves should be worn that are resistant to permeation by the chemical and inspected by the user for the absence of pin holes.
- E. Whenever exposure by inhalation is likely and exceeds OSHA's airborne limits described in the Safety Data Sheet (SDS) a chemical fume hood must be used; if this is not possible consult with your supervisor and/or Environmental Health and Safety before doing any such work. Researchers are encouraged to work with hazardous chemicals in a chemical fume hood at all times.
- F. Carefully inspect all protective equipment before using. **Do not use defective protective equipment.** Keep protective equipment clean.
- G. Laboratory users should ensure that they have in their laboratory an eyewash unit connected to the potable water supply. This eyewash unit should be operated periodically (at least weekly) by the user to verify proper operation and **testing documented on log**. Keep electrical wires/equipment away from the area of the eyewash.
- H. Laboratory users should know the location of the nearest emergency shower.

5.1.4 Housekeeping

- A. Access to emergency equipment, showers, eyewashes, and exits should never be blocked by anything, not even a temporarily parked chemical, housekeeping or maintenance type cart and/or construction material. Do not stage regulated medical waste bins awaiting pickup or packing material in the vicinity of a safety shower.
- B. Original labels on containers of chemicals must be protected so that the identity of the contents and the hazards those contents present is known. When chemicals are transferred from the original container to a secondary container, a new label should be attached that shows the chemical name(s) and primary hazard (flammable, corrosive, etc.). In any event, at the end of each workday, the contents of all unlabeled containers should be labeled and spent chemicals are to be considered wastes and placed into a properly labeled waste container. If unlabeled containers of chemicals are discovered, properly label the container if the contents are known, or call Environmental Health and Safety so that the material can be properly identified and disposed. Every effort should be made to identify its contents as handling/processing an unknown chemical is very dangerous to staff.
- C. Laboratory personnel should keep all work areas, especially laboratory benches, clear of clutter.
- D. All aisles, hallways, and stairs (egress paths) should be kept clear of all chemicals as required by fire codes and the Fire Marshal.
- E. All chemicals should be placed in their assigned storage areas at the end of each workday. See also 5.2.2.
- F. Promptly clean up all small chemical spills on previously prepared surfaces when appropriate expertise, protective apparel and equipment and disposal resources are available to safely accomplish the task. Properly dispose of the spilled chemical and cleanup materials through Environmental Health and Safety. For emergency assistance dial "7777" and report the incident to the Public Safety Dispatcher.
- G. All working surfaces and floors should be cleaned regularly. Always, consider the measures that should be taken to prevent injury to personnel entering the laboratory to clean, collect waste, repair or remove equipment, etc.

5.1.5 Prior Approval (See also 5.2)

- A. Mandatory Prior Approval by Environmental Health and Safety (x2723):

Employees must obtain prior approval to proceed with a specific laboratory task from the PI in the research laboratory or the supervisor in other laboratories and Environmental Health and Safety when:

- When a task is inherently dangerous; such as the use of a poisonous gas, risk of explosion, perchloric acid work, etc.
- A laboratory accident has occurred or it is suspected that laboratory personnel may have become ill because of the laboratory work and the cause has not been identified and corrected.
- Working with dangerous materials, see Section 5.2.9, 5.2.10.

- B. Suggested Prior P.I./Supervisor Approval

Employees should obtain prior approval to proceed with a laboratory task from the PI in the research laboratory or the supervisor in other laboratories when:

A new laboratory procedure or test is to be carried out that has potentially dangerous or toxic repercussions.

It is likely that toxic limit concentrations (PEL, TLV, etc.) could be exceeded or that other harm is likely. See also paragraph 5.1.7.

There is a failure of any equipment used in the process, especially safeguards such as fume hoods or clamped apparatus.

There are unexpected results/reactions that could impact safety.

Working alone or unattended operation.

5.1.6 Spills and Accidents

Small chemical spills onto previously prepared surfaces should be promptly cleaned up when appropriate expertise, protective apparel, equipment and proper disposal resources are available to safely accomplish the task. Environmental Health and Safety staff are trained to OSHA's Hazardous Material Technical level to handle other than small controlled spills. If emergency assistance is needed dial "7777" and report the incident to the Public Safety Dispatcher or pull a fire alarm station. Assistance will be provided in accordance with an Institutional Contingency Plan. If in doubt, the spill should be reported to Public Safety, the laboratory cleared of personnel and the laboratory door kept closed. See also paragraph 5.1.1A. Environmental Health and Safety should also be called for assistance.

Any employee injury or suspected occupational illness must be reported to Human Resources (x4589) where a report of injury will be completed. See also paragraph 4.2. Medical treatment/evaluation of such occupational incidents is handled during normal work hours by Employee Health Service (x2893). Outside of normal work hours contact or visit the Emergency Department (x2588) and inform them that you are a UConn Health Employee and care is required for a work-related incident. Dial "7777" for help in an emergency.

5.1.7 Workplace Monitoring

OSHA and this CHP recognize that regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices or when a highly toxic substance is stored or used regularly. The Chemical Hygiene Officer should be contacted when such monitoring may be indicated. The CHO will then determine when such monitoring is needed and accomplish such monitoring when necessary.

The Chemical Hygiene Officer will monitor the employee's exposure as required by the Laboratory Standard, to any substance regulated by an OSHA standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level threaten to exceed the permissible exposure limit [PEL]).

5.1.8 Waste Chemicals

Chemical wastes are to be handled and disposed of as outlined in paragraph 5.1.1 (Q). Environmental Health and Safety collects chemical wastes for proper disposal.

5.1.9 Safe Storage of Chemicals – Chemical Compatibility Chart

It is imperative that chemicals and/or chemical waste be stored to avoid spontaneous chemical reactions that could jeopardize personal safety. The table below places various chemicals into groups and indicates what groups can be safely stored in the same immediate area. If any questions arise, please contact Environmental Health and Safety (x2723).

5.1.10 Working alone

Working alone must be avoided when the potential for a debilitating injury is possible. Such situations would include working with power equipment, high pressure systems, very reactive chemicals toxic gases/vapors that could render an individual unconscious, a lab member should maintain a “buddy system”. Should an accident occur, the “buddy” can call for immediate assistance and render first aid. See also 5.1.1M, Unattended Operations.

5.1.11 Chemical Inventory Program

UConn Health has implemented a process for tracking all incoming hazardous chemicals. Environmental Health and Safety bar codes significant volumes of chemicals and enters that information into a database. Bar coded chemicals will have “red ball sticker” (or similar) on the container to assist in identification. The Principal Investigator and/or lab staff must inform Environmental Health and Safety when a container is empty or discarded, or when a chemical container is moved to another location. Call x2723 for reporting a spent or moved chemical container. See Environmental Health and Safety website for a full description of the inventory program.

Chemical Compatibility Chart

Below is a chart adapted from the CRC Laboratory Handbook, which groups various chemicals in to 23 groups with examples and incompatible chemical groups. This chart is by no means complete but it will aid in making decisions about storage. For more complete information please refer to the MSDS for the specific chemical.

Group # Name	Example	Incompatible Groups
1 Inorganic Acids	Hydrochloric acid Hydrofluoric acid Hydrogen chloride Hydrogen fluoride Nitric acid Sulfuric acid Phosphoric acid	2,3,4,5,6,7,8,10,13,14,16,17,18,19,21,22,23
2 Organic acids	Acetic acid Butyric acid Formic acid Propionic Acid	1,3,4,7,14,16,17,18,19,22
3 Caustics	Sodium hydroxide Ammonium hydroxide solution	1,2,6,7,8,13,14,15,16,17,18,20,23
4 Amines and Alkanolamines	Aminoethylethanolamine Aniline Diethanolamine Diethylamine Dimethylamine Ethylenediamine 2-Methyl-5-ethylpyridine Monoethanolamine Pyridine Triethanolamine Triethylamine Triethylenetetramine	1,2,5,7,8,13,14,15,16,17,18,23
5 Halogenated Compounds	Allyl chloride Carbon tetrachloride Chlorobenzene Chloroform Methylene chloride Monochlorodifluoromethane 1,2,4-Trichlorobenzene 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	1,3,4,11,14,17
6 Alcohols Glycols Glycol Ether	1,4-Butanediol Butanol (iso, n, sec, tert) Diethylene glycol Ethyl alcohol Ethyl butanol Ethylene glycol Furfuryl alcohol Isoamyl alcohol Methyl alcohol Propylene glycol	1,7,14,16,20,23
7 Aldehydes Acetaldehyde	Acrolein Butyraldehyde Crotonaldehyde Formaldehyde Furfural Paraformaldehyde Propionaldehyde	1,2,3,4,6,8,15,16,17,19,20,23
8 Ketones	Acetone Acetophenone Diisobutyl ketone Methyl ethyl ketone	1,3,4,7,19,20
9 Saturated Hydrocarbons	Butane Cyclohexane Ethane Heptane Paraffins Paraffin wax Pentane Petroleum ether	20
10 Aromatic Hydrocarbons	Benzene Cumene Ethyl benzene Naphtha Naphthalene Toluene Xylene	1,20

11 Olefins	Butylene 1-Decene 1-Dodecene Ethylene Turpentine	1,5,20
12 Petroleum Oils	Gasoline Mineral Oil	20
13 Esters	Amyl acetate Butyl acetates Castor oil Dimethyl sulfate Ethyl acetate	1,3,4,19,20
14 Monomers Polymerizable Esters	Acrylic acid Acrylonitrile Butadiene Acrylates	1,2,3,4,5,6,15,16,19,20,21,23
15 Phenols	Carbolic acid Cresote Cresols Phenol	3,4,7,14,16,19,20
16 Alkylene Oxides	Ethylene oxide Propylene oxide	1,2,3,4,6,7,14,15,17,18,19,23
17 Cyanohydrins	Acetone cyanohydrin Ethylene cyanohydrin	1,2,3,4,5,7,16,19,23
18 Nitriles	Acetonitrile Adiponitrile	1,2,3,4,16,23
19 Ammonia	Ammonium Hydroxide Ammonium Gas	1,2,7,8,13,14,15,16,17,20,23
20 Halogens	Chlorine Fluorine	3,6,7,8,9,10,11,12,13,14,15,19,21,22
21 Ethers	Diethyl Ether THF	1,14,20
22 Phosphorus	Phosphorus, Elemental	1,2,3,20
23 Acid Anhydrides	Acetic anhydride Propionic anhydride	1,3,4,6,7,14,16,17,18,19

Incompatible Groups:

Acidic and Alkaline
 Spontaneously Combustible and Acidic
 Acidic and Flammable
 Acidic and Cyanide
 Acidic and Reactive Sulfides
 Oxidizers and Organics
 Nitrates and Acids
 Ammoniated Compounds and Hypochlorites and Bleach
 Organic Nitrates/Perchlorates and other Oxidizers or Metals
 Azides and Metals, Metal Salts, Acids, Strong Oxidizers, Halogens
 Perchloric Acid and Metals, Metal Salts, Charcoal, Ethers, Organics, Combustibles, Acids

5.2 Procedure-Specific Safety Procedures Special Chemicals

Any written laboratory procedures should include a written description of the specific safety practices required by and/or reference the CHP. Employees should read and understand these practices and Chemical Hygiene Plan requirements before commencing a procedure. Specific additional safety procedures follow, in this section, for the laboratory use of chemicals that may present special hazards.

5.2.1 Procedures for Carcinogens, Reproductive and other Toxins, Substances That Have a High Degree of Acute Toxicity, and Chemicals of Unknown Toxicity

For enhanced protection laboratory employees must follow the additional procedures described in this section when performing laboratory work with any **select carcinogen, reproductive and other toxins**, substance that has a **high degree of acute toxicity**, or a chemical whose **toxic properties are unknown** (when using or handling amounts greater than a few milligrams to a few grams, depending on the substance). These additional procedures do not apply when the principal investigator/supervisor has coordinated the work with the Chemical Hygiene Officer (CHO) and the CHO has concluded that exposures, because of the conditions of use, will not routinely exceed the action level or the permissible exposure level or when the CHO and Principal Investigator/supervisor have agreed on other safety procedures.

A. The following definitions will apply for UConn Health defined SPECIAL CHEMICALS:

1. **Select carcinogen:** Any substance defined as such in 29 CFR 1910.1450 and any other substance described as such in the applicable SDS. See Appendix A, paragraph 1910.1450 b, for the OSHA definition. Appendix B lists such chemicals commonly used in medical research and the approval levels for using certain quantities of the listed chemicals. The UConn Health's **Guidelines for The Laboratory Use of Chemical Carcinogens** (available from Environmental Health and Safety) follows the procedures used at the NIH and applies to the use of such Appendix B carcinogens at the UConn Health. Appendix D is an expanded list of select carcinogens. A chemical listed in Appendix D, but not in Appendix B, must be used in accordance with the procedures outlined in 5.2.1 B to F.
2. **Reproductive and other toxins:** Reproductive toxins are any substance described as such in the applicable SDS. Consider also those substances identified as such in Thomas H. Shepard, **Catalog of Teratogenic Agents**, 6th ed., Johns Hopkins Hospital. Examples of reproductive toxins include dibromochloro-propane (DBCP), ethylene oxide, inorganic lead compounds, formamide, alkyl mercury compounds and glycol ethers (2-methoxy-ethanol, 2-ethoxyethanol, and their acetates). Questions on reproductive toxins should be addressed to Environmental Health and Safety. See Appendix A, paragraph 1910.1450 b for the OSHA definition.

Toxins (i.e., biological toxins): A comprehensive list of all biological toxins would be too large to include here, however, biological toxins include bacterial endo- and exotoxins, vertebrate, invertebrate and plant venoms and poisons, or any toxic product of a biological organism. Some of the most toxic molecules are produced biologically.

Use, Possession and transportation of “select agent” biological toxins are prohibited by Federal law, and very severe criminal and/or civil penalties exist for these activities when unauthorized. Use of “select agent” toxins must be approved by the Biological Safety Officer and/or the Institutional Biosafety Committee and they must be ordered through Environmental Health and Safety. A current list of “select agents” including toxins may be found at <http://www.cdc.gov/od/sap/>.

For safe handling of biological toxins, refer to Section VIII-G and Appendix I (eye) of Biosafety in Microbiological and Biomedical Laboratories 5th Ed. (<http://www.cdc.gov/od/ohs/biosfty/bmb15/bmb15toc.htm>)

If planning experimentation with aerosolized or nebulized biological toxins, please contact Environmental Health and Safety (EHS) for guidance about use of engineering controls. Cloning or other work with nucleic acids coding for biological toxins may fall under the NIH Guidelines for Research Involving Recombinant DNA Molecules and require documentation and Institutional Biosafety Committee approval. Please contact Environmental Health and Safety.

3. **High acute toxicity** substance: Any DOT poison gas and any substance described in the applicable SDS as a "highly toxic chemical" (e.g. hydrogen cyanide). Questions on substances that should be considered "high acute toxicity" must be referred to Environmental Health and Safety.
 4. Chemicals with **unknown toxicity**: A chemical for which there is no known statistically significant study conducted in accordance with established scientific principles that establishes its toxicity.
 5. **Designated Area**: A hood, glove box, portion of a laboratory, or an entire laboratory room designated as the only area where work with quantities of the "special chemical" shall be conducted.
- B. Prior to ordering a "special chemical" the principal investigator/laboratory supervisor must determine how to comply with these additional safety requirements. Prior to use the PI/supervisor must specify the designated area(s) and post the boundaries clearly. The principal investigator/supervisor designating an area for the use of "special chemicals" must consult with Environmental Health and Safety and post the designated area in accordance with recommendations. OSHA places very strict requirements on the use of certain carcinogens. Only those persons trained by the principal investigator/supervisor to work with the "special chemical" and informed of its toxicity may use the substance. Such work must be done in the designated area. All users of special chemicals should conduct their work in accordance with the CHP and the principles outlined below. Certain biological toxins require registration with the Federal Government, background checks on users and other measures PRIOR TO obtaining the substance. See select agent list in Section 5.2.1.A.2. Unauthorized use of these materials will result in SEVERE personal Federal penalties.
1. Use the smallest amount of chemical that is consistent with the requirements of the work to be done. A materials inventory log is required as well as increased security for access to such areas.
 2. Minimize personal exposure by the consistent use, as appropriate, of a chemical hood, properly selected gloves, safety goggles, and laboratory coat that is removed by the individual prior to his/her leaving the laboratory.
 3. Use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.
 4. Work on a spill containment tray and/or absorbent pad to facilitate cleanup and decontamination in case of a spill.
 5. Prepare any wastes from work with "special chemicals" for disposal as recommended by Environmental Health and Safety.

6. If the chemical is listed in Appendix B or D, conform to the recommendations of UConn Health's **Guidelines for The Laboratory Use of Chemical Carcinogens**.
- C. During storage and use, compressed gas cylinders containing a DOT poison gas should be kept in a ventilated enclosure (e.g. a lecture bottle of chlorine in a lecture bottle stand in a chemical hood). The user should keep other "special chemicals" in closed containers inside a closed secondary container in an area where the container is protected from damage. Both containers should have a proper label that identifies the contents and the type of special chemical hazard(s). Where feasible, containers of "special chemicals" should be kept in a locked cabinet, drawer, room, etc.
 - D. Because the decontamination of jewelry may be difficult or impossible, jewelry should not be worn when working with "special chemicals."
 - E. Any surface contaminated with a "special chemical" should be properly disposed of or thoroughly cleaned and decontaminated. For a limited number of chemicals, suggested decontamination methods are available from Environmental Health and Safety. When such proven decontamination methods are not available, the potentially contaminated area should be cleaned three times with a suitable solvent and then double rinsed with water. Contact Environmental Health and Safety for information on how to dispose of contaminated materials and materials used to decontaminate surfaces. See also Section 5.1.6 on spills.
 - F. As a minimum, during use of "special chemicals" users should wear gloves resistant to permeation by the "special chemical", a laboratory coat and, if eye contact is possible, safety goggles. Wash hands and the face promptly if contact is suspected and as soon as work with such "special chemicals" is completed. See also Section 5.1.3.

5.2.2 Procedures for Flammable Chemicals

In general, the flammability of a liquid is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical's vapor to ignite momentarily in air under certain controlled conditions.

- A. Liquids with a flash point below 100 °F (37.8 °C) are considered "flammable liquids."
- B. OSHA standards and the National Fire Protection Association (NFPA) guidelines apply to the use of flammable liquids in the laboratory. Consultant advice on these Fire Safety Regulations is available from the UConn Health's Fire Marshall.
- C. Quantities of flammable liquids in the laboratory should be kept to a minimum consistent with laboratory needs and fire code mandates. Flammable liquids should be stored as required in this CHP under Section 5.3.2, Flammable liquids. Large volume containers (4 Liter, 20 Liter (5 gallon)) containers must be stored in a flammable storage cabinet or stored in the high hazard chemical storage rooms located on the renovated "L" building. Items from which flammable vapors can evolve (e.g. ether) must not be stored in refrigerators/freezers, unless they are explosion-proof or explosion-safe.

- D. Flammable liquids should be used only in well ventilated areas away from sources of ignition.
- E. Special fire hazard potentials should be assumed to exist whenever oxygen is in use and/or oxygen concentrations in air are elevated above normal levels.
- F. Always store flammable liquids away from oxidizers. Some common strong oxidizers are listed in Appendix E.
- G. Be aware that liquids with flash points at and above 100°F may also present a significant fire hazard in case of ignition.

5.2.3 Procedures for Reactive Chemicals

Reactive chemicals are substances which may enter into violent reactions with the spontaneous liberation of heat and/or gases too rapidly to be safely dissipated. This may result in the rupture of the container, an explosion, fire or the release of toxic gases/vapors. Reactive chemicals have often been categorized into two groups. The first group, Unstable Compounds, includes Explosives (e.g. TNT) and Others (e.g. monomers such as ethylene). The second group of reactives, Unstable Mixtures, includes Explosives (purposefully mixed oxidizers and reducers, such as black powder), Air Sensitive Compounds (e.g. phosphorus), Water-Reactive Compounds (e.g. sodium metal) and Other Mixtures of oxidizing agents with reducing agents (e.g. perchloric acid and cellulose). Labels may indicate that the chemical has reactive properties by a symbol such as **oxy**(oxidizer) or **-W**-(water reactive). The most complete and reliable reference on chemical reactivity is found in the current edition of the **Handbook of Reactive Chemicals** by L. Bretherick, published by Butterworths and kept in Environmental Health and Safety. Reactivity information is also commonly found on the manufacturers' MSDSs. Consult Environmental Health and Safety for more information on reactive chemicals.

- A. A reactive chemical is one that:
 - 1. Is described as such in Bretherick or on the MSDS;
 - 2. Is ranked by the National Fire Protection Association (NFPA) as 3 or 4 for reactivity;
 - 3. Is identified by the DOT as
 - An oxidizer,
 - An organic peroxide, or
 - An explosive, Class A, B, or C,
- NOTE:** Appendix E lists some common laboratory reagents that have reactive properties that require special precautions during use and storage.
- B. Laboratory users should handle reactive chemicals with all proper safety precautions, including segregation in storage. For example, nitric acid (a good oxidizer) should not be stored with flammables. Water reactives should not be stored in a location where the item could get wet. Users should not mix for the first time even small quantities of such reactive chemicals with other chemicals without prior approval of the P.I./supervisor. For hot perchloric acid digestions contact Environmental Health and Safety. This is necessary because the condensation of

hot perchloric acid vapors inside the hood can result in the formation of explosive compounds that are shock sensitive. If picric acid crystals must be used, procedures should be established to keep the crystals moist with water. Dry picric acid crystals are a shock sensitive explosive. These materials can form such sensitive explosives and must be handled and stored with extreme care. Some chemicals upon aging form reactive compounds. For example, diethyl ether forms peroxides. Thus, ether has an expiration date. Users should make all attempts at using less hazardous alternate methods or product substitution as these hazards have been previously addressed. Users should limit quantities of such materials and have a management system so that outdated quantities of ether are collected by Environmental Health and Safety. Use of these materials should be avoided and handled with extreme caution. Environmental Health and Safety should be contacted for detailed advice on handling these materials.

5.2.4 Procedures for Corrosive Chemicals and Contact-Hazard Chemicals

Corrosive chemicals are those substances that, by direct chemical action, are injurious to body tissues or corrosive to metals. Users of corrosive liquids should take special precautions so that direct contact does not occur. Common corrosive liquids include the inorganic acids (hydrochloric, nitric, etc.), organic acids (acetic, butyric, etc.), caustic solutions (ammonia, sodium hydroxide, etc.), other inorganics (bromine, phosphorous trichloride, etc.), and other organics (acetic anhydride, liquefied phenol, 2-aminoethanol, etc.). Corrosivity, allergenic, and sensitizer information is given in manufacturers' MSDSs and on labels.

A. A corrosive chemical is one that:

1. Fits the OSHA definition of corrosive; or
2. The SDS states that the material is corrosive or identified on the container label.
3. Defined by the DOT as a corrosive.

B. A contact-hazard chemical is an allergen or sensitizer that:

1. Is so identified or described in the SDS or on the label;
2. Is so identified or described in the medical or industrial hygiene literature; or
3. Is known or found to be an allergen or sensitizer.

C. As noted in 5.1.3 corrosive and contact hazard chemicals should be handled with all proper safety precautions, including wearing safety goggles when the potential exists for eye contact, gloves tested for absence of pin holes and resistant to permeation and degradation, and a laboratory coat and/or laboratory apron, as appropriate. Always consider the additional need for a faceshield, especially in case of a splash potential. In case of direct contact with such chemicals, immediately irrigate the area with copious amounts of water and seek medical attention. Take note of eyewash, sinks and emergency shower locations.

5.2.5 Procedures for Compressed Gases

Note the special procedures in paragraph 5.2.1.A.3 and 5.2.1.C that must be followed when using compressed gases classified as a "poison" by the DOT. All compressed gas cylinders must be kept properly secured during transportation, storage and use. Cylinders equipped for a protective valve cap must have the protective cap installed during any cylinder movement and during storage (cylinders should not be moved with the regulator installed). Users and P.I.s/supervisors are encouraged to consult Environmental Health and Safety for more specific safety information on the gases or gas mixtures they plan to use.

5.2.6 Procedures for Cryogenic Liquids

In addition to the potential hazards that may result because of their chemical composition, cryogenic liquids have other hazardous properties related to their low temperatures and the tremendous volumes of gases released upon vaporization. These materials evaporate very quickly and can cause an oxygen deficient atmosphere if used in large quantities. In some situations an oxygen monitor may be appropriate. Cryogenic liquids should be used and transported in containers designed to handle such liquids. Areas where such materials are used or stored should be well ventilated. When working with such liquids users should wear suitable protective equipment (e.g. protective gloves, a laboratory coat, and when the potential exists for a splash an impermeable apron and eye protection). Extreme care should always be taken to have an open vent on such containers because liquid vaporization can cause extreme pressures to be generated if the container is not adequately vented. Properly insulated gloves must be worn to avoid freezing of extremities.

5.2.7 Procedures for Chemotherapy Agents

For detailed procedures on safe handling and disposal of antineoplastic and hazardous drugs call Environmental Health and Safety or visit <http://wp.research.uh.uconn.edu/rcs/ehs/>

5.2.8 Homeland Security Chemicals of Interest

The Department of Homeland Security has developed a list of chemicals that could be a threat to National Security. The quantities of these chemicals present on the UConn Health campus are limited by this Federal Regulation and such chemicals must be tracked by Environmental Health and Safety. A list of these chemicals is provided in Appendix G. Inventories of these chemicals are maintained using the chemical inventory system.

5.2.9 Pyrophoric and Water Reactive Chemicals

Pyrophoric materials are those chemicals that ignite upon exposure to oxygen and/or water. *Violent reactions can occur if these materials are not properly handled, causing serious injury and/or death.* Extreme heat and hydrogen are liberated upon ignition and protection from this physical hazard is of utmost importance. These materials also pose other common hazards such as corrosivity, teratogenicity, organic peroxide formation, and potential damage to the liver, kidneys and other body organs if material enters the body. **Call Environmental Health and Safety for guidance and review of your proposed procedure if you plan to use these materials.** It is imperative that the SDS (Safety Data Sheet, formally known as MSDS) be consulted prior to handling

any chemical. Appendix E, Sections B, C, D, E and F contain a partial list of chemicals that are of significant concern. A general listing of common chemicals that react violently with water (humid air) and/or oxygen and that must be stored so that they never come in contact with air include but not limited to:

Alkali metals (lithium, sodium, potassium, rubidium, cesium)
Alkali metal hydrides
Alkali metal amides
Metal alkyls, such as lithium alkyls/aluminum alkyls
Grignard reagent (mixture includes magnesium and ethyl ether)
Halides of non-metals, BCL_3 , BF_3 , PCL_3 , PCL_5 , $SiCL_4$, S_2CL_2
Anhydrous metal halides, $ALCL_3$, $TiCL_4$, $ZrCL_4$, $SnCL_4$
Phosphorous pentoxide
Calcium carbide

General guidance for controlling the hazards from these chemicals includes:

- Use another chemical that is safer
- Obtain minimal volumes
- Do not accumulate these chemicals
- Obtain and become familiar with the SDS
- Develop a procedure with Office of Research Safety Input
- Safety and hands on training is required
- Knowledge of emergency showers and eyewash locations
- Do not work alone with these materials
- Develop Emergency procedures

It is also imperative that personal protective equipment (PPE) be used at all times. As a minimum:

- Wear ANSI/OSHA Approved safety glasses
- Wear full face shield if potential for explosion exists
- Wear protective gloves
- Fire Resistant lab coats are required
- Open toed shoes are not permitted
- Work in a fume hood/glove box

5.2.10 Peroxidizable Compounds

Peroxidizable compounds tend to absorb and react with oxygen from the air to form unstable peroxides. The table below lists specific chemicals that are peroxidizable. Procedures for handling these compounds include:

1. Date all peroxidizable compounds **when received** and **when opened**.
2. Compounds in Group A should be discarded as waste 3 months after opening. Group B compounds 1 year after opening.
3. Inspect all containers of undetermined age prior to opening. If container appears old or in bad condition, do not attempt to open.
4. Order minimal amounts of these chemicals. Avoid inventory build-up.
5. Store separately from oxidizers and mineral acids.

Table 1 -- Peroxidizable compounds

Group A

Isopropyl ether	
Divinyl acetylene	Butadiene
Vinylidene chloride	Vinyl pyridine
Potassium metal	Tetrafluoroethylene
Sodium metal	Chloroprene
Group B	
Diethyl ether	<i>Shock/heat-sensitive compounds</i> Ammonium perchlorate
Dicyclopentadiene	Dibenzoyl peroxide
Tetrahydrofuran	Ammonium permanganate
Diacetylene	Anhydrous perchloric acid
Dioxane	Dinitrobenzene (ortho)
Methyl acetylene	Butyl Hydroperoxide
Decahydronaphthalene (Decalin)	Ethyl methyl ketone peroxide
Tetrahydronaphthalene (Tetralin)	Butyl perbenzoate
Ethylene glycol dimethyl ether	Ethyl nitrate
Vinyl ethers	Butyl peroxyacetate, tert
Acetamethyl methacrylate	Hydroxylamine
Chlorotrifluoroethylene	Peroxyacetic acid
Styrene	1Chloro2,4dinitrobenzene
Vinyl acetylene	Picric acid
Acrylic acid	Cumene hydroperoxide
Vinyl acetate	Trinitrobenzene
Acrylonitrile	Diacetyl peroxide
Vinyl chloride	Trinitrotoluene

5.3 Control Measures and Equipment

Chemical safety is achieved by continual awareness by the user and P.I./supervisor of the specific hazards of the chemicals being used and by reducing the risk of such potential hazards by the implementation of suitable practices and controls, including engineering controls (e.g. chemical hoods). P.I.s and laboratory supervisors should be alert to detect the malfunction of engineering and other safeguards. All engineering safeguards and controls should be properly maintained, inspected on a regular basis, and never overloaded beyond their design limits. Facilities Development & Operations maintains and inspects installed engineering controls such as chemical hoods in order to ensure their proper performance. The Bioengineering Facility can provide investigators, on a fee-for-service basis, assistance on problems related to laboratory instrumentation. Users should follow proper procedures so that they obtain the full protection that may be afforded by such controls. Users should promptly report suspected problems with installed engineering controls, such as chemical hoods, to Facilities Development & Operations for evaluation and correction (at no charge to the user). Environmental Health and Safety can provide special training on the proper use of such controls and routinely verifies the proper operation of chemical fume hoods.

5.3.1 Ventilation

- A. Facilities Development & Operations will maintain good laboratory ventilation (supply and exhaust air). Work with significant quantities of toxic chemicals that have low air concentration limits, or that have high vapor pressures, should always be done in a fume hood. During nights and weekends, laboratory supply ventilation is reduced and users should place special emphasis on using chemical fume hoods for all operations that might release significant amounts of chemicals and/or contact Facilities Development & Operations so that their general ventilation needs can be met. Such Facilities Development & Operations contact can be made 24-hours a day by calling the Environmental Control Center (ECC, ext. 2338).
- B. Chemical hoods should provide a minimum average face velocity of 100 feet per minute at a 24" sash height for new VAV (Variable Air Volume) hoods and a 75 feet per minute average face velocity for original hoods (no controller). Environmental Health and Safety maintains a file of annual hood flow certifications. Call Environmental Health and Safety for any questions (x2723).
- C. Laboratory employees should understand and comply with the following principles:
 - 1. A chemical fume hood is a safety backup for condensers, traps, or other devices that collect vapors and fumes. It should not be used to "dispose" of chemicals by evaporation unless the vapors are trapped and recovered for proper waste disposal. For a chemical fume hood to provide significant protection it must be used and maintained properly by the user;
 - 2. The work or apparatus inside the hood should be placed at least six inches behind the sash;
 - 3. The fume hood sash should be closed at all times except when necessary to adjust the apparatus that is inside the hood (when hoods have horizontal sliding panes, the panes should be kept closed);
 - 4. The hood fan should be kept "on" whenever a chemical is inside the hood, whether or not any work is being done in the hood;
 - 5. Personnel should be aware of the steps to be taken in the event of power failure or other hood failure (e.g. stop work, cover chemicals, close hood, notify supervisor or PI);
 - 6. Environmental Health and Safety inspects hoods semi-annually to be sure they are working properly;
 - 7. Hoods should not normally be used as storage areas for chemicals, apparatus, or other materials.
- D. Environmental rooms are NOT well ventilated and procedures carried out in such rooms should be carefully designed to minimize personal exposures.
- E. In addition to chemical hoods, many laboratories have biological safety cabinets. Users are responsible for an initial and yearly certification of biosafety cabinets used for personnel protection as outlined in the UConn Health's Biosafety Guidelines. Volatile materials must not be used in a biological safety cabinet as it re-circulates air back into the lab.

- F. Hot perchloric acid digestions are not permitted without prior approval by Environmental Health and Safety.

5.3.2 Flammable Liquid Storage

- A. Flammable liquids (see paragraph 5.2.2) in quantities greater than 500 mL should be kept in flammable liquids storage cabinets or in the chemical storage rooms provided in the renovated floor of "L" building. If such flammable liquid storage cabinets are not available, the flammable liquids should be kept inside cabinets and not left on the floor or counters. When flammable storage cans are used, never disable the spring-loaded closure. Always keep the flame-arrestor screen in place; replace the screen if it is punctured or damaged. Flammables should not be stored with incompatible materials like oxidizers or in refrigerators and freezers unless they are explosion-proof or explosion-safe. Refrigeration explosions have occurred due to vaporization of flammables in storage and ignition when the compressor switches on.
- B. Cabinets designed for the storage of flammable materials should be properly used and maintained. The user should read and follow the manufacturer's information and should also follow these general safety practices:
1. Store only compatible materials inside a cabinet;
 2. Do not store paper or cardboard or other combustible packaging material with flammable liquids;
 3. The manufacturer establishes quantity limits for various sizes of flammable-liquid storage cabinets; cabinet should not be overloaded.

5.3.3 Eyewash Fountains and Safety Showers

- A. All laboratories have been provided with an eyewash connected to the potable water system. Safety showers are located in the hallways. Users need to know the location and how to operate such devices.
- B. Users need to flush and check (and document) the functioning of their eyewash fountains weekly and make sure that electrical wires, glassware and other devices are clear of the eyewash. Facilities Development & Operations periodically checks the emergency showers and verifies proper operation. Users are encouraged to report problems with eyewash locations promptly to Facilities Development & Operations for evaluation and repair.
- C. Be sure that access to eyewash fountains and safety showers is not restricted or blocked.

5.3.4 Respirators

- A. UConn Health has a respirator use policy and can be found on Environmental Health and Safety (EHS) homepage. (See Section 2.0). Use of respirators to protect against a chemical exposure requires that the potential respirator user contact Environmental Health and Safety so that the following actions are coordinated and completed:
- Evaluation of air concentration of agent as necessary

- Selection of the respirator by the EHS;
 - Annual Fit testing of the respirator by the EHS;
 - Training on the use, care and limitations of the respirator by the EHS; and
 - Annual Employee medical certification to wear a respirator by Employee Health Service.
- B. Surgical masks are not to be used nor are they sufficient to provide respiratory protection against chemical or particulate exposures.
- C. Engineering and process controls are the preferred method of controlling airborne exposures to chemical vapors and particulates. Respirators may be used under very specific conditions with prior approval by Environmental Health and Safety.
- D. Respirators may be worn on a voluntary basis if an employee contacts the EHS. This would include situations where exposure to nuisance dusts, mold, animal dander, etc may be possible.

5.3.5 Vapor Detection

Odor should not be relied upon as a means of determining that inhalation exposure limits are or are not being exceeded but can be an indication of a problem. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, whether or not a suspicious odor is noticed, notify the supervisor and/or Environmental Health and Safety. Odors that may pose an eminent danger (i.e., natural gas smell) should be handled as an emergency and "7777" should be called and the area cleared. UConn Health Fire personnel will respond. As an interim measure, laboratory use of the chemical should be stopped, or the use of the chemical limited to a chemical hood.

5.3.6 Asbestos

Original laboratory and hood counters were made of an asbestos cement material. Hood walls are often made of asbestos board. These materials present no health problem unless the fibers are released to the air. Thus, such counters and walls should be kept in good condition and must not be drilled, cut, etc. since such action could release asbestos fibers into the air. All renovation/construction work should be referred to the Facilities Development & Operations (x2125). Please refer to the UConn Health [Asbestos Awareness Policy](#) for more detailed information.

6. RECORDS AND RECORDKEEPING

6.1 General

The Laboratory Standard requires that records of air concentration monitoring results, exposure assessments, medical consultations, and examinations be maintained and that they be accessible to employees or their representatives and CT OSHA.

6.2 Environmental Health and Safety (EHS)

EHS maintains the records of air concentration monitoring results and exposure assessments. Additionally, EHS maintains records of attendance at Laboratory Safety Training sessions and

maintains UConn Health's OSHA 300 Log of Occupational Injuries and Illnesses. EHS also maintains the SDS computer database. (See Section 6.4 for access instructions)

6.3 Employee Health Service

The Employee Health Service maintains the records of medical consultations and examinations of employees.

6.4 Safety Data Sheets (formally MSDS)

OSHA has required the implementation of the world wide Safety Data Sheet (SDS) system that contains similar information as the MSDS publications. All governmental agencies are converting to the SDS system, as part of the GHS initiative, to create safety information for chemicals that is consistent worldwide.

The preferred method of accessing an SDS is through the internet or Environmental Health and Safety Homepage <http://wp.research.uh.uconn.edu/rcs/ehs>.

As a result of OSHA's Hazardous Communication Standard, manufacturers are required to supply SDS's with their products. An SDS provides detailed information regarding the properties of a chemical or material, including general safety information such as handling, personal protective equipment and response to spills. The SDS's are forwarded to Environmental Health and Safety, where they are scanned into a database and the hard copy filed. Users of chemicals are encouraged to copy SDS's they use for reference and forward the original SDS to EHS. It should be noted that SDS's may contain inaccuracies, or not provide enough details for an adequate safety evaluation. EHS should be contacted (x2723) if there are any questions or concerns about the use of a specific chemical.

As a back-up to the computer based system, EHS (x2723) can be contacted for hard copies of SDS's or to obtain verbal information for a particular SDS. The computer database may be accessed through Environmental Health and Safety homepage <http://wp.research.uh.uconn.edu/rcs/ehs/>.

Other sources of information resident in Environmental Health and Safety for chemical safety include:

Bretherick's **Handbook of Reactive Chemicals**; Lenga's The Sigma-Aldrich Library of **Chemical Safety Data**; Matheson's **Gas Data Book**; **The Merck Index** and **The NIOSH Pocket Guide to Chemical Hazards**

6.4.1 SDS Access Through Office of Research Safety Homepage

Initially, you may have to search for MSDS instead of SDS, until such time manufacturers issue new SDS's.

<http://wp.research.uh.uconn.edu/rcs/ehs/>

Click on "**MSDS Express Database**" (has product names and chemical names - Enter Chemical/Product Name

6.4.2 SDS Access Through Internet

Initially, you may have to search for MSDS instead of SDS, until such time manufacturers issue new SDS's.

Safety information, product information and SDS's are also available on the internet. Using a search engine such as Yahoo or Google information about most products is readily available. For example, Google "ethanol SDS".

6.5 Additional Information

Environmental Health and Safety and/or the Employee Health Service should be contacted when additional information is needed on the records outlined above or on chemical health and safety needs.

7. ACKNOWLEDGEMENTS/REFERENCES

The preparation of this Chemical Hygiene Plan relied upon the regulatory requirements of the OSHA Laboratory Standard and its nonmandatory appendices. Extensive material was incorporated from the references cited below:

- A. **Developing A Chemical Hygiene Plan**; J. Young, W. Kingsley, G. Wahl; American Chemical Society; 1990.
- B. **Prudent Practices for Handling Hazardous Chemicals in Laboratories**; National Research Council; National Academy Press; 1981.
- C. **Laboratory Standard Seminar**; J.T. Baker Inc.; Office of Training Services; 1990.
- D. **NIH Guidelines for the Laboratory Use of Chemical Carcinogens**; NIH Publication No. 81-2385, 1981.
- E. **SAF-T-TRAINING MANUAL, Hazard Communication and Right-to-Know Training Program**; J.T.Baker Chemical Co.; 1986.

8. ANNUAL REVIEW AND EVALUATION OF EFFECTIVENESS OF THE CHEMICAL HYGIENE PLAN

EHS will review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update its contents, if necessary. Faculty, staff and students are encouraged to provide suggestions for improvements of this plan to Environmental Health and Safety (x2723).

9. HAZARD COMMUNICATION PLAN UPDATE

The Occupational Safety and Health Administration implemented a Hazard Communication Rule, which UConn Health complied with as of the effective date of May 23, 1988. The purpose of this rule is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to the employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training. UConn Health developed a plan, "UConn Health Hazard Communication Rule Compliance Policy", which has been in effect since its inception date. The basic components of this plan were to ensure that SDS's are available to all employees, that effected staff and students are trained and that staff and students are informed of their right to know the hazards associated with handling chemical compounds. The original Hazard Communication Rule

Compliance Policy is available by contacting Environmental Health and Safety. This section (9.0) of the Chemical Hygiene Plan serves to update the original Hazardous Communication Rule Policy. OSHA's Hazard Communication Standard is attached in Appendix F.

9.1 Hazardous Communication Training and Right to Know

All new staff are required, as part of their Department of Human Resources Orientation, to attend a 4 hour training session. Environmental Health and Safety has a designated block of time to provide introductory training on hazards communication, SDS's and their availability, working with chemicals safely in the laboratory and other important safety related topics. New employees and students are instructed that if working in a lab or working with chemicals, more extensive training is required. The dates and times of these extensive training sessions are posted on Environmental Health and Safety's computer based home page. All new employees and students are provided a booklet during the Human Resources training session entitled "UConn Health Safety Information", which summarizes various safety issues, emergency phone numbers, procedures for waste disposal, etc.

Environmental Health and Safety, in conjunction with Human Resources and the Medical and Dental Dean's Offices, have established various methods for notifying new employees and students of training requirements. These methods include:

- A biweekly new employee training session during which introductory lab safety training is provided, and those who will be working in research/hospital labs are informed that they must attend a more detailed safety training session. These sessions are provided monthly. In addition, all new employees are given initial bloodborne pathogen training.
- New employees are provided a summary pamphlet that provides basic safety information and safety procedures.
- The Schools of Dental/Medical Education arrange specialized training sessions for new students with Environmental Health and Safety.
- Human Resources provides a new hire list to Environmental Health and Safety biweekly. The supervisors of individuals working in labs are notified by letter of training requirements and training dates.
- Environmental Health and Safety conducts lab safety audits twice yearly and during these inspections a list of lab employees is generated and training status determined. The lab supervisors are notified by letter of individuals that require training.

10. APPENDICIES

APPENDIX A

- **Part Number: 1910**
- **Part Title: Occupational Safety and Health Standards**
- **Subpart: Z**
- **Subpart Title: Toxic and Hazardous Substances**
- **Standard Number: 1910.1450**
- **Title: Occupational exposure to hazardous chemicals in laboratories.**

- Appendix: A, B

1910.1450(a)
Scope and application.

1910.1450(a)(1)
This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

1910.1450(a)(2)
Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

1910.1450(a)(2)(i)
For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

1910.1450(a)(2)(ii)
Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

1910.1450(a)(2)(iii)
Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

1910.1450(a)(3)
This section shall not apply to:

1910.1450(a)(3)(i)
Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

1910.1450(a)(3)(ii)
Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1910.1450(a)(3)(ii)(A)
Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

1910.1450(a)(3)(ii)(B)
Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

1910.1450(b)
Definitions —

Action level means a concentration designated in 29 CFR part 1910 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.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (see select carcinogen).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Hazardous chemical means any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§1910.1200).

Health hazard means a chemical that is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in appendix A of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definition of "simple asphyxiant").

Laboratory means 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 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. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a moveable 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.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

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

Medical consultation means 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.

Mutagen means chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (§1910.1200) shall be considered mutagens for purposes of this section.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self reactive; pyrophoric (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust.

The criteria for determining whether a chemical is classified as a physical hazard are in appendix B of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definitions of "combustible dust" and "pyrophoric gas").

Protective laboratory practices and equipment means 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.

Reproductive toxins mean chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this section.

Select carcinogen means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

1910.1450(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

1910.1450(d)

Employee exposure determination --

1910.1450(d)(1)

Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

1910.1450(d)(2)

Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

1910.1450(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(4)

Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

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).

1910.1450(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:

1910.1450(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii)

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

1910.1450(e)(2)

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

1910.1450(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;

1910.1450(e)(3)(i)

Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(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;

1910.1450(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;

1910.1450(e)(3)(iv)

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

1910.1450(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;

1910.1450(e)(3)(vi)

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

1910.1450(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

1910.1450(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:

1910.1450(e)(3)(viii)(A)

Establishment of a designated area;

1910.1450(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D)

Decontamination procedures.

1910.1450(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.

1910.1450(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.

1910.1450(f)(2)

Such information shall 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. The frequency of refresher information and training shall be determined by the employer.

1910.1450(f)(3)

Information. Employees shall be informed of:

1910.1450(f)(3)(i)

The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii)

the location and availability of the employer's Chemical Hygiene Plan;

1910.1450(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;

1910.1450(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(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, safety data sheets received from the chemical supplier.

1910.1450(f)(4)

Training.

1910.1450(f)(4)(i)

Employee training shall include:

1910.1450(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.);

1910.1450(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

1910.1450(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.

1910.1450(f)(4)(ii)

The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

1910.1450(g)

Medical consultation and medical examinations.

1910.1450(g)(1)

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1910.1450(g)(1)(i)

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 shall be provided an opportunity to receive an appropriate medical examination.

1910.1450(g)(1)(ii)

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.

1910.1450(g)(1)(iii)

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 consultation shall be for the purpose of determining the need for a medical examination.

1910.1450(g)(2)

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.

1910.1450(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

1910.1450(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4)

Physician's written opinion.

1910.1450(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A)

Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B)

The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(C)

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; and

1910.1450(g)(4)(i)(D)

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.

1910.1450(g)(4)(ii)

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

1910.1450(h)

Hazard identification.

1910.1450(h)(1)

With respect to labels and safety data sheets:

1910.1450(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii)

Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

1910.1450(h)(2)(i)

If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

1910.1450(h)(2)(ii)

If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

1910.1450(h)(2)(iii)

If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of safety data sheets and labeling.

1910.1450(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j)

Recordkeeping.

1910.1450(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR

1910.1020.

1910.1450(k)

[Reserved]

1910.1450(l)

Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996; 71 FR 16674, April 3, 2006; 77 FR 17887, March 26, 2012]

APPENDIX B

Approval Levels for the Laboratory Use of Chemical Carcinogens at the National Institutes of Health

Compound *	Use Condition	Principal Investigator Approval Level	Office of Research Safety Approval
Benzene ▪ Carbon tetrachloride ▪ Chloroform ▪ 1,2-Dibromo-3-chloropropane ▪ 1,1-Dimethylethylenimine ▪ p-Dioxane ▪ Ethylene dibromide ▪ Propylenimine	Storage Normal Operation (1) Complex Operation (2)	≤ 10 liters (l) ≤ 1l < 0.1l	> 10l > 1l < 0.1l
Ethionine ▪ 3'-methyl-4-aminoazobenzene ▪ Urethane	Storage Normal Operation Complex Operation	≤ 1000g ≤ 100g < 10g	> 1000g > 100g 10g to 100g
Bromoethyl methanesulfonate ▪ Chloromethyl methyl ether. Diepoxybutane ▪ 1,1-Dimethylhydrazine ▪ 1,2 Dimethylhydrazine ▪ Ethylenimine Ethyl methanesulfonate ▪ Hydrazine ▪ Methylhydrazine ▪ Methyl methanesulfonate ▪ N-N itorsodiethylamine ▪ N-Nitrosodimethylamine ▪ N-Nitrosodi-nbutylamine ▪ N-Nitrosodi-n-propylamine ▪ N-Nitroso-N-ethylurethane ▪ N-Nitroso-N-methylurethane ▪ N-Nitrosopiperidine ▪ Polychlorinated biphenyls ▪ β-Propiolactone	Storage Normal Operation Complex Operation	< 1l < 0.1l < 0.01l	1l to 10l 0.1l to 1l 0.01l to 0.1l
N-Acetoxy-2-acetylaminofluorene ▪ 2-Acetylaminofluorene ▪ Aflatoxins ▪ o-Aminoazotoluene ▪ 2-Aminofluorene ▪ Benz[a]anthracene ▪ Benzo[a]pyrene ▪ Chlorambucil ▪ Cycasin Diazomethane ▪ Dibenz[a,h]anthracene ▪ 7,12-Dimethylbenz[a]anthracene ▪ 4-Dimethylaminazobenzene ▪ 3-3'-Dimethylbenzidine ▪ 1,4-Dinitrosopiperazine ▪ N-Hydroxy-2-acetylaminofluorene ▪ 3-Methylcholanthrene ▪ 4,4'-Methylene bis(2-chloroaniline) ▪ -Methyl-3-nitro-1-nitrosoguanidine ▪ 1-Naphthylamine ▪ N-[4-(5-Nitro 2-furyl)-2-thiazoyl]-formamide ▪ N-N itroso-N-ethylurea ▪ N-Nitroso-N methylurea ▪ 4-Nitroquinoline-1-oxide ▪ Procarbazine ▪ 1,3-Propane sultone ▪ m-Toluenediamine ▪ Uracil mustard ▪ Vinyl chloride	Storage Normal Operation Complex Operation	< 100g < 10g < 1g	100g to 1000g 10g to 100g 1g tp 10 g
Bis(chloromethyl)ether	Storage Normal Operation Complex Operation	— — —	≤1l ≤ 0.01l —
4-Aminobiphenyl ▪ Benzidine ▪ 3,3'-Dichlorobenzidine ▪ 3,3'-Dimethoxybenzidine ▪ 2-NapUthylamine ▪ 4-Nitrobiphenyl	Storage Normal Operation Complex Operation	— — —	≤ 100g ≤ 1g —

Note: Approval levels apply to principal investigators and laboratory/branch chiefs who have successfully completed the NIH course in the recognition and control of chemical hazards in the laboratory

(1) Normal Operation: Any operation involving simple manipulations or reactions, where the potential for release of the material is remote (e.g., dilutions; qualitative, controlled transfer of test materials; use of analytical standards).

(2) Complex Operation: Any operation involving the manipulation, handling, or reaction of materials where the potential for release of the material is significant (e.g., rapid, exothermic reactions; imparting of sufficient energy to a test system (heating, mixing, delivery under pressure) so that uncontrolled release of the material could occur; transfer of electrostatic powders).

* Uses of Listed Compounds fall under UConn Health Guidelines for the Laboratory Use of Chemical Carcinogens.

APPENDIX C

List of Related UConn Health

Safety and Health Policies and Guidelines

Guidelines for the Conduct of Activities with Biohazardous Materials at UConn Health

Guidelines for the Laboratory Use of Chemical Carcinogens

Policy for Chemical and Laboratory Safety Training

UConn Health Policy - Selection and Use of Personal Protective Equipment

Regulated Medical Waste Disposal Policy

Lockout/Tagout Policy

Policy and Procedures, Permit Required Confined Spaces

UConn Health Contingency Plan

Exposure Control Plan – Bloodborne Pathogen

Respirator Policy

TB Policy

Infection Control Manual

Radiation Safety Manual

Note: Majority of these procedures/policies are available by accessing Environmental Health and Safety homepage, <http://wp.research.uh.uconn.edu/rcs/ehs>.

APPENDIX D

Substances Listed in the Thirteenth Report on Carcinogens

Known To Be Human Carcinogens

Aflatoxins
Alcoholic Beverage Consumption
4-Aminobiphenyl
Analgesic Mixtures Containing Phenacetin (see Phenacetin and Analgesic Mixtures Containing Phenacetin)
Aristolochic Acids
Arsenic and Inorganic Arsenic Compounds
Asbestos
Azathioprine
Benzene
Benzidine (see Benzidine and Dyes Metabolized to Benzidine)
Beryllium and Beryllium Compounds
Bis(chloromethyl) Ether and Technical-Grade Chloromethyl Methyl Ether
1,3-Butadiene
1,4-Butanediol Dimethanesulfonate
Cadmium and Cadmium Compounds
Chlorambucil
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (see Nitrosourea Chemotherapeutic Agents)
Chromium Hexavalent Compounds
Coal Tars and Coal-Tar Pitches
Coke-Oven Emissions
Cyclophosphamide
Cyclosporin A
Diethylstilbestrol
Dyes Metabolized to Benzidine (Benzidine Dye Class) (see Benzidine and Dyes Metabolized to Benzidine)
Erionite
Estrogens, Steroidal
Ethylene Oxide
Formaldehyde
Hepatitis B Virus
Hepatitis C Virus
Human Papillomaviruses: Some Genital-Mucosal Types
Melphalan
Methoxsalen with Ultraviolet A Therapy
Mineral Oils: Untreated and Mildly Treated
Mustard Gas
2-Naphthylamine
Neutrons (see Ionizing Radiation)
Nickel Compounds (see Nickel Compounds and Metallic Nickel)
Radon (see Ionizing Radiation)
Silica, Crystalline (Respirable Size)
Solar Radiation (see Ultraviolet Radiation Related Exposures)
Soots
Strong Inorganic Acid Mists Containing Sulfuric Acid
Sunlamps or Sunbeds, Exposure to (see Ultraviolet Radiation Related Exposures)
Tamoxifen
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
Thiotepa
Thorium Dioxide (see Ionizing Radiation)
Tobacco Smoke, Environmental (see Tobacco-Related Exposures) Tobacco Smoking (see Tobacco-Related Exposures)
Tobacco, Smokeless (see Tobacco-Related Exposures)
o-Toluidine
Ultraviolet Radiation, Broad-Spectrum (see Ultraviolet Radiation Related Exposures)
Vinyl Chloride (see Vinyl Halides [selected])

Wood Dust

X-Radiation and Gamma Radiation (see Ionizing Radiation)

Reasonably Anticipated To Be Human Carcinogens

Acetaldehyde

2-Acetylaminofluorene

Acrylamide

Acrylonitrile

Adriamycin

2-Aminoanthraquinone

o-Aminoazotoluene

1-Amino-2,4-dibromoanthraquinone

2-Amino-3,4-dimethylimidazo[4,5-*f*]quinoline (see Heterocyclic Amines [Selected])

2-Amino-3,8-dimethylimidazo[4,5-*f*]quinoxaline (see Heterocyclic Amines [Selected])

1-Amino-2-methylantraquinone

2-Amino-3-methylimidazo[4,5-*f*]quinoline (see Heterocyclic Amines [Selected])

2-Amino-1-methyl-6-phenylimidazo[4,5-*b*]pyridine (see Heterocyclic Amines [Selected])

Amitrole

o-Anisidine and Its Hydrochloride

Azacitidine

Basic Red 9 Monohydrochloride

Benz[*a*]anthracene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Benzo[*b*]fluoranthene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Benzo[*j*]fluoranthene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Benzo[*k*]fluoranthene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Benzo[*a*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Benzotrithloride

2,2-Bis(bromomethyl)-1,3-propanediol (Technical Grade)

Bis(chloroethyl) Nitrosourea (see Nitrosourea Chemotherapeutic Agents)

Bromodichloromethane

1-Bromopropane

Butylated Hydroxyanisole

Captafol

Carbon Tetrachloride

Ceramic Fibers (Respirable Size)

Chloramphenicol

Chlorendic Acid

Chlorinated Paraffins (C₁₂, 60% Chlorine)

Chloroform

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (see Nitrosourea Chemotherapeutic Agents)

3-Chloro-2-methylpropene

4-Chloro-*o*-phenylenediamine

Chloroprene

p-Chloro-*o*-toluidine and Its Hydrochloride

Chlorozotocin (see Nitrosourea Chemotherapeutic Agents)

Cisplatin

Cobalt Sulfate

Cobalt-Tungsten Carbide: Powders and Hard Metals

p-Cresidine

Cumene

Cupferron

Dacarbazine

Danthron

2,4-Diaminoanisole Sulfate

2,4-Diaminotoluene

Diazoaminobenzene

Dibenz[*a,h*]acridine (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Dibenz[*a,j*]acridine (see Polycyclic Aromatic Hydrocarbons: 15 Listings)

Dibenz[*a,h*]anthracene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
7H-Dibenzo[*c,g*]carbazole (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
Dibenzo[*a,e*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
Dibenzo[*a,h*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
Dibenzo[*a,l*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
Dibenzo[*a,l*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
2,3-Dibromo-1-propanol
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine and Its Dihydrochloride
Dichlorodiphenyltrichloroethane
1,2-Dichloroethane
Dichloromethane
1,3-Dichloropropene (Technical Grade)
Diepoxybutane
Diesel Exhaust Particulates
Di(2-ethylhexyl) Phthalate
Diethyl Sulfate
Diglycidyl Resorcinol Ether
3,3'-Dimethoxybenzidine (see 3,3'-Dimethoxybenzidine and Dyes Metabolized to 3,3'-Dimethoxybenzidine)
4-Dimethylaminoazobenzene
3,3'-Dimethylbenzidine (see 3,3'-Dimethylbenzidine and Dyes Metabolized to 3,3'-Dimethylbenzidine)
Dimethylcarbonyl Chloride
1,1-Dimethylhydrazine
Dimethyl Sulfate
Dimethylvinyl Chloride
1,6-Dinitropyrene (see Nitroarenes [Selected])
1,8-Dinitropyrene (see Nitroarenes [Selected])
1,4-Dioxane
Disperse Blue 1
Dyes Metabolized to 3,3'-Dimethoxybenzidine (3,3'-Dimethoxybenzidine Dye Class) (see 3,3'-Dimethoxybenzidine and Dyes Metabolized to 3,3'-Dimethoxybenzidine)
Dyes Metabolized to 3,3'-Dimethylbenzidine (3,3'-Dimethylbenzidine Dye Class) (see 3,3'-Dimethylbenzidine and Dyes Metabolized to 3,3'-Dimethylbenzidine)
Epichlorohydrin
Ethylene Thiourea
Ethyl Methanesulfonate
Furan
Glass Wool Fibers (Inhalable), Certain
Glycidol
Hexachlorobenzene
Hexachloroethane Hexamethylphosphoramide Hydrazine and Hydrazine Sulfate Hydrazobenzene
Indeno[1,2,3-*cd*]pyrene (see Polycyclic Aromatic Hydrocarbons: 15 Listings) Iron Dextran Complex
Isoprene
Kepone
Lead and Lead Compounds
Lindane, Hexachlorocyclohexane (Technical Grade), and Other Hexachlorocyclohexane Isomers
2-Methylaziridine
5-Methylchrysene (see Polycyclic Aromatic Hydrocarbons: 15 Listings)
4,4'-Methylenebis(2-chloroaniline)
4,4'-Methylenebis(*N,N*-dimethyl)benzenamine
4,4'-Methylenedianiline and Its Dihydrochloride
Methyleugenol
Methyl Methanesulfonate
N-Methyl-*N'*-Nitro-*N*-Nitrosoguanidine (see *N*-Nitrosamines: 15 Listings)

Metronidazole
Michler's Ketone
Mirex
Naphthalene
Nickel, Metallic (see Nickel Compounds and Metallic Nickel)
Nitrilotriacetic Acid
o-Nitroanisole
Nitrobenzene
6-Nitrochrysene (see Nitroarenes [Selected])
Nitrofen
Nitrogen Mustard Hydrochloride
Nitromethane
2-Nitropropane
1-Nitropyrene (see Nitroarenes [Selected])
4-Nitropyrene (see Nitroarenes [Selected])
N-Nitrosodi-*n*-butylamine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosodiethanolamine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosodiethylamine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosodimethylamine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosodi-*n*-propylamine (see *N*-Nitrosamines: 15 Listings)
N-Nitroso-*N*-ethylurea (see *N*-Nitrosamines: 15 Listings)
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (see *N*-Nitrosamines: 15 Listings)
N-Nitroso-*N*-methylurea (see *N*-Nitrosamines: 15 Listings)
N-Nitrosomethylvinylamine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosomorpholine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosornicotine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosopiperidine (see *N*-Nitrosamines: 15 Listings)
N-Nitrosopyrrolidine (see *N*-Nitrosamines: 15 Listings)
N-Nitrososarcosine (see *N*-Nitrosamines: 15 Listings)
o-Nitrotoluene
Norethisterone
Ochratoxin A
4,4'-Oxydianiline
Oxymetholone
Pentachlorophenol and By-products of Its Synthesis
Phenacetin (see Phenacetin and Analgesic Mixtures Containing Phenacetin) Phenazopyridine Hydrochloride
Phenolphthalein Phenoxybenzamine Hydrochloride Phenytoin and Phenytoin Sodium Polybrominated Biphenyls
Polychlorinated Biphenyls Procarbazine and Its Hydrochloride Progesterone
1,3-Propane Sultone β -Propiolactone Propylene Oxide Propylthiouracil Reserpine
Riddelliine
Safrole
Selenium Sulfide
Streptozotocin (see Nitrosoarea Chemotherapeutic Agents)
Styrene
Styrene-7,8-oxide
Sulfallate
Tetrachloroethylene
Tetrafluoroethylene
Tetranitromethane
Thioacetamide
4,4'-Thiodianiline
Thiourea
Toluene Diisocyanates
Toxaphene
Trichloroethylene
2,4,6-Trichlorophenol

1,2,3-Trichloropropane

Tris(2,3-dibromopropyl) Phosphate

Ultraviolet Radiation A (see Ultraviolet Radiation Related Exposures)

Ultraviolet Radiation B (see Ultraviolet Radiation Related Exposures)

Ultraviolet Radiation C (see Ultraviolet Radiation Related Exposures)

Urethane

Vinyl Bromide (see Vinyl Halides [Selected])

4-Vinyl-1-cyclohexene Diepoxide

Vinyl Fluoride (see Vinyl Halides [Selected])

APPENDIX E

A. List of Chemicals Used at UConn Health and Some Common Chemicals with Potential Reactive Concerns*

CHEMICALS AND COMPOUNDS IN USE OR HAVE BEEN USED AT THE UCONN HEALTH (QUANTITIES RANGE FROM TRACE TO LITERS AND IS BASED ON WASTE DISPOSAL RECORDS)

4-AMINO BUTYRIC ACID	ACETALDEHYDE
ACETIC ACID	ACETIC ANHYDRIDE
ACETONE	ACETONITRILE
ACRYLAMIDE	ALCOHOLS
ALUMINUM SULFATE	AMALGAM
AMMONIUM ACETATE	AMMONIUM MOLYBDATE
AMMONIUM HYDROXIDE	AMMONIUM ISOTHIOCYANATE
AMMONIUM PERSULFATE	AMMONIUM SULFIDE
AMMONIUM SULFATE	AMYL ACETATE
ANTIFREEZE	BARIUM HYDROXIDE
BENZALDEHYDE	BENZENE
BENZOIC ACID	BUTANOL
BUTYL CHLORIDE	CACODYLIC ACID
CADMIUM ACETATE	CADMIUM
CADMIUM SULFATE	CALCIUM CHLORIDE
CARBON TETRACHLORIDE	CHARCOAL
CHEMO AGENTS	CHLORAL HYDRATE
CHLOROBUTANE	CHLOROFORM
CHROMIC SULFURIC ACID	CHROMIUM POTASSIUM SULFATE
CHROMIUM SALT	CITRIC ACID
CUPRIC NITRATE	CYANIDE COMPOUNDS
CYCLOHEXANONE	CYCLOHEXLAMINE
CYCLOHEXIMIDE	DAB-DA-BENZIDENE
DICHLOROMETHANE	DICYCLOHEXYLCARBODIMIDE
DIETHYL POLYCARBONATE	DIHYDRO-2-MERCAPTO-PYRIMIDINE
DIMETHYL SULFATE	DIMETHYL SULFIDE
DIMETHYL SULFOXIDE	DIMETHYLAMINOETHANOL
DIMETHYLFORMAMIDE	DINITROPHENOL
DIOXANE	DIPHENYLAMINE
DISINFECTANTS	ETHANOLAMINE
ETHER	ETHIDIUM BROMIDE
ETHYL ACETATE	ETHYL CHLORIDE
ETHYL ISOCYANIDE	ETHYLENEDIAMINE
FORMALIN	FORMAMIDE
FORMIC ACID	FORMALDEHYDE
GLUTARALDEHYDE	GLYCEROL
GOLD CHLORIDE	GUANIDINE ISOTHIOCYANATE
HALOTHANE	HEPTANE
HEPTOFLUOROBUTYRIC ACID	HEXANE
HYDROCHLORIC ACID	HYDRAZINE
HYDROFLUORIC ACID	HYDROGEN PEROXIDE
HYDROXYLAMINE HYDROCHLORIDE	IODINE
IDOACETAMIDE	LACTIC ACID
LEAD	LEAD ACETATE
LEAD CITRATE	LITHIUM ACETATE
LITHIUM ALUMINIUM HYDRIDE	LITHIUM BROMIDE

LITHIUM CARBONATE	LITHIUM CHLORIDE
LITHIUM HYDROXIDE	MAGNESIUM ACETATE
MAGNESIUM CHLORIDE	MAGNESIUM NITRATE
MERCAPTOETHANOL	MERCURIC CHLORIDE
MERCURY/ITEMS	METHOXYBENZENE
METHYL METHACRYLATE	METHYLBUTANE
METHYLETHYLKETONE MEK	NATRIAMLAURYL SULFATE
NICKEL AMMONIUM SULFATE	NITRIC ACID
NITROANILINE	NITROPHENOL
NITROQUINOLINE OXIDE	OSMIUM TETROXIDE
OXALIC ACID	OXALYL CHLORIDE
PAINT	PARAFORMALDEHYDE
PENTACHLOROPHENOL	PENTANE
PERCHLORIC ACID	PERIODIC ACID
PHENOL	PHENYL HYDRAZINE
PHENYLENE DIAMINE	PHENYLISOTHIOCYANATE
PHOSPHORIC ACID	PHOSPHOROUS OXICHLORIDE
PHOSPHOROUS PENTOXIDE	PHOTO FIXER
PICRIC ACID	PIPERIDINE
POTASSIUM CHLORIDE	POTASSIUM CYANIDE
POTASSIUM DICHROMATE	POTASSIUM FERRICYNIDE
POTASSIUM HEXACYANO FERRATE	POTASSIUM HYROXIDE
POTASSIUM PHOSPHATE	POTASSIUM THIOCYANATE
PROPAR	PROPIONIC ACID
PYRIDINE	PYROPHOSPHATE
RADIOACTIVES	SCINTILLATION FLUIDS
SILVER NITRATE	SODIUM ACETATE
SODIUM ARSENATE	SODIUM AZIDE
SODIUM BOROXYDRIDE	SODIUM CYANIDE
SODIUM FLUOROACETATE	SODIUM FLUORIDE
SODIUM HYDROXIDE	SODIUM META-PERIODATE
SODIUM NITRATE	SODIUM NITRITE
SODIUM PERIODATE	SODIUM PHOSPHATE
SODIUM PYROPHOSPHATE	SODIUM SULFATE
SODIUM SULFIDE	SODIUM THIOCYANATE
SUCCINIC ANHYDRIDE	SULFONIC ACID
SULFOSALICYLIC ACID	SULFURIC ACID
TEMED	TETRAHYDROFURAN
TITANOUS CHLORIDE	TOLUENE
TOLUIDINE	TRICHLOROACETIC ACID-TCA
TRICHLOROTRIFLUOROETHANE	TRIETHANOLAMINE-TEA
TRIETHYLAMINE	TRIFLUOROACETIC ACID
TRIMETHYL PENTANE	TRIMETHYL PHOSPHATE
TRYPTOPHAN	WASTE OILS
XYLENES	ZINC

B. COMMON EXPLOSIVE COMPOUNDS (+, used or has been used at UConn Health)

1. Acetylenic Compounds

- Acetylene +
- Copper(I) Acetylide
- Ethoxyacetylene
- Propyne
- Propyne Peroxide
- Disilver Acetylide

2. Azides

- Benzenesulphonyl Azide
- Carbonyl Diazide
- Silver Azide
- Lead(II) Azide

3. Azo Compounds

- Diazirine
- Azomethane
- Diazomethane

4. Chlorite/Chlorate/Perchlorate Compounds

- Silver Chlorite
- Silver Chlorate
- Potassium Chlorite
- Lead Tetrachloride

5. Fulminates

- Silver Fulminate
- Mercury(II) Fulminate
- Sodium Fulminate
- Copper(II) Fulminate

7. Other Nitrogen-Containing Compounds (Diazonium Salts, Nitros Compounds, Amides, Nitrides)

- Silver Amide
- Silver Nitride
- Nitrosylcyanide
- Disulfur Dinitride

8. Picrates

- Picric Acid +
- Lead Picrate

9. Peroxides

- Diacetyl Peroxide
- Zinc Peroxide
- Dimethyl Peroxide

10. Strained Ring Compounds

- Benzvalene
- Prismane

11. Polymerizable Compounds

- Acrylic Acid
- Ethylene
- Butadiene
- Styrene
- Vinyl Chloride
- Cyclopentadiene

6. Nitro Compounds and Nitrate Esters

- Nitromethane
- Nitroglycerine
- Nitrocellulose
- Trinitrotoluene

C. WATER REACTIVE COMPOUNDS

- Alkali Metals (e.g., lithium, sodium)
- Organometallic Compounds (e.g., tetramethylaluminum)
- Halides (e.g., acetyl chloride, titanium tetrachloride)
- Hydrides (e.g., diborane, sodium hydride)
- Peroxides (e.g., sodium peroxide)
- Carbides (e.g., calcium carbide)
- Oxides (e.g., sodium oxide)
- Phosphides (e.g., aluminum phosphide)
- Anhydrides (e.g., acetic anhydride) +
- Other Hydrolyzable Compounds (e.g., chlorosulfonic acid, aluminum tribromide)

D. STRONG OXIDIZERS

Fluorine	Hypochlorites +
Ozone	Nitrates +
Chlorine	Nitrites +
Persulfates	Nitrous Oxide +
Peroxides +	Liquid Oxygen +
Peroxy Acids	Liquid Air
Perchlorates +	Chlorosulfonic Acid
Dichromates	Nitromethane
Chromates +	Chlorates +
Permanganates	

E. STRONG REDUCERS

Finely Divided	Metals Sodium
Hydrazine +	Lithium
Hydrides +	Potassium
Hydrogen	Butadiene
Aniline	Acetylides

F. COMMON REACTIVE CHEMICALS

Ammonium Nitrate	Hydrazinium Chlorate
Ammonium Perchlorate	Hydrazinium Chlorite
Benzoyl Peroxide	Hydrogen Peroxide (concentrated) +
2-Butanone Peroxide	Hydroxylammonium Nitrate
tert-Butyl Hydroperoxide	Lauroyl Peroxide
tert-Butyl Peroxide	Lithium Acetylide
Calcium Hydride	Magnesium Perchlorate
Cesium Mercury(I)	Perchlorate +
Chromium Nitrate	Nitroethane
Chromium Trioxide	Nitromethane
Diborane	2-Nitropropane
Diethylaluminum Hydride	o-Nitrotoluene
Dimethyl Phosphine	p-Nitrotoluene
m-Dinitrobenzene	Peroxides +
p-Dinitrobenzene	Phosphorus (red)
Divinylbenzene	Picric Acid +
Germane	Potassium
Hydrazine +	Trinitrotoluene
Hydrazine +	Hydrate +

*Not a comprehensive list. Users should always consult information furnished by the chemical supplier and other standard references outlined in the Chemical Hygiene Plan.

APPENDIX F

Part Number: 1910

- Part Title: Occupational Safety and Health Standards
- Subpart: Z
- Subpart Title: Toxic and Hazardous Substances
- Standard Number: 1910.1200
- Title: Hazard Communication.

- Appendix: A , B , C , D , E , F

Note: The following text for 1910.1200 has been updated to align with the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 3, issued in the Federal Register, March 26, 2012. This rule became effective May 25, 2012.

Also, the Hazard Communication page, on OSHA.gov, includes downloadable versions of the revised 1910.1200 Final Rule and appendices, updated to align with the GHS; a comparison of the Hazard Communication Standard, issued in 1994 (HazCom 1994), with the revised Hazard Communication Final Rule issued in 2012 (HazCom 2012); frequently asked questions on the revisions; and new guidance materials on the revisions. The page also contains the full regulatory text and appendices of HazCom 1994.

1910.1200(a)

Purpose.

1910.1200(a)(1)

The purpose of this section is to ensure that the hazards of all chemicals produced or imported are classified, and that information concerning the classified hazards is transmitted to employers and employees. The requirements of this section are intended to be consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), Revision 3. The transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, safety data sheets and employee training.

1910.1200(a)(2)

This occupational safety and health standard is intended to address comprehensively the issue of classifying the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legislative or regulatory enactments of a state, or political subdivision of a state, pertaining to this subject. Classifying the potential hazards of chemicals and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

1910.1200(b)

Scope and application.

1910.1200(b)(1)

This section requires chemical manufacturers or importers to classify the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers. (Employers who do not produce or import chemicals need only focus on those parts of this rule that deal with establishing a workplace program and communicating information to their workers.)

1910.1200(b)(2)

This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

1910.1200(b)(3)

This section applies to laboratories only as follows:

1910.1200(b)(3)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(3)(ii)

Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible during each workshift to laboratory employees when they are in their work areas;

1910.1200(b)(3)(iii)

Employers shall ensure that laboratory employees are provided information and training in accordance with paragraph (h) of this section, except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section; and,

1910.1200(b)(3)(iv)

Laboratory employers that ship hazardous chemicals are considered to be either a chemical manufacturer or a distributor under this rule, and thus must ensure that any containers of hazardous chemicals leaving the laboratory are labeled in accordance with paragraph (f) of this section, and that a safety data sheet is provided to distributors and other employers in accordance with paragraphs (g)(6) and (g)(7) of this section.

1910.1200(b)(4)

In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

1910.1200(b)(4)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

1910.1200(b)(4)(ii)

Employers shall maintain copies of any safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a safety data sheet as soon as possible for sealed containers of hazardous chemicals received without a safety data sheet if an employee requests the safety data sheet, and shall ensure that the safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

1910.1200(b)(4)(iii)

Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(2)(iii) of this section), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

1910.1200(b)(5)

This section does not require labeling of the following chemicals:

1910.1200(b)(5)(i)

Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(ii)

Any chemical substance or mixture as such terms are defined in the Toxic Substances Control Act (15 U.S.C. 2601 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(5)(iii)

Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device or product, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.) or the Virus-Serum-Toxin Act of 1913 (21 U.S.C. 151 et seq.), and regulations issued under those Acts, when they are subject to the labeling requirements under those Acts by either the Food and Drug Administration or the Department of Agriculture;

1910.1200(b)(5)(iv)

Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 et seq.) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol, Tobacco, Firearms and Explosives;

1910.1200(b)(5)(v)

Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission; and,

1910.1200(b)(5)(vi)

Agricultural or vegetable seed treated with pesticides and labeled in accordance with the Federal Seed Act (7 U.S.C. 1551 et seq.) and the labeling regulations issued under that Act by the Department of Agriculture.

1910.1200(b)(6)

This section does not apply to:

1910.1200(b)(6)(i)

Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that Act by the Environmental Protection Agency;

1910.1200(b)(6)(ii)

Any hazardous substance as such term is defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.) when the hazardous substance is the focus of remedial or removal action being conducted under CERCLA in accordance with Environmental Protection Agency regulations.

1910.1200(b)(6)(iii)

Tobacco or tobacco products;

1910.1200(b)(6)(iv)

Wood or wood products, including lumber which will not be processed, where the chemical manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility (wood or wood products which have been treated with a hazardous chemical covered by this standard, and wood which may be subsequently sawed or cut, generating dust, are not exempted);

1910.1200(b)(6)(v)

Articles (as that term is defined in paragraph (c) of this section);

1910.1200(b)(6)(vi)

Food or alcoholic beverages which are sold, used, or prepared in a retail establishment (such as a grocery store, restaurant, or drinking place), and foods intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(vii)

Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.), when it is in solid, final form for direct administration to the patient (e.g., tablets or pills); drugs which are packaged by the chemical manufacturer for sale to consumers in a retail establishment (e.g., over-the-counter drugs); and drugs intended for personal consumption by employees while in the workplace (e.g., first aid supplies);

1910.1200(b)(6)(viii)

Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace;

1910.1200(b)(6)(ix)

Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended;

1910.1200(b)(6)(x)

Nuisance particulates where the chemical manufacturer or importer can establish that they do not pose any physical or health hazard covered under this section;

1910.1200(b)(6)(xi)

Ionizing and nonionizing radiation; and,

1910.1200(b)(6)(xii)

Biological hazards.

1910.1200(c)

Definitions. Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Chemical means any substance, or mixture of substances.

Chemical manufacturer means an employer with a workplace where chemical(s) are produced for use or distribution.

Chemical name means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name that will clearly identify the chemical for the purpose of conducting a hazard classification.

Classification means to identify the relevant data regarding the hazards of a chemical; review those data to ascertain the hazards associated with the chemical; and decide whether the chemical will be classified as hazardous according to the definition of hazardous chemical in this section. In addition, classification for health and physical hazards includes the determination of the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

Commercial account means an arrangement whereby a retail distributor sells hazardous chemicals to an employer, generally in large quantities over time and/or at costs that are below the regular retail price.

Common name means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

Designated representative means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

Director means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Distributor means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

Employee means a worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. Workers such as office workers or bank tellers who encounter hazardous chemicals only in non-routine, isolated instances are not covered.

Employer means a person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

Exposure or exposed means that an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (e.g. accidental or possible) exposure. "Subjected" in terms of health hazards includes any route of entry (e.g. inhalation, ingestion, skin contact or absorption.)

Foreseeable emergency means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

Hazard category means the division of criteria within each hazard class, e.g., oral acute toxicity and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

Hazard class means the nature of the physical or health hazards, e.g., flammable solid, carcinogen, oral acute toxicity.

Hazard not otherwise classified (HNOC) means an adverse physical or health effect identified through evaluation of scientific evidence during the classification process that does not meet the specified criteria for the physical and health hazard classes

addressed in this section. This does not extend coverage to adverse physical and health effects for which there is a hazard class addressed in this section, but the effect either falls below the cut-off value/concentration limit of the hazard class or is under a GHS hazard category that has not been adopted by OSHA (e.g., acute toxicity Category 5).

Hazard statement means a statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

Hazardous chemical means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

Health hazard means a chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A to §1910.1200—Health Hazard Criteria.

Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

Importer means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

Label means an appropriate group of written, printed or graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached to the immediate container of a hazardous chemical, or to the outside packaging.

Label elements means the specified pictogram, hazard statement, signal word and precautionary statement for each hazard class and category.

Mixture means a combination or a solution composed of two or more substances in which they do not react.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; or in contact with water emits flammable gas. See Appendix B to §1910.1200—Physical Hazard Criteria.

Pictogram means a composition that may include a symbol plus other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical. Eight pictograms are designated under this standard for application to a hazard category.

Precautionary statement means a phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical, or improper storage or handling.

Produce means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

Product identifier means the name or number used for a hazardous chemical on a label or in the SDS. It provides a unique means by which the user can identify the chemical. The product identifier used shall permit cross-references to be made among the list of hazardous chemicals required in the written hazard communication program, the label and the SDS.

Pyrophoric gas means a chemical in a gaseous state that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.

Responsible party means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

Safety data sheet (SDS) means written or printed material concerning a hazardous chemical that is prepared in accordance with paragraph (g) of this section.

Signal word means a word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used in this section are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for the less severe.

Simple asphyxiant means a substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death.

Specific chemical identity means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

Substance means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix E to §1910.1200—Definition of Trade Secret, sets out the criteria to be used in evaluating trade secrets.

Use means to package, handle, react, emit, extract, generate as a byproduct, or transfer.

Work area means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

Workplace means an establishment, job site, or project, at one geographical location containing one or more work areas.

1910.1200(d)
Hazard classification.

1910.1200(d)(1)
Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to classify the chemicals in accordance with this section. For each chemical, the chemical manufacturer or importer shall determine the hazard classes, and, where appropriate, the category of each class that apply to the chemical being classified. Employers are not required to classify chemicals unless they choose not to rely on the classification performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

1910.1200(d)(2)
Chemical manufacturers, importers or employers classifying chemicals shall identify and consider the full range of available scientific literature and other evidence concerning the potential hazards. There is no requirement to test the chemical to determine how to classify its hazards. Appendix A to § 1910.1200 shall be consulted for classification of health hazards, and Appendix B to § 1910.1200 shall be consulted for the classification of physical hazards.

1910.1200(d)(3)
Mixtures.

1910.1200(d)(3)(i)
Chemical manufacturers, importers, or employers evaluating chemicals shall follow the procedures described in Appendices A and B to Sec. 1910.1200 to classify the hazards of the chemicals, including determinations regarding when mixtures of the classified chemicals are covered by this section.

1910.1200(d)(3)(ii)
When classifying mixtures they produce or import, chemical manufacturers and importers of mixtures may rely on the information provided on the current safety data sheets of the individual ingredients, except where the chemical manufacturer or importer knows, or in the exercise of reasonable diligence should know, that the safety data sheet misstates or omits information required by this section.

1910.1200(e)
Written hazard communication program.

1910.1200(e)(1)
Employers shall develop, implement, and maintain at each workplace, a written hazard communication program which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, safety data sheets, and employee information and training will be met, and which also includes the following:

1910.1200(e)(1)(i)
A list of the hazardous chemicals known to be present using a product identifier that is referenced on the appropriate safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

1910.1200(e)(1)(ii)
The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

1910.1200(e)(2)

Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

1910.1200(e)(2)(i)

The methods the employer will use to provide the other employer(s) on-site access to safety data sheets for each hazardous chemical the other employer(s)' employees may be exposed to while working;

1910.1200(e)(2)(ii)

The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

1910.1200(e)(2)(iii)

The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

1910.1200(e)(3)

The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

1910.1200(e)(4)

The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of 29 CFR 1910.1020 (e).

1910.1200(e)(5)

Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the written hazard communication program may be kept at the primary workplace facility.

1910.1200(f)

Labels and other forms of warning—

1910.1200(f)(1)

Labels on shipped containers. The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked. Hazards not otherwise classified do not have to be addressed on the container. Where the chemical manufacturer or importer is required to label, tag or mark the following information shall be provided:

1910.1200(f)(1)(i)

Product identifier;

1910.1200(f)(1)(ii)

Signal word;

1910.1200(f)(1)(iii)

Hazard statement(s);

1910.1200(f)(1)(iv)

Pictogram(s);

1910.1200(f)(1)(v)

Precautionary statement(s); and,

1910.1200(f)(1)(vi)

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

1910.1200(f)(2)

The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(i) through (v) of this section is in accordance with Appendix C to § 1910.1200, for each hazard class and associated hazard category for the hazardous chemical, prominently displayed, and in English (other languages may also be included if appropriate).

1910.1200(f)(3)

The chemical manufacturer, importer, or distributor shall ensure that the information provided under paragraphs (f)(1)(ii) through (iv) of this section is located together on the label, tag, or mark.

1910.1200(f)(4)
Solid materials.

1910.1200(f)(4)(i)

For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

1910.1200(f)(4)(ii)

The label may be transmitted with the initial shipment itself, or with the safety data sheet that is to be provided prior to or at the time of the first shipment; and,

1910.1200(f)(4)(iii)

This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself, and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grains).

1910.1200(f)(5)

Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.) and regulations issued under that Act by the Department of Transportation.

1910.1200(f)(6)

Workplace labeling. Except as provided in paragraphs (f)(7) and (f)(8) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with either:

1910.1200(f)(6)(i)

The information specified under paragraphs (f)(1)(i) through (v) of this section for labels on shipped containers; or,

1910.1200(f)(6)(ii)

Product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards of the hazardous chemical.

1910.1200(f)(7)

The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(6) of this section to be on a label. The employer shall ensure the written materials are readily accessible to the employees in their work area throughout each work shift.

1910.1200(f)(8)

The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. For purposes of this section, drugs which are dispensed by a pharmacy to a health care provider for direct administration to a patient are exempted from labeling.

1910.1200(f)(9)

The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

1910.1200(f)(10)

The employer shall ensure that workplace labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

1910.1200(f)(11)

Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within six months of becoming aware of the new information, and shall ensure that labels on containers of hazardous chemicals shipped after that time contain the new

information. If the chemical is not currently produced or imported, the chemical manufacturer, importer, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

1910.1200(g)
Safety data sheets.

1910.1200(g)(1)
Chemical manufacturers and importers shall obtain or develop a safety data sheet for each hazardous chemical they produce or import. Employers shall have a safety data sheet in the workplace for each hazardous chemical which they use.

1910.1200(g)(2)
The chemical manufacturer or importer preparing the safety data sheet shall ensure that it is in English (although the employer may maintain copies in other languages as well), and includes at least the following section numbers and headings, and associated information under each heading, in the order listed (See Appendix D to § 1910.1200—Safety Data Sheets, for the specific content of each section of the safety data sheet):

1910.1200(g)(2)(i)
Section 1, Identification;

1910.1200(g)(2)(ii)
Section 2, Hazard(s) identification;

1910.1200(g)(2)(iii)
Section 3, Composition/information on ingredients;

1910.1200(g)(2)(iv)
Section 4, First-aid measures;

1910.1200(g)(2)(v)
Section 5, Fire-fighting measures;

1910.1200(g)(2)(vi)
Section 6, Accidental release measures;

1910.1200(g)(2)(vii)
Section 7, Handling and storage;

1910.1200(g)(2)(viii)
Section 8, Exposure controls/personal protection;

1910.1200(g)(2)(ix)
Section 9, Physical and chemical properties;

1910.1200(g)(2)(x)
Section 10, Stability and reactivity;

1910.1200(g)(2)(xi)
Section 11, Toxicological information;

1910.1200(g)(2)(xii)
Section 12, Ecological information;

1910.1200(g)(2)(xiii)
Section 13, Disposal considerations;

1910.1200(g)(2)(xiv)
Section 14, Transport information;

1910.1200(g)(2)(xv)
Section 15, Regulatory information; and

1910.1200(g)(2)(xvi)
Section 16, Other information, including date of preparation or last revision.

Note 1 to paragraph (g)(2): To be consistent with the GHS, an SDS must also include the headings in paragraphs (g)(2)(xii) through (g)(2)(xv) in order.

Note 2 to paragraph (g)(2): OSHA will not be enforcing information requirements in sections 12 through 15, as these areas are not under its jurisdiction.

1910.1200(g)(3)

If no relevant information is found for any sub-heading within a section on the safety data sheet, the chemical manufacturer, importer or employer preparing the safety data sheet shall mark it to indicate that no applicable information was found.

1910.1200(g)(4)

Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one safety data sheet to apply to all of these similar mixtures.

1910.1200(g)(5)

The chemical manufacturer, importer or employer preparing the safety data sheet shall ensure that the information provided accurately reflects the scientific evidence used in making the hazard classification. If the chemical manufacturer, importer or employer preparing the safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the safety data sheet within three months. If the chemical is not currently being produced or imported, the chemical manufacturer or importer shall add the information to the safety data sheet before the chemical is introduced into the workplace again.

1910.1200(g)(6)(i)

Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate safety data sheet with their initial shipment, and with the first shipment after a safety data sheet is updated;

1910.1200(g)(6)(ii)

The chemical manufacturer or importer shall either provide safety data sheets with the shipped containers or send them to the distributor or employer prior to or at the time of the shipment;

1910.1200(g)(6)(iii)

If the safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the distributor or employer shall obtain one from the chemical manufacturer or importer as soon as possible; and,

1910.1200(g)(6)(iv)

The chemical manufacturer or importer shall also provide distributors or employers with a safety data sheet upon request.

1910.1200(g)(7)(i)

Distributors shall ensure that safety data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a safety data sheet is updated;

1910.1200(g)(7)(ii)

The distributor shall either provide safety data sheets with the shipped containers, or send them to the other distributor or employer prior to or at the time of the shipment;

1910.1200(g)(7)(iii)

Retail distributors selling hazardous chemicals to employers having a commercial account shall provide a safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a safety data sheet is available;

1910.1200(g)(7)(iv)

Wholesale distributors selling hazardous chemicals to employers over-the-counter may also provide safety data sheets upon the request of the employer at the time of the over-the-counter purchase, and shall post a sign or otherwise inform such employers that a safety data sheet is available;

1910.1200(g)(7)(v)

If an employer without a commercial account purchases a hazardous chemical from a retail distributor not required to have safety data sheets on file (i.e., the retail distributor does not have commercial accounts and does not use the materials), the retail distributor shall provide the employer, upon request, with the name, address, and telephone number of the chemical manufacturer, importer, or distributor from which a safety data sheet can be obtained;

1910.1200(g)(7)(vi)

Wholesale distributors shall also provide safety data sheets to employers or other distributors upon request; and,

1910.1200(g)(7)(vii)

Chemical manufacturers, importers, and distributors need not provide safety data sheets to retail distributors that have informed them that the retail distributor does not sell the product to commercial accounts or open the sealed container to use it in their own workplaces.

1910.1200(g)(8)

The employer shall maintain in the workplace copies of the required safety data sheets for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s). (Electronic access and other alternatives to maintaining paper copies of the safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options.)

1910.1200(g)(9)

Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the material safety data sheets may be kept at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

1910.1200(g)(10)

Safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work area(s).

1910.1200(g)(11)

Safety data sheets shall also be made readily available, upon request, to designated representatives, the Assistant Secretary, and the Director, in accordance with the requirements of § 1910.1020(e).

1910.1200(h)

Employee information and training.

1910.1200(h)(1)

Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new chemical hazard the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and safety data sheets.

1910.1200(h)(2)

Information. Employees shall be informed of:

1910.1200(h)(2)(i)

The requirements of this section;

1910.1200(h)(2)(ii)

Any operations in their work area where hazardous chemicals are present; and,

1910.1200(h)(2)(iii)

The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and safety data sheets required by this section.

1910.1200(h)(3)

Training. Employee training shall include at least:

1910.1200(h)(3)(i)

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

1910.1200(h)(3)(ii)

The physical, health, simple asphyxiation, combustible dust, and pyrophoric gas hazards, as well as hazards not otherwise classified, of the chemicals in the work area;

1910.1200(h)(3)(iii)

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; and,

1910.1200(h)(3)(iv)

The details of the hazard communication program developed by the employer, including an explanation of the labels received on shipped containers and the workplace labeling system used by their employer; the safety data sheet, including the order of information and how employees can obtain and use the appropriate hazard information.

1910.1200(i)
Trade secrets.

1910.1200(i)(1)
The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name, other specific identification of a hazardous chemical, or the exact percentage (concentration) of the substance in a mixture, from the safety data sheet, provided that:

1910.1200(i)(1)(i)
The claim that the information withheld is a trade secret can be supported;

1910.1200(i)(1)(ii)
Information contained in the safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

1910.1200(i)(1)(iii)
The safety data sheet indicates that the specific chemical identity and/or percentage of composition is being withheld as a trade secret; and,

1910.1200(i)(1)(iv)
The specific chemical identity and percentage is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph (i).

1910.1200(i)(2)
Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity and/or specific percentage of composition of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity or percentage composition of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

1910.1200(i)(3)
In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity or percentage composition, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

1910.1200(i)(3)(i)
The request is in writing;

1910.1200(i)(3)(ii)
The request describes with reasonable detail one or more of the following occupational health needs for the information:

1910.1200(i)(3)(ii)(A)
To assess the hazards of the chemicals to which employees will be exposed;

1910.1200(i)(3)(ii)(B)
To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

1910.1200(i)(3)(ii)(C)
To conduct pre-assignment or periodic medical surveillance of exposed employees;

1910.1200(i)(3)(ii)(D)
To provide medical treatment to exposed employees;

1910.1200(i)(3)(ii)(E)
To select or assess appropriate personal protective equipment for exposed employees;

1910.1200(i)(3)(ii)(F)
To design or assess engineering controls or other protective measures for exposed employees; and,

1910.1200(i)(3)(ii)(G)
To conduct studies to determine the health effects of exposure.

1910.1200(i)(3)(iii)

The request explains in detail why the disclosure of the specific chemical identity or percentage composition is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(ii) of this section:

1910.1200(i)(3)(iii)(A)

The properties and effects of the chemical;

1910.1200(i)(3)(iii)(B)

Measures for controlling workers' exposure to the chemical;

1910.1200(i)(3)(iii)(C)

Methods of monitoring and analyzing worker exposure to the chemical; and,

1910.1200(i)(3)(iii)(D)

Methods of diagnosing and treating harmful exposures to the chemical;

1910.1200(i)(3)(iv)

The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

1910.1200(i)(3)(v)

The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

1910.1200(i)(4)

The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

1910.1200(i)(4)(i)

May restrict the use of the information to the health purposes indicated in the written statement of need;

1910.1200(i)(4)(ii)

May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

1910.1200(i)(4)(iii)

May not include requirements for the posting of a penalty bond.

1910.1200(i)(5)

Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

1910.1200(i)(6)

If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

1910.1200(i)(7)

If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity or percentage composition, the denial must:

1910.1200(i)(7)(i)

Be provided to the health professional, employee, or designated representative, within thirty days of the request;

1910.1200(i)(7)(ii)

Be in writing;

1910.1200(i)(7)(iii)

Include evidence to support the claim that the specific chemical identity or percent of composition is a trade secret;

1910.1200(i)(7)(iv)

State the specific reasons why the request is being denied; and,

1910.1200(i)(7)(v)

Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the trade secret.

1910.1200(i)(8)

The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

1910.1200(i)(9)

When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

1910.1200(i)(9)(i)

The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity or percentage composition is a trade secret;

1910.1200(i)(9)(ii)

The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

1910.1200(i)(9)(iii)

The health professional, employee or designated representative has demonstrated adequate means to protect the confidentiality.

1910.1200(i)(10)(i)

If OSHA determines that the specific chemical identity or percentage composition requested under paragraph (i)(3) of this section is not a "bona fide" trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

1910.1200(i)(10)(ii)

If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

1910.1200(i)(11)

If a citation for a failure to release trade secret information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules, when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation "in camera" or issue appropriate orders to protect the confidentiality of such matters.

1910.1200(i)(12)

Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

1910.1200(i)(13)

Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process information which is a trade secret.

1910.1200(j)

Effective dates.

1910.1200(j)(1)

Employers shall train employees regarding the new label elements and safety data sheets format by December 1, 2013.

1910.1200(j)(2)

Chemical manufacturers, importers, distributors, and employers shall be in compliance with all modified provisions of this section no later than June 1, 2015, except:

1910.1200(j)(2)(i)

After December 1, 2015, the distributor shall not ship containers labeled by the chemical manufacturer or importer unless the label has been modified to comply with paragraph (f)(1) of this section.

1910.1200(j)(2)(ii)

All employers shall, as necessary, update any alternative workplace labeling used under paragraph (f)(6) of this section, update the hazard communication program required by paragraph (h)(1), and provide any additional employee training in accordance with paragraph (h)(3) for newly identified physical or health hazards no later than June 1, 2016.

1910.1200(j)(3)

Chemical manufacturers, importers, distributors, and employers may comply with either § 1910.1200 revised as of October 1, 2011, or the current version of this standard, or both during the transition period.

[59 FR 17479, April 13, 1994; 59 FR 65947, Dec. 22, 1994; 61 FR 5507, Feb. 13, 1996; 77 FR 17785, March 26, 2012]

APPENDIX G
DHS Chemicals of Interest

Chemical of Interest	Synonym	CAS
Aluminum powder		7429-90-5
Ammonium nitrate [more than 0.2% combustible substances including any organic substance calculated as carbon, to the exclusion of any other added substance]		6484-52-2
Ammonium nitrate, solid [nitrogen conc. ≥23%]		6484-52-2
Ammonium perchlorate		7790-98-9
Arsenic trichloride	Arsenous trichloride	7784-34-1
Arsine		7784-42-1
Barium oxide		18810-58-7
1,4-Bis(2-chloroethylthio)-n-butane		142868-93-7
Bis(2-chloroethylthio)methane		63869-13-6
Bis(2-chloroethylthiomethyl)ether		63918-90-1
1,5-Bis(2-chloroethylthio)-n-pentane		142868-94-8
1,3-Bis(2-chloroethylthio)-n-propane		63905-10-2
Boron tribromide		10294-33-4
Boron trichloride	Borane, trichloro	10294-34-5
Boron trifluoride	Borane, trifluoro	7637-07-2
Bromine chloride		13863-41-7
Carbonyl fluoride		353-50-4
Carbonyl sulfide		463-58-1
Chlorine		7782-50-5
Chlorine pentafluoride		13637-63-3
Chlorine trifluoride		7790-91-2
Chlorosarin	[o-Isopropyl methylphosphonochloridate]	1445-76-7
Chlorosoman	[o-Pinacolyl methylphosphonochloridate]	7040-57-5
Cyanogen	[Ethanedinitrile]	460-19-5
Cyanogen chloride		506-77-4
DF	Methyl phosphonyl difluoride	676-99-3
Diazodinitrophenol		87-31-0
Diborane		19287-45-7
Dichlorosilane	[Silane, dichloro-]	4109-96-0
Diethyl methylphosphonite		15715-41-0
Diethyleneglycol dinitrate		693-21-0
Dingu	[Dinitroglycoluril]	55510-04-8
Dinitrogen tetroxide		10544-72-6
Dinitrophenol		25550-58-7
Dinitroresorcinol		519-44-8
Dipicryl sulfide		115937
Dipicrylamine [or] Hexyl	[Hexanitrodiphenylamine]	131-73-7
Ethyl phosphonyl difluoride		753-98-0
Ethyldiethanolamine		139-87-7
Ethylphosphonothioic dichloride		993-43-1

Fluorine		7782-41-4
Germane		7782-65-2
Germanium tetrafluoride		7783-58-6
Guanyl nitrosaminoguanylidene hydrazine		
Hexaethyl tetraphosphate and compressed gas		757-58-4
Hexafluoroacetone		684-16-2
Hexanitrostilbene		20062-22-0
Hexolite	[Hexotol]	121-82-4
HMX	[Cyclotetramethylene-tetranitramine]	2691-41-0
HN1 (nitrogen mustard-1)	[Bis(2-chloroethyl)ethylamine]	497270
HN2 (nitrogen mustard-2)	[Bis(2-chloroethyl)methylamine]	51-75-2
HN3 (nitrogen mustard-3)	[Tris(2-chloroethyl)amine]	555-77-1
Hydrogen bromide (anhydrous)		10035-10-6
Hydrogen chloride (anhydrous)		7647-01-0
Hydrogen cyanide	[Hydrocyanic acid]	74-90-8
Hydrogen fluoride (anhydrous)		7664-39-3
Hydrogen iodide, anhydrous		10034-85-2
Hydrogen peroxide (concentration of at least 35%)		7722-84-1
Hydrogen selenide		2148909
Hydrogen sulfide		2148878
Isopropylphosphonothioic dichloride		1498-60-8
Isopropylphosphonyl difluoride		677-42-9
Lead azide		13424-46-9
Lead styphnate	[Lead trinitroresorcinate]	15245-44-0
Lewisite 1	[2-Chlorovinyl)dichloroarsine]	541-25-3
Lewisite 2	[Bis(2-chlorovinyl)chloroarsine]	40334-69-8
Lewisite 3	[Tris(2-chlorovinyl)arsine]	40334-70-1
Magnesium (powder)		7439-95-4
MDEA	[Methyldiethanolamine]	105-59-9
Mercury fulminate		628-86-4
Methyl mercaptan	[Methanethiol]	74-93-1
Methylchlorosilane		993-00-0
Methylphosphonothioic dichloride		676-98-2
N,N-(2-diethylamino)ethanethiol		100-38-9
N,N-(2-diisopropylamino)ethanethiol	N,N-diisopropyl-(beta)-aminoethane thiol	1439977
N,N-(2-dimethylamino)ethanethiol		654482
N,N-(2-dipropylamino)ethanethiol		1439946
N,N-Diethyl phosphoramidic dichloride		1498-54-0
N,N-Diisopropyl phosphoramidic dichloride		23306-80-1
N,N-Dimethyl phosphoramidic dichloride	[Dimethylphosphoramido- dichloridate]	677-43-0
N,N-Dipropyl phosphoramidic dichloride		40881-98-9
Nitric acid		7697-37-2
Nitric oxide	[Nitrogen oxide (NO)]	10102-43-9
Nitrobenzene		98-95-3
Nitrocellulose		9004-70-0
Nitrogen mustard hydrochloride	[Bis(2-chloroethyl)methylamine hydrochloride]	55-86-7

Nitrogen trioxide		10544-73-7
Nitroglycerine		55-63-0
Nitromannite	[Mannitol hexanitrate, wetted]	15825-70-4
Nitromethane		75-52-5
Nitrostarch		9056-38-6
Nitrosyl chloride		2696-92-6
Nitrotriazolone		932-64-9
o,o-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate		78-53-5
Octolite		57607-37-1
Octonal		78413-87-3
O-Mustard (T)	[Bis(2- chloroethylthioethyl)ether]	63918-89-8
Oxygen difluoride		7783-41-7
Pentolite		8066-33-9
Perchloryl fluoride		7616-94-6
PETN	[Pentaerythritol tetranitrate]	28799
Phosgene	[Carbonic dichloride] or carbonyldichloride]	75-44-5
Phosphine		7803-51-2
Phosphorus		7723-14-0
Phosphorus oxychloride	[Phosphoryl chloride]	10025-87-3
Phosphorus trichloride		2125683
Picrite	[Nitroguanidine]	556-88-7
Potassium chlorate		698078
Potassium nitrate		7757-79-1
Potassium perchlorate		7778-74-7
Potassium permanganate		7722-64-7
Propylphosphonothioic dichloride		227920
Propylphosphonyl difluoride		690-14-2
QL	[o-Ethyl-o-2-diisopropylaminoethyl methylphosphonite]	57856-11-8
RDX	[Cyclotrimethylenetrinitramine]	121-82-4
RDX and HMX mixtures		121-82-4
Sarin	[o-Isopropyl methylphosphonofluoridate]	107-44-8
Selenium hexafluoride		7783-79-1
Sesquimustard	[1,2-Bis(2-chloroethylthio)ethane]	3563-36-8
Silicon tetrafluoride		7783-61-1
Sodium azide		26628-22-8
Sodium chlorate		2146053
Sodium nitrate		7631-99-4
Soman	[o-Pinacolyl methylphosphonofluoridate]	96-64-0
Stibine		7803-52-3
Sulfur dioxide (anhydrous)		2025884
Sulfur mustard (Mustard gas (H))	[Bis(2-chloroethyl)sulfide]	505-60-2
Sulfur tetrafluoride	[Sulfur fluoride (SF ₄), (T-4)-]	7783-60-0
Tabun	[o-Ethyl-N,N-dimethylphosphoramido- cyanidate]	77-81-6
Tellurium hexafluoride		7783-80-4

Tetranitroaniline		53014-37-2
Tetrazene	[Guanyl nitrosaminoguanyltetrazene]	109-27-3
Thiodiglycol	[Bis(2-hydroxyethyl)sulfide]	111-48-8
Titanium tetrachloride	[Titanium chloride (TiCl ₄) (T-4)-]	7550-45-0
TNT	[Trinitrotoluene]	118-96-7
Torpex	[Hexotonal]	67713-16-0
Triethanolamine		102-71-6
Triethanolamine hydrochloride		637-39-8
Triethyl phosphite		122-52-1
Trifluoroacetyl chloride		354-32-5
Trifluorochloroethylene	[Ethene, chlorotrifluoro]	79-38-9
Trimethyl phosphite		121-45-9
Trinitroaniline		26952-42-1
Trinitroanisole		606-35-9
Trinitrobenzene		99-35-4
Trinitrobenzenesulfonic acid		2508-19-2
Trinitrobenzoic acid		129-66-8
Trinitrochlorobenzene		88-88-0
Trinitrofluorenone		129-79-3
Trinitro-meta-cresol		602-99-3
Trinitronaphthalene		55810-17-8
Trinitrophenetole		4732-14-3
Trinitrophenol		88-89-1
Trinitroresorcinol		82-71-3
Tritonal		54413-15-9
Tungsten hexafluoride		7783-82-6
VX	[o-Ethyl-S-2- diisopropylaminoethyl methyl phosphonothiolate]	50782-69-9