



CHEMICAL HYGIENE PLAN

Version 2.0
Adopted April 30, 2017
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Chemical Hygiene/Radiation Safety Officer

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I. POLICY STATEMENT

Carleton College exists to advance the education of its students. Achieving this goal involves the use of materials that require specific precautions be taken to protect the health of those exposed. Therefore, it shall be the policy of Carleton College to communicate any risks or dangers associated with handling hazardous chemicals to employees and students involved in such operations and to communicate available practices and procedures for protection against such identified hazards.

It will be the responsibility of the senior management and its designees to ensure that the proper information is obtained and disseminated to the appropriate individuals and to provide a safe environment. It will be the responsibility of all individuals to follow safe practices and procedures as outlined in the standard operating procedures and other reference materials.

Carleton College is not creating a new role or responsibility for any of our employees. The Chemical Hygiene Plan is intended to supplement normal activities in the specific area of chemical health hazards in the laboratory and other work areas. Current safety policies remain in effect.

The effectiveness of the Chemical Hygiene Plan, as with all safety programs, depends upon the active support and involvement of all personnel.

II. DESIGNATION OF RESPONSIBILITY

Purpose: To establish the position of Chemical Hygiene Officer. An individual will be designated to be responsible for the development and implementation of the Chemical Hygiene Plan (CHP), in compliance with Code of Federal Regulations, title 29, section 1910.1450, the Occupational Health and Safety Administration's standard, *Occupational Exposure to Hazardous Chemicals in Laboratories*. This individual will be referred to as the Chemical Hygiene Officer (CHO). The CHO has the authority to enforce the policies and procedures of the CHP.

1. Chemical Hygiene Officer: Wayne A. Brown is appointed the Chemical Hygiene Officer. The specific responsibilities of this position are listed in Section III. The CHO is responsible for the development and implementation of the Chemical Hygiene Plan. The CHO will provide technical guidance to the staff in developing practices and procedures for the CHP to assure employee and student protection when performing workplace and laboratory procedures involving the use of hazardous chemicals.
2. As part of Carleton College's Environmental Health and Safety (EHS) Department, the CHO has the authority to implement the program and insure compliance by all employees and students. The CHO will coordinate all aspects of the program and delegate individual duties to specific individuals as appropriate, in order to maintain uniform implementation of the CHP.

III. RESPONSIBILITIES

Purpose: A brief outline of responsibilities for those persons involved will help in the overall program direction. The following responsibilities are not all-inclusive, but are designed to give guidance in program development. Since each laboratory or work area is different, those responsibilities may vary.

Scope: This procedure is intended to cover those employees who are directly involved with handling of hazardous materials or supervision of those activities.

Carleton College EHS

Responsibilities

1. Ensure all management personnel are aware of the Chemical Hygiene Plan (CHP).
2. Appoint a Chemical Hygiene Officer with the authority to enforce the policies and procedures of the CHP.

3. Periodically audit the Chemical Hygiene Plan's progress and implementation. The CHO assisted, by elements of Carleton College EHS and the Safety Committee, will perform this function.

Senior Management

Responsibilities

Management provides the leadership, vision, and resources needed to implement an effective safety and health program. Management leadership means that business owners, managers, and supervisors:

- Make worker safety and health a core organizational value.
- Are fully committed to eliminating hazards, protecting workers, and continuously improving workplace safety and health.
- Provide sufficient resources to implement and maintain the safety and health program.
- Visibly demonstrate and communicate their safety and health commitment to workers and others.
- Set an example through their own actions.

Chemical Hygiene Officer

Responsibilities

1. Provide technical assistance/guidance to administrators, laboratory directors and supervisors in developing and implementing chemical hygiene procedure and practices.
2. Monitor the institution's procurement, use and disposal of hazardous chemical materials.
3. Maintain an up-to-date file of safety data sheets or appropriate alternative. Maintain an inventory of all hazardous chemicals in an up-to-date manner.
4. Help laboratory managers or project directors develop and implement the use of adequate procedures and use of personal protective equipment to safeguard employee health.
5. Know the current legal requirements with respect to the CHP, regulated substances and disposal methods.
6. Coordinate emergency procedure and fire department activities related to hazardous chemicals.
7. Conduct audits to determine the implementation and effectiveness of the CHP and compliance with college policy and governing federal and state regulations.

Laboratory Director/Manager/Faculty Principle Investigator

Responsibilities

1. Review operations with supervisors to determine what jobs/procedures require chemical hygiene training.
2. Maintain an up-to-date chemical inventory. Changes to the inventory should be made as they occur. A review of the entire inventory will be conducted at least annually.
3. Follow-up to ensure supervisors are carrying out prescribed college policy.
4. Notify the Chemical Hygiene Officer of any operating changes affecting the hazardous chemicals being used or new chemical hazards being introduced into the laboratory.
5. Insure up-to-date records are maintained on training of all employees required to handle hazardous chemicals. Cooperate with Carleton EHS to assure training documentation for inclusion in the employee's record.
6. Assist the CHO in development of Standard Operating Procedures (SOP) for chemical safety when hazardous chemicals are used.

Laboratory or Area Supervisor

Responsibilities

1. Identify all jobs/procedures requiring the use of hazardous chemicals and list those chemicals.
2. With the assistance of the Supervisor and the CHO, develop SOP's that address safe handling of hazardous chemicals identified.
3. Insure provision and documentation of training employees in the safe handling of hazardous chemicals using established SOP's.
4. Periodically inspect engineering controls and personal protective equipment, and review administrative controls
5. Make routine surveys of the work area to ensure practices are being followed.
6. Ensure manufactures'/suppliers' labels have not been defaced or removed.
7. Ensure that a copy of the Chemical Hygiene Plan and SDS's are readily accessible to workers immediately upon request.
8. Enforce applicable safety and health rules.

Laboratory Employee/Chemical User

Responsibilities

1. Obey established safety rules.
2. Follow established SOP's when performing any work with hazardous chemicals.
3. Know where the CHP and the SDS's are kept/accessed in one's work area.
4. Use engineering controls and personal protective equipment as required by laboratory standard operating procedures.
5. Inform your supervisor of:
 - a. Any symptoms of overexposure that may possibly be related to hazardous chemicals.
 - b. Missing labels on containers
 - c. Malfunctioning safety equipment.
6. Do not remove or deface labels on the containers.
7. Know the location of, and how to use the SDS, emergency equipment, first aid supplies, emergency eyewash, engineering controls devices, etc.
8. Know (your) role in emergency procedures.
9. Know the emergency evacuation route from the laboratory or work area.

IV. HAZARD COMMUNICATION and IDENTIFICATION

Purpose: This section outlines a method for determining the health hazards of chemicals that will be used by the laboratory and other work areas. For any chemical that is purchased from any outside supplier, the manufacturer's or supplier's SDS and label will be the principal source of hazard communication (**HAZCOM**) information, with particular attention given to **Global Harmonization System (GHS)** warnings and symbols. Any chemical produced in the laboratory, or produced as a by-product, will be assumed to be hazardous unless, or until, its identity can be determined and a specific hazard analysis is performed.

This section also identifies the system used to prevent accidents and ensure the safety and health of our employees. Employees are informed of the elements and function of the OSHA HAZCOM standard, the hazardous properties of chemicals with which they work, safe handling procedures and measures to use to protect themselves from

chemical hazards. The HAZCOM plan also details the acquisition and maintenance of SDS's and container labeling and applies directly to hazardous chemical use in all Carleton College workspaces. [See Attachment B]

Scope: This section covers all faculty, staff, and students who utilize hazardous chemicals or materials associated with the performance of any activity at Carleton College. It includes all hazardous chemicals used in the laboratory, whether brought there from an outside manufacturer or supplier, or produced in the laboratory as a product, intermediate or byproduct.

HAZCOM:

1. In conjunction with the appropriate supervisor the CHO will review each new or revised SDS when it is received from a manufacturer or supplier. The review will be conducted to assure that it is complete and that it provides information concerning the health hazards, special procedures or practices for handling and storage, emergency procedures and disposal methods. The SDS review will also determine if special procedures or practices need to be implemented to assure safe handling. Because most safety data sheets are readily available via internet in various electronic formats, workspaces equipped with internet access can be used as primary SDS sources. **However, before any chemical may be opens for use, a hard copy of a SDS MUST be on file and immediately available upon worker request.** Manufacturer SDS's must conform to 29 CFR 1910.1200 (g)(2).
2. The Purchaser of a given chemical substance will be responsible for procuring SDS's from all hazardous materials suppliers for review, with the assistance of the CHO, then storing for use by employees upon request. If available, suppliers' samples must include a safety data sheet for the use of operating personnel in evaluating the product. The CHO will assist laboratory managers or supervisors in the development and maintenance of each respective chemical inventory.
3. If a Safety Data Sheet is missing, the purchaser will secure it by contacting the manufacturer. This allows the person in most immediate need to get the information first. Suppliers who fail to cooperate in providing SDS's will be identified to the appropriate management personnel for disposition. This may also the include cessation of all future purchasing.
4. **Laboratory Safety Date Sheets:** The following procedures cover record keeping and filing of SDS's for chemicals used in the laboratories and other workspaces.
 - a. Upon placing verbal and written orders for chemical reagents, a request will be issued for shipment of a SDS to the purchaser's attention, arriving either before or with the product.
 - b. In each laboratory, before any chemical is opened for use, a hard copy of its must be on file in the laboratory where stored and used.
 - c. The laboratory / work area SDS's should be used for employee training and use, and must be available for employee access immediately upon request.

- d. The CHO will ensure that SDS's be made available to any outside medical provider or public service agency that has a need for the information.
5. Information supplied by the product and manufacturer will be relied upon to properly determine the hazards of any particular chemical used in the laboratories. Safety data sheets, that are incomplete or appear to be in error, will be referred back to the manufacturer information update or change. If any missing information is noticed or appears to be inaccurate, the worker should contact his/her supervisor or the CHO.
6. SDS's should be maintained in accordance with 1910.20-Subpart C-General Safety and Health Provisions - "Access to Employee Exposure and Medical Records." Paragraph (d) Preservations of Records; (1) (ii) (A) & (B), Safety Data Sheets: and paragraph (c) (5) (iv). Records Concerning the Identity of a Substance or Agent need not be retained for any specific period, as long as some record of the identity of the substance or agent, where it was used, and when it was used is retained for at least thirty years. SDS's for products that are not currently used or that have been changed will be maintained in an inactive file for a minimum of 30 years.
7. In addition to the SDS's, other information concerning the hazards, safe handling, storage, and disposal can be found through literature searches including source material derived from internet discovery, consultation with colleagues, alternative manufacturers and regulatory agencies.
8. **Container Labels:** All labels affixed to incoming chemicals containers must be maintained. Workers must contact their supervisors or the CHO if any container labels are missing or defaced. The container with missing or defaced labels will be removed from stock by the CHO and not returned until the condition has been rectified. [See Attachment C]
9. Labels are designed to provide information to employees concerning the hazards of various chemicals. Therefore, it is important the hazardous chemicals remain in properly labeled containers. The following procedures apply to all manufacturers' labels.
 - a. All manufacturers' labels will be left on the containers. If any container labels are missing or defaced, please contact your supervisor.
 - b. As a minimum, each manufacturer's label should contain the following per 29 CFR 1910.1200 (f)(1)(I) – (vi):
 - i. Product identifier
 - ii. GHS Signal word
 - iii. Hazard statement(s)
 - iv. Pictogram(s)
 - v. Precautionary statement(s)
 - vi. Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

- c. Workers unfamiliar with the contents of a label, please see the lab supervisor for a further explanation.
10. In the laboratory, storage, reaction or processing containers should be labeled with:
 - a. Product identifier and [29 CFR 1910.1200 (f)(6)(ii)]
 - b. Words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals [29 CFR 1910.1200 (f)(6)(ii)]
 - c. Date of initiation
 - d. Name of initiator
 11. The CHO will ensure containers of chemical produced in-house will be labeled with appropriate hazard information.
 12. **Training:** This procedure outlines the college's policy for training employees who are required to handle hazardous chemicals. Carleton College 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 will 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. [29 CFR 1910.1200(h)(1); **See Attachment B**]

The information and Training Program will teach employees about the hazards of the chemicals used in their areas and the protective measures by which they can protect themselves from exposure to these chemicals. As a minimum, the following areas will be covered either in training sessions or provided as reference materials to which each employee has ready access:

- a. The contents of Federal Standards, "Occupational Exposure to Hazardous Chemicals in Laboratories"; 29 CFR 1910.1200 and 1910.1450 (where applicable)
- b. The college's Chemical Hygiene Program and where it is located
- c. Permissible Exposure Limits for chemicals regulated by OSHA and other established exposure limits which will be used during employee exposure determination
- d. Symptoms associated with overexposure to hazardous materials
- e. The Hazard Communication (HAZCOM) procedure associated with chemicals used in laboratories. This will be accomplished by showing the employee how to read SDS's and manufacturers' labels
- f. Use of personal protective equipment

- g. Standard operating procedure to be used when hazardous chemicals are used
- h. Emergency procedures
- i. Storage procedures
- j. Waste disposal

Training Program

I. The program will be presented in three parts

- A. Part I will present an explanation of the OSHA regulations, worker's "Right-to know," the college's HAZCOM program and Chemical Hygiene Plan at the time of hire.
- B. Part II, presented by a Supervisor or the CHO, will include information on the hazards associated with chemicals found in the employee's work area(s), SDS Access, a detailed explanation of all applicable parts of the CHP will be provided to the employee.
 - 1. New hires trained during the orientation period of their employment. Specific hazard information and control measures will be presented by the supervisor upon assignment to a specific work area **before** the employee works with hazardous chemicals.
 - 2. Transferred employees will be trained by the supervisor of the new department **before** working with hazardous chemicals.
- C. Part III, Standard Operating Procedures (SOP), are detailed and specific step-by-step directions for tasks performed in the area in which the employee works. These will be taught by the Supervisor as needed.

II. Supplemental training

- A. Triggered when new chemical hazards or new procedures with new hazards are introduced into the lab. Training presented to the employee affected by the supervisor with assistance from CHO.
- B. Refresher training will be provided as determined by the supervisor and/or the CHO.

III. Training Documentation

- A. Each department will document worker training
- B. Human Resources in concert with EHS will maintain training records

HAZARD IDENTIFICATION:

The mitigation of exposures, injuries or illnesses, and the lessening of risks associated with the workplace use of hazardous chemicals, begins with the recognition, evaluation, and control of the hazards presented by each chemical used. The procedure describes how the company will evaluate and control the chemical hazards in the laboratory.

Safety Data Sheets specify the health and physical hazards associated with a given chemical. The CHO, Principle Investigators and Supervisors will collaborate to interpret this information, especially Permissible Exposure Limits (PEL's) and Threshold Limit Values (TLV's) in relationship to the degree of hazard presented by chemicals used in the laboratories and various facilities. Such evaluation will establish the strategic use of engineering, administrative, and personal protective equipment controls to facilitate the safe use of hazardous materials. Those efforts will be coordinated by the Chemical Hygiene Officer, who should be contacted immediately with questions concerning employee/student exposure to hazardous materials.

General Hazard Identification Process:

1. Collect Information

Review all available information to find hazards that have already been identified by others.

Examples:

- Safety data sheets
- Equipment manuals
- Inspection reports
- Insurance reports
- Past incident data
- Relevant OSHA data
- Consultation reports

2. Inspect and Observe

Inspect equipment and work areas when not in operation, using common sense and drawing on the knowledge of the operators to identify potential hazards. Be sure to observe processes in action as well; doing so may uncover additional hazards that would not be otherwise obvious.

3. Involve Workers

Often, talking to workers and listening to their feedback is the most effective way to quickly find hazards. Be sure to stay engaged with them and listen closely, as they may not always know that they are describing a hazard.

Hazard I.D. (cont.)

4. **Investigate Incidents**

Although the goal is zero incidents, when one happens, it is important to take that as an opportunity to learn about hazards that may have been overlooked. Investigate to find true *root causes* and address systemic issues.

5. **Prioritize**

Evaluate the hazards you have identified and mitigate the most hazardous first. Hazards can be assessed both in terms of severity (how bad the potential outcome is) and exposure (how likely an occurrence is). Typically, a combination of these two factors plays into the prioritization of mitigations.

6. **Review and Repeat**

Hazard identification in a cyclical process, driven by the scientific method model, that should repeat more frequently with the use of increasingly hazardous materials, and when there are changes in chemicals, procedures, personnel and increases in accidents.

1. **Employee Exposure Determination:** In many of the lab procedures, multiple hazardous chemicals are used. However, the quantities are small and the duration of use is short. For these reasons, monitoring of the potential employee exposure due to airborne chemicals will be conducted if there is sufficient reason to believe that an exposure is possible. The following criteria will be used to determine if monitoring will be conducted:
 - a. The toxicity and volatility of the hazardous chemical in use. If a highly toxic or highly volatile material is handled during a procedure, these operations will be placed on a priority evaluation list to determine if sampling is needed.
 - b. The manner in which the procedure is conducted, i.e. procedures that must be conducted outside a lab hood or unventilated area, if toxic chemicals must be heated, or procedures must be conducted in open vessels not closed containers.
 - c. Quantity of, and frequency at which a hazardous chemical is used.
 - d. Report of an employee experiencing signs or symptoms of exposure, such as skin or eye irritation, shortness of breath, headache, etc.
2. As required by the OSHA Lab standard [29 CFR 1910.1450], monitoring will be conducted if the above conditions could result in an employee's overexposure

during use of the chemicals regulated by OSHA and listed in 29 CFR 1910 Subpart Z.

a. **OSHA Regulated Substances include but are not limited to:**

Asbestos

Vinyl chloride

Inorganic arsenic

Lead

Chromium (VI)

Cadmium

Benzene

1,2-dibromo-3-chloropropane

Acrylonitrile

Ethylene oxide

Formaldehyde

Methylenedianiline

1,3-Butadiene

Methylene Chloride

b. Monitoring of employee exposure may also be conducted for any other chemicals used in the lab if the conditions stated under paragraph 1 are experienced.

c. The CHO will coordinate employee monitoring. The CHO should be contacted if the above conditions are observed or if plans for a new procedure or use of a new chemical could be expected to create any of the conditions stated above.

3. Personal Protective Equipment

a. Respirator. Selection, use, maintenance and storage of all respiratory protective equipment will be in accordance with a respiratory protection program to be developed and implemented only upon assessment of need. Otherwise, any campus worker may request the use of a mask (such as N95) to filter nuisance dusts and particles.

- b. Safety glasses will be worn at all times when working in any lab where hazardous chemicals are used. Additional requirements for eye protection, such as chemical splash guard, goggles, etc., will be determined by the lab SOP for use of the chemical.
 - c. Protective clothing requirements, such as, lab coats, protective gloves, coveralls, etc., will be determined by the lab SOP for use of that chemical.
4. Preventive Maintenance Programs
- a. Local Exhaust Ventilation (LEV) - Hood performance
 - i. Use smoke tubes to visualize the air flow patterns within the hood. Excessive turbulence, uneven exhaust air flow patterns, effects of make-up air will be evident from the smoke tube evaluation.
 - ii. Measure the air velocity with a calibrated anemometer. Make a series of measurements to assure the even distribution of the exhausted air steam. Air velocities should not vary more than 20%-25% over the face of the hood.
 - iii. Always perform this evaluation with the hood sash in the full "working" position. If adequate velocities are not attainable at the full open position, remove the hood from service until it can be maintained.
 - b. Exhaust fan
 - i. Maintain the exhaust fan, e.g. drive belts, lubrication, etc.
 - ii. Observe proper direction of the fan rotation.
 - iii. Determine the condition of the fan blades.
 - iv. Check the performance of multi-speed fans, solenoids, etc., which can affect the performance of the hood under different operating conditions.
 - c. Additions to the LEV systems. Whenever an additional hood or other ventilated equipment is added to the system, the entire system should be re-evaluated. Following the evaluation, if changes are necessary, they should be made to the system before it is returned to service.
5. Eyewashes and safety showers must be checked on a weekly basis by a designated individual.

V. STANDARD OPERATING PROCEDURES

Purpose: A general procedure for developing standard operating procedures (SOP) to protect the health of the laboratory employee is presented in this section. Each SOP will contain the practices and procedures required to protect the employee's health

when working with hazardous chemicals. The importance of SOP's can not be stressed enough. Not only do they provide specific step-by-step instructions in the correct way to perform a given task, they protect the individual supervisors and the institution as a whole from potential litigation in the event of an accident. The CHO will always be available for assisting in the development of SOP's. However, since the CHO does not perform on a regular basis all of the various procedures that can be outlined by a SOP, it will be necessary for the supervisors who possess practiced expertise and who are in regular contact with such procedures to be primarily responsible for SOP development.

Scope: A standard operating procedure must be developed and implemented for handling of any hazardous chemicals.

1. If any laboratory procedure will result in the production of a by-product that is unknown, it will be considered hazardous and handled accordingly to the SOP for work with particularly hazardous substance.
2. If any laboratory procedure results in an intermediate or final product whose composition is known, a literature search will be conducted to determine the hazardous nature of the chemical. Following this hazard evaluation, the CHO in conjunction with other members of the management staff, as needed, will develop appropriate practices and procedures to assure safe handling, use, storage and disposal of the chemical. These procedures will be included with the SOP's for working with hazardous chemicals to ensure employee protection.

Procedures:

1. Using the Carleton College SOP form provided at the end of this section, the director of each lab is responsible for developing and effectively implementing SOPs for the safe handling of all hazardous chemicals in his/her laboratory. In the development of SOPs, the CHO will provide technical assistance concerning personal protective equipment that is needed by the individual(s) performing a given task.
 - a. An individual SOP is not required for each chemical in use. However, the SOP's which are developed should provide guidance which includes all known hazards of all chemicals in use.
 - b. An SOP must be written for any procedure that requires that prior approval be given.
2. At a minimum, each SOP should include the items listed below, for example, if the procedure can be performed outside a laboratory hood, don't omit engineering controls. Rather, indicate that the lab hood is not required.
 - a. Where applicable, SOP's should include the following:
 - i. Hazardous chemicals involved;
 - ii. Chemicals procedures;
 - iii. Instruments used;

- iv. Engineering controls;
 - v. Personal protective equipment;
 - vi. Step-by-step procedure.
- b. Where particularly hazardous chemicals are in use, the following measures should be considered for the SOP.
- i. Maintain records of quantities stored and used
 - ii. Store in a ventilated area. Store in a container that is large enough to contain a spill of the entire container
 - iii. Transfer all materials in an oversized container
 - iv. Work in a designated area, such as a lab hood, glove box or other designated area that is well marked.
 - v. Wear eye protection. At a minimum use safety glasses, if splashes are possible additional protection may be required.
 - vi. Wear protective clothing, a lab coat as a minimum, to avoid contamination in the event of an unplanned release.
 - vii. Wear protective gloves if manipulations must be conducted by hand or if the hands could be contaminated or injured.
 - viii. Protect all work surfaces from contamination. Use wet methods whenever possible. If material is dry or aerosol production is possible, equipment with HEPA filters must be used to limit contaminated area or equipment that must be cleaned.
 - ix. Following completion of the procedures, decontaminate all work surfaces, equipment, glassware, flasks, vacuum tubes and instruments.
 - x. Dispose of waste materials properly. Refer to the SOP on Hazardous Waste Disposal.
 - xi. Remove contaminated protective clothing and dispose or clean properly.
 - xii. As a final step, wash carefully and decontaminate yourself.
- c. The following SOPs requirements are included for all areas as appropriate practice:
- i. Eating, drinking, smoking
 - ii. Dress code
 - iii. PPE
 - iv. Chemical transportation policy and protocol
 - v. Chemical storage policy and protocol
 - vi. Fume hood face velocity testing policy and protocol
 - vii. Spill response plan
 - viii. Accident/injury response plan
- d. The following SOPs requirements will be included for lab or work areas when appropriate:
- i. Waste minimization and disposal policy
 - ii. Solvent policy

- iii. Acid/base policy
 - iv. Toxin policy
 - v. Select carcinogen policy
 - vi. Noise policy
3. SOP's for the hazardous chemicals handled in each lab are provided by each laboratory director/supervisor.
 4. Use the following format in guiding SOP development:

See Attachment F

VI. MEDICAL EVALUATION PROGRAM

Purpose: This procedure describes the general circumstances in which routine medical evaluation, medical consultations and medical examinations will be provided to laboratory employees.

Scope: Medical evaluation following potential or measured overexposures, as well as, routine medical evaluations for such things as use of eye and respiratory protection are detailed in procedure.

Procedures:

- A. Medical evaluation will be provided to lab employees under the conditions detailed below:
 - 1. Routine medical evaluations will be provided for employees required to use personal protective equipment, such as prescription safety glasses and respiratory protection.
 - 2. Medical evaluation is required by OSHA health Standard (29 CFR 1910 Subpart Z), where employee monitoring has indicated an exposure above the action level (AL) or permissible exposure limit (PEL) where no AL exists.
 - 3. A medical consultation between a licensed physician and the affected employee(s), for the purpose of determining the need for additional medical examinations, will be provided as follows:
 - a. Whenever an employee develops signs or symptoms associated with hazardous chemicals that are used in their laboratory.
 - b. Following the occurrence of an event such as a spill, leak, or explosion involving a hazardous material which was likely to result in employee exposure.
- B. Initial evaluations will be provided by or under the direct supervision of a licensed physician at college occupational health clinic. Additional evaluation, examinations or test may be conducted at the local health care facility depending on the capabilities of the in-house Medical Facility.
- C. The following information will be provided to the physician before or at the time of consultation.
 - 1. Identity of the hazardous material(s).
 - 2. Description of the conditions under which the exposure occurred. This description will include exposure data when available.

3. Description of the signs and symptoms resulting from exposure to the hazardous chemical in question.
- D. Whenever a medical consultation or examination is provided for an employee, a written opinion will be required from the physician. The following information will be required in the opinion.
1. Recommendation(s) for any medical following-up, including additional consultation, examination or tests.
 2. Result of any medical examinations or test that may have been performed.
 3. Any medical condition revealed during the examination that may place the employee at increased health risk as a result of exposure to a hazardous material found in the lab.
 4. A statement that the examining physician has informed the employee of the results of the examination and that the physician has informed the employee of any condition that may require further examination or treatment.
- E. **IMPORTANT NOTE:** For the employee's protection, the physician will be informed that no condition, unrelated to the occupational exposure, shall be revealed at any time to the employer.
- F. All medical consultations, examinations and tests resulting from this procedure will be provided to the employee at no expense.

VII. HAZARDOUS WASTE DISPOSAL

Purpose: It is the legal responsibility of each lab, in concert with the CHO, to develop and implement a procedure to dispose of hazardous waste in a manner which protects human health and the environment.

Scope: All hazardous chemical wastes resulting from any lab procedure must be considered as hazardous waste. The technical description of types of hazardous waste materials are detailed in the procedure below.

Procedures:

See Attachment H

ATTACHMENTS

Attachment A

General Employee Information Bulletin for the Occupational Exposure to Hazardous Chemicals in Laboratories

In a continuing effort to inform employees of safe practices, Carleton College has initiated a Chemical Hygiene Plan to determine the potential for employee exposures to hazardous chemicals and the procedures, practices and equipment we have established to protect our employees from those hazards.

This program will meet the requirements of the federal regulation known as "Occupational Exposures to Hazardous Chemicals in Laboratories, Final Rule," which is commonly known as "The Lab Standard."

This law has specific requirements for training you, the employee; providing information about our written programs; and establishing of certain laboratory procedures to minimize the potential for exposure to hazardous chemicals in our laboratories.

Your supervisor will be informing you of any operations where hazardous chemicals are present and where additional information may be obtained concerning those chemicals.

Some of the above activities will involve a detailed study. So, you may notice people in the lab or be asked questions about your job. Please cooperate with these people. The information they are gathering is for your protection.

It has always been Carleton College's policy to protect you, our employees. These new people will supplement those efforts.

If you have any questions, contact the Chemical Hygiene Officer at Ext. 7554; Hoppin House, 202.

Attachment B

HAZCOM

Small Entity Compliance

(OSHA)

HAZARD COMMUNICATION

Small Entity Compliance Guide for Employers That Use Hazardous Chemicals





Occupational Safety and Health Act of 1970

“To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health.”

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This publication provides a general overview of a particular standards-related topic. This publication does not alter or determine compliance responsibilities which are set forth in OSHA standards, and the *Occupational Safety and Health Act*. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

This guidance document is not a standard or regulation, and it creates no new legal obligations. It contains recommendations as well as descriptions of mandatory safety and health standards. The recommendations are advisory in nature, informational in content, and are intended to assist employers in providing a safe and healthful workplace. The Occupational Safety and Health Act requires employers to comply with safety and health standards and regulations promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm.

HAZARD COMMUNICATION

Small Entity Compliance Guide for Employers That Use Hazardous Chemicals

**Occupational Safety and Health Administration
U.S. Department of Labor**



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I. INTRODUCTION

Chemicals have become an important element of almost every aspect of modern life. All of these chemicals—from cleaning fluids to pharmaceuticals, pesticides, and paints—are produced in workplaces, and may be used in workplaces downstream. While these chemicals have utility and benefits in their applications, they also have the potential to cause adverse effects. These adverse effects include both health hazards (such as carcinogenicity and sensitization), and physical hazards (for example, flammability and reactivity properties). In order to protect workers from these effects—and to reduce the occurrence of chemical source illnesses and injuries—employers need information about the hazards of the chemicals they use, as well as recommended protective measures. Workers have both a right and a need to know this information too, especially so that they can take steps to protect themselves when necessary.

No one knows exactly how many chemicals may be present in American workplaces. The total number of chemical substances that have been developed and registered in the Chemical Abstracts Service Registry reached 60 million in 2011—the last 10 million of those were added in less than two years. Many of them involve innovations such as the application of nanotechnology.

While not all of these chemicals are produced commercially today, this vast number indicates the scope of the potential problems in workplaces with regard to the safe use of chemicals. In addition, most chemical substances are formulated into mixtures for use in the workplace. Therefore, the number of unique chemical mixtures is far greater than the number of substances, and most workers are exposed to mixtures.

According to the Bureau of Labor Statistics (BLS), acute illnesses and injuries due to chemical exposures in the workplace have decreased 42% since the Hazard Communication Standard was first promulgated.

The scope of workplaces in which chemical exposures occur is also very broad. While most people can readily associate working in a chemical manufacturing plant as being a job that involves chemical exposures, there are many other types of facilities where such usage is also commonplace. For example, construction workers may be exposed to paints, lacquers, thinners, asphalt fumes, or crystalline silica. Hair stylists are exposed to chemical dyes and other hair products that contain hazardous chemicals. All of these types of exposures are of concern in terms of protecting workers, and ensuring that chemicals are used safely.

Audience for this Guide

This guide is intended to help small employers comply with the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (HCS). The guide is advisory in nature and informational in content. It is not itself a standard or regulation, and it creates no new legal obligations. The employer must refer to the appropriate standard to ensure it is in compliance. In 25 states and two territories, OSHA standards are enforced by the state agency responsible for the OSHA-approved state plan. These states are: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wyoming. Connecticut, Illinois, New Jersey, New York, and the Virgin Islands operate OSHA-approved State Plans that apply only to state and local government employees. State plans must adopt and enforce standards that are either identical to or at least as effective as the Federal OSHA standards.

OSHA's Hazard Communication Standard

OSHA's HCS, [29 CFR 1910.1200](#), addresses the informational needs of employers and workers with regard to chemicals. The HCS was first promulgated in 1983, and covered the manufacturing sector. It was later expanded to cover all industries where workers are potentially exposed to hazardous chemicals.

The revised Hazard Communication Standard is expected to build on the success of the original Hazard Communication Standard and prevent an estimated additional 585 injuries and illnesses and 43 fatalities annually. It will reduce trade barriers and result in estimated annualized benefits in productivity improvements for American businesses that regularly handle, store and use hazardous chemicals, as well as cost savings for American businesses when revising safety data sheets and labels for chemicals covered under the standard.

In 2012, the HCS was modified to align its provisions with the United Nations' Globally Harmonized System of Classification and Labelling of Chemicals (GHS). Many benefits will result from revising the HCS to be consistent with the GHS. In particular, the GHS helps to ensure that imported chemicals will be accompanied by consistent hazard and precautionary information to protect workers exposed in the U.S. In addition, the revised HCS can facilitate trade in chemicals since it reduces potential barriers posed by differing global requirements for classification and labeling of chemicals.

“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.

“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.

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

The HCS is a unique OSHA standard in a number of respects. It incorporates what is referred to as a *downstream flow of information* from chemical manufacturers, importers, and distributors, to employers using the products:

- The standard requires chemical manufacturers and importers to **classify** the hazards of the chemicals they produce or import, and to prepare appropriate **labels** and **safety data sheets** (SDSs) to convey the hazards, as well as recommended protective measures.
- Chemical manufacturers, importers, and distributors must ensure that the containers of these hazardous chemicals are labeled when shipped, and that SDSs are provided downstream with the first shipment and when the SDSs are updated.

Thus, those who know the most about the chemicals—the companies that produce, import, or distribute them—have the responsibility to assess available information, and convey what is needed to downstream employers where the hazardous chemicals are used. The scope of coverage with regard to employers is addressed in paragraph (b)(2) of the standard:

(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.

There are a number of definitions that impact the interpretation of this definition of coverage (see box to the left), but most workplaces will be subject to the rule.

As an employer who is a chemical user, you are required to receive labels and SDSs from your suppliers. Employers have responsibilities under the HCS to establish hazard communication programs, and provide workers with access to labels and SDSs, in addition to informing and training these workers. The responsibilities for hazard communication are illustrated in Figure 1.

“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.

“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.)

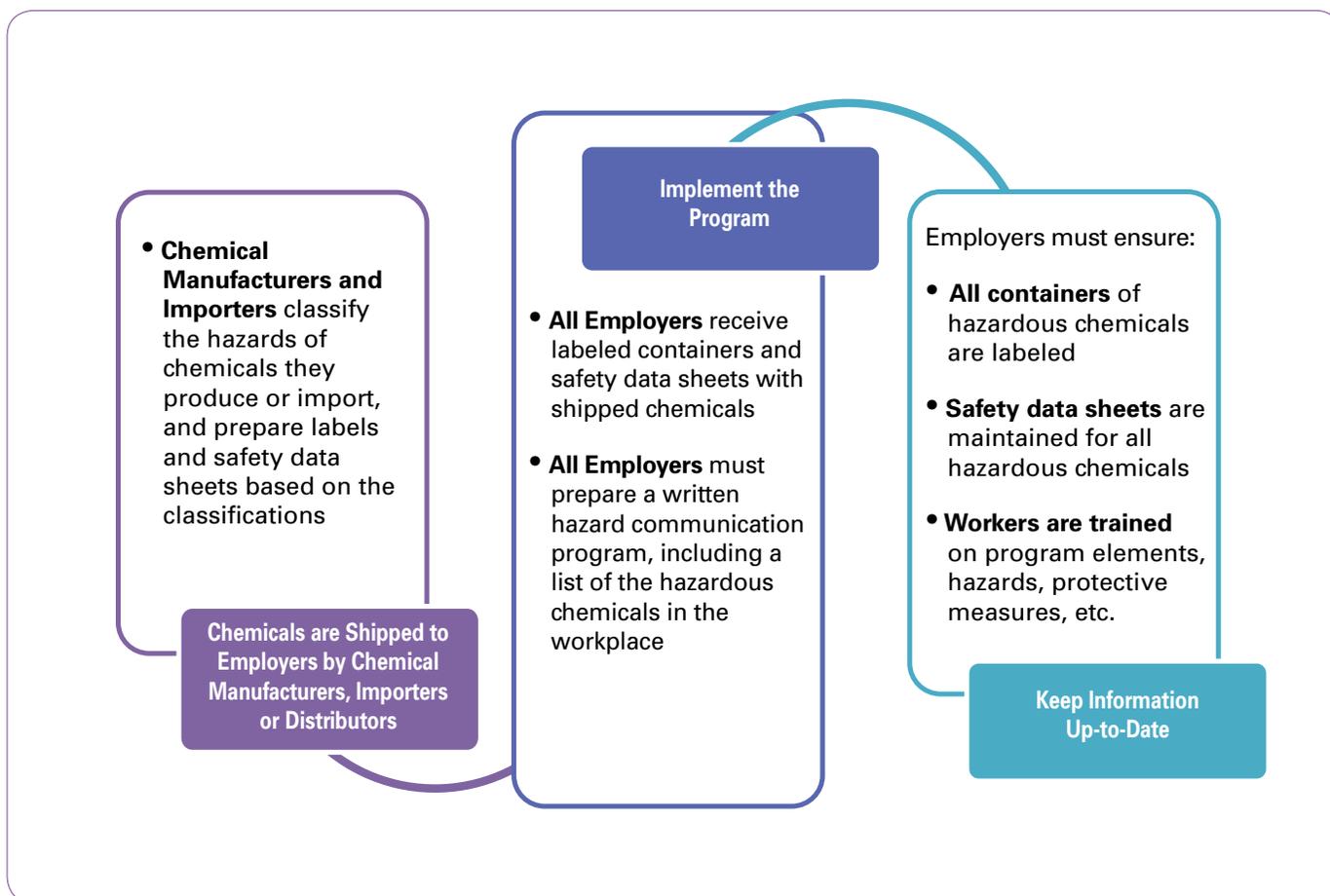
“Produce” means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

“Use” means to package, handle, react, emit, extract, generate as a by-product, or transfer.

This guide addresses employer responsibilities under the HCS. Many of the provisions of the standard apply only to chemical manufacturers, importers, or distributors. This guide will focus on assisting employers that only use but do not produce chemicals, in order to identify the parts of the rule that apply to their facilities, and help them to develop and implement an effective hazard communication program.

The 2012 revisions to the HCS, also referred to as “HazCom 2012” in this document, primarily address how chemical manufacturers and importers classify chemical hazards and prepare required labels and SDSs. If you are not a chemical manufacturer or importer, and you already have a hazard communication program that complies with the original HCS, you will have limited changes to make related to compliance with the revised standard.

Figure 1: How Hazard Communication Works



In order to understand the requirements of HazCom 2012 as applied to your workplace, it is useful to have a general familiarity with the organization of the standard. It is divided into regulatory paragraphs that describe requirements, which are further supplemented by appendices that contain specific details.

Organization of the Regulatory Requirements for Hazard Communication

Paragraphs of the Standard	Appendices to the Standard
(a) Purpose	Appendix A , Health Hazard Criteria (Mandatory)
(b) Scope and Application	
(c) Definitions	Appendix B , Physical Hazard Criteria (Mandatory)
(d) Hazard Classification	
(e) Written Hazard Communication Program	Appendix C , Allocation of Label Elements (Mandatory)
(f) Labels and Other Forms of Warning	
(g) Safety Data Sheets	Appendix D , Safety Data Sheets (Mandatory)
(h) Employee Information and Training	
(i) Trade Secrets	Appendix E , Definition of "Trade Secret" (Mandatory)
(j) Effective Dates	
	Appendix F , Guidance for Hazard Classifications re: Carcinogenicity (Non-Mandatory)

Under the HCS, an employer must prepare and implement a hazard communication program for workers potentially exposed to hazardous chemicals. The requirements most relevant to this responsibility can be found in paragraphs (e), (f), (g), and (h) as listed above and indicated in purple. The other parts of the standard may provide some guidance on understanding the requirements (such as Paragraph (c) Definitions), but your responsibilities are to employees in your workplace, and those responsibilities are specified in the standard paragraphs highlighted in the table above.

As previously mentioned, your suppliers must provide hazard information in the form of labels on containers and SDSs when you receive a chemical. The focus of the information is to provide the identities and hazards of the chemicals, their characteristics and properties, and how potential adverse effects can be prevented. A **"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.

In addition to the health and physical hazards listed above, there may be some hazards that do not meet the specified criteria for the physical and health hazard classes provided in HazCom 2012. In these cases, the chemical manufacturer or importer will designate the hazards as "hazards not otherwise classified" (HNOC), and must provide information on the SDS to ensure that downstream employers are aware of these other effects and any appropriate protective measures.

HCS Health and Physical Hazards

Health Hazards	Physical Hazards
<ul style="list-style-type: none"> • Acute toxicity • Skin corrosion/irritation • Serious eye damage/eye irritation • Respiratory or skin sensitization • Germ cell mutagenicity • Carcinogenicity • Reproductive toxicity • Specific target organ toxicity – single and repeated exposure • Aspiration hazard • Simple asphyxiant 	<ul style="list-style-type: none"> • Explosives • Flammable gases • Flammable aerosols • Oxidizing gases • Gases under pressure • Flammable liquids • Flammable solids • Self-reactive chemicals • Pyrophoric liquids • Pyrophoric solids • Pyrophoric gas • Self-heating chemicals • Chemicals which in contact with water, emit flammable gases • Oxidizing liquids • Oxidizing solids • Organic peroxides • Corrosive to metals • Combustible dust

HazCom 2012 refers to each of the defined hazards as a **“hazard class.”** Most of these hazard classes are subsequently divided into one or more **“hazard category(ies).”** This classification is done by the chemical manufacturer or importer, and is based on the severity of the effect, and the type of data available to indicate each effect. This is important to employers because it leads directly to the information that is subsequently provided on labels and SDSs for the chemical. For example, there are four categories in the hazard class for flammable liquids. These categories are based primarily on flashpoints, so the lower the flashpoint, the more severe the effect. The warnings provided on labels will reflect this severity in different statements depending on which category the chemical falls into based on its flashpoint. The category itself does not appear on the label, but it is available on the SDS for the employer’s reference. As an example of hazard categories under HazCom 2012, the following is the criteria for categorizing chemicals classified as flammable liquids:

Criteria for Flammable Liquids

Category	Criteria
1	Flash point < 23°C (73.4°F) and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C (73.4°F) and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C (73.4°F) and ≤ 60°C (140°F)
4	Flash point > 60°C (140°F) and ≤ 93°C (199.4°F)

As an employer who uses but does not manufacture or import chemicals, you are not responsible for making classifications or evaluating the hazards of a chemical. You must receive a label and SDS from your supplier based on the classification the supplier has made given the available scientific data on the product. All of the criteria used by the chemical manufacturer or importer to perform the classification are provided in HazCom 2012 in Appendices A and B.

Employers are allowed to perform their own classifications if they choose not to rely on the information provided by the chemical manufacturer or importer. If you choose to perform your own classification you will need to comply with the requirements in Appendices A and B of the standard.

If you choose to rely on the classification performed by the manufacturer or importer, it is not necessary to be familiar with the criteria for classifying the chemicals, or the scientific data supporting classification. However, you must have a basic understanding of the hazardous effects caused by the chemicals in your workplace. You must also have such an understanding in order to use the information to select protective measures, and ensure proper management of the chemicals in your workplace. Additionally, you must include information on the different types of hazards of the chemicals used in your workplace and how workers can protect themselves in your information and training program.

Compliance Dates

The first compliance date of importance is **December 1, 2013**. By that date, you must train your employees about the format and presentation of the new labels and SDSs they will be seeing in the workplace. Over the course of several years, your suppliers will be updating labels and SDSs to comply with the new requirements. It is, therefore, important to ensure that you and your employees are able to access and use the information provided in the new approach. All new labels and SDSs must be finished by **June 1, 2015**; however, if you order from a distributor you may still receive labels compliant with HazCom 1994 (the hazard communication standard issued in 1994 and replaced in 2012 by the revised standard) until **December 1, 2015**. If an employer identifies new hazards after December 1, 2015 due to the reclassification of the hazardous chemicals, it has six months, until **June 1, 2016**, to ensure that those hazards are included in the hazard communication program, workplace labeling reflects those new hazards, and employees are trained on the new hazards. During the transition from current requirements to the new requirements, employers may comply with either HazCom 1994 or HazCom 2012, both of which require a hazard communication program.

HazCom 2012 – Complete Schedule of Effective Dates

Effective Completion Date	Requirement(s)	Who
December 1, 2013	Train employees on the new label elements and SDS format.	Employers
June 1, 2015 December 1, 2015	Comply with all modified provisions of HazCom 2012, except: Distributors may ship products labeled by the manufacturer or importer under the old system until December 1, 2015.	Chemical manufacturers, importers, distributors and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary, and provide additional employee training for newly-identified physical or health hazards.	Employers
Transition Period	Comply with either HazCom 2012, HazCom 1994, or both.	All chemical manufacturers, importers, distributors and employers

II. STEPS TO AN EFFECTIVE HAZARD COMMUNICATION PROGRAM

All workplaces where workers are exposed to hazardous chemicals must have a written hazard communication program that describes how the HazCom standard is implemented in that facility. When hazard communication is implemented effectively, it has significant benefits for both the employer and the workers in a workplace. Employers need the information provided to them in order to assess the safety and health aspects of their workplace appropriately, and to select needed control measures for the chemicals that are present. The information provided on SDSs may also be used by employers to select the least hazardous chemical available to accomplish what is needed in the workplace. Substitution of a less hazardous chemical benefits workers because they will not be exposed to the greater hazards, and benefits employers because they may have less need for controls in some situations. The information employers receive on labels and SDSs will help them meet requirements for a safe and healthful workplace.

An effective hazard communication program benefits both workers and employers. The information provided by suppliers allows employers to design and implement a chemical safety and health management program.

Workers are entitled to the information about the identities and hazards of the chemicals they are potentially exposed to when working. When workers have such information, they are able to take steps to protect themselves, and to implement the controls their employer has selected for them. Knowing the health effects

is important so that any signs or symptoms of exposure can be evaluated. Furthermore, being aware of the chemicals and associated hazards can help the worker determine how the exposure may affect preexisting medical conditions.

In a survey conducted by the U.S. Government Accountability Office (GAO), approximately 30% of responding small businesses indicated they used information on SDSs to find less hazardous chemicals to use in their workplaces.

Some employers view hazard communication as merely a “paper exercise,” regarding compliance as just making sure that all the required labels and SDSs are available, but not using the information. Hazard communication is much more than a paper exercise when implemented properly. The proper use of the information by employers to control chemical exposure results in a decrease in illnesses and injuries caused by chemicals in the workplace—a clear benefit for exposed workers. Effective hazard communication also helps with effective management of chemicals in the workplace, resulting in increased productivity, decreased workers’ compensation costs, and other employer benefits.

The HCS includes a three-part approach to communicating information to downstream employers, as well as workers.

- Labeling containers of hazardous chemicals, which serves as an immediate warning of hazards
- SDSs, which are sources of detailed information on the hazardous chemical
- Training on the hazards

An effective hazard communication program can be accomplished in six steps (Figure 2).

Figure 2: Six Steps to an Effective Hazard Communication Program

1. Learn the Standard/Identify Responsible Staff	<ul style="list-style-type: none">• Obtain a copy of OSHA’s Hazard Communication Standard.• Become familiar with its provisions.• Make sure that someone has primary responsibility for coordinating implementation.• Identify staff for particular activities (e.g., training).
2. Prepare and Implement a Written Hazard Communication Program	<ul style="list-style-type: none">• Prepare a written plan to indicate how hazard communication will be addressed in your facility.• Prepare a list or inventory of all hazardous chemicals in the workplace.
3. Ensure Containers are Labeled	<ul style="list-style-type: none">• Keep labels on shipped containers.• Label workplace containers where required.
4. Maintain Safety Data Sheets	<ul style="list-style-type: none">• Maintain safety data sheets for each hazardous chemical in the workplace.• Ensure that safety data sheets are readily accessible to employees.
5. Inform and Train Employees	<ul style="list-style-type: none">• Train employees on the hazardous chemicals in their work area before initial assignment, and when new hazards are introduced.• Include the requirements of the standard, hazards of chemicals, appropriate protective measures, and where and how to obtain additional information.
6. Evaluate and Reassess Your Program	<ul style="list-style-type: none">• Review your hazard communication program periodically to make sure that it is still working and meeting its objectives.• Revise your program as appropriate to address changed conditions in the workplace (e.g., new chemicals, new hazards, etc.).

1. Learn the Standard/Identify Responsible Staff

- Obtain a copy of OSHA's Hazard Communication Standard.
- Become familiar with its provisions.
- Make sure that someone has primary responsibility for coordinating implementation.
- Identify staff for particular activities (e.g., training).

You are already on your way to accomplishing Step 1 by reading this guide. It is always best to review the actual provisions of the standard to ensure you are in full compliance. OSHA provides online access to the standard, as well as guidance, interpretations, and other relevant materials on its hazard communication web page: www.osha.gov/dsg/hazcom. The full regulatory text can be found at: www.osha.gov/dsg/hazcom/HCSFinalRegTxt.html.

As noted above, the provisions that apply to employers simply using chemicals in the workplace, rather than those that produce or import chemicals, are found primarily in the following paragraphs:

- (e) Written Hazard Communication Program;*
- (f) Labels and Other Forms of Warning;*
- (g) Safety Data Sheets; and*
- (h) Employee Information and Training.*

You can focus on the requirements in these paragraphs to determine what is needed for compliance in your workplace. There may also be other provisions of the standard that help establish compliance requirements in some workplaces.

Paragraph (b), Scope and Application, specifies two types of work operations where the coverage of the rule is limited. These are laboratories and operations where chemicals are only handled in sealed containers (e.g., a warehouse). Employers with these types of work operations have reduced obligations under the HCS and basically only need to keep labels on containers as they are received; maintain SDSs that are received, and give employees access to them; and provide information and training to employees.

Laboratories and operations where chemicals are only handled in sealed containers do not have to have written hazard communication programs and lists of chemicals.

The limited coverage for laboratories and sealed container operations addresses your obligation to your own workers in the operations involved. However, when laboratory employers or employers where only sealed containers are involved act as chemical manufacturers, distributors or importers, they must fulfill their duties as suppliers. For example, in warehouse operations where the employees are only exposed to sealed containers, paragraph (b)(4) of the standard would apply. When these chemicals are distributed to downstream users, paragraph (b)(4) requires the company to provide HazCom 2012-compliant labels and SDSs to downstream customers at the time of the first shipment and when the SDS is updated.

Paragraph (c), Definitions, can be used to determine the meaning of some provisions in HazCom 2012 through the definitions provided for the terms used in them. This guide will highlight some of these definitions, but you may want to consult the definitions for other terms to help ensure you fully understand your compliance obligations in the workplace.

Hazard communication must be a continuing program in your facility. Compliance with the HCS is not a "one shot deal." In order to have a successful program, it will be necessary to assign responsibility to staff for both the initial and ongoing activities needed to comply with the standard. In some cases, these activities may already be part of current job assignments. For example, site supervisors are frequently responsible

for on-the-job training sessions. Early identification of the responsible workers, and their involvement in the development of your plan of action, will result in a more effective program design.

In order to ensure you have an effective program and address all of the necessary components, responsibility for implementation of hazard communication should be assigned to someone to coordinate. While different people may be responsible for certain parts of implementation, there should nevertheless

be someone who has overall responsibility. Approaching compliance consistently, and comprehensively, is the key to success.

The person responsible for the overall coordination may not be the best person to accomplish all of the elements. For example, training workers may require different expertise than coordinating compliance. The standard allows employers the flexibility to do what is best in their own facilities as long as compliance with all elements is achieved.

2. Prepare and Implement a Written Hazard Communication Program

- Prepare a written plan to indicate how hazard communication will be addressed in your facility.
- Prepare a list or inventory of all hazardous chemicals in the workplace.

Paragraph (e), Written Hazard Communication Program, requires employers to prepare and implement a written hazard communication program. This does not need to be lengthy or complicated. The main intent of the requirement is to help ensure that compliance with the standard is done in a systematic way and that all elements are coordinated. Thus, the program must describe how the employer will address the requirements of paragraphs (f) Labels and Other Forms of Warning; (g) Safety Data Sheets; and (h) Employee Information and Training, in the workplace. A sample written program is provided in Appendix A of this guide.

In addition, the written program must include the following items:

- **Paragraph (e)(1): A list of the hazardous chemicals known to be present in the workplace.** The list may be kept using any **product identifier** from the SDS. Thus, the list may be kept by product name, common name, or chemical name. The important aspect of this requirement is that the term used on the list must also be available on both the SDS and the label so that these documents can be cross-referenced. The list can be compiled in whatever way the employer finds most useful and applicable to the workplace. A list of all hazardous chemicals in the entire workplace may be most suitable for very small facilities, where there are few work areas and all workers are potentially exposed to essentially the same products. For larger workplaces, it may be more convenient to compile lists of hazardous chemicals by work area and have them assembled together as the overall list for the workplace.

The list is an inventory of chemicals for which the employer must ensure that there is an SDS available. Compiling the list also helps employers keep track of the chemicals present, and to identify chemicals that are no longer being used, and thus could be removed from the workplace. Removing such chemicals may also reduce potential adverse effects that could occur in the workplace.

The best way to prepare a comprehensive list may be to survey the workplace. Purchasing records may also help and employers should establish procedures to ensure that purchasing procedures result in receiving SDSs before a material is used in the workplace. Prior to purchasing chemicals, review the hazards of the chemicals and evaluate if less hazardous chemicals can be used instead.

“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.

The broadest possible perspective should be taken when doing the survey. Sometimes people think of “chemicals” as being only liquids in containers. The HCS covers chemicals in all forms—liquids, solids, gases, vapors, fumes, and mists—whether they are “contained” or not. The hazardous nature of the chemical and the potential for exposure are

the factors that determine whether a chemical is covered. If the chemical is not hazardous, it is not covered by the standard. If there is no potential for exposure (e.g., the chemical is inextricably bound and cannot be released), the chemical is not covered by the standard.

Look around. Identify chemicals in containers, including pipes, but also think about chemicals that are generated during work operations. For example, welding fumes, dusts, and exhaust fumes are all sources of chemical exposures. Read the labels provided by suppliers for hazard information. Make a list of all chemicals in the workplace that are potentially hazardous. For your own information and planning, you may also want to note on the list the location(s) of the products within the workplace, and an indication of the hazards as found on the label. This will help as you prepare the rest of your program.

Paragraph (b) of the standard, scope and application, includes exemptions for various chemicals or workplace situations. After compiling the complete list of chemicals, you should review paragraph (b) to determine if any of the items can be eliminated from the list because they are exempted materials. For example, food, drugs, and cosmetics brought into the workplace for personal consumption by workers are exempt.

Once you have compiled a complete list of the potentially hazardous chemicals in the workplace, the next step is to determine if you have received SDSs for all of them. Check your files against the inventory you have just compiled. Employers are required to have SDSs for all hazardous chemicals that they use. If any are missing, contact your supplier and request one. It is a good idea to document these requests, either by keeping a copy of a letter or e-mail, or a note regarding telephone conversations. If you cannot show a good faith effort to receive the SDS, you can be cited for not having the SDS for a hazardous chemical. If you have SDSs for chemicals that are not on your list, figure out why. Maybe you do not use the chemical anymore. Or maybe you missed

it in your survey. Some suppliers provide SDSs for products that are not hazardous. These SDSs do not have to be maintained.

Do not allow workers to use any hazardous chemicals for which you have not received an SDS. The SDS provides information you need to ensure that proper protective measures are implemented prior to worker exposure.

■ ***Paragraph (e)(1)(ii): Methods to inform employees of the hazards of non-routine tasks.***

The written program needs to include how an employer will inform workers of hazards that are outside of their normal work routine. While workers' initial training will address the types of exposures they will encounter in their usual work routines, there may be other tasks to be performed on occasion that will expose these workers to different hazards, as well as require novel control measures. For example, in a manufacturing facility, it may be necessary periodically to drain and clean out reactor vessels. For this task, workers may be exposed to cleaning chemicals that are not normally in the workplace, and the usual controls for the process may not protect them, so personal protective equipment may have to be worn. The written program needs to address how the employer will handle such situations and make sure that workers involved have the necessary information to stay protected.

■ ***Paragraph (e)(2): Multi-Employer Workplaces.***

Where there is more than one employer operating on a site, and employees may be exposed to the chemicals used by each employer, the employer's written hazard communication program must address:

- How on-site access to SDSs will be provided to the other employer(s).
- How such employers will be informed of needed precautionary measures.
- How such employers will be informed of the on-site labeling system if it is different from the labels specified for shipped containers under the standard.

In summary, if you are not a new employer, you should already have a written hazard communication program for your workplace. Review your written program to ensure that it is consistent with the HazCom 2012 requirements. It may need to be updated; for example, you may have to add or delete chemicals from the list in the program, or change your description of the approach to workplace labeling.

If your workers' job assignment requires travel between various geographical locations, you may keep the written program at the primary work location.

Many trade associations and other professional groups have provided sample programs and other assistance materials to employers. These have been very helpful to many employers since they tend to be tailored to the particular industry involved. You may wish to investigate whether

your industry trade groups have developed such materials. Additionally, a sample written hazard communication program is included in Appendix A to this guide.

Although such general guidance may be helpful, you must remember that the written program has to reflect what you are doing in your workplace. Therefore, if you use a generic program it must be adapted to address the facility that it actually covers. For example, the written plan must list the chemicals present at the site, indicate who is to be responsible for the various aspects of the program in your facility, and indicate where written materials will be made available to workers.

If OSHA inspects your workplace, the OSHA Compliance Safety and Health Officer (CSHO) will ask to see your written plan.

3. Ensure Containers are Labeled

- Keep labels on shipped containers.
- Label workplace containers where required.

Labels are the first part (**paragraph (f) Labels and Other Forms of Warning**) of the three-part approach to communicating information downstream mentioned earlier. A label must be on the immediate container of every hazardous chemical. The label is an immediate type of warning since it is present in the work area, right on the actual container of a hazardous chemical. It is a snapshot of the hazards and protective information related to the chemical, and a summary of the more detailed information available on the SDS.

When you purchase a hazardous chemical from a supplier, you will receive a container that is labeled with the information required under the HCS. Employers can rely on the information provided by their suppliers. The label requirements in the HCS changed significantly with the publication of HazCom 2012. Under the prior standard, chemical manufacturers and importers were required to convey the hazards and identity of the products, but were not given specifications on how this was to be done. As a result, labels varied in terms of how the information was conveyed, the terminology used, and the design of the label. This made it more difficult for employers and workers to access and comprehend the information presented than if chemical manufacturers and importers follow the same approach.

The label requirements for the revised standard are more specific, which will lead to increased uniformity. This should benefit employers and workers by providing the information in standardized language and graphics, making it easier to understand, and helping to ensure that labels on containers of the same chemical from different suppliers have the same information.

HazCom 2012 provides chemical manufacturers and importers the information to be conveyed once they have determined the hazard of a chemical. The labels you receive on a shipped

container must have the following information, located together (other information may also appear on the label):

- Product identifier
- Signal word
- Hazard statement(s)
- Pictogram(s)
- Precautionary statement(s)
- Name, address, and phone number of the responsible party
- The **product identifier** is any chemical, common, or trade name or designation that the chemical manufacturer or importer chooses to use on the label. The term must also appear on the SDS. The signal word, hazard statement(s), pictogram(s), and precautionary statement(s) are the **label elements** that comprise the primary information about hazards and protective measures on the label.
- A **signal word** is 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 the standard are **“danger”** and **“warning.”** “Danger” is used for the more severe hazards, while “warning” is used for the less severe hazards. Signal words were not previously used in the HCS, although they do often appear on consumer labels. It is important to be aware of—and train workers on—the way signal words convey a difference in the severity of the hazard. While the product is hazardous wherever a signal word is indicated, the signal word chosen can give a preliminary idea of the relative significance of the effect.
- A **hazard statement** is 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.
Example: Fatal if swallowed.

- The hazard statement(s) for a hazardous chemical describe the hazard(s) in text, in a simple, direct manner. There is a hazard statement for each hazard category of a hazard class, and it will vary depending on the degree of hazard. The example presented above is a hazard statement for acute oral toxicity. The hazard statement conveys that the chemical is severely toxic, and ingestion of the chemical results in death. But for less toxic chemicals, the hazard statement may be “toxic if swallowed” or “harmful if swallowed.” As with the signal words, this information conveys the relative severity of the hazard, which impacts how it is handled and controlled.
- A **pictogram** is 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. Under HazCom 2012, pictograms are black symbols, on a white background, with a red diamond border. For example, this is the pictogram for oxidizers:



Pictograms are an important addition to the hazard communication tools in the standard. A pictogram draws the attention of a label reader, and you and your workers should be aware that the appearance of a pictogram in a red diamond frame means that a hazard of concern is present in the product. Some of the pictograms in the standard have symbols that resemble the hazardous effect, and others are merely meant to attract attention. Pictograms may be used for several different hazardous effects as well (see Figure 3).

Pictograms have long been used internationally because they convey information without text. This allows users who are either literate in a different language than that used on the label or who are not literate at all to understand that the chemical is hazardous.

One of the systems that has long used pictograms is the international transport system. This system has been adopted by the U.S. Department of Transportation (DOT), and is familiar to those who handle shipping containers in the United States. The symbols have been harmonized as much as possible for the hazards covered both in transport and in the workplace. While both pictograms are diamond-shaped, the transport system's pictograms have backgrounds of various colors. Where the shipping container is also the container used in the workplace, workers must be made aware of the DOT pictograms¹, as they may appear on the label in addition to, or instead of, the HazCom 2012 pictograms used to represent the same hazard. See Figure 4 for examples of DOT pictograms. Note that the environment pictogram located in the center of the bottom row in Figure 3 is not required under the OSHA standard since OSHA does not regulate environmental hazards. However, you may see this pictogram used on labels and SDSs to convey environmental hazards, and that will provide useful information for you to use in managing your chemicals.

1. The U.S. Department of Transportation (DOT) uses the terms transport “placards” or “labels” to refer to the diamond-shaped (square on point) graphic elements that are used to identify shipments of hazardous materials. However, for the purpose of this document, these graphic elements are referred to as “pictograms.” More information on DOT placards or labels may be found at www.dot.gov.

Figure 3: HazCom 2012 Pictograms

<p>Health Hazard</p>  <ul style="list-style-type: none"> • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity 	<p>Flame</p>  <ul style="list-style-type: none"> • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides 	<p>Exclamation Mark</p>  <ul style="list-style-type: none"> • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
<p>Gas Cylinder</p>  <ul style="list-style-type: none"> • Gases Under Pressure 	<p>Corrosion</p>  <ul style="list-style-type: none"> • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals 	<p>Exploding Bomb</p>  <ul style="list-style-type: none"> • Explosives • Self-Reactives • Organic Peroxides
<p>Flame Over Circle</p>  <ul style="list-style-type: none"> • Oxidizers 	<p>Environment (Non-Mandatory)</p>  <ul style="list-style-type: none"> • Aquatic Toxicity 	<p>Skull and Crossbones</p>  <ul style="list-style-type: none"> • Acute Toxicity (fatal or toxic)

Figure 4: Examples of Transport Pictograms

 <ul style="list-style-type: none"> • Flammable Gas • Flammable Aerosol 	 <ul style="list-style-type: none"> • Flammable solids • Self-Reactive substances and mixtures 	 <ul style="list-style-type: none"> • Pyrophoric solids • Pyrophoric liquids • Self-heating Substances and mixtures
 <ul style="list-style-type: none"> • Substances and mixtures, which in contact with water, emit flammable gases 	 <ul style="list-style-type: none"> • Oxidizing gases • Oxidizing liquids • Oxidizing solids 	 <ul style="list-style-type: none"> • Self reactive substances and mixtures (type B) • Organic peroxides
 <ul style="list-style-type: none"> • Explosives (Division 1.4) 	 <ul style="list-style-type: none"> • Explosives (Division 1.5) 	 <ul style="list-style-type: none"> • Explosives (Division 1.6)
 <ul style="list-style-type: none"> • Gases under pressure 	 <ul style="list-style-type: none"> • Acute toxicity: Oral • Acute toxicity: Skin • Acute toxicity: Inhalation 	 <ul style="list-style-type: none"> • Corrosive to metals • Skin corrosion/irritation
 <ul style="list-style-type: none"> • Aquatic toxicity (Acute) • Aquatic toxicity (Chronic) 	 <ul style="list-style-type: none"> • Organic Peroxides 	

- A **precautionary statement** is 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.
Example: Do not eat, drink, or smoke when using this product.

Precautionary statements are key to helping you decide what you need to do to protect workers and your workplace. There are four types of statements: *Prevention, Response, Storage, and Disposal*. These have been assigned to hazard classes and categories.

Therefore, a compliant HazCom 2012 label on a shipped container will have at least the following information as shown in Figure 5 (supplemental information is permitted as long as it does not conflict with the required information).

You are required by paragraph (f)(6) of the standard to ensure that containers of hazardous chemicals in your workplace are labeled. For those containers that are received already labeled from

the supplier, and are used in the workplace, simply maintaining the label received from the supplier is the best and easiest option. However, the standard is flexible, and employers may relabel these containers, or label other containers used in the workplace with various options as long as workers have immediate access to the specific information about the physical and health hazards of the chemical. This could be included in the workplace hazard communication program.

Under paragraph (f)(7), employers may use signs, placards, process sheets, batch tickets, operating procedures, or other written material instead of affixing labels to individual stationary process containers, as long as the alternative method identifies which containers it applies to and conveys at least general information regarding the hazards of the chemicals. Paragraph (f)(8) of the standard also addresses portable containers into which the hazardous chemicals are transferred from a labeled container, and which are for the immediate use of the employee who performs the transfer. These portable containers do not have to be labeled.

Figure 5: Example of Required HCS Label Elements

Product Identifier

Pictogram *(Symbol in Red Frame)*



Signal Word *(Danger)*

Hazard Statement(s) *(Extremely flammable gas)*

Precautionary Statement(s) *(Keep away from heat and open flames. No smoking. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so. Store in well-ventilated place.)*

**Name, Address, and Telephone Number
of Manufacturer, Importer, or Other Responsible Party**

Some employers use third-party workplace label systems, such as those that have numerical ratings to indicate the hazards (e.g., National Fire Protection Association (NFPA) or Hazardous Materials Identification System (HMIS)). These may be used in conjunction with the supplemental information on the label to ensure that workers have complete information, as long as the ratings are consistent with the hazard definitions in HazCom 2012, i.e., the criteria used to assign the numerical ratings reflects the hazard categories in each hazard class in HazCom 2012. One note with regard to numerical ratings—these systems generally use the number 1 to indicate the lowest degree of hazard, and the number 4 as the highest degree. This is the opposite of the hazard category numbering in HazCom 2012. Therefore, if as an employer you are preparing such labels based on information on the SDS, you must ensure that the numbers are properly applied to reflect the accurate degree of hazard information. Category numbers do not appear on HazCom 2012 shipped container labels, and are not equivalent to the hazard rating systems.

HazCom 2012 hazard category numbers are not required to appear on shipped container labels, and are not equivalent to the NFPA and HMIS hazard rating systems.

The employer must make sure that labels in the workplace are legible and prominently displayed. While the label information must be in English, employers are free to add warnings in other languages if workers would find that helpful. OSHA has prepared QuickCards™ to describe the label elements ([OSHA 3492](#)), as well as illustrate the pictograms ([OSHA 3491](#)). These are available on the OSHA web page, or can be obtained from your local OSHA area office.

If your workplace is inspected by OSHA, CSHOs will be looking for at least the following aspects of your labeling approach:

1. Designation of person(s) responsible for ensuring compliant labeling of shipped and in-plant containers;
2. Description of written alternatives to labeling of stationary process containers (if used);
3. Appropriate labels on all workplace containers, including those received from a supplier, secondary containers, and stationary process containers;
4. A description and explanation of labels on both shipped and workplace containers included in the employee training program; and,
5. Procedures to review and update workplace label information when necessary.

4. Maintain Safety Data Sheets

- Maintain safety data sheets for each hazardous chemical in the workplace.
- Ensure that safety data sheets are readily accessible to employees.

The second part in the approach to communicating information in HazCom 2012 is to maintain SDSs (**paragraph (g) Safety Data Sheets and Mandatory Appendix D**). The SDSs are the source of detailed information on hazardous chemicals. This includes information for many different audiences—employers, workers, safety and health professionals, emergency responders, government agencies, and consumers. It is difficult for one document to serve the needs of all of these different audiences since some require much more technical information than others. Therefore, the SDS sections have generally been organized so that the information of most use to exposed workers, emergency responders, and others who do not need extensive technical detail is in the beginning of the SDS, while the more technical information most commonly read by health and safety professionals is located in the later sections. For example, a description of a chemical's health effects appears in Section 2, hazard identification, but the toxicological data upon which the determination of these effects is based appears in Section 11, toxicological information. All of the sections are available to any reader, but there is a difference between what is necessary for a broader audience (workers and emergency responders, for example), and what might be needed by others designing protective measures or providing medical services.

The SDS requirements in HazCom 2012 are based on an internationally agreed upon 16-section SDS. This format is based on ANSI Z400.1², so it

is most likely already familiar to your employees. HazCom 2012 establishes section headings for the SDS, as well as the order in which they are to be provided, and the minimum information required to be included in each section under Appendix D of the standard. However, the information in some of the sections are non-mandatory because they address information that involve the requirements of other government bodies, and thus are not under OSHA's jurisdiction. Even though these sections are not considered mandatory by OSHA, the headings are still required to be present on the SDS. They will provide useful information for you to address other requirements you may need to follow. The sixteen sections are as follows, with the non-mandatory sections indicated in italics:

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure control/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. *Ecological information*
13. *Disposal considerations*
14. *Transport information*
15. *Regulatory information*
16. Other information

Chemical manufacturers and importers are required to obtain or develop an SDS for each hazardous chemical they produce or import. Chemical manufacturers, importers, and

² The first American National Standard Institute (ANSI) standard developed to assist in the preparation of safety data sheets (*American National Standard for Hazardous Industrial Chemicals—Material Safety Data Sheets—Preparation*) was issued in 1993. This standard was updated in 1998 and 2004. In 2010, it was combined with ANSI Z129 and renamed, *American National Standard for Hazardous Workplace Chemicals—Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation*.

distributors are responsible for ensuring that their customers are provided a copy of these SDSs, at the time of the first shipment, and when an SDS is updated with new and significant information. Employers must have an SDS for each hazardous chemical which they use. Employers may rely on the information received from their suppliers unless they know the information is incorrect. If you do not receive an SDS automatically, you must request one as soon as possible. If you receive an SDS that is obviously inadequate, with, for example, blank spaces, you must request an appropriately completed one. If your request for an SDS or for a corrected SDS does not produce the information needed, you should contact your local OSHA area office for assistance in obtaining the SDS. Employers must maintain the current version of the SDS; if a new SDS is received with a shipment, they must maintain and make available the new SDS.

The SDSs must be in English. Many larger manufacturers also produce SDSs in other languages. If you have workers who speak language(s) other than English, you may be able to obtain SDSs in those languages to ensure effective hazard communication.

Employers must maintain copies of SDSs in their workplaces, and must ensure that SDSs are readily accessible to workers when they are in their work areas during their work shifts. This accessibility may be accomplished in many different ways. You must decide what is appropriate for your particular workplace. Some employers keep the SDSs in a binder in a central location (e.g., in a pick-up truck on a construction site). Others, particularly in workplaces with large numbers of chemicals, provide access electronically. However, if access to SDSs is provided electronically, there must be an adequate back-up system in place in the event of a power outage, equipment failure, or other emergency involving the primary electronic system. As long as workers can get the information when they need it, any approach may be used. When workers must travel between workplaces during a work shift, SDSs may be kept at the primary workplace facility. No matter what system

is used, employers must ensure that workers and medical personnel can immediately obtain the required information in an emergency.

In order to ensure that you have a current SDS for each chemical in the plant as required, and that worker access is provided, OSHA's CSHOs will be looking for the following items in your program:

1. Designation of person(s) responsible for obtaining and maintaining the SDSs;
2. How such sheets are maintained in the workplace (e.g., in notebooks in the work area(s) or electronically), and how workers obtain access to them when they are in their work area during the work shift;
3. Procedures to follow when the SDS is not received at the time of the first shipment;
4. An SDS for each hazardous chemical in the workplace, and training of workers that includes review of SDS format and use.

For employers using hazardous chemicals, an important aspect of the hazard communication program is to ensure that someone is responsible for obtaining and maintaining the SDSs for every hazardous chemical in the workplace. To ensure that your hazard communication program improves safety and health with regard to chemical use, you should review the SDSs, and use the information to choose the needed protective measures to prevent or reduce exposures in your workplace. SDSs should be used to evaluate your workplace, and establish a plan to ensure it is safe. The following is a section-by-section description of the information required for each part of the SDS from Appendix D of HazCom 2012. Become familiar with the information available in each section of an SDS so that you will be able to more quickly access this information in an emergency and make better use of the data available.

OSHA has developed a QuickCard™ on SDSs (OSHA 3493) that may be useful in your training program. It is available on the OSHA Hazard Communication web page at www.osha.gov/dsg/hazcom, or from your local OSHA area office.

Minimum Information for an SDS

Heading	Subheading
1. Identification	<ul style="list-style-type: none">(a) Product identifier used on the label;(b) Other means of identification;(c) Recommended use of the chemical and restrictions on use;(d) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party;(e) Emergency phone number.
2. Hazard(s) identification	<ul style="list-style-type: none">(a) Classification of the chemical in accordance with paragraph (d) of §1910.1200;(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accord with paragraph (f) of §1910.1200. (Hazard symbols may be provided as graphical reproductions in black and white or the name of the symbol, e.g., flame, skull and crossbones);(c) Describe any hazards not otherwise classified that have been identified during the classification process;(d) Where an ingredient with unknown acute toxicity is used in a mixture at a concentration $\geq 1\%$ and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required.
3. Composition/ information on ingredients	<p>Except as provided for in paragraph (i) of §1910.1200 on trade secrets:</p> <p>For Substances</p> <ul style="list-style-type: none">(a) Chemical name;(b) Common name and synonyms;(c) CAS number and other unique identifiers;(d) Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. <p>For Mixtures</p> <p>In addition to the information required for substances:</p> <ul style="list-style-type: none">(a) The chemical name and concentration (exact percentage) or concentration ranges of all ingredients which are classified as health hazards in accordance with paragraph (d) of §1910.1200 and<ul style="list-style-type: none">(1) are present above their cut-off/concentration limits; or(2) present a health risk below the cut-off/concentration limits.(b) The concentration (exact percentage) shall be specified unless a trade secret claim is made in accordance with paragraph (i) of §1910.1200, when there is batch-to-batch variability in the production of a mixture, or for a group of substantially similar mixtures (<i>See A.0.5.1.2</i>) with similar chemical composition. In these cases, concentration ranges may be used. <p>For All Chemicals Where a Trade Secret is Claimed</p> <p>Where a trade secret is claimed in accordance with paragraph (i) of §1910.1200, a statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.</p>

Heading	Subheading
4. First-aid measures	(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion; (b) Most important symptoms/effects, acute and delayed; (c) Indication of immediate medical attention and special treatment needed, if necessary.
5. Firefighting measures	(a) Suitable (and unsuitable) extinguishing media; (b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products); (c) Special protective equipment and precautions for firefighters.
6. Accidental release measures	(a) Personal precautions, protective equipment, and emergency procedures; (b) Methods and materials for containment and cleaning up.
7. Handling and storage	(a) Precautions for safe handling; (b) Conditions for safe storage, including any incompatibilities.
8. Exposure controls/ personal protection	(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available; (b) Appropriate engineering controls; (c) Individual protection measures, such as personal protective equipment.
9. Physical and chemical properties	(a) Appearance (physical state, color, etc.); (b) Odor; (c) Odor threshold; (d) pH; (e) Melting point/freezing point; (f) Initial boiling point and boiling range; (g) Flash point; (h) Evaporation rate; (i) Flammability (solid, gas); (j) Upper/lower flammability or explosive limits; (k) Vapor pressure; (l) Vapor density; (m) Relative density; (n) Solubility(ies); (o) Partition coefficient: n-octanol/water; (p) Auto-ignition temperature; (q) Decomposition temperature; (r) Viscosity.

Heading	Subheading
10. Stability and reactivity	(a) Reactivity; (b) Chemical stability; (c) Possibility of hazardous reactions; (d) Conditions to avoid (e.g., static discharge, shock, or vibration); (e) Incompatible materials; (f) Hazardous decomposition products.
11. Toxicological information	Description of the various toxicological (health) effects and the available data used to identify those effects, including: <ul style="list-style-type: none"> (a) Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); (b) Symptoms related to the physical, chemical and toxicological characteristics; (c) Delayed and immediate effects and also chronic effects from short- and long-term exposure; (d) Numerical measures of toxicity (such as acute toxicity estimates); (e) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA.
12. Ecological information (Non-mandatory)	<ul style="list-style-type: none"> (a) Ecotoxicity (aquatic and terrestrial, where available); (b) Persistence and degradability; (c) Bioaccumulative potential; (d) Mobility in soil; (e) Other adverse effects (such as hazardous to the ozone layer).
13. Disposal considerations (Non-mandatory)	Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.
14. Transport information (Non-mandatory)	<ul style="list-style-type: none"> (a) UN number; (b) UN proper shipping name; (c) Transport hazard class(es); (d) Packing group, if applicable; (e) Environmental hazards (e.g., Marine pollutant (Yes/No)); (f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code); (g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises.
15. Regulatory information (Non-mandatory)	Safety, health and environmental regulations specific for the product in question.
16. Other information, including date of preparation or last revision	The date of preparation of the SDS or the last change to it.

5. Inform and Train Employees

- Train employees on the hazardous chemicals in their work area before initial assignment, and when new hazards are introduced.
- Include the requirements of the standard, hazards of chemicals, appropriate protective measures, and where and how to obtain additional information.

The third part of the hazard communication approach in HazCom 2012 is employee information and training (**paragraph (h) Employee Information and Training**).

The key requirement is in paragraph (h)(1):

(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.

For information and training to be effective, the workers in the training must comprehend the hazards in the workplace and ways to protect themselves. OSHA does not expect that workers will be able to recall and recite all data provided about each hazardous chemical in the workplace. What is most important is that workers understand that they are exposed to hazardous chemicals, know how to read labels and SDSs, and have a general understanding of what information is provided in these documents, and how to access these tools. Workers must also be aware of the protective measures available in their workplace, how to use or implement these measures, and who they should contact if an issue arises.

Information and training may be done either by individual chemical, or by hazard classes and categories (such as acute toxicity or flammable liquids). If there are only a few chemicals in the workplace, then you may want to discuss each one individually. Where there are large numbers of

chemicals, or the chemicals change frequently, you will probably want to train generally based on the hazard classes and categories. Workers must have access to the substance-specific information on the labels and SDSs.

HazCom 2012 requires employers to both provide certain information to employees and to train employees. The standard requires employees to be informed of:

- The general requirements of the Hazard Communication Standard;
- Where hazardous chemicals are located in their work areas (operations where exposure may occur); and,
- What the workplace hazard communication program includes, and where and how they can access the program.

Training, on the other hand, is a more active process. The training conducted to comply with HazCom 2012 must address the following:

- 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.);
- 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;
- 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,

- 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 SDS, including the format of the SDS (where each type of information is located) and how employees can obtain and use the appropriate hazard information.

A properly conducted training program will ensure worker comprehension and understanding. It is not sufficient to either just read material to the workers, or simply hand them material to read. As explained in Dr. Michaels' *OSHA Training Standards Policy Statement (April 28, 2010)*, OSHA requires employers to present information in a manner and language that their employees can understand. If employers customarily need to communicate work instructions or other workplace information to employees in a language other than English, they will also need to provide safety and health training to employees in the same manner. Similarly, if the employee's vocabulary is limited, the training must account for that limitation. By the same token, if employees are not literate, telling them to read training materials will not satisfy the employer's training obligation.

In conducting a training program, you want to create a climate where workers feel free to ask questions. This will help you to ensure that the information is understood. You must always remember that the underlying purpose of the HCS is to reduce the incidence of chemical source illnesses and injuries. This will be accomplished by modifying behavior through the provision of hazard information and information about protective measures. If your program works, you and your workers will better understand the chemical hazards in the workplace, and how to protect workers from experiencing adverse effects. The procedures you establish regarding, for example, purchasing, storing, and handling of these chemicals will improve, and thereby reduce the risks posed to workers exposed to the chemical hazards involved.

Furthermore, your workers' comprehension will also be increased, and proper work practices will be more likely followed in your workplace.

If you are going to do the training yourself, you will have to understand the material and be prepared to motivate the workers to learn. This is not always an easy task, but the benefits are worth the effort. More information regarding appropriate training can be found in Appendix B of this guide, which provides steps to follow in setting up and conducting training.

In reviewing your hazard communication program with regard to information and training, the following items need to be considered:

1. Designation of person(s) responsible for conducting training;
2. Format of the program to be used (audiovisuals, classroom instruction, etc.);
3. Elements of the information and training program (should be consistent with the elements in paragraph (h) of the standard); and,
4. Procedure to train new workers at the time of their initial assignment to work with a hazardous chemical, and to train workers when a new chemical hazard is introduced into the workplace.

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train workers. When assessing an employer's compliance with hazard communication training requirements, OSHA CSHOs will talk to workers to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and SDSs. It should be noted that if workers do not speak English, the employer must convey the hazard communication information in the language they understand—just like other job requirements and instructions are provided. OSHA has bilingual CSHOs, and they will be speaking to workers who speak another language to determine compliance.

The standard does not require employers to maintain records of employee training, but many employers choose to do so. This may help you monitor your own program to ensure that all workers are appropriately trained. Keeping records that document who was trained, when the training was conducted, and what was covered is also helpful to document compliance with OSHA's training requirement in case of an inspection. The standard does not require retraining on a regular schedule, it simply requires retraining if there is a new chemical hazard introduced into the work area. If your initial training program includes all potential hazards covered by HazCom 2012, there is no retraining required. However, it is good business practice to repeat and reinforce what is learned in training to make sure that workers retain the hazard information.

If you already have a hazard communication training program, you may simply have to update it to comply with HazCom 2012. In particular, by December 1, 2013, you will need to train your employees about the new label and SDS formats they will be seeing in their work areas. Additional hazard training is not required if you have already trained under the existing hazard communication requirements. However, after you receive all of the new labels and SDSs, and have updated your hazard communication program, you may find that

there is a type of hazard on which employees have not yet received training. You will need to train employees on these new hazards at the time you become aware of the new hazard. If you become aware of new hazards after December 1, 2015, you will have until June 1, 2016 to ensure those hazards are included in the hazard communication program, the workplace labeling reflects these new hazards, and employees are trained on these new hazards.

An employer can provide employees information and training through whatever means are found appropriate. Although there will always have to be some training onsite (such as informing workers of the location and availability of the written program and SDSs), employee training may be satisfied in part by general training about the requirements of the HCS and about chemical hazards on the job which is provided by, for example, trade associations, unions, colleges, and professional schools. In addition, previous training, education and experience of a worker may relieve the employer of some of the burdens of informing and training that worker. Regardless of the method relied upon, however, the employer is always ultimately responsible for ensuring that workers are adequately trained. If the CSHO finds that the training is deficient, the employer will be cited for the deficiency regardless of who actually provided the training on behalf of the employer.

6. Evaluate and Reassess Your Program

- Review your hazard communication program periodically to make sure that it is still working and meeting its objectives.
- Revise your program as appropriate to address changed conditions in the workplace (e.g., new chemicals, new hazards, etc.).

Because your hazard communication program must remain up to date, it will be necessary to periodically evaluate and reassess your program.

The information in your written program must be accurate. The list of hazardous chemicals required to be maintained as part of the written program will serve as an inventory. As new chemicals are purchased, the list must be updated. Revisions to the inventory of chemicals should be made when you eliminate chemicals in the workplace, or when you bring in a new chemical. The inventory also can be used to ensure that you have SDSs for all chemicals in the workplace, and such revisions are key to ensuring that is achieved. In addition, designation of people to handle different parts of the program should also be current and accurate. Many companies have found it convenient to include on their purchase orders the name and address of the person designated in their company to receive SDSs to help maintain a complete set.

Program coordinators should routinely walk around the workplace to check that containers are labeled as required and that workers are following established work practices to protect themselves from chemical exposure. Proactive monitoring of the workplace is critical to ensuring compliance with the HCS.

As new SDSs are received, there should be a process in place to review them and determine whether any handling procedures need to change to protect against the hazards of these chemicals. Using information on the SDS effectively will make safer workplace conditions a standard business practice in your facility.

This simple checklist will help to ensure that you are in compliance with the standard:

- Obtained/accessed a copy of the standard. _____
- Read and understood the requirements. _____
- Assigned responsibility for tasks. _____
- Prepared an inventory of chemicals. _____
- Ensured that containers are labeled. _____
- Obtained SDSs for each chemical. _____
- Prepared written program. _____
- Made SDSs available to workers. _____
- Conducted training for workers. _____
- Established procedures to maintain current program. _____
- Established procedures to evaluate program effectiveness, including maintenance of SDSs. _____

III. CONCLUSION

OSHA believes that the Hazard Communication Standard is of critical importance to ensuring that hazardous chemicals are identified, and that proper measures are implemented in workplaces to achieve safe use and handling. By understanding the hazards of the chemicals, and using available information to pick the proper control measures

to address these hazards, employers can achieve many benefits for themselves, as well as for their exposed workers. HazCom 2012 provides the framework for building a chemical safety and health management program in a workplace. Figure 6 illustrates the steps that have been discussed to ensure that a workplace hazard communication program is effective.

Figure 6: An Effective Hazard Communication Program



APPENDIX A: SAMPLE WRITTEN HAZARD COMMUNICATION PROGRAM

The following sample hazard communication program is based on the requirements of the Hazard Communication Standard (HazCom 2012), 29 CFR 1910.1200. The intent of this sample is to provide an easy-to-use format that can be modified to address the specific situation in your workplace. You are free to use whatever format you choose to develop your program—there is no requirement to follow this example. However, if you use this or any other sample program, you must customize it to your specific workplace, otherwise you will not be in compliance with the HCS.

HAZARD COMMUNICATION PROGRAM

1. Company Policy

To ensure that information about the dangers of all hazardous chemicals used by *(Name of Company)* is known by all affected workers, the following hazard communication program has been implemented. Under this program, workers will be informed of the requirements of the OSHA Hazard Communication Standard, the operations where exposure to hazardous chemicals may occur, and how workers can access this program, as well as labels and SDSs.

This program applies to any chemical which is known to be present in the workplace in such a manner that workers may be exposed under normal conditions of use or in a foreseeable emergency. All work areas that involve potential exposure to chemicals are part of the hazard communication program. Copies of the hazard communication program are available in the **(location)** for review by any interested worker.

(Name of responsible person and/or position) is the program coordinator, with overall responsibility for the program, including reviewing and updating this plan as necessary.

2. Container Labeling

(Name of responsible person and/or position) will verify that all containers received for use will be clearly labeled in accord with the requirements of HazCom 2012, including a product identifier, pictogram, hazard statement, signal word, and precautionary statements, as well as the supplier's contact information (name and address).

The *(name of responsible person and/or position)* in each work area will ensure that all secondary containers are labeled with the original supplier's label or with an alternative workplace label. For help with labeling, see *(name of responsible person and/or position)*.

On the following individual stationary process containers, we are using *(description of labeling system used)* rather than a label to convey the required information:

(List containers here)

We are using an in-house labeling system *(describe any in-house system which conveys required workplace label information)*.

The *(name of responsible person and/or position)* will review the company labeling procedures every *(provide a time period)* and will update labels as required.

3. Safety Data Sheets (SDSs)

The *(name of responsible person and/or position)* is responsible for establishing and monitoring the company SDS program. The procedure below will be followed when an SDS is not received at the time of initial shipment:

(Describe procedure to be followed here)

Copies of SDSs for all hazardous chemicals to which workers are exposed or are potentially exposed will be kept in *(identify location)*. Workers can access SDSs by *(insert procedure for access)*.

Note: If alternatives to paper copies of SDSs are used, describe the format used and how workers can access the SDSs.

SDSs will be readily available to all workers in each work area during each work shift. If an SDS is not available, contact (*name of responsible person and/or position*).

When revised SDSs are received, the following procedures will be followed to replace old SDSs:

(Describe procedures)

The (*name of responsible person and/or position*) is responsible for reviewing the SDSs received for safety and health implications, and initiating any needed changes in workplace practices.

4. Employee Information and Training

(*Name of responsible person and/or position*) is responsible for employee information and training.

Every worker who will be potentially exposed to hazardous chemicals will receive initial training on the Hazard Communication standard and this program before starting work.

The training program for new workers is as follows (*describe how the training will be presented, and what it will include*).

Prior to introducing a new chemical hazard into any work area, each worker in that work area will be given information and training as outlined above for the new chemical hazard. The training format will be as follows:

(Describe training format, such as audiovisuals, interactive computer programs, classroom instruction, etc.)

5. Hazards of Non-routine Tasks

Periodically, workers are required to perform non-routine tasks that are hazardous. Examples of non-routine tasks are: confined space entry, tank cleaning, and painting reactor vessels. Prior to starting work on such projects, each affected worker will be given information by (*Name of responsible person and/or position*) about the hazardous chemicals he or she may encounter during such activity. This information will include specific chemical hazards, protective and safety measures the worker should use, and steps

the company is taking to reduce the hazards, including ventilation, respirators, the presence of another worker (buddy systems), and emergency procedures.

6. Informing Other Employers/Contractors

It is the responsibility of (*Name of responsible person and/or position*) to provide other employers and contractors with information about hazardous chemicals that their workers may be exposed to on this work site, and suggested precautions for workers. It is the responsibility of (*Name of responsible person and/or position*) to obtain information about hazardous chemicals used by other employers to which our workers may be exposed.

Other employers and contractors will be provided with SDSs for hazardous chemicals generated by this company's operations in the following manner:

(Describe company policy here)

In addition to providing a copy of an SDS to other employers, other employers will be informed of necessary precautionary measures to protect workers exposed to operations performed by this company.

Also, other employers will be informed of the hazard labels used by the company. If alternative workplace labeling systems are used, the other employers will be provided with information to understand the labels used for hazardous chemicals to which their workers may have exposure.

7. List of Hazardous Chemicals

A list of all known hazardous chemicals in the workplace is attached to this program. This list includes the name of each chemical, and the work area(s) in which each of the chemicals is used. Further information on each chemical may be obtained from the SDSs, located in (**identify location**).

When new chemicals are received, this list is updated within (x) days of introduction into the workplace. To ensure that any new chemical is added in a timely manner, the following procedures shall be followed:

(Identify procedures to be followed)

The hazardous chemical inventory is compiled and maintained by **(Name of responsible person and/or position and telephone number)**.

8. Chemicals in Unlabeled Pipes

Work activities may be performed by workers in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these

areas, the worker shall be informed by *(Name of responsible person and/or position)* about the identity and hazards of the chemicals in the pipe, as well as required precautionary measures required to be followed.

9. Program Availability

A copy of this program will be made available, upon request, to workers, their designated representatives, and OSHA.

APPENDIX B: QUICK GUIDE TO HAZARD COMMUNICATION TRAINING

The Hazard Communication Standard (HCS) (29 CFR 1910.1200) requires employers that have hazardous chemicals in their workplaces to implement a hazard communication program.

The program includes information about labels on containers, safety data sheets (SDSs), and training for workers. Each employer must describe in a written program how it will meet the requirements of the HCS in each of these areas.

For employers that use chemicals, rather than produce them, labels and SDSs are received with the products they purchase. These written documents form the basis of the hazard communication program, providing information for both employers and workers about the hazards of the chemicals, as well as ways to protect people from experiencing adverse effects as a result of their use. Training is the last step to be undertaken to implement an effective hazard communication program. Through proper training, the employer has the opportunity to ensure that workers understand the hazards of the chemicals they work

with, as well as what steps to take to ensure that they are protected from them. It also introduces them to labels and SDSs, explaining how to access these documents in their own workplace to obtain additional information. Training is therefore a critical part of the approach to hazard communication, tying together the three major components in an understandable form.

Before providing training, the employer should have a basic understanding of the requirements of the HCS, and have prepared its hazard communication program. This quick guide will focus on what is needed to set up a hazard communication training program. It is based on *Training Requirements in OSHA Standards and Training Guidelines (OSHA 2254)* developed by OSHA to assist employers to design any type of occupational safety and health training program, but relates the Guidelines specifically to hazard communication. It is a step-by-step approach. OSHA has also developed a series of QuickCards™ on elements of the training that employers may find useful: www.osha.gov/dsg/hazcom/ghsquickcards.html.

Training Step	Factors to Consider
Determining if training is needed	Are workers potentially exposed to hazardous chemicals in your workplace? You can determine this by reviewing the labels received on containers of chemicals you use, as well as safety data sheets (SDSs). You must have a hazard communication program if you have workers who are potentially exposed to hazardous chemicals. Training workers is part of the required hazard communication program. Therefore, training is needed wherever workers are potentially exposed to hazardous chemicals in their workplaces.
Identifying training needs	Workers must be trained before they are initially assigned to work where they are potentially exposed to a hazardous chemical. Therefore, if you have never provided training before, you must train all workers who are potentially exposed. Once this initial training is completed, you must train any new workers who are hired and will be working with hazardous chemicals. You must also provide training whenever a new hazard is introduced, or when workers change jobs and therefore face potential exposures. While training is not required to be repeated on a regular basis, you may want to consider doing that to be sure that workers remember what they have learned. It is also a good opportunity for you to review your hazard communication program, and make sure that it is still working effectively.

Training Step	Factors to Consider
<p>Identifying goals and objectives</p>	<p>Compliance with the requirements of the Hazard Communication Standard is a primary goal. Compliance will promote a safer workplace by ensuring that the potential hazards of chemicals are known both to you and to your workers. In addition, the measures to follow to prevent adverse health or physical effects resulting from chemical exposures should be familiar to everyone in the workplace. Preparing for the training gives you an opportunity to review the hazards of the chemicals you have in the workplace, and to consider substituting less hazardous chemicals where appropriate. It also allows you to review the protective measures you have in place to ensure that they are working, and to consider other types of protection as well. Implementation of a hazard communication program should be useful both to employers that have hazardous chemicals as part of their workplace processes, and to workers who are exposed to those chemicals. Training ties together all of the aspects of the workplace hazard communication program to relate it to the actual workplace conditions. Thus both employers and workers should be more familiar with the hazards present, know what steps must be taken to control those hazards, and be assured that the workplace is safer. They should also know how to obtain more information when needed from the container labels and the SDSs.</p> <p>You may want to consider if you have any additional learning objectives you would like to accomplish through this training program. For example, you may also have compliance obligations for related standards that could be combined into this program and accomplished in one training session (such as training required under the Respiratory Protection standard). Also, it may be an opportunity to review safe work practices and ways to perform jobs in a more efficient manner, and tie this into avoiding chemical hazards.</p>
<p>Identifying learning activities</p>	<p>The Hazard Communication Standard specifies what information must be provided to workers:</p> <ul style="list-style-type: none"> • The requirements of the Hazard Communication Standard; • Any operations in their work area where hazardous chemicals are present; and • The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and SDSs required by the standard. <p>In addition to providing this information to workers, they must be trained on the following:</p> <ul style="list-style-type: none"> • 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.); • The physical and health hazards of the chemicals in the work area; • The measures workers can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect workers from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and • The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the SDS, and how workers can obtain and use the appropriate information. <p>The way in which this information is conveyed is left up to the trainer to determine. You can use any type of media available to you (such as slides, videos, computer interactive programs). Combinations of media are often an effective way to keep the workers' attention. In addition, active participation is important, so you may want to include learning activities that allow the workers to participate and have hands-on experiences. Relating the information to their specific workplace conditions helps to ensure that you meet the requirements of the standard, as well as improving learning and making the training more interesting.</p>

Training Step	Factors to Consider
Conducting the training	<p>Preparation: In order to train workers under the Hazard Communication Standard, the trainer must be familiar with:</p> <ul style="list-style-type: none"> • the requirements of the standard that apply to the workplace; • the hazardous chemicals in the workplace to which workers are potentially exposed, as well as the types of hazards they pose; • the hazard communication program implemented in the workplace; and • the protective measures being employed in the workplace to prevent adverse effects from occurring. <p>In addition to being thoroughly familiar with the material to be covered in the training, the trainer must be aware of the facilities available for the training, including the physical location, the type of equipment (e.g., a PowerPoint projector, computer), and plan the training session accordingly based on the conditions.</p> <p>Presenting the training: The purpose of the training is to convey information that is important to the student, and will achieve a safer workplace. Care should be taken to ensure that the facilities are conducive to a successful training session, and that the presentation is done in a way that motivates learning and a positive outcome. Worker participation helps to ensure that the learning objectives are accomplished. This can be done through hands-on examples, discussions, and other active means of conveying the required information.</p>
Evaluating program effectiveness	<p>Consideration should be given to including some sort of evaluation tool in the training to obtain feedback from the workers on the presentation, what formats might work better, and what they learned. This could be in the form of a sheet to be filled out by workers after the training. In evaluating the effectiveness of the program, you should observe how the training has changed worker behavior. For example, if workers have better compliance with use of protective measures (such as wearing gloves when appropriate), this could factor into the evaluation of the program.</p>
Improving the training	<p>The trainers should use their own impressions as well as feedback from the students to improve the training before it is presented again. If workers are not interested in the training as it is conducted, do not appear motivated, and do not exhibit an increased knowledge of hazards and the use of protective practices, it may be necessary to review and revise the training to achieve a better outcome.</p>

Following these seven steps should enable you to design and implement an effective hazard communication training program. A safer workplace

benefits the employer as well as the worker, and their shared interest in this goal should help to achieve effective hazard communication training.

WORKERS' RIGHTS

Under OSHA law, workers are entitled to working conditions that do not pose a risk of serious harm. To help assure a safe and healthful workplace, the law provides workers with the right to:

- File a confidential complaint with OSHA to have their workplace inspected.
- Receive information and training about hazards, methods to prevent harm, and the OSHA standards that apply to their workplace. The training must be done in a language and vocabulary workers can understand.
- Receive copies of records of work-related injuries and illnesses that occur in their workplace.
- Receive copies of the results from tests and monitoring done to find and measure hazards in their workplace.
- Receive copies of their workplace medical records.
- Participate in an OSHA inspection and speak in private with the inspector.
- File a complaint with OSHA if they have been retaliated against by their employer as the result of requesting an inspection or using any of their other rights under the OSH Act.
- File a complaint if punished or retaliated against for acting as a “whistleblower” under the 21 additional federal laws for which OSHA has jurisdiction.

For more information, visit OSHA’s Workers’ Rights page at www.osha.gov/workers.html.

OSHA ASSISTANCE, SERVICES AND PROGRAMS

OSHA offers free compliance assistance to employers and workers. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using illness and injury prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs.

Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA’s illness and injury prevention program web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA [6742] to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on Consultation Services, visit www.osha.gov/consultation, or call 1-800-321-OSHA [6742].

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/dcsp/compliance_assistance/index_programs.html.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provides the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. OSHA Strategic Partnerships are formalized through unique agreements designed to encourage, assist, and recognize partner efforts to eliminate serious hazards and achieve model workplace safety and health practices. Through the Alliance Program, OSHA works with groups committed to worker safety and health to prevent workplace fatalities, injuries and illnesses by developing compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries. In VPP, management, labor, and OSHA work cooperatively and proactively to prevent fatalities, injuries, and illnesses through a system focused on: hazard prevention and control, worksite analysis, training, and management commitment and worker involvement.

Occupational Safety and Health Training

The OSHA Training Institute in Arlington Heights, Illinois, provides basic and advanced training and education in safety and health for federal and state compliance officers, state consultants, other federal agency personnel and private sector employers, workers, and their representatives. In addition, 27 OSHA Training Institute Education Centers at 42 locations throughout the United States deliver courses on OSHA standards and occupational safety and health issues to thousands of students a year.

For more information on training, contact the OSHA Directorate of Training and Education, 2020 Arlington Heights Road, Arlington Heights, IL 60005; call 1-847-297-4810; or visit www.osha.gov.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures/booklets that cover a wide variety of job hazards and other topics;
- Fact Sheets, which contain basic background information on safety and health hazards;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing workplace hazards. To sign up for *QuickTakes* visit OSHA's web site at www.osha.gov and click on *QuickTakes* at the top of the page.

To view materials available online or for a listing of free publications, visit OSHA's web site at www.osha.gov. You can also call 1-800-321-OSHA [6742] to order publications.

OSHA's web site also has a variety of eTools. These include utilities such as expert advisors,

electronic compliance assistance, videos and other information for employers and workers. To learn more about OSHA's safety and health tools online, visit www.osha.gov.

NIOSH HEALTH HAZARD EVALUATION PROGRAM

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more about the Health Hazard Evaluation Program:

- Call (513) 841-4382, or to talk to a staff member in Spanish, call (513) 841-4439; or
- Send an email to HHERequestHelp@cdc.gov.

OSHA REGIONAL OFFICES

Region I

Boston Regional Office
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II

New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III

Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV

Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V

Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI

Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII

Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII

Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX

San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa,
Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X

Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

HOW TO CONTACT OSHA

For questions or to get information or advice, to report an emergency, report a fatality or catastrophe, order publications, sign up for OSHA's e-newsletter *QuickTakes*, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

**For assistance, contact us.
We are OSHA. We can help.**





U.S. Department of Labor

For more information:



www.osha.gov (800) 321-OSHA (6742)

Attachment C

Lab Safety Labeling and Safety of Chemicals

(OSHA Quick Facts)

Laboratory Safety Labeling and Transfer of Chemicals

Permanent Container Labels

Employers must ensure that no worker uses, stores, or allows any other person to use or store any hazardous substance in a laboratory if the container (including bags, barrels, bottles, boxes, cans, cylinders, drums and reaction vessels) does not meet the following labeling requirements in OSHA's Hazard Communication standard [29 CFR 1910.1200(f)(1)]:

Replacement Label Requirements

- 1 The identity of the chemical and appropriate hazard warnings must be shown on the label.
 - 2 The hazard warning must provide users with an immediate understanding of the primary health and/or physical hazard(s) of the hazardous chemical through the use of words, pictures, symbols, or any combination of these elements.
 - 3 The name and address of the manufacturer, importer or other responsible party must be included on the label.
- The hazard label message must be legible, permanently displayed and written in English.

Portable (Secondary) Container Labels

Often, laboratory operations require transferring chemicals from the original labeled container into a secondary container (e.g., beaker, flask, or bottle). Portable containers must comply with the labeling requirements listed above if any of the following events occur:

- The material is not used within the work shift of the individual who makes the transfer.
- The worker who made the transfer leaves the work area.
- The container is moved to another work area and is no longer in the possession of the worker who filled the container.

continued on page 2

The identity of the chemical and appropriate hazard warnings must be shown on the label.

For assistance, contact us. We can help. It's confidential.



Occupational Safety
and Health Administration
www.osha.gov 1-800-321-6742

Laboratory Safety Labeling and Transfer of Chemicals

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- Labels on portable containers are not required if the worker who made the transfer uses all of the contents during the work shift.

Transfer Label Requirements

When a secondary container is used for longer than one shift or does not meet the requirements outlined in the Permanent Container Labels section, above, a label needs to be applied to the secondary container. This label must contain two key pieces of information: the identity of the hazardous chemical(s) ¹ in the container (e.g., chemical name) and the hazards present. ² There are many ways to communicate this hazard information. Employers should select a system that will work for each location.

Replacement Container Label

The existing label on a container entering the workplace from a supplier must not be removed, altered or defaced. If a chemical container's original label must be replaced, the new label must contain the same information as the original. Only use labels, ink and markings that are not soluble in the liquid content of the container.

The existing label on a container entering the workplace from a supplier must not be removed, altered or defaced.

For assistance, contact us. We can help. It's confidential.



Occupational Safety
and Health Administration
www.osha.gov 1-800-321-6742

Attachment D

Academic Labs Rule, Container Labels

(ORCR)

Academic Labs Rule Container Label Examples

Environmental Protection Agency

Office of Resource Conservation and Recovery (ORCR)

formerly known as Office of Solid Waste (OSW)

Disclaimer: EPA provides this training as an assistance tool for the convenience of the regulated community. It is not a regulation, nor can it be considered a substitute for the regulations themselves, or for related laws and applicable court decisions. EPA does not intend this training material to be cited as legal precedent before a court or before EPA.

Container Labeling Under the Academic Labs Rule (Subpart K) is Different from the SAA Labeling

- Subpart K allows flexibility in where and when the HW determination is made
- Because the HW determination is not made at the exact time as the point of generation, the container labeling must provide sufficient information to allow a HW determination to be made at a later time

Container Labeling

Satellite Accumulation Area

Containers of HW must be labeled with the words

- “Hazardous Waste” OR
- “Other words that identify the contents of the container”

“Affixed or Attached To” Label

“Associated with” Label

May be “affixed or attached” if preferred

Subpart K

Containers of Unwanted Materials must be labeled with:

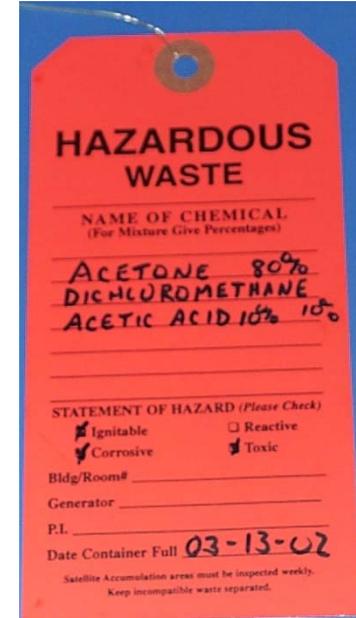
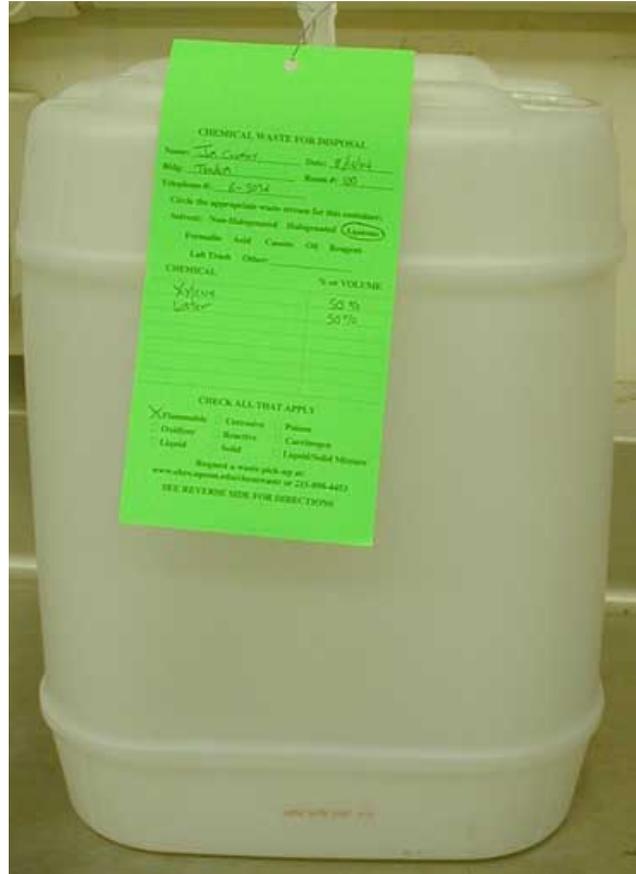
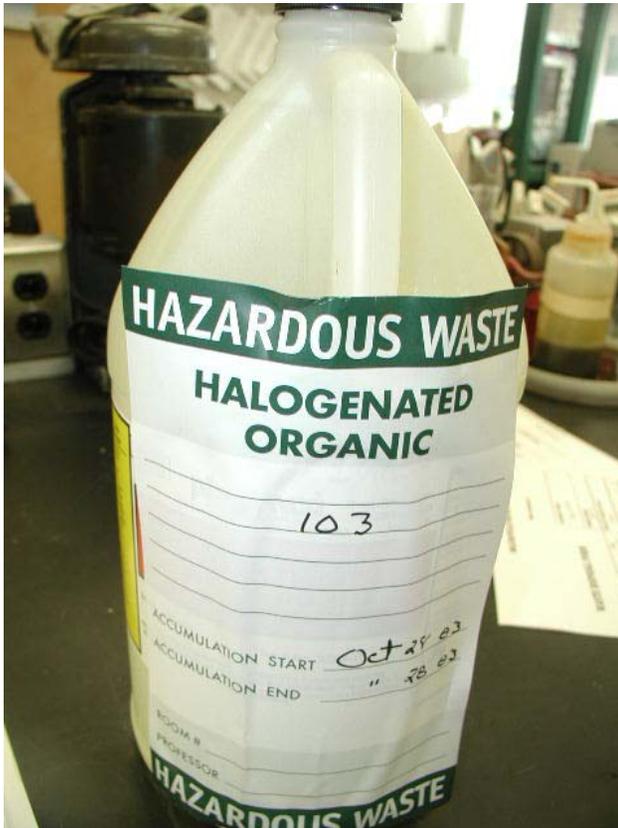
- The words “Unwanted Materials” or another equally effective term used consistently and
- Information to alert emergency responders to the contents of the container (e.g., name of chemical) and
- Information sufficient to make a hazardous waste determination and
- Accumulation start date

Terminology

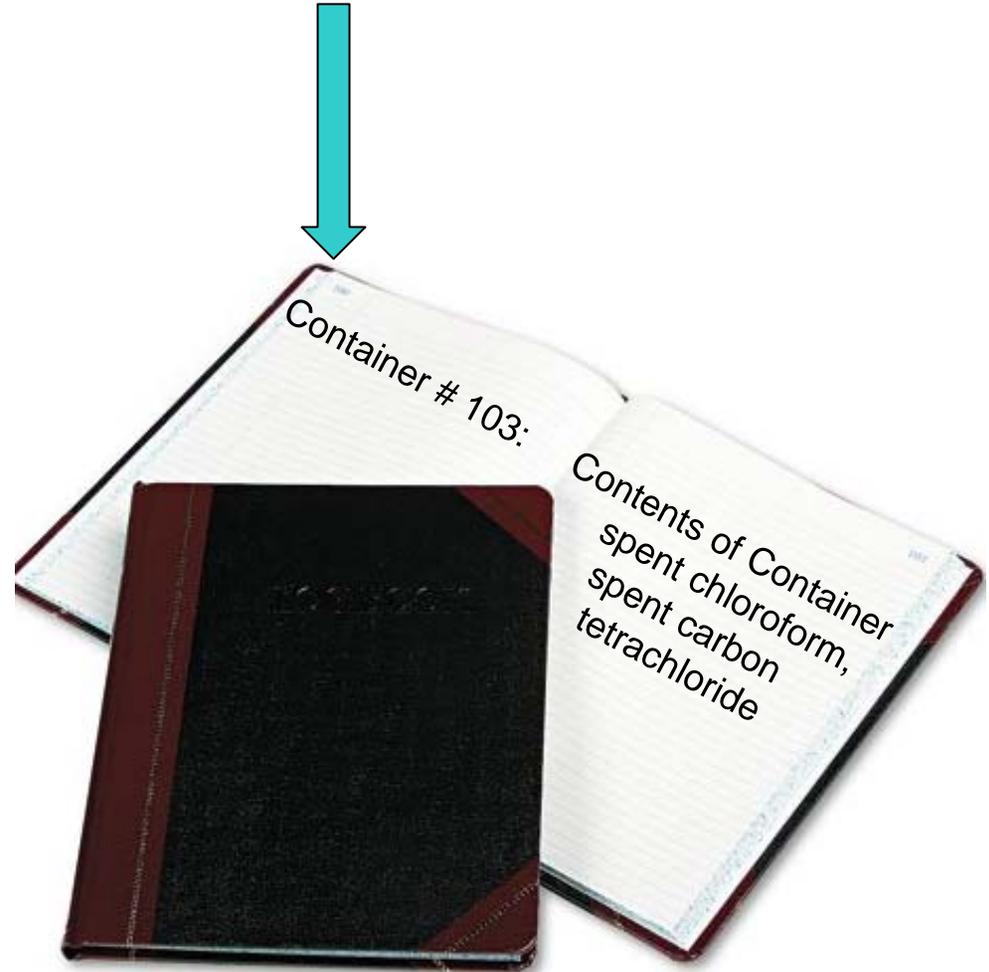
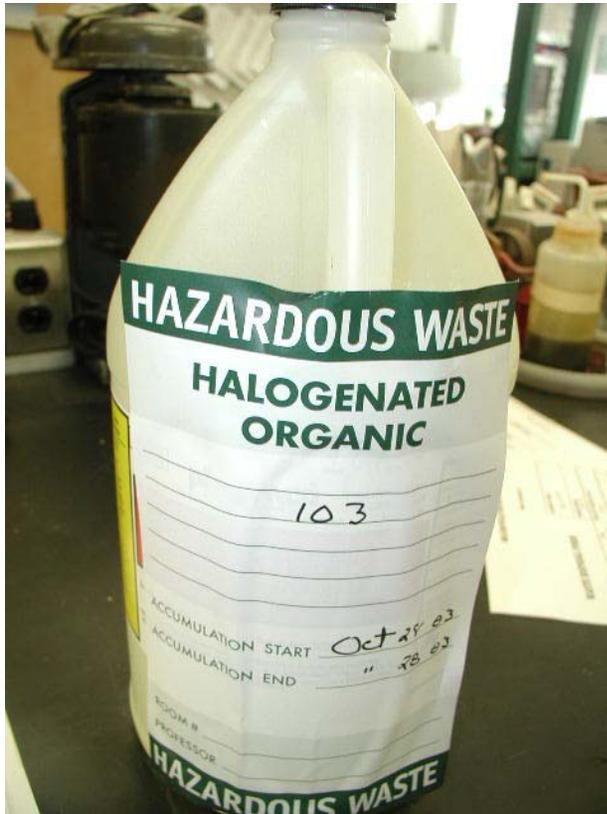
- What does “Affixed or Attached to” label mean?
 - Label must be physically connected to, and not be separated from, the container
 - Examples:
 - Sticker on the bottle of unwanted material
 - Label attached to bottle with wire or tape (reminder-securely attached)

- What does “Associated With” label mean?
 - Labeling system that allows you to track information back to a specific container such as:
 - Spreadsheet
 - Log Book
 - Barcoding
 - “Associated with” labels do not have to be physically with the containers
 - Information can be stored electronically

Examples of "Affixed or Attached to" Labels



Example of “Associated With” Label



“Affixed or Attached to” Label that corresponds with the “Associated with” label to the right

Container Labeling for Subpart K

- Often, you can take the label in use in your SAA area and modify it slightly to work for Subpart K labeling
 - The following slides include example labels that colleges and universities are currently using
- Examples demonstrate the flexibility of the two types of labeling:
 1. label “affixed or attached to” the container
 2. label “associated with” the container
- Examples are illustrative only and are not meant to be exhaustive

Solvent Container Labels Under Subpart K

- The following slides show 3 container label examples for unwanted materials that are non-halogenated solvents that would be listed hazardous waste when the hazardous waste determination is made
- Container labels for unwanted materials that are halogenated solvents can be done in a very similar way
- Key to making a HW determination and assigning proper HW codes - need to know whether solvent has been spent or not

Label Example for Unwanted Materials

“Affixed or Attached to” Label

Information to alert Emergency Responders to the contents of the container

The words Unwanted Materials or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

Information to alert Emergency Responders to the contents of the container

Information to make a HW Determination and Information to alert Emergency Responders to the contents of the container

LAB HAZARDOUS WASTE

Waste Name
(No abbreviations or chemical formulas)

NON-HALOGENATED SOLVENT WASTE

S P E N T	Hazardous Constituents	Est. %
	<u>ACETONE</u>	<u>50</u>
	<u>ETHANOL</u>	<u>40</u>
	<u>XYLENE</u>	<u>10</u>
	_____	_____

Hazard(s)
(Check all that apply)

Ignitable (D001) _____ Corrosive (D002)
 _____ Reactive (D003) _____ Oxidizer (D001)
 _____ Halogen (F001 - F005) _____ Toxic (D004 - D042)

Container Start Date: 10/4/07 Container Fill Date: _____
 Generated by: J. M. SMITH Ext: 4321

Accumulation Start Date

Label Example for Unwanted Materials

“Affixed or Attached to” Label

Lab Waste

University of Washington
 Environmental Health & Safety (206) 616-5835 UoW 1157

The words **Unwanted Materials** or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

Chemical Composition and Associated Hazard	
Spent Methyl Ethyl Ketone (MEK)	
Spent Xylene	
Spent Ethyl Benzene	
Container Number 567	
<input type="checkbox"/> Corrosive <input type="checkbox"/> Reactive <input type="checkbox"/> Other (explain) <input type="checkbox"/> Non-Hazardous <input checked="" type="checkbox"/> Toxic <input checked="" type="checkbox"/> Ignitable <input type="checkbox"/> Oxidizer	
Waste Generator information	Labeled By
Department	Phone
Building	Room

Information to alert Emergency Responders to the contents of the container

And

Information to make a HW Determination

Information to alert Emergency Responders to the contents of the container

“Associated with” Label (Log Book)

Container Number	Accumulation Start Date
567	12/15/09

Accumulation Start Date

Thanks to University of Washington for use of their label.

Label Example for Unwanted Materials

“Affixed or Attached to” Label



The words **Unwanted Materials** or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

Accumulation Start Date

Information to alert Emergency Responders to the contents of the container

Thanks to the Bradley Corporation for use of their label

“Associated With” Label (Barcode)

Enough information for a trained professional to make a hazardous waste determination



- The barcode must contain enough information to make a hazardous waste determination which could be **Spent Methyl Ethyl Ketone (MEK), Spent Xylene, Spent Ethyl Benzene**

Subpart K Container Label Examples Continued

- The following slides show two container label examples for unwanted materials that would be determined to be:
 1. Characteristic hazardous waste
 2. Non-hazardous waste (which are also unwanted materials while in the laboratory)

Label Example for Unwanted Materials

“Affixed or Attached to” Label

Information to alert Emergency Responders to the contents of the container

And

Information to make a HW Determination

The words Unwanted Materials or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

LAB HAZARDOUS WASTE

Contents: (No Formulas or Abbreviations)

Isopropanol (70%)

HAZARDS (CHECK THE HAZARD THAT BEST DESCRIBES THE CONTENTS OF THE CONTAINER)

IGNITABLE TOXIC CORROSIVE REACTIVE

OXIDIZER OTHER: _____

DATE CONTAINER STARTED

10 | 20 | 09 BLD. _____ DEPT. _____ RM _____

MANAGER: _____ TEL. _____

Information to alert Emergency Responders to the contents of the container

Accumulation Start Date

Label Example for Unwanted Materials

Information to alert Emergency Responders to the contents of the container

And

Information to make a HW Determination

REFER TO LABELING INSTRUCTIONS ON REVERSE SIDE

C 08076

Lab Unwanted Materials

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

CONTENTS

USE FULL CHEMICAL NAME
NO FORMULAS OR ABBREVIATIONS

1. **Ethidium Bromide** % _____

2. _____ % _____

3. _____ % _____

4. _____ % _____

HAZARDS (SEE REVERSE SIDE)

IGNITABLE/FLAMMABLE OXIDIZER

CORROSIVE TOXIC/POISON

OTHER (SPECIFY) _____

MARK DATE WHEN CONTAINER STARTED

DATE **09** / **13** / **09**

Building _____ Room No. _____

PI/Manager _____

Phone _____

The words Unwanted Materials or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

Information to alert Emergency Responders to the contents of the container

Accumulation Start Date

Example Labels from Clean-out

- Containers of unwanted materials from a once-per-12 month laboratory clean-out are labeled
 - According to the same labeling requirements as all other containers of unwanted materials in the laboratory
 - This way there is one labeling system in the laboratory
- You may want to add information to the label to identify containers from a laboratory clean-out, especially if you plan to move them to a central accumulation area
- A label distinguishing laboratory clean-out containers will assist you in knowing what you need to count toward generator status
- The following two examples are for unused unwanted materials from a laboratory clean-out

Label Example for Unwanted Materials

“Affixed or Attached to” Label

Unwanted Materials Label

The words Unwanted Materials or equally effective term used consistently and written in Part I of the LMP (e.g. Lab Waste)

DO NOT FILL THE CONTAINER TO THE TOP – LEAVE 2” BETWEEN THE TOP OF THE WASTE AND THE LID.

ROOM# _____ BLDG NAME _____

NAME OF GENERATOR _____

CONTAINER SIZE _____

START DATE 8/16/09

Accumulation Start Date

DATE OF FINAL ACCUMULATION _____

CHEMICAL(S) NAME

Information to make a HW Determination

And

Information to alert Emergency Responders to the contents of the container

Unused Ethyl Ether

LAB CLEAN-OUT WASTE

Label Example for Unwanted Materials

“Affixed or Attached to” Label

Unwanted Materials Container 123

PRESS HARD WITH BALL-POINT PEN AND PEEL AT SLIT!
DETACH TOP COPY AND CARBON AT PERFORATION! ATTACH
BOTTOM COPY TO CONTAINER. SEND TOP COPY TO:
ENVIRONMENTAL HEALTH & SAFETY, 201 PALM RD., ITHACA, NY

NYDOOO0810986 B 03335

CORNELL UNIV., ENVIRONMENTAL HEALTH & SAFETY
201 PALM ROAD, ITHACA, NY 14850

BLDG. & RM. DATE
NAME TEL.#

CHECK TYPE CHEMICAL NAME/Volume or Weight

- Poison
- Flamm. Solvent
- Halogen Solvent
- Oxidizer
- Flamm. Solid
- Corrosive–Acid
- Corrosive–Alkali
- Corrosive–Solid
- Irritant

Acetone

HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal
If found contact the nearest police or Public Safety authority or the U.S. EPA

NYDOOO0810986 B 03335

HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal
If found contact the nearest police or Public Safety authority or the U.S. EPA

The words Unwanted Materials or equally effective term used consistently and written in Part I of the LMP

Information to alert Emergency Responders to the contents of the container

Information to alert Emergency Responders to the contents of the container

“Associated With” Label (Log Sheet)

Container Number	Accumulation Start Date	Information to make HW determination
123	12/10/09	100% Unused Acetone from Lab Clean-Out

Accumulation Start Date

Enough information for a trained professional to make a hazardous waste determination

Helpful Tips

- Look at your labels now- you may be able to change the words “Hazardous Waste” and use the same labels
- When you choose what to call unwanted materials, think about how it will help you separate unwanted materials from the laboratory (regulated under Subpart K) from hazardous waste generated elsewhere on campus (regulated under satellite accumulation area and standard generator regulations)
- You may want to include a check box on your label to distinguish between used and unused unwanted materials

More Helpful Tips

- You may want to design additional labels or fields for
 - working containers
 - laboratory clean-out waste

- If you have a central accumulation area (90 or 180-day area), you may want to make a label for your containers of unwanted material that can be adapted easily once the containers have been transported to the hazardous waste central accumulation area
 - Remember once your container arrives at the central accumulation area it must be dated according to the SQG and LQG generator regulations
 - Remember that within 4 days of arriving in the central accumulation area, the words “Hazardous Waste” must be added to a container of unwanted material that is a hazardous waste to indicate that the initial hazardous waste determination has been made

Attachment E

Comparing the Academic Laboratory Rule

to the

SAA Regulations

(ORCR)



Comparing the Academic Laboratories Rule to the Satellite Accumulation Area Regulations

Environmental Protection Agency
Office of Resource Conservation and Recovery (ORCR)
formerly known as the Office of Solid Waste (OSW)

Disclaimer: EPA provides this training as an assistance tool for the convenience of the regulated community. It is not a regulation, nor can it be considered a substitute for the regulations themselves, or for related laws and applicable court decisions. EPA does not intend this training material to be cited as legal precedent before a court or before EPA.

Outline

- Basics of the Labs Rule
- Rationale for the Labs Rule
- Main Provisions of the Labs Rule
- Status of State Authorization

Basic Facts About the Labs Rule

- Establishes new **Subpart K** in 40 CFR Part 262 for laboratories owned by eligible academic entities
 - Labs typically operate under the satellite accumulation area (SAA) regulations of 40 CFR 262.34(c)
 - Subpart K provides alternate RCRA generator regulations for managing hazardous waste in academic labs
- Rule is a mix of performance-based standards and specific standards for the lab
- Each eligible academic entity must develop a laboratory management plan (LMP)

Labs Rule is Optional on 2 Levels

1. STATES

The rule is deemed “as stringent” as current RCRA generator regulations

- Authorized states may, but are not required to adopt Subpart K

After the Labs Rule is effective in your State...

2. ELIGIBLE ACADEMIC ENTITIES

Subpart K is an optional rule for eligible academic entities

- Eligible academic entities can choose to comply with existing regulations or Subpart K

Rationale for the Academic Labs Rule

- Teaching and research labs differ from industry in the following ways:
 - **Hazardous waste generation pattern** is different
 - Hundreds of different hazardous wastes that vary over time
 - Small amounts of each hazardous waste
 - Many individuals generating hazardous waste in many labs (i.e., many points of generation)
 - Individuals generating the hazardous waste are often **students**, who
 - Have inherently high turnover (thus difficult to train)
 - Lack the expertise & accountability of a professional workforce

Rationale for the Academic Labs Rule

Hazardous waste generation pattern

+ ***Student presence***

***Very difficult to make
accurate HW determinations
at the point of generation***

Rationale for the Academic Labs Rule

Solution:

- Require trained professionals to make the HW determination instead of students
- Allow HW determination to be made after initial point of generation
- Any material in the laboratory that has the potential to be HW is managed as HW in the laboratory

Applicability of the Two Regulatory Provisions

Satellite Accumulation Area

Satellite Accumulation Area (SAA)

Applies to SQGs and LQGs

Applies to any SQG or LQG that chooses to establish an SAA “at or near the point of generation”

Subpart K

Laboratory

Applies to CESQGs, SQGs and LQGs

Applies only to labs at an “**eligible academic entity**” that opts into Subpart K:

- College or University (C/U)
- Teaching Hospital that is owned by or has a formal written affiliation agreement with a C/U
- Non-profit Research Institute that is owned by or has a formal written affiliation agreement with a C/U

Terminology of the Two Regulatory Provisions

Satellite Accumulation Area

Hazardous Waste (HW)

Acute Hazardous Waste
(124 P-listed chemicals with 1qt
threshold in SAA)

< 90/180 day generator
accumulation area

Subpart K

“Unwanted Material” OR
other “equally effective term” that you
choose

Reactive Acutely Hazardous
Unwanted Material
(6 P-listed chemicals with 1 qt
threshold in lab)

Central accumulation area (CAA)

Who is NOT Eligible to Opt In?

Subpart K

- Commercial R&D labs
 - do not meet student criteria of the rule's rationale

- Government research labs
 - we lacked sufficient information regarding the student criteria

- High school labs

Laboratory

Subpart K

What is a Laboratory*?	YES	NO
<ul style="list-style-type: none"> ■ Teaching & research labs ■ Art studios ■ Photo labs ■ Field labs ■ Diagnostic labs in teaching hospitals ■ Areas that support labs (e.g., chemical stockrooms & prep rooms) 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ 	
<ul style="list-style-type: none"> ■ Chemical stockrooms that do not support labs ■ Vehicle maintenance areas ■ Machine shops ■ Print shops ■ Commercial photo processing ■ Power plants 		<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓

* Laboratories must be OWNED by the eligible academic entity

Notification

Satellite Accumulation Area

SQGs and LQGs must notify that they are generating HW but do not have to specify that they are accumulating HW in an SAA

Subpart K

Eligible Academic Entity must notify its authorized state that it is opting into Subpart K

- Use the Site ID Form (Form 8700-12) to notify
- Site ID Form has been modified to include new box for Subpart K
- Can withdraw from Subpart K using the same form

All laboratories at an EPA ID # (or site) must opt in together

Container Labeling

Satellite Accumulation Area

Containers of HW must be labeled with the words

- “Hazardous Waste” OR
- “Other words that identify the contents of the container”

“Affixed or Attached To” Label

“Associated with” Label

May be “affixed or attached” if preferred

Subpart K

Containers of Unwanted Materials must be labeled with:

- The words “Unwanted Materials” or another “equally effective term” used consistently and
- Information to alert emergency responders to the contents of the container (e.g., name of chemical) and
- Information sufficient to make a hazardous waste determination and
- Accumulation start date

Container Management

Satellite Accumulation Area

1. Containers must be in good condition
2. Contents must be compatible with container
3. Containers must be kept closed except:
 - When adding or removing HW

Subpart K

1. Containers must be in good condition
2. Contents must be compatible with container
3. Containers must be kept closed except:
 - When adding, removing, or bulking unwanted materials
 - **Working container*** may be open until end of procedure or shift, whichever is first
 - When venting of a container is necessary
 - For operation of equipment such as HPLCs
 - To avoid pressure build-up

* Working container ≤ 2 gallons

Training

Satellite Accumulation Area

No training of SAA personnel is required

Training required for personnel outside SAA

- Must have standard RCRA generator training, pursuant to their generator status
- No CAA at CESQGs, so no training required

Subpart K

Training that is “commensurate with duties” is required for all laboratory personnel which includes:

- Laboratory workers, and
- Students

Training required for personnel outside lab (trained professionals)

- Must have standard RCRA generator training, pursuant to their generator status
- Trained professional at CESQGs must train to SQG standards

Removing HW from the Laboratory

Satellite Accumulation Area

Volume-driven removals of HW from SAA:

- 3 days to remove the excess of 55 gallons of hazardous waste, if 55 gallons of HW (or 1 quart acute HW) is exceeded

Subpart K

Time-driven removals of unwanted materials from laboratory:

- All containers must be removed from the lab at a regular interval not to exceed 6 months, or
- Rolling 6 months: each container must be removed within 6 months from the container's accumulation start date

AND

Volume-driven removals of unwanted materials from lab:

- 10 days to remove unwanted materials if 55 gallons (or 1 quart of acute reactives) is exceeded

Acutes in the Laboratory

Satellite Accumulation Area

In the SAA:

Acute Hazardous Waste

- 124 P-listed chemicals (unused commercial chemical products)
- If **1 quart** is exceeded in SAA, must be removed within 3 days

Generator status for facility: all 124 P-listed chemicals have **1 kg**/month threshold that triggers LQG status

Subpart K

In the lab:

Reactive Acutely Hazardous Unwanted Material

- 6 reactive P-listed chemicals (unused commercial chemical products)
- If **1 quart** is exceeded in lab, must be removed within 10 calendar days

1. P006 – Aluminum phosphide
2. P009 – Ammonium picrate
3. P065 – Mercury fulminate
4. P081 - Nitroglycerine
5. P112 - Tetranitromethane
6. P122 – Zinc phosphide (> 10%)

Generator status for facility: all 124 P-listed chemicals have **1 kg**/month threshold that triggers LQG status

Hazardous Waste Determination

Satellite Accumulation Area

Generator must make HW determination at the **point of generation**

- The time and place HW is first generated

Individuals generating the HW generally make the initial HW determination

Subpart K

Eligible Academic Entity can choose when and where to make HW determination:

- In the laboratory (but after the time of initial HW generation), or
- Within 4 calendar days of arriving at an on-site:
 - Central accumulation area (CAA = 90/180/270 day area), or
 - Interim status or permitted treatment, storage, or disposal facility (TSDF)

Individuals making the HW determination must be “**trained professionals**”

HW Determination in a CAA

Subpart K

- Must date the container when it arrives at CAA, which starts the
 - 4-day clock for HW determination
 - 90- or 180-day clock for accumulation time
- Must determine whether the unwanted material is a HW within 4 days of arriving at the on-site CAA
- If it's a HW, must add the words "hazardous waste"
 - Must go on the "affixed or attached to" container label
- Can delay adding the **HW code** until immediately prior to off-site shipment
 - Can go on "affixed or attached to" label or "associated with" label

Hazardous Waste Determination

Subpart K

- The point of generation remains the same, only the hazardous waste determination is delayed
- All unwanted materials are **managed as hazardous waste** in the laboratory until the hazardous waste determination is made
- Unwanted materials in the laboratory will likely include materials that turn out to be non-hazardous wastes once the hazardous waste determination is made

On-site Consolidation

(Transferring Containers Outside the SAA/Lab)

Satellite Accumulation Area

- Containers may **NOT** be transferred between SAAs, therefore on-site consolidation may **ONLY** occur in a
 - central accumulation area

Subpart K

- Containers **MAY** be transferred between laboratories, therefore on-site consolidation **MAY** occur in a
 - laboratory or
 - in a central accumulation area
- Consolidation laboratory
 - Same time limits on how long containers can remain in the laboratory (i.e., 6 months)
 - Same volume limits on how much unwanted material is allowed in the laboratory
 - Only trained professionals can transfer the containers outside the lab

Off-site Consolidation

Satellite Accumulation Area

No provision for a generator to consolidate HW at an off-site location, unless the receiving facility is:

- An interim status or permitted TSDF or
- A transfer facility

Subpart K

No provision for a generator to consolidate HW at an off-site location, unless the receiving facility is:

- An interim status or permitted TSDF or
- A transfer facility

Laboratory Clean-Out Incentives

Satellite Accumulation Area

No incentives to conduct laboratory clean-outs are provided:

- If exceed 55 gallons of HW, must remove the excess within 3 days
- All HW generated in a laboratory clean-out must be counted toward generator status
- Laboratory clean-outs will often increase generator status (e.g. from SQG to LQG)

Subpart K

Regulatory incentives to conduct laboratory clean-out are provided:

- Laboratory clean-out waste has no volume limit--must remove all laboratory clean-out waste after 30 days
- HW generated during a laboratory clean-out that is **unused** commercial chemical product does not have to be counted toward generator status
- Incentives can be used one time per laboratory per 12 months

Laboratory Clean-Out Details

Subpart K

- Laboratory clean-outs are not mandatory
- 30-day clock for clean-out begins when you start sorting through cabinets and taking inventory
- At the end of 30 days, all laboratory clean-out unwanted materials must be removed from the laboratory and
 - Sent to on-site CAA or on-site TSDF, or
 - Sent off-site for disposal

Laboratory Clean-Out Details

Subpart K

- **On-site Management** of laboratory clean-out waste
 - **Unused** commercial chemical products are not counted toward generator status
 - CESQGs and SQGs will not have increased regulatory burden because of a laboratory clean-out
- **Off-site Management** of laboratory clean-out waste
 - If weight of laboratory clean-out waste makes the eligible academic entity exceed the CESQG monthly limits, then all HW must be managed and disposed of as HW when sent **off-site**
 - >1 kg of acute HW or
 - >100 kg of HW
- **Manifesting** laboratory clean-out waste
 - Use Box 14 on the manifest titled, “Special Handling Instructions and Additional Information”
 - Indicate that a portion or all the waste on the manifest is from a Subpart K laboratory clean-out

Laboratory Clean-out Example

Subpart K

- Squeaky Clean University (SCU) is a normally a CESQG
- Squeaky Clean University conducts a laboratory clean-out:
 - Generates 5 kg P-listed acute HW (unused commercial chemical products)
 - This amount is greater than the **1 kg** of acute HW/month weight limit for CESQGs
 - Normally, Squeaky Clean University would become an LQG for the month
 - But, Squeaky Clean University does not count the 5 kg of unused commercial chemical product towards its generator status
 - Squeaky Clean University remains a CESQG for purposes of on-site accumulation
 - Squeaky Clean University does not have to do Biennial Reporting, contingency plans, etc.
 - For off-site management, since the CESQG limits have been exceeded, all HW must be managed as HW when sent off-site (e.g., manifested, LDRs, TSDF, etc.)

Laboratory Management Plan (LMP)

Satellite Accumulation Area

LMP is not required

Subpart K

Two-part LMP is required

1. Contents of Part I are **enforceable**
 - 2 elements
 - Identify options for container labeling
 - Identify option for regular removal of unwanted material from laboratories
2. Contents of Part II are **not enforceable**
 - 7 elements
 - Best intended practices for laboratory HW management

Laboratory Management Plan (LMP)

- Contents of Part I of LMP are **Enforceable**
 - you can be held in violation if your practices vary from the LMP procedures you develop

- Contents of Part II of LMP are **Not Enforceable**
 - you can NOT be held in violation if your practices vary from the LMP procedures you develop

- You can be held in violation if all 9 required elements are not reasonably addressed in your LMP

Laboratory Management Plan (LMP)

- One LMP covers all laboratories at an EPA ID # (or site) that opts in
- If you have multiple EPA ID #'s (or sites) that opt in
 - One LMP can cover multiple sites
- LMP can be incorporated into another plan
 - e.g., OSHA's Chemical Hygiene Plan
- LMP includes procedures many of you have already developed

Recordkeeping

Subpart K

- Laboratory clean-outs must be documented
 - Identify laboratory cleaned out
 - Start and end date of laboratory clean-out
 - Volume of laboratory clean-out hazardous waste
- Training records must be kept by LQGs for
 - Laboratory workers (but not for students)
 - Trained professionals (as required by existing generator regulations)

Cost Savings for Eligible Academic Entities

- Economic Assessment for the Labs Rule
 - Of the eligible academic entities projected to opt into Subpart K, annual cost savings ranged from
 - \$1,000 to just over \$12,000
- Sector-specific generator regulations tailored to work with the normal operations of teaching and research laboratories
- Potential for better compliance and to move beyond compliance
 - e.g., waste minimization, green chemistry, both of which may reduce costs
- Safer laboratories may reduce occurrence of accidents and releases
- Reduced liability from better laboratory hazardous waste management
 - Potential for lower insurance rates

Where Is the Labs Rule Effective Now?

(Status as of 5/11/2010)

- Rule is effective in states and territories that are not authorized to run RCRA programs
 1. Alaska
 2. Iowa
 3. Indian Nations
 4. Territories: Puerto Rico, American Samoa, Northern Mariana Islands, US Virgin Islands

- Eight RCRA-authorized states have adopted the Labs Rule but not yet been authorized for the Labs Rule
 1. Alabama
 2. Arkansas
 3. Idaho
 4. Mississippi
 5. Montana
 6. New Jersey
 7. Pennsylvania
 8. Virginia

- Two additional states that are using the Labs Rule
 1. Wisconsin
 2. South Dakota

* Reminder: The Labs Rule (Subpart K) must be effective in a state before an eligible academic entity in that state may opt into the Labs Rule

Managing the Change to Subpart K

- Some institutions are nervous about changing to the new Subpart K
- We recommend talking to your state regulatory agency prior to opting into Subpart K to talk through concerns and to begin a dialogue
- Many of you are already operating under a similar system
- **Change is possible! And a few schools have already paved the way**

ORCR's Labs Team

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<http://www.epa.gov/wastes/hazard/generation/labwaste>

Attachment F

Standard Operating Procedures

(Template)



STANDARD OPERATING PROCEDURE TEMPLATE

#1	PROCEDURE OR EXPERIMENT DESCRIPTION:
<p>[Title and Brief Description]</p>	
<p style="text-align: center;">Type of Procedure [Check all the apply]:</p> <p><input type="checkbox"/> Generic Laboratory Procedure [Ex. Washing glassware, reagent preparation] <input type="checkbox"/> Specific Chemical Use in General Lab Work [Ex. Sulfuric Acid, methanol, etc.] <input type="checkbox"/> Specific Chemical Process [Ex. titration, distillation, etc.] <input type="checkbox"/> Instrumental Analysis <input type="checkbox"/> Class Demonstration meeting NFPA criteria <input type="checkbox"/> Other: describe</p>	
#2	SAFETY REVIEW and HAZARD SUMMARY
<p>1. Hazardous Substances [List hazardous substances, their quantities and concentrations]</p> <p><input type="checkbox"/> GHS Hazard Classes and Signal Words Involved</p> <p>[Refer to Safety Data Sheet s (SDSs) at CEMS, Sigma-Aldrich, etc. to determine hazards classes;]</p> <p><u>Physical</u> Explosives (<input type="checkbox"/> Danger or <input type="checkbox"/> Warning) Oxidizers (<input type="checkbox"/> Danger or <input type="checkbox"/> Warning) Flammable (<input type="checkbox"/> Danger or <input type="checkbox"/> Warning) Corrosive (<input type="checkbox"/> Warning only) Compressed Gas (<input type="checkbox"/> Warning only)</p> <p><u>Health</u> Corrosive (<input type="checkbox"/> Danger only) Toxic (<input type="checkbox"/> Danger) Health Hazard (<input type="checkbox"/> Danger or <input type="checkbox"/> Warning) Irritant (<input type="checkbox"/> Warning only) Environmental (<input type="checkbox"/> Warning only)</p>	

2. Other Hazards
- Biological hazards
 - Electric hazards
 - Mechanical hazards
 - Glassware hazards
 - Use of radiation
 - Use of cryogenic liquid
3. Identify and Assess the Three Scenarios of Greatest Concern
(1 = possible in normal operations; 2 = possible in upset conditions; 3 = not possible)

Physical risks

- Explosion
- Fire
- Uncontrolled reaction (oxidizers or corrosives)
- Corrosive equipment contamination
- Sudden release of compressed gas

Health Risks

- Contamination resulting in systematic health effects
- Corrosive body contamination
- Irritating body contamination
- Environmental impacts

4. References

- Safety Data Sheets
- Laboratory Chemical Safety Summaries
- Specific process instructions
- General chemistry literature
- Previous Experience

[List references you are using for the safe and effective design of your process or experiment, including safety literature and peer-reviewed journal articles.]

#3

STORAGE REQUIREMENTS

- Flammables cabinet
- Corrosives cabinet
- High hazard storage for security reasons
- Inventory controlled storage for safety reasons
- General storage

#4

STEP-BY-STEP OPERATING PROCEDURE

[For each step's description, include any step-specific hazard, personal protective equipment, engineering controls, and designated work areas.

- a. **Guidance on Engineering and Ventilation Controls** – Guidance is available from Carleton Chemical Hygiene Office (CHO), 222-7554.

Local ventilation:

- Fume hood
- Elephant trunk
- Biosafety cabinet

General ventilation

- Standard ventilation rate (8 air changes per hour)
- Moderate ventilation rate (6 air changes per hour)
- Specific ventilation rate (specify)

b. **Guidance on Personal Protective Equipment** – Refer to SDS or contact Carleton EHS [222-4146 or 222-7554 for assistance in determining required personal protective equipment.

- Gloves**
- Eye protection
- Body protection

c. **Designated work area(s)** *specify work areas and clean up requirements to manage contamination concerns*

[Describe the possible risks involved with failure to follow a step in the SOP in the right hand column. **Steps 1 and 2, as specified, are always the first steps in a laboratory procedure.**]

**Step-by-Step Description of Your
Process or Experiment**

1. Don personal protective equipment.

- appropriate street clothing (long pants, closed-toed shoes)
- gloves; indicate type: _____
- safety goggles safety glasses face shield
- lab coat flame-resistant lab coat
- other: _____

<p>2. Check the location/accessibility/certification of the safety equipment that serves your lab:</p>	
ITEM	STATUS
Laboratory Fume Hood/Glove Box or other Ventilation Control	Location: _____ <i>Check sticker to ensure that hood was certified within last 12 months.</i>
Eyewash/Safety Shower	Location: _____ <i>Ensure that it is accessible, not blocked. Check tag that it has been tested within last month.</i>
First Aid Kit	Location: _____
Chemical Spill Kit	Location: _____
Fire Extinguisher	Location: _____
Telephone	Location: _____
Fire Alarm Manual Pull Station	Location: _____
<p>3. [Here is where steps to implement the desired task begin. A teaching or research lab procedure would be inserted here.]</p>	
<p>[Describe the next step in the procedure. Insert additional rows in table, as needed.]</p>	
<p>4. Properly dispose of hazardous solvents, solutions, mixtures, and reaction residues as hazardous waste. [Consult SDS or CHO.]</p>	
<p>5. Clean up work area and lab equipment. [Describe specific cleanup procedures for work areas and lab equipment that must be performed after completion of your process or experiment. For carcinogens and reproductive toxins, designated areas must be immediately wiped down following each use.]</p>	
<p>6. Remove PPE and wash hands.</p>	

#5	KEY SAFETY BRIEFING POINTS
-----------	-----------------------------------

- i. Chemical Hazards
- ii. Risk Scenarios
- iii. Ventilation and other shielding required
- iv. PPE required
- v. Emergency Equipment and Procedures based on scenarios

#6	WASTE DISPOSAL
-----------	-----------------------

[Describe the types and quantities of waste you anticipate generating and consult Chemical Hygiene Office (CHO) at 222-7554 for guidance on disposal procedures.]

#7

TRAINING AND OVERSIGHT REQUIREMENTS

General Training (*check all that apply*):

- General Lab Safety Orientation: use of ventilation, PPE and emergency equipment
- Chemical Hazard Recognition and Assessment (GHS, Hazard Communication / Right-To-Know)
- Blood borne Pathogens management
- Biosafety and contamination control
- Radiation Safety procedures
- Laser Safety practices
- Other: _____

[Depending on the hazardous materials and processes you will be working with in this SOP, additional safety training may be required by the College.]

Location Where Training Records Maintained:

Laboratory-specific training (*check all that apply*):

- Review of SDS for chemicals involved in process/experiment
- Review of this SOP
- Other: _____

Location Where Records Maintained:

Is working alone permitted?

Are unattended operations permitted?

Frequency of housekeeping inspections

Frequency of compliance inspections

#8	PRIOR APPROVALS
-----------	------------------------

[You **must** seek prior approval from your principal investigator (PI) or Lab Supervisor if you plan to use **restricted chemicals** (Ex. Dimethyl mercury)]

You should also consult your PI, Lab Supervisor or the Chemical Hygiene Officer (CHO) if your experiments involve **high-risk chemicals and operations**, as special safety precautions may need to be taken. High-risk chemicals and operations may involve chemicals with a high level of acute toxicity, carcinogens, reproductive toxins, and highly reactive materials.

Your PI or lab supervisor's prior approval **shall** be documented by his/her signature in the Approval Signature section of this document.

Prior Approval (check if applicable):

Prior approval from the PI or lab supervisor is required for this procedure

#9	PRIOR APPROVALS
-----------	------------------------

Department	[Specify]
Procedure Title	[Specify]
Author	[Name of PI, Lab Supervisor, or EHS as appropriate]
Creation/Revision Date	[Specify]
Responsible Person	[Name of PI, Lab Supervisor, or Autonomous Researcher actually performing or supervising this procedure]
Approval Signature and date approved	[Obtain prior approval, as appropriate.] _____ Print Name _____ Signature _____ Date _____
Office Phone	[Specify]
Lab Phone	[Specify]
Location(s) Covered by Procedure	[Specify]
Emergency Contact	[Specify]

Attachment G

Chemical Inventory

Campus Environmental Management System

(CEMS)

The complete chemical inventory can be accessed via internet by authorized personnel through CEMS.

Attachment H

MNPCA Small Quantity Hazardous Waste

Generator Self-Audit Checklist



Self-audit checklists provide businesses with an easy way to review compliance with Minnesota's environmental laws and rules. However, because the laws and rules are numerous and often complicated, this checklist cannot be a complete guide to legal obligations. You may have obligations that are not covered on this checklist. In the Twin Cities metro area, your county environmental department may have additional hazardous waste requirements.

If you have questions about this checklist or would like a paper copy of any of the fact sheets listed, call the Minnesota Pollution Control Agency (MPCA) Small Business Environmental Assistance Program at 651-282-6143 or 1-800-657-3938.

Is this the right checklist?

- **Small Quantity Generator (SQG)** – Between 220 and 2200 pounds hazardous waste generated each month (about one-half to four 55-gallon drums). Less than 2.2 pounds acute hazardous waste generated each month. If this describes your business, use this checklist. If you need additional copies of this checklist, it can be found on the Minnesota Pollution Control Agency (MPCA) website at <http://www.pca.state.mn.us/index.php/view-document.html?gid=4974>.

If you are not an SQG, use one of the following two checklists:

- **Very Small Quantity Generator (VSQG)** – 220 pounds or less of hazardous waste generated each month (about half of a 55-gallon drum). Less than 2.2 pounds acute hazardous waste generated each month.
The checklist for VSQGs can be found on the Minnesota Pollution Control Agency (MPCA) website at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=4973>.
- **Large Quantity Generator (LQG)** – More than 2,200 pounds hazardous waste (more than four 55-gallon drums) or more than 2.2 pounds acute hazardous waste generated each month. The checklist for LQGs can be found on the Minnesota Pollution Control Agency (MPCA) website at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=4975>.

More information: MPCA hazardous waste fact sheets are online at <http://www.pca.state.mn.us/waste/pubs/business.html> and can help you:

- Find information on each topic in this checklist – look for the “10 Steps to Compliance”
- Determine if a waste is hazardous using Step 1 of the “10 Steps to Compliance”
- Manage specific hazardous wastes
- Manage used oil, fluorescent lights, electronic wastes, and other wastes with special requirements

Instructions:

- If you answer “Yes,” you are in compliance with the rule discussed in that question.
- If you answer “No,” you are not meeting the requirements of the rule and need to make changes at your business.
- Answer “N/A” if you have determined the rule does not apply to you.

Licensing

- 1. Do you have a hazardous waste generator identification number, also known as an U.S. Environmental Protection Agency (EPA) ID number or Hazardous Waste ID number?**

Look up your business on the MPCA's What's In My Neighborhood webpage if you are unsure:

<http://www.pca.state.mn.us/wimn>.

- Yes
- No. Fill out the “Notification of Regulated Waste Activity” form to have one assigned. The form is available at the bottom of the MPCA Hazardous Waste publications webpage at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- 2. Is your hazardous waste license up to date?**

Licenses must be renewed annually. In most of Minnesota, the license is issued by the MPCA. If you are in the Twin Cities metro area, the license is issued by your county.

More information: MPCA Hazardous Waste Licensing webpage at <http://www.pca.state.mn.us/dm0r8a6>.

- Yes
- No

3. Is your hazardous waste license displayed in a public area at the licensed site?

- Yes
 No

Waste Evaluation

List your hazardous wastes here:

4. Have you considered all your wastes when determining which ones are hazardous?

Easy-to-miss hazardous wastes include those that go to the sewer, are recycled on-site, are recycled off-site as a feedstock or byproduct, might be inappropriately disposed of with trash, or are inappropriately managed (such as leaving solvent rags out to dry).

Don't forget to report these hazardous wastes on your hazardous waste license application. Hazardous wastes that are sent to the sewer, recycled on site, or recycled off site as feedstock or byproduct are commonly forgotten.

- Yes
 No

5. If you have a new waste or make changes that result in a different or changed waste, do you evaluate the waste within 60 days so you know if it is hazardous or non-hazardous?

Tip: Figure out a way to remind yourself to do the waste evaluation when you make changes or introduce a new product. For example, you could put a monthly reminder in your calendar, or keep a copy of the MPCA fact sheet on how to determine whether a waste is hazardous in the folder with your purchase order forms. MPCA fact sheet #w-hw1-01, "Evaluate Waste" at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- Yes
 No

Labeling

More information: MPCA "[Label and Store Hazardous Waste](http://www.pca.state.mn.us/waste/pubs/business.html)" fact sheet #w-hw1-04-05 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

6. Are all hazardous waste storage containers and tanks labeled with the words "Hazardous Waste"?

- Yes
 No

7. Are all hazardous waste storage containers and tanks labeled with a clear description of the waste?

- Yes
 No

8. Are all hazardous waste storage containers and tanks labeled with the date that waste was first added to the container?

- Yes
 No

Storage Requirements

More information: MPCA "[Label and Store Hazardous Waste](http://www.pca.state.mn.us/waste/pubs/business.html)" fact sheet #w-hw1-04-05 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

9. Are all hazardous waste storage containers compatible with the waste stored in them?

Make sure that the containers will not absorb, react with, or be affected by the contents.

- Yes
 No

10. Are all hazardous waste storage containers in good condition?

Use sturdy and strong containers that will not leak if they are bumped by equipment or dropped, especially when they are full. Containers with rust, corrosion, or dents are more likely to leak or break.

- Yes
- No

11. Have you protected all hazardous waste storage containers that will deteriorate if left in the sun or rain?

- Yes
- No
- N/A

12. Are all hazardous waste storage containers closed except when waste is being added or removed?

'Closed' means they will not spill if tipped. Drums have their snap rings locked, funnels latched, or bungs screwed in tight, and snap-lid buckets are completely closed.

- Yes
- No

13. Are incompatible wastes separated?

Separate containers with incompatible contents by using a dike, berm, secondary containment, or distance between the containers.

- Yes
- No
- N/A

14. Is there enough aisle space between hazardous waste containers that you can easily inspect each container and remove a leaking one without moving any others?

- Yes
- No

15. Are hazardous waste storage areas protected from accidental damage by vehicles or equipment such as forklifts and pallet jacks?

- Yes
- No

16. Are hazardous waste containers that hold free liquids placed on an impermeable surface?

'Impermeable' means there are no cracks, drains, or sumps that would allow a spill to escape, and the surface will not react with or be damaged by the waste. Solvents and oils will dissolve asphalt, so do not store solvents or oils on asphalt. Corrosive materials will eat away at concrete unless it is sealed with a corrosive-resistant epoxy, so do not store corrosive materials on unsealed concrete.

- Yes
- No

17. Are floor drains in hazardous waste storage areas sealed to prevent releases?

The remaining floor drains in your facility can remain open, but they must be managed appropriately.

More information: MPCA "[Floor Drains and Flammable Traps](#)" fact sheet #w-hw4-18 and MPCA "[Land Application of Trap and Holding Tank Wastes](#)" fact sheet #w-sw4-18 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- Yes
- No
- N/A

18. Do you store less than 6600 pounds of hazardous waste (about twelve 55-gallon drums) at any time?

Do not exceed the storage limit of 6600 pounds of hazardous waste. Storing more than 6600 pounds makes you a storage facility, which requires a permit and has many additional requirements.

- Yes
- No

19. Do you ship hazardous waste within 180 days (about six months) of the date waste is first added to the container? Or, if you are more than 200 miles from the destination facility and disposal arrangements have been made, do you ship hazardous waste within 270 days (about nine months)?

Take care not to exceed the storage limit of 6600 pounds during the extended storage time.

- Yes
- No

20. Do you store less than 2.2 pounds of acute hazardous waste?

Do not exceed the storage limit of 2.2 pounds of acute hazardous waste. More information: MPCA fact sheet #w-hw2-02, [P List of Acute Hazardous Wastes](http://www.pca.state.mn.us/waste/pubs/business.html), at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- Yes
- No
- N/A

21. If you store more than 2.2 pounds of acute waste, do you ship acute hazardous waste within 90 days of the date you reach the storage limit of 2.2 pounds?

- Yes
- No
- N/A

22. If you store more than 2.2 pounds of acute waste, during the time between reaching the storage limit for acute hazardous waste (2.2 pounds) and shipping the waste, do you meet the employee training and emergency planning requirements for Large Quantity Generators?

More information: MPCA fact sheet #w-hw1-09c, "[Train Employees -- LQG](http://www.pca.state.mn.us/waste/pubs/business.html)" and MPCA fact sheet #w-hw1-08c, "[Plan for Emergencies -- LQG](http://www.pca.state.mn.us/waste/pubs/business.html)" at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- Yes
- No
- N/A

23. Do you conduct and document inspections of hazardous waste storage containers and storage areas every week?

An inspection log to document weekly inspections is available in MPCA fact sheet #w-hw2-41, "[Documenting Container Inspections](http://www.pca.state.mn.us/waste/pubs/business.html)," at <http://www.pca.state.mn.us/waste/pubs/business.html>, or you can make your own.

- Yes
- No
- N/A

24. Are ignitable or reactive hazardous wastes kept at least 50 feet from your property line?

If your property is too small for this to be possible, contact your local fire marshal and follow the fire code requirements.

- Yes
- No
- N/A

25. Additional requirement for outdoor storage:

For hazardous waste containers stored outdoors, is the storage area curbed?

Curbing must be sufficient to contain a release.

- Yes
- No
- N/A

26. Additional requirement for outdoor storage:

Are hazardous waste containers that are stored outdoors protected from unauthorized access?

- Yes
- No
- N/A

27. Additional requirement for outdoor storage:

Are ignitable or reactive hazardous wastes that are stored outdoors stored under roofing to protect them from precipitation and overheating?

- Yes
- No
- N/A

Satellite Accumulation

More information: MPCA "[Label and Store Hazardous Waste](http://www.pca.state.mn.us/waste/pubs/business.html)" fact sheet #w-hw1-04-05 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

List your satellite hazardous wastes here:

28. For satellite accumulation containers, at each point of generation do you accumulate 55 gallons or less of each hazardous waste or 1 quart or less of each acute hazardous waste?

- Yes
- No
- N/A

29. Are satellite accumulation containers labeled with the words "Hazardous Waste" and a clear description of the waste?

- Yes
- No
- N/A

30. For satellite accumulation containers located away from the point of generation, are they inspected weekly and documented?

Satellite accumulation containers must either be under the direct control of the operator and visually inspected daily, or inspected weekly and the inspections documented.

- Yes
- No
- N/A

31. For full satellite accumulation containers, is the fill date marked on the containers?

You must ship the waste within 180 days of the fill date. If you are more than 200 miles from the destination facility and disposal arrangements have been made, you must ship the waste within 270 days.

- Yes
- No
- N/A

32. For full satellite accumulation containers, are they moved to the hazardous waste storage area within three days of the fill date?

- Yes
- No
- N/A

Used Oil

Used oil and oily wastes are common problem areas during inspections. This section covers only the most frequent violations for used oil storage. For more complete guidance, there are used oil fact sheets on the MPCA Hazardous Waste Publications webpage at <http://www.pca.state.mn.us/waste/pubs/business.html>. The fact sheets discuss the rules for used oil storage, marketing, burning, and transporting.

List your used oil and oily wastes here:

33. Are all used oil storage containers and tanks labeled with the words “Used oil,” “Used oily waste,” or “Used oil filters”?

- Yes
- No
- N/A

34. Are all containers of used oil and oily wastes in good condition?

Use sturdy and strong containers that will not leak if they are bumped by equipment or dropped, especially when they are full. Containers with rust, corrosion, or dents are more likely to leak or break.

- Yes
- No
- N/A

35. Are all containers of used oil and oily wastes closed except when waste is being added or removed?

‘Closed’ means they will not spill if tipped – drums have their snap rings locked, funnels latched, or bungs screwed in tight, and snap-lid buckets are completely closed.

- Yes
- No
- N/A

36. Are all containers of used oil and oily wastes placed on a reasonably impermeable surface?

‘Impermeable’ means there are no cracks, drains, or sumps that would allow a spill to escape, and the surface will not react with or be damaged by the waste. Oil will dissolve an asphalt surface, so asphalt is not acceptable for storing containers of used oil.

- Yes
- No
- N/A

37. When you clean up oil spills, whether indoors or outdoors, do you make sure the oily wastes (such as kitty litter, floor dry, or dirt) are disposed of as oily waste?

Do not dispose of these wastes with your trash.

- Yes
- No
- N/A

38. Since used oil that will be recycled doesn’t require a manifest to ship, do you make sure you keep receipts or a log of each shipment?

- Yes
- No
- N/A

Universal Wastes: Batteries, Fluorescent Lights, and Mercury-containing Equipment

For clarification on what qualifies as a universal waste, see MPCA “[Managing Universal Wastes](http://www.pca.state.mn.us/waste/pubs/business.html)” fact sheet #w-hw4-62 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

List your universal wastes here:

39. Are universal wastes or their containers labeled "Universal Waste -- [type of waste]," "Waste [type of waste]," or "Used [type of waste]"?

For example, “Universal Waste – fluorescent lights” or “Used batteries.”

- Yes
- No
- N/A

40. Are universal wastes stored in closed containers that are structurally sound, adequate to prevent breakage, and compatible with the waste?

- Yes
- No
- N/A

41. Are universal waste containers in good condition and free of leaks, spills, or damage?

- Yes
- No
- N/A

42. Do you keep universal waste for one year or less?

Tip: To keep track of how long you have kept it, mark the waste with the date it was generated or keep a log.

- Yes
- No
- N/A

43. Are leaking or damaged universal waste batteries stored in a closed container that is structurally sound and compatible with the waste?

Common types of universal waste batteries are lead-acid, NiCad, and lithium >9 volts.

- Yes
- No
- N/A

44. Are broken fluorescent light bulbs stored in a closed container?

A PVC pipe with endcaps can be used to store used fluorescent light bulbs, including those with broken tips. Fluorescent light bulbs that have accidentally shattered should be stored in an airtight container that will hold the small pieces of glass (do not use a cardboard box or plastic bag). Do not intentionally break fluorescent bulbs.

- Yes
- No
- N/A

Disposal and Shipping

More information: MPCA "[Treat or Dispose of Hazardous Waste Correctly](http://www.pca.state.mn.us/waste/pubs/business.html)" fact sheet #w-hw1-06 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

45. Before hazardous wastes leave your site, do you make sure:

- The waste is properly identified, labeled, and packaged for transport
- The waste is properly loaded and secured in the transport vehicle
- The vehicle displays required placards if necessary. If placards are required, prepare and maintain a transportation security plan

- Yes
- No

46. Does your hazardous waste hauler meet the following requirements?

- Has a Hazardous Waste ID number
- Meets U.S. Department of Transportation qualifications for vehicle operators
- Maintains adequate liability insurance
- Transports the waste to a permitted facility
- Registered with the Alliance for Uniform Hazardous Materials Transportation Procedures if it will transport your waste to or through any of the participating states (as of 2014: Michigan, Nevada, Ohio, Oklahoma, and West Virginia)

- Yes
- No
- N/A

47. If you dispose of hazardous waste to the sewer (down the drain), have you notified your municipal waste water treatment plant?

Follow your waste water treatment plant's requirements. This may include pretreatment requirements or restrictions on volume. Remember to report these often-forgotten wastes on your annual license application. Do not dispose of hazardous waste to a septic system.

More information: MPCA fact sheet #w-hw4-49, "[Sewering Liquid Waste](http://www.pca.state.mn.us/waste/pubs/business.html)" at <http://www.pca.state.mn.us/waste/pubs/business.html>.

- Yes
- No
- N/A

48. Do you make sure empty containers meet the following three requirements before recycling them or disposing of them with solid waste?

- All the waste that can be removed has been removed
- Less than 3% of the original weight remains in containers that hold 119 gallons or less, or less than 0.3% of the original weight remains in containers that hold more than 119 gallons
- Allowed by your recycler or solid waste hauler

- Yes
- No
- N/A

Manifests

More information: MPCA "[Manifest Shipments of Hazardous Waste](http://www.pca.state.mn.us/waste/pubs/business.html)" fact sheet #w-hw1-07 at <http://www.pca.state.mn.us/waste/pubs/business.html>.

49. Are all shipments of hazardous waste made using a Uniform Hazardous Waste Manifest?

Some wastes, such as used oil that will be recycled and universal wastes, may be shipped using shipping papers rather than a manifest.

- Yes
- No

50. Before your waste is loaded on the transporter's vehicle, do you double check that the information on your manifest is accurate and complete?

Although most hazardous waste transporters will pre-fill a manifest with your information, you remain responsible for its accuracy.

- Yes
- No

51. Do you make sure the manifest is signed?

- Yes
- No

52. Do you make sure all six pages of the manifest are legible before the shipment leaves your site?

- Yes
- No

53. After your transporter has signed and dated the manifest, do you copy the "Generator Initial Copy" (also known the "two-signature page") and send it to the MPCA within five days of shipment?

- Yes
- No

54. After you receive a signed and dated copy of the "Designated Facility to Generator Copy" (also known as the "three-signature page"), do you make sure that you, your transporter, or the facility mail a legible photocopy to the MPCA within 40 days of the facility's acceptance of the waste?

- Yes
- No

55. Do you submit an exception report to the MPCA if you do not receive the "Designated Facility to Generator Copy" (also known as the "three-signature page") back from the destination facility within 45 days of shipment?

- Yes
- No
- N/A

56. If you export your hazardous waste, do you follow all applicable rules for notification, consent, EPA acknowledgement of consent, and shipping papers/manifests?

More information on requirements for exporting hazardous waste can be found by searching for "MN Rule 7045.0302" on the Internet.

- Yes
- No
- N/A

Emergency Planning and Preparedness

More information: MPCA fact sheet #w-hw1-08b, "[Plan for Emergencies -- SQG](http://www.pca.state.mn.us/waste/pubs/business.html)" at <http://www.pca.state.mn.us/waste/pubs/business.html>.

Report leaks or spills that might pollute the air, land, or water immediately to the
Minnesota Duty Officer at
651-649-5451 or **1-800-422-0798**.

The duty officer is available 24 hours a day.

Call fire, police, ambulance, or cleanup services as needed.

The Duty Officer will not contact them for you.

If in doubt, report.

57. Do you provide immediate access to emergency communications for employees working with hazardous waste?

Examples include an alarm call button or telephone in a storage room, having employees carry hand-held radios or cell phones, or having employees use a 'buddy system' so that an employee working with hazardous waste is always within voice contact of another employee outside of the hazardous waste area.

- Yes
- No

58. Do you have a suitable communication system to provide emergency instructions to company personnel?

For small shops, the human voice may be sufficient. For larger shops an intercom, loudspeaker, alarm system, or telephone may be needed.

- Yes
- No

59. Is a telephone or radio available on site for employees to contact emergency responders?

- Yes
- No

60. Do you keep emergency and spill equipment (such as fire extinguishers, absorbent materials, and spill containers) in or near the hazardous waste storage area?

- Yes
- No

61. Is emergency and spill equipment appropriate for the type and amount of wastes on site?

- Yes
- No

62. Is emergency and spill equipment in operating condition and accessible at all times?

- Yes
- No

63. Is emergency equipment tested and maintained according to the manufacturer's instructions?

- Yes
- No

64. Are fire protection systems, including all portable fire extinguishers, inspected, and tested at least annually by a licensed inspector?

- Yes
- No

65. Have you made and documented the following arrangements with local authorities?

- Familiarize police, fire, and emergency response teams with the hazardous waste on site, the properties and hazards of the waste, storage and accumulation areas for the waste, employee work areas, employee evacuation routes, and facility access roads.
- Designate a primary emergency authority in case more than one emergency response agency responds to an emergency at your facility.
- Familiarize local hospitals with the wastes on site and the types of injuries or illnesses that could result.

- Yes
- No

66. Do you have a designated emergency coordinator?

An emergency coordinator must be on site or on call at all times. Assign backup coordinators in case the primary coordinator is unavailable.

- Yes
- No

69. Have you posted the following emergency information next to each telephone that an employee might use in a hazardous waste emergency?

More information: "[Emergency Plan Packet for Small Quantity Generators](http://www.pca.state.mn.us/waste/pubs/business.html)" at <http://www.pca.state.mn.us/waste/pubs/business.html> provides a template you can use.

- Names and telephone numbers of the primary and backup emergency coordinators
- Telephone number of the fire department
- Locations of fire extinguishers, spill control equipment, and fire alarms.

- Yes
- No

Training

More information: MPCA fact sheet #w-hw1-09b, "[Train Employees -- SQG](http://www.pca.state.mn.us/waste/pubs/business.html)" at <http://www.pca.state.mn.us/waste/pubs/business.html>.

68. Do you train all employees who have hazardous waste management or emergency response duties?

Train employees on the waste handling, emergency procedures, and sections of the contingency plan relevant to their job.

- Yes
- No

69. Are employees trained within six months of the start of their hazardous waste-related duties?

- Yes
- No

70. Do you document the training?

- Yes
- No

Recordkeeping

71. Do you keep the following required records available for inspection at the licensed site for a minimum of three years?

The MPCA strongly recommends keeping SDSs (Safety Data Sheets), correspondence, and all the documents listed below for the life of the business.

- Copies of license applications
- Testing and analytical reports (keep for three years after the last time the waste is shipped)
- Training documents, including which employees fulfill which hazardous waste job duties (keep records for three years after employee leaves)
- Weekly inspection logs
- Manifests and/or shipping records
- Shipping records for used oil, oily waste, and used oil filters (if you have these wastes)
- Manifest exception reports (if you have any)

- Yes
 No

You have completed the questions for this checklist.

Review your answers. **Make changes at your business to correct any questions marked "No."**

Person completing checklist:

Print name: _____ Title: _____

Signature: _____ Date (mm/dd/yyyy): _____

Notes:

Attachment I

Hazardous Waste Identification

(OSHA)

Introduction to
**Hazardous Waste
Identification**
(40 CFR Parts 261)

HAZARDOUS WASTE IDENTIFICATION

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1. INTRODUCTION

"Is my waste a hazardous waste regulated under the Resource Conservation and Recovery Act (RCRA)?" This is one of the most common and basic RCRA questions and is the key to the RCRA hazardous waste program. If something is not a hazardous waste, it is not regulated under RCRA. Proper identification of a hazardous waste can be a difficult and confusing task, as the RCRA regulations establish a complex definition of the term "hazardous waste." To help make sense of what is and is not a hazardous waste, this module presents the steps involved in the process of identifying, or "characterizing," a hazardous waste.

While introducing the entire hazardous waste identification process, this module will focus on the final steps, the definition of a hazardous waste. The other steps in the process, including the definition of solid waste and the solid and hazardous waste exclusions will be discussed in other modules.

After reading this module, you will be able to explain the hazardous waste identification process and the definition of hazardous waste, and be familiar with the following concepts:

- hazardous waste listings
- hazardous waste characteristics
- the "mixture" and "derived-from" rules
- the "contained-in" policy
- the Hazardous Waste Identification Rules (HWIR).

2. REGULATORY OVERVIEW

What is a hazardous waste? In its most basic form, the answer to that question can be quite simple. A hazardous waste is a waste with a chemical composition or other properties that make it capable of causing illness, death, or some other harm to humans and other life forms when mismanaged or released into the environment. Developing a regulatory program that ensures the safe handling of such dangerous wastes, however, demands a far more precise definition of the term. EPA therefore created hazardous waste identification regulations that outline a process to determine whether any particular material is a hazardous waste for the purposes of RCRA.

2.1 HAZARDOUS WASTE IDENTIFICATION PROCESS

Proper hazardous waste identification is essential to the success of the hazardous waste management program. The RCRA regulations at 40 CFR §262.11 require that any person who produces or generates a waste must determine if that waste is hazardous. In doing so, §262.11 presents the steps in the hazardous waste identification process:

- Is the waste a "solid waste"?
- Is the waste specifically excluded from the RCRA regulations?
- Is the waste a "listed" hazardous waste?
- Does the waste exhibit a characteristic of hazardous waste?

When faced with the question of whether or not a waste is regulated as hazardous under RCRA, turn to §262.11. This regulation will remind you of the four steps in the RCRA hazardous waste identification process.

IS THE WASTE A SOLID WASTE?

Hazardous waste identification begins with an obvious point: in order for any material to be a hazardous waste, it must first be a waste. But, deciding whether an item is or is not a waste is not always easy. For example, a material (like an aluminum can) that one person discards could seem valuable to another person who recycles that material. EPA developed a set of regulations to assist in determining whether a material is a waste. RCRA uses the term "solid waste" in place of the common term "waste." Under RCRA, the term "solid waste" means any waste, whether it is a solid, semisolid, or liquid. The first section of the RCRA hazardous waste identification regulations focuses on the definition of solid waste. For this module, you need only understand in general terms the role that the definition of solid waste plays in the RCRA hazardous waste identification process. Another module, [Definition of Solid Waste and Hazardous Waste Recycling](#), explains the definition of solid waste in greater detail.

IS THE WASTE EXCLUDED?

Only a small fraction of all RCRA solid wastes actually qualify as hazardous wastes. At first glance, one would imagine that distinguishing between hazardous and nonhazardous wastes is a

simple matter of chemical and toxicological analysis. Other factors must be considered, however, before evaluating the actual hazard that a waste's chemical composition poses. Regulation of certain wastes may be impractical, unfair, or otherwise undesirable, regardless of the hazards they pose. For instance, household waste can contain dangerous chemicals, like solvents and pesticides, but making households subject to the strict RCRA waste management regulations would create a number of practical problems. Congress and EPA exempted or excluded certain wastes, like household wastes, from the hazardous waste definition and regulations. Determining whether or not a waste is excluded or exempted from hazardous waste regulation is the second step in the RCRA hazardous waste identification process. Only after determining that a solid waste is not somehow excluded from hazardous waste regulation should the analysis proceed to evaluate the actual chemical hazard that a waste poses. The module entitled Solid and Hazardous Waste Exclusions explains which wastes are excluded from hazardous waste regulation.

IS THE WASTE A LISTED HAZARDOUS WASTE, OR DOES IT EXHIBIT A CHARACTERISTIC?

The final steps in the hazardous waste identification process determine whether a waste actually poses a sufficient chemical or physical hazard to merit regulation. These steps in the hazardous waste identification process involve evaluating the waste in light of the regulatory definition of hazardous waste. The remainder of this module explains the definition of hazardous waste in detail.

2.2 DEFINITION OF HAZARDOUS WASTE

A discussion of the definition of hazardous waste should begin with Congress' original statutory definition of the term. RCRA §1004(5) defines hazardous waste as:

A solid waste, or combination of solid waste, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

This broad statutory definition provides a general indication of which wastes Congress intended to regulate as hazardous, but it obviously does not provide the clear distinctions necessary for industrial waste handlers to determine whether their wastes pose a sufficient threat to warrant regulation or not. Congress instructed EPA to develop more specific criteria for defining hazardous waste. There are therefore two definitions of hazardous waste under the RCRA program: a statutory definition and a regulatory definition. The statutory definition cited above is seldom used today. It served primarily as a general guideline for EPA to follow in developing the regulatory definition of hazardous waste. The regulatory definition is an essential element of the current RCRA program. It precisely identifies which wastes are subject to RCRA waste management regulations.

Congress asked EPA to fulfill the task of developing a regulatory definition of hazardous waste by using two different mechanisms: by listing certain specific wastes as hazardous and by identifying characteristics which, when present in a waste, make it hazardous. Following its statutory mandate, EPA developed a regulatory definition of hazardous waste that incorporates both listings and characteristics.

HAZARDOUS WASTE LISTINGS

A hazardous waste listing is a narrative description of a specific type of waste that EPA considers dangerous enough to warrant regulation. Hazardous waste listings describe wastes from various industrial processes, wastes from specific sectors of industry, or wastes in the form of specific chemical formulations. Before developing a hazardous waste listing, EPA thoroughly studies a particular wastestream and the threat it can pose to human health and the environment. If the waste poses enough of a threat, EPA includes a precise description of that waste on one of the hazardous waste lists in the regulations. Thereafter, any waste fitting that narrative listing description is considered hazardous, regardless of its chemical composition or any other potential variable. For example, one of the current hazardous waste listings reads as: "API separator sludge from the petroleum refining industry." An API separator is a device commonly used by the petroleum refining industry to separate contaminants from refinery wastewaters. After studying the petroleum refining industry and typical sludges from API separators, EPA decided these sludges were dangerous enough to warrant regulation as hazardous waste under all circumstances. The listing therefore designates all petroleum refinery API separator sludges as hazardous. Chemical composition or other factors about a specific sample of API separator sludge are not relevant to its status as hazardous waste under the RCRA program.

Using listings to define hazardous wastes presents certain advantages and disadvantages. One advantage is that listings make the hazardous waste identification process easy for industrial waste handlers. Only knowledge of a waste's origin is needed to determine if it is listed; laboratory analysis is unnecessary. By comparing any waste to narrative listing descriptions, one can easily determine whether or not the waste is hazardous. EPA's use of listings also presents certain disadvantages. For example, listing a waste as hazardous demands extensive study of that waste by EPA. EPA lacks the resources to investigate the countless types of chemical wastes produced in the United States – the hazardous waste listings simply cannot address all dangerous wastes. Another disadvantage of the hazardous waste listings is their lack of flexibility. Listings designate a waste as hazardous if it falls within a particular category or class. The actual composition of the waste is not a consideration as long as the waste matches the appropriate listing description. For instance, some API separator sludges from petroleum refining might contain relatively few hazardous constituents and pose a negligible risk to human health and the environment. Such sludges are still regulated as hazardous, however, because the listing for this wastestream does not consider the potential variations in waste composition. Thus, the hazardous waste listings can unnecessarily regulate some wastes that do not pose a significant health threat. It is also possible for industries to substantially change their processes so that wastes would no longer meet a listing description in spite of the presence of hazardous constituents. The hazardous waste characteristics provide an important complement to listings

by addressing most of the shortcomings of the listing methodology of hazardous waste identification.

HAZARDOUS WASTE CHARACTERISTICS

A hazardous waste characteristic is a property which, when present in a waste, indicates that the waste poses a sufficient threat to merit regulation as hazardous. When defining hazardous waste characteristics, EPA does not study particular wastestreams from specific industries. Instead, EPA asks the question, "what properties or qualities can a waste have which cause that waste to be dangerous?" For example, EPA found that ignitability, or the tendency for a waste to easily catch fire and burn, is a dangerous property. Thus, ignitability is one of the hazardous waste characteristics and a waste displaying that property is regulated as hazardous, regardless of whether the waste is listed. When defining hazardous waste characteristics, EPA identifies, where practicable, analytical tests capable of detecting or demonstrating the presence of the characteristic. For instance, EPA regulations reference a laboratory flash point test to be used when deciding if a liquid waste is ignitable. Whether or not a waste displays a hazardous characteristic generally depends on how it fares in one of the characteristics tests. Therefore, the chemical makeup or other factors about the composition of a particular waste typically determine whether or not it tests as hazardous for a characteristic.

Using characteristics to define hazardous wastes presents certain advantages over designating hazardous wastes by listings. One advantage is that hazardous characteristics and the tests used to evaluate their presence have broad applicability. Once EPA has defined a characteristic and selected a test for use in identifying it, waste handlers can evaluate any wastestream to see if it is classified as a hazardous waste. Furthermore, use of characteristics can be a more equitable way of designating wastes as hazardous. Instead of categorizing an entire group of wastes as hazardous, characteristics allow a waste handler to evaluate each waste sample on its own merits and classify it according to the actual danger it poses. Aware of these advantages, EPA originally planned to use characteristics as the primary means of identifying hazardous waste. EPA hoped to define and select test methods for identifying all hazardous characteristics, including organic toxicity, mutagenicity (the tendency to cause mutations), teratogenicity (the tendency to cause defects in offspring), bioaccumulation potential, and phytotoxicity (toxicity to plants). EPA encountered problems, however, when trying to develop regulatory definitions of these properties. One primary problem was that no straightforward testing protocols were available for use in determining if a waste possessed any of these characteristics. For example, deciding if a particular wastestream poses an unacceptable cancer risk demands extensive laboratory experimentation. Requiring such analysis on a routine basis from industrial waste handlers would be impractical. Therefore, EPA developed a hazardous waste definition that relies on both listings and characteristics to define hazardous wastes.

2.3 LISTED HAZARDOUS WASTES

EPA has studied and listed as hazardous hundreds of specific industrial wastestreams. These wastes are described or listed on four different lists that are found in the regulations at Part 261, Subpart D. These four lists are:

- The F list — The F list designates particular solid wastes from certain common industrial or manufacturing processes as hazardous. Because the processes producing these wastes can occur in different sectors of industry, the F list wastes are known as wastes from nonspecific sources. The F list is codified in the regulations at §261.31.
- The K list — The K list designates particular solid wastes from certain specific industries as hazardous. K list wastes are known as wastes from specific sources. The K list is found at §261.32.
- The P list and the U list — These two lists are similar in that both list pure or commercial grade formulations of certain specific unused chemicals as hazardous. Both the P list and U list are codified in §261.33.

These four lists each designate anywhere from 30 to a few hundred wastestreams as hazardous. Each waste on the lists is assigned a waste code consisting of the letter associated with the list followed by three numbers. For example, the wastes on the F list are assigned the waste codes F001, F002, and so on. These waste codes are an important part of the RCRA regulatory system. Assigning the correct waste code to a waste has important implications for the management standards that apply to the waste.

LISTING CRITERIA

Before listing any waste as hazardous, the Agency developed a set of criteria to use as a guide when determining whether or not a waste should be listed. These listing criteria provide a consistent frame of reference when EPA considers listing a wastestream. Remember that EPA only uses these criteria when evaluating whether to list a waste; the listing criteria are not used by waste handlers, who refer to the actual hazardous waste lists for hazardous waste identification purposes. There are four different criteria upon which EPA may base its determination to list a waste as hazardous. These criteria are codified in Part 261, Subpart B. Note that these four criteria do not directly correspond to the four different lists of hazardous waste. The four criteria EPA may use to list a waste are:

- The waste typically contains harmful chemicals, and other factors indicate that it could pose a threat to human health and the environment in the absence of special regulation. Such wastes are known as toxic listed wastes.
- The waste contains such dangerous chemicals that it could pose a threat to human health and the environment even when properly managed. Such wastes are known as acutely hazardous wastes.
- The waste typically exhibits one of the four characteristics of hazardous waste described in the hazardous waste identification regulations (ignitability, corrosivity, reactivity, or toxicity).

- When EPA has to cause to believe for some other reason, the waste typically fits within the statutory definition of hazardous waste developed by Congress.

EPA may list a waste as hazardous for any and all of the above reasons. The majority of listed wastes fall into the toxic waste category. To decide if a waste should be a toxic listed waste, EPA first determines whether it typically contains harmful chemical constituents. Appendix VIII of Part 261 contains a list of chemical compounds or elements which scientific studies show to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms. If a waste contains chemical constituents found on the Appendix VIII list, EPA then evaluates 11 other factors to determine if the wastestream is likely to pose a threat in the absence of special restrictions on its handling. These additional considerations include a risk assessment and study of past cases of damage caused by the waste.

Acutely hazardous wastes are the second most common type of listed waste. EPA designates a waste as acutely hazardous if it contains Appendix VIII constituents that scientific studies show to be fatal to humans or animals in low doses. In a few cases, acutely hazardous wastes contain no Appendix VIII constituents, but are extremely dangerous for another reason. An example is the listed waste P081, which designates unused discarded formulations of nitroglycerine as acutely hazardous. Although nitroglycerine is not an Appendix VIII hazardous constituent, wastes containing unused nitroglycerine are so unstable that they pose an acute hazard. The criteria for designating a waste as acutely hazardous require only that EPA considers the typical chemical makeup of the wastestream. EPA is not required to study other factors, such as relative risk and evidence of harm, when listing a waste as acutely hazardous.

To indicate its reason for listing a waste, EPA assigns a hazard code to each waste listed on the F, K, P, and U lists. These hazard codes are listed below. The last four hazard codes apply to wastes that have been listed because they typically exhibit one of the four regulatory characteristics of hazardous waste. You will learn more about the four characteristics of hazardous waste. The hazard codes indicating the basis for listing a waste are:

Toxic Waste	(T)
Acute Hazardous Waste	(H)
Ignitable Waste	(I)
Corrosive Waste	(C)
Reactive Waste	(R)
Toxicity Characteristic Waste	(E)

The hazard codes assigned to listed wastes affect the regulations that apply to handling the waste. For instance, acute hazardous wastes accompanied by the hazard code (H) are subject to stricter management standards than most other wastes.

THE F LIST: WASTES FROM NONSPECIFIC SOURCES

The F list designates as hazardous particular wastestreams from certain common industrial or manufacturing processes. F list wastes usually consist of chemicals that have been used for their intended purpose in an industrial process. That is why F list wastes are known as

"manufacturing process wastes." The F list wastes can be divided into seven groups, depending on the type of manufacturing or industrial operation that creates them. The seven categories of F-listed wastes are:

- spent solvent wastes (F001 - F005)
- wastes from electroplating and other metal finishing operations (F006 - F012, F019)
- dioxin-bearing wastes (F020 - F023 and F026 - F028)
- wastes from the production of certain chlorinated aliphatic hydrocarbons (F024, F025)
- wastes from wood preserving (F032, F034, and F035)
- petroleum refinery wastewater treatment sludges (F037 and F038)
- multisource leachate (F039).

Spent Solvent Wastes

Waste codes F001 - F005 apply to wastestreams from the use of certain common organic solvents. Solvents are chemicals with many uses, although they are most often used in degreasing or cleaning. The solvents covered by the F listings are commonly used in industries ranging from mechanical repair to dry cleaning to electronics manufacturing. EPA decided that only certain solvents used in certain ways produce wastestreams that warrant a hazardous waste listing. Therefore, a number of key factors must be evaluated in order to determine whether the F001 - F005 waste codes apply to a particular waste solvent. First, one or more of the 31 specific organic solvents designated in the F001 - F005 listing description must have been used in the operation that created the waste. Second, the listed solvent must have been used in a particular manner – it must have been used for its "solvent properties," as EPA defines that expression. Finally, EPA decided that only a wastestream created through use of concentrated solvents should be listed. Thus, the concentration of the solvent formulation or product before its use in the process that created the waste is also a factor in determining the applicability of the F001 - F005 listing.

The F001 - F005 spent solvent listings provide a good illustration of a principle common to all listed hazardous wastes. To determine whether a waste qualifies as listed, knowledge of the process that created the waste is essential, while information about the waste's chemical composition is often irrelevant. For example, the F005 listing description can allow two different wastes with identical chemical contents to be regulated differently because of subtle differences in the processes that created the wastes. A waste made up of toluene and paint is F005 if the toluene has been used to clean the paint from brushes or some other surface. A waste with the same chemical composition is not F005 if the toluene has been used as an ingredient (such as a thinner) in the paint. EPA considers use as a cleaner to be "use as a solvent;" use as an ingredient does not qualify as solvent use. As you can see, knowledge of the process that created a waste is the key in evaluating whether a waste can be a hazardous spent solvent or other listed hazardous waste.

Wastes from Electroplating and Other Metal-Finishing Operations

The listed hazardous wastes F006 - F012 and F019 are wastes commonly produced during electroplating and other metal finishing operations. Diverse industries use electroplating and other methods to change the surface of metal objects in order to enhance the appearance of the objects, make them more resistant to corrosion, or impart some other desirable property to them. Industries involved in plating and metal finishing range from jewelry manufacture to automobile production. A variety of techniques can be used to amend a metal's surface. For example, electroplating uses electricity to deposit a layer of a decorative or protective metal on the surface of another metal object. Chemical conversion coating also amends the surface of a metal, but does so by chemically converting (without use of electricity) a layer of the original base metal into a protective coating. Because each of these processes produces different types of wastes, EPA only designated wastes from certain metal-finishing operations as hazardous. The first step in determining whether one of the F006-F012 or F019 listings applies to a waste is identifying the type of metal finishing process involved in creating the waste:

- F006 - F009 listings only apply to wastes from electroplating operations
- F010 - F012 listings only apply to wastes from metal heat treating operations
- the F019 listing only applies to wastes from the chemical conversion coating of aluminum.

Dioxin-Bearing Wastes

The listed wastes F020 - F023 and F026 - F028 are commonly known as the "dioxin-bearing wastes." These listings describe a number of wastestreams that EPA believes are likely to contain dioxins, which are considered to be among the most dangerous known chemical compounds. The dioxin listings apply primarily to manufacturing process wastes from the production of specific pesticides or specific chemicals used in the production of pesticides. The F027 listing deserves special notice because it does not apply to used manufacturing wastes. It applies only to certain unused pesticide formulations. F027 is in fact the only listing on the F list or K list that describes an unused chemical rather than an industrial wastestream consisting of chemicals that have served their intended purpose. With the exception of F028, all of the dioxin-bearing wastes are considered acute hazardous wastes and are designated with the hazard code (H). These wastes are therefore subject to stricter management standards than other hazardous wastes.

Wastes from the Production of Certain Chlorinated Aliphatic Hydrocarbons

The F024 and F025 listings designate as hazardous certain wastestreams produced in the manufacture of chlorinated aliphatic hydrocarbons. These listings stand out on the F list (the list of wastes from nonspecific sources) because they focus on wastes from a very narrow industrial sector. Many other wastestreams from the manufacture of organic chemicals are listed on the K list, the list of wastes from specific sources, including two waste codes for chlorinated aliphatic wastes, K174 and K175.

Wood Preserving Wastes

The F032, F034, and F035 listings apply to certain wastes from wood preserving operations. Many types of wood used for construction or other non-fuel applications is chemically treated to slow the deterioration caused by decay and insects. Such chemical treatment is commonly used in telephone poles, railroad ties, and other wood products prepared to withstand the rigors of outdoor use. Wood preservation typically involves pressure treating the lumber with pentachlorophenol, creosote, or preservatives containing arsenic or chromium. (It should be noted that after December 31, 2003, many wood treaters will not be using arsenic or chromium based inorganic preservatives.) The wood preserving process creates a number of common wastestreams containing these chemicals. For example, once wood has been treated with a preservative excess preservative drips from the lumber. The F032, F034, and F035 listings designate this preservative drippage as listed hazardous waste. These listings also apply to a variety of other residues from wood preserving. Whether the F032, F034, or F035 listings apply to a particular wood preserving waste depends entirely on the type of preservative used at the facility. Waste generated from wood preserving processes using pentachlorophenol is F032, waste from the use of creosote is F034, and waste from treating wood with arsenic or chromium is F035. The K list also includes a waste code, K001, which applies to bottom sediment sludge from treating wastewaters associated with processes using pentachlorophenol and/or creosote.

Petroleum Refinery Wastewater Treatment Sludges

The F037 and F038 listings apply to specific wastestreams from petroleum refineries. The petroleum refining process typically creates large quantities of contaminated wastewater. Before this wastewater can be discharged to a river or sewer, it must be treated to remove oil, solid material, and chemical pollutants. Gravity provides a simple way of separating these pollutants from refinery wastewaters. Over time, solids and heavier pollutants precipitate from wastewaters to form a sludge. Other less dense pollutants accumulate on the surface of wastewaters, forming a material known as float. These gravitational separation processes can be encouraged through chemical or mechanical means. The F037 listing applies to the sludges and float created by gravitational treatment of petroleum refinery wastewaters. The F038 listing applies to sludges and float created during the chemical or physical treatment of refinery wastewaters. The K list also includes waste codes for certain petroleum wastestreams generated by the petroleum refining industry. These waste codes are K048 through K052 and K169 through K172.

Multisource Leachate

The F039 listing applies to multisource leachate, the liquid material that accumulates at the bottom of a hazardous waste landfill. Understanding the natural phenomenon known as leaching is essential to understanding a number of key RCRA regulations. Leaching occurs when liquids such as rainwater filter through soil or buried materials, such as wastes placed in a landfill. When this liquid comes in contact with buried wastes, it leaches or draws chemicals out of those wastes. This liquid (called leachate) can then carry the leached chemical contaminants further into the ground, eventually depositing them elsewhere in the subsurface or in groundwater. The leachate that percolates through landfills, particularly hazardous waste landfills, usually contains high concentrations of chemicals, and is often collected to minimize the potential that it may enter the subsurface environment and contaminate soil or groundwater. This leachate that

percolates through hazardous waste landfills and other buried hazardous waste is designated as F039.

THE K LIST: WASTES FROM SPECIFIC SOURCES

The K list of hazardous wastes designates particular wastes from specific sectors of industry and manufacturing as hazardous. The K list wastes are therefore known as wastes from specific sources. Like F list wastes, K list wastes are manufacturing process wastes. They contain chemicals that have been used for their intended purpose. To determine whether a waste qualifies as K-listed, two primary questions must be answered. First, is the facility that created the waste within one of the industrial or manufacturing categories on the K list? Second, does the waste match one of the specific K list waste descriptions? The 13 industries that can generate K list wastes are:

- wood preservation
- inorganic pigment manufacturing
- organic chemicals manufacturing
- inorganic chemicals manufacturing
- pesticides manufacturing
- explosives manufacturing
- petroleum refining
- iron and steel production
- primary aluminum production
- secondary lead processing
- veterinary pharmaceuticals manufacturing
- ink formulation
- coking (processing of coal to produce coke, a material used in iron and steel production).

Remember that not all wastes from these 13 industries are hazardous, only those specifically described in the detailed K list descriptions.

Previously, the K list included waste codes for 17 different industries. However, EPA revoked the K waste codes applicable to the wastestreams in the primary copper, primary lead, primary zinc, and ferroalloys industries (K064, K065, K066, K090, and K091) (63 FR 28556, 28579; May 26, 1998). Currently, there are no K waste codes applicable to these four industries.

In general, the K listings target much more specific wastestreams than the F listings. For example, EPA added a number of listings to the petroleum refining category of the K list. EPA estimates that one hundred facilities nationwide produce wastestreams covered by these new K listings. In contrast, F-listed spent solvent wastes are commonly generated in thousands of different plants and facilities. You may also notice that industries generating K-listed wastes, such as the wood preserving and petroleum refining industries, can also generate F-listed wastes. Typically, K listings describe more specific wastestreams than F listings applicable to the same industry. For example, K051 and K048 designate as hazardous two very specific types of petroleum refinery wastewater treatment residues: wastewater treatment sludges created in API separators and wastewater treatment float created using dissolved air flotation (DAF) pollution

control devices. The F037 and F038 listings complement these two K listings by designating as hazardous all other types of petroleum refinery wastewater treatment sludges and floats. These petroleum refinery listings illustrate that the K listings are typically more specific than the F listings. They also illustrate that the two lists are in many ways very similar.

THE P AND U LISTS: DISCARDED COMMERCIAL CHEMICAL PRODUCTS

The P and U lists designate as hazardous pure or commercial grade formulations of certain unused chemicals. As you will see, the P and U listings are quite different from the F and K listings. For a waste to qualify as P- or U-listed, a waste must meet the following three criteria:

- the waste must contain one of the chemicals listed on the P or U list
- the chemical in the waste must be unused
- the chemical in the waste must be in the form of a "commercial chemical product," as EPA defines that term.

The following paragraphs explore these three criteria in detail and examine EPA's rationale in creating the P and U lists.

You have already learned that hazardous waste listings are narrative descriptions of specific wastestreams and that a waste's actual chemical composition is generally irrelevant to whether a listing applies to it. At first glance, the P and U listings seem inconsistent with these principles. Each P and U listing consists only of the chemical name of a compound known to be toxic or otherwise dangerous; no description is included. EPA adopted this format because the same narrative description applies to all P and U list wastes. Instead of appearing next to each one of the hundreds of P and U list waste codes, this description is found in the regulatory text that introduces the two lists.

The generic P and U list waste description involves two key factors. First, a P or U listing applies only if one of the listed chemicals is discarded unused. In other words, the P and U lists do not apply to manufacturing process wastes, as do the F and K lists. The P and U listings apply to unused chemicals that become wastes. Unused chemicals become wastes for a number of reasons. For example, some unused chemicals are spilled by accident. Others are intentionally discarded because they are off-specification and cannot serve the purpose for which they were originally produced.

The second key factor governing the applicability of the P or U listings is that the listed chemical must be discarded in the form of a "commercial chemical product." EPA uses the phrase commercial chemical product to describe a chemical that is in pure form, that is in commercial grade form, or that is the sole active ingredient in a chemical formulation. The pure form of a chemical is a formulation consisting of 100 percent of that chemical. The commercial grade form of a chemical is a formulation in which the chemical is almost 100 percent pure, but contains minor impurities. A chemical is the sole active ingredient in a formulation if that chemical is the only ingredient serving the function of the formulation. For instance, a pesticide made for killing insects may contain a poison such as heptachlor as well as various solvent ingredients which act as carriers or lend other desirable properties to the poison. Although all of

these chemicals may be capable of killing insects, only the heptachlor serves the primary purpose of the insecticide product. The other chemicals involved are present for other reasons, not because they are poisonous. Therefore, heptachlor is the sole active ingredient in such a formulation even though it may be present in low concentrations.

As you can see, the P and U listings apply only to a very narrow category of wastes. For example, an unused pesticide consisting of pure heptachlor is listed waste P059 when discarded. An unused pesticide consisting of pure toxaphene is listed waste P123 when discarded. An unused pesticide made up of 50 percent heptachlor and 50 percent toxaphene as active ingredients, while being just as deadly as the first two formulations, is not a listed waste when discarded. That is because neither compound is discarded in the form of a commercial chemical product. Why did EPA choose such specific criteria for designating P- or U-listed chemicals as hazardous? When first developing the definition of hazardous waste, EPA was not able to identify with confidence all the different factors that can cause a waste containing a known toxic chemical to be dangerous. It was obvious, however, those wastes consisting of pure, unadulterated forms of certain chemicals were worthy of regulation. EPA used the P and U lists to designate hazardous wastes consisting of pure or highly concentrated forms of known toxic chemicals. As you will see in the following sections of the module, wastes that remain unregulated by listings may still fall under protective hazardous waste regulation due to the four characteristics of hazardous waste.

2.4 CHARACTERISTIC HAZARDOUS WASTES

A hazardous waste characteristic is a property that indicates that a waste poses a sufficient threat to deserve regulation as hazardous. EPA tried to identify characteristics which, when present in a waste, can cause death or illness in humans or ecological damage. EPA also decided that the presence of any characteristic of hazardous waste should be detectable by using a standardized test method or by applying general knowledge of the waste's properties. EPA believed that unless generators were provided with widely available and uncomplicated test methods for determining whether their wastes exhibited hazardous characteristics, this system of identifying hazardous wastes would be unfair and impractical. Given these criteria, EPA only finalized four hazardous waste characteristics. These characteristics are a necessary supplement to the hazardous waste listings. They provide a screening mechanism that waste handlers must apply to all wastes from all industries. In this sense, the characteristics provide a more complete and inclusive means of identifying hazardous wastes than do the hazardous waste listings. The four characteristics of hazardous waste are:

- ignitability
- corrosivity
- reactivity
- toxicity.

The regulations explaining these characteristics and the test methods to be used in detecting their presence are found in Part 261, Subpart C. Note that although waste handlers can use the test methods referenced in Subpart C to determine whether a waste displays characteristics, they are not required to do so. In other words, any handler of industrial waste may apply knowledge of

the waste's properties to determine if it exhibits a characteristic, instead of sending the waste for expensive laboratory testing. As with listed wastes, characteristic wastes are assigned waste codes. Ignitable, corrosive, and reactive wastes carry the waste codes D001, D002, and D003, respectively. Wastes displaying the characteristic of toxicity can carry any of the waste codes D004 through D043.

IGNITABILITY

Ignitable wastes are wastes that can readily catch fire and sustain combustion. Many paints, cleaners, and other industrial wastes pose such a fire hazard. Most ignitable wastes are liquid in physical form. EPA selected a flash point test as the method for determining whether a liquid waste is combustible enough to deserve regulation as hazardous. The flash point test determines the lowest temperature at which a chemical ignites when exposed to flame. Many wastes in solid or nonliquid physical form (e.g., wood, paper) can also readily catch fire and sustain combustion, but EPA did not intend to regulate most of these nonliquid materials as ignitable wastes. A nonliquid waste is only hazardous due to ignitability if it can spontaneously catch fire under normal handling conditions and can burn so vigorously that it creates a hazard. Certain compressed gases and chemicals called oxidizers can also be ignitable. Ignitable wastes carry the waste code D001 and are among the most common hazardous wastes. The regulations describing the characteristic of ignitability are codified at §261.21.

CORROSIVITY

Corrosive wastes are acidic or alkaline (basic) wastes which can readily corrode or dissolve flesh, metal, or other materials. They are also among the most common hazardous wastestreams. Waste sulfuric acid from automotive batteries is an example of a corrosive waste. EPA uses two criteria to identify corrosive hazardous wastes. The first is a pH test. Aqueous wastes with a pH greater than or equal to 12.5, or less than or equal to 2 are corrosive under EPA's rules. A waste may also be corrosive if it has the ability to corrode steel in a specific EPA-approved test protocol. Corrosive wastes carry the waste code D002. The regulations describing the corrosivity characteristic are found at §261.22.

REACTIVITY

A reactive waste is one that readily explodes or undergoes violent reactions. Common examples are discarded munitions or explosives. In many cases, there is no reliable test method to evaluate a waste's potential to explode or react violently under common handling conditions. Therefore, EPA uses narrative criteria to define most reactive wastes and allows waste handlers to use their best judgment in determining if a waste is sufficiently reactive to be regulated. This is possible because reactive hazardous wastes are relatively uncommon and the dangers they pose are well known to the few waste handlers who deal with them. A waste is reactive if it meets any of the following criteria:

- it can explode or violently react when exposed to water, when heated, or under normal handling conditions

- it can create toxic fumes or gases when exposed to water or under normal handling conditions
- it meets the criteria for classification as an explosive under Department of Transportation rules
- it generates toxic levels of sulfide or cyanide gas when exposed to a pH range of 2 through 12.5.

Wastes exhibiting the characteristic of reactivity are assigned the waste code D003. The reactivity characteristic is described in the regulations at §261.23.

TOXICITY CHARACTERISTIC

The leaching of toxic compounds or elements into groundwater drinking supplies from wastes disposed of in landfills is one of the most common ways the general population can be exposed to the chemicals found in industrial wastes. EPA developed a characteristic designed to identify wastes likely to leach dangerous concentrations of certain known toxic chemicals into groundwater. In order to predict whether any particular waste is likely to leach chemicals into groundwater in the absence of special restrictions on its handling, EPA first designed a lab procedure that replicates the leaching process and other effects that occur when wastes are buried in a typical municipal landfill. This lab procedure is known as the Toxicity Characteristic Leaching Procedure (TCLP). Using the TCLP on a waste sample creates a liquid leachate that is similar to the liquid EPA would expect to find in the ground near a landfill containing the same waste. Once the leachate is created in the lab, a waste handler must determine whether it contains any of 39 different toxic chemicals above specified regulatory levels. If the leachate sample contains a sufficient concentration of one of the specified chemicals, the waste exhibits the toxicity characteristic (TC). EPA used groundwater modeling studies and toxicity data for a number of common toxic compounds and elements to set these threshold concentration levels. Much of the toxicity data were originally developed under the Safe Drinking Water Act.

However, there is one exception to using the TCLP to identify a waste as hazardous. The D.C. Circuit Court, in *Association of Battery Recyclers vs. EPA*, vacated the use of the TCLP to determine whether manufactured gas plant (MGP) wastes exhibit the characteristic of toxicity. As previously stated, the TCLP replicates the leaching process in municipal landfills. The court found that EPA did not produce sufficient evidence that co-disposal of MGP wastes from remediation sites with municipal solid waste (MSW) has happened or is likely to happen. On March 13, 2002, in response to the court vacatur, EPA codified language exempting MGP waste from the toxicity characteristic regulation (67 FR 11251).

To recap, determining whether a waste exhibits the toxicity characteristic involves two principal steps: (1) creating a leachate sample using the TCLP; and (2) evaluating the concentration of 39 chemicals in that sample against the regulatory levels listed below in Table 1. If a waste exhibits the TC, it carries the waste code associated with the compound or element that exceeded the regulatory level. The following table presents the toxicity characteristic waste codes, regulated constituents, and regulatory levels. This table and the regulations describing the characteristic of toxicity are

codified at §261.24.

Table 1
TOXICITY CHARACTERISTIC CONSTITUENTS AND REGULATORY LEVELS

Waste Code	Contaminants	Concentration
D004	Arsenic	5.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D007	Chromium	5.0
D023	o-Cresol*	200.0
D024	m-Cresol*	200.0
D025	p-Cresol*	200.0
D026	Total Cresols*	200.0
D016	2,4-D	10.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D012	Endrin	0.02
D031	Heptachlor (and its epoxide)	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D008	Lead	5.0
D013	Lindane	0.4
D009	Mercury	0.2
D014	Methoxychlor	10.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D010	Selenium	1.0
D011	Silver	5.0
D039	Tetrachloroethylene	0.7
D015	Toxaphene	0.5
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D017	2,4,5-TP (Silvex)	1.0
D043	Vinyl chloride	0.2

*If o-, m-, and p-cresols cannot be individually measured, the regulatory level for total cresols is used.

2.5 WASTES LISTED SOLELY FOR EXHIBITING THE CHARACTERISTIC OF IGNITABILITY, CORROSIVITY, AND/OR REACTIVITY

Hazardous wastes listed solely for exhibiting the characteristic of ignitability, corrosivity, and/or reactivity are not regulated the same way that other listed hazardous wastes are regulated under RCRA. When wastes are generated that meet a listing description for one of the 29 wastes listed only for exhibiting the characteristic of ignitability, corrosivity, and/or reactivity, the waste is not hazardous if it does not exhibit a characteristic (66 FR 27266, 27283; May 16, 2001). This concept is consistent with the mixture and derived-from rules, which will be discussed in detail later in this module. For example, F003 is listed for the characteristic of ignitability. If a waste is generated and meets the listing description for F003 but does not exhibit the characteristic of ignitability, it is not regulated as a hazardous waste. However, such wastes are still subject to the land disposal restrictions unless they do not exhibit a characteristic at the point of generation.

2.6 THE MIXTURE AND DERIVED-FROM RULES

So far, this module has introduced the fundamentals of the hazardous waste identification process and an overview of the hazardous waste listings and characteristics. You should now be able to explain in general terms which solid wastes are hazardous wastes. Now we analyze a new question: "When do these hazardous wastes cease being regulated as hazardous wastes?" The regulations governing this issue are commonly known as the mixture and derived-from rules.

BACKGROUND

When EPA first developed the RCRA regulations and the definition of hazardous waste in the late 1970s, the Agency focused on establishing the listings and characteristics, criteria allowing industry to identify which wastes deserved regulation as hazardous wastes. Commenters on EPA's original proposed regulations brought up other key questions about the hazardous waste identification process. For example, these commenters asked, "once a waste is identified as hazardous, what happens if that waste changes in some way? If the hazardous waste is changed, either by mixing it with other wastes or by treating it to modify its chemical composition, should it still be regulated as hazardous?" Faced with a short time frame for answering this difficult question, EPA developed a fairly simple and strict answer and presented it in the mixture and derived-from rules.

LISTED HAZARDOUS WASTES

The mixture and derived-from rules operate differently for listed waste and characteristic wastes. The mixture rule for listed wastes states that a mixture made up of any amount of a nonhazardous solid waste and any amount of a listed hazardous waste is considered a listed hazardous waste. In other words, if a small vial of listed waste is mixed with a large quantity of nonhazardous waste, the resulting mixture bears the same waste code and regulatory status as the original listed component of the mixture. This principle applies regardless of the actual health

threat posed by the waste mixture or the mixture's chemical composition. The derived-from rule governs the regulatory status of materials that are created by treating or changing a hazardous waste in some way. For example, ash created by burning a hazardous waste is considered "derived-from" that hazardous waste. The derived-from rule for listed wastes states that any material derived from a listed hazardous waste is also a listed hazardous waste. Thus, ash produced by burning a listed hazardous waste bears that same waste code and regulatory status as the original listed waste, regardless of the ash's actual properties.

The net effect of the mixture and derived-from rules for listed wastes can be summarized as follows: once a waste matches a listing description, it is forever a listed hazardous waste, regardless of how it is mixed, treated, or otherwise changed. Furthermore, any material that comes in contact with the listed waste will also be considered listed, regardless of its chemical composition.

Although the regulations do provide a few exceptions to the mixture and derived-from rules, most listed hazardous wastes are subject to the strict principles outlined above. Why did EPA create such a rigid system? To understand the logic behind the mixture and derived-from rules, one must consider the circumstances under which EPA developed them. If EPA relied solely on the narrative listing descriptions to govern when a waste ceased being hazardous, industry might easily circumvent RCRA's protective regulation. For example, a waste handler could simply mix different wastes and claim that they no longer exactly matched the applicable hazardous waste listing descriptions. These wastes would no longer be regulated by RCRA, even though the chemicals they contained would continue to pose the same threats to human health and the environment. EPA was not able to determine what sort of treatment or concentrations of chemical constituents indicated that a waste no longer deserved regulation. EPA therefore adopted the simple, conservative approach of the mixture and derived-from rules, while admitting that these rules might make some waste mixtures and treatment residues subject to unnecessary regulation. Adopting the mixture and derived-from rules also presented certain advantages. For instance, the mixture rule gives waste handlers a clear incentive to keep their listed hazardous wastes segregated from other nonhazardous or less dangerous wastestreams. The greater the volume of hazardous waste, the more expensive it is to store, treat and dispose.

CHARACTERISTIC WASTES

As mentioned previously, the mixture and derived-from rules apply differently to listed and characteristic wastes. A mixture involving characteristic wastes is hazardous only if the mixture itself exhibits a characteristic. Similarly, treatment residues and materials derived from characteristic wastes are hazardous only if they themselves exhibit a characteristic. Unlike listed hazardous wastes, characteristic wastes are hazardous because they possess one of four unique and measurable properties. EPA decided that once a characteristic waste no longer exhibits one of these four dangerous properties, it no longer deserves regulation as hazardous. Thus, a characteristic waste can be made nonhazardous by treating it to remove its hazardous property; however, EPA places certain restrictions on the manner in which a waste can be treated. You will learn more about these restrictions in the module entitled Land Disposal Restrictions. Handlers who render characteristic wastes nonhazardous must consider these restrictions when treating wastes to remove their hazardous properties.

WASTE LISTED SOLELY FOR EXHIBITING THE CHARACTERISTIC OF IGNITABILITY, CORROSIVITY, AND/OR REACTIVITY

All wastes listed solely for exhibiting the characteristic of ignitability, corrosivity and/or reactivity characteristic (including mixtures, derived-from, and as-generated wastes) are not regulated as hazardous wastes once they no longer exhibit a characteristic (66 FR 27266, 27268; May 16, 2001). EPA can list a waste as hazardous if that waste typically exhibits one or more of the four hazardous waste characteristics. If a hazardous waste listed only for the characteristics of ignitability, corrosivity and/or reactivity is mixed with a solid waste, the original listing does not carry through to the resulting mixture if that mixture does not exhibit any hazardous waste characteristics. For example, EPA listed the F003 spent solvents as hazardous because these wastes typically display the ignitability characteristic. If F003 waste is treated by mixing it with another waste, and the resulting mixture does not exhibit a characteristic, the F003 listing no longer applies. (Be aware, however, that for the land disposal restrictions, the Agency places certain controls on how hazardous wastes can be treated or mixed with other wastes. Any hazardous waste mixing must be consistent with these rules.)

If a waste derived from the treatment, storage, or disposal of a hazardous waste listed for the characteristics of ignitability, corrosivity, and/or reactivity, no longer exhibits one of those characteristics, it is not a hazardous waste (§261.3(g)(2)(ii)). For example, if a sludge is generated from the treatment of F003, and that sludge does not exhibit the characteristic of ignitability, corrosivity, or reactivity, the F003 listing will not apply to the sludge.

MIXTURE RULE EXEMPTIONS

There are a few situations in which EPA does not require strict application of the mixture and derived-from rules. EPA determined that certain mixtures involving listed wastes and certain residues from the treatment of listed wastes typically do not pose enough of a health or environmental threat to deserve regulation as listed wastes. The principal regulatory exclusions from the mixture and derived-from rules are summarized below.

There are eight exemptions from the mixture rule. The first exemption from the mixture rule applies to mixtures of characteristic wastes and specific mining wastes excluded under §261.4(b)(7). This narrow exemption allows certain mixtures to qualify as nonhazardous wastes, even if the mixtures exhibit one or more hazardous waste characteristics. The module entitled Solid and Hazardous Waste Exclusions will explain in more detail the mining waste or Bevill exclusion.

The remaining exemptions from the mixture rule apply to certain listed hazardous wastes that are discharged to wastewater treatment facilities (§261.3(a)(2)(iv)). Many industrial facilities produce large quantities of nonhazardous wastewaters as their primary wastestreams. These wastewaters are typically discharged to a water body or local sewer system after being treated to remove pollutants, as required by the Clean Water Act. At many of these large facilities, on-site cleaning, chemical spills, or laboratory operations also create relatively small secondary wastestreams that are hazardous due to listings or characteristics. For example, a textile plant producing large quantities of nonhazardous wastewater can generate a secondary wastestream of

listed spent solvents from cleaning equipment. Routing such secondary hazardous wastestreams to the facility's wastewater treatment system is a practical way of treating and getting rid of these wastes. This management option triggers the mixture rule, however, since even a very small amount of a listed wastestream combined with very large volumes of nonhazardous wastewater causes the entire mixture to be listed. EPA provided exemptions from the mixture rule for a number of these situations where relatively small quantities of listed hazardous wastes are routed to large-volume wastewater treatment systems. To qualify for this exemption from the mixture rule, the amount of listed waste introduced into a wastewater treatment system must be very small (or de minimis) relative to the total amount of wastewater treated in the system, and the wastewater system must be regulated under the Clean Water Act.

DERIVED-FROM RULE EXEMPTIONS

There are five regulatory exemptions from the derived-from rule. The first of these derived-from rule exemptions applies to materials that are reclaimed from hazardous wastes and used beneficially. Many listed and characteristic hazardous wastes can be recycled to make new products or be processed to recover usable materials with economic value. Such products derived from recycled hazardous wastes are no longer solid wastes. Using the hazardous waste identification process discussed at the beginning of this module, if the materials are not solid wastes, then whether they are derived from listed wastes or whether they exhibit hazardous characteristics is irrelevant. The module entitled Definition of Solid Waste and Hazardous Waste Recycling will explain which residues derived from hazardous wastes actually cease to be wastes and qualify for this exemption.

The other four exemptions from the derived-from rule apply to residues from the treatment of specific wastes using specific treatment processes. For example, K062 describes spent pickle liquor from the iron and steel industry. Pickle liquor is an acid solution used to finish the surface of steel. When pickle liquor is spent and becomes a waste, it usually contains acids and toxic heavy metals. This waste can be treated by mixing it with lime to form a sludge. This treatment, called stabilization, neutralizes the acids in the pickle liquor and makes the metals less dangerous by chemically binding them within the sludge. EPA studied this process and determined that K062 treated in this manner no longer poses enough of a threat to warrant hazardous waste regulation. Therefore, lime-stabilized waste pickle liquor sludge derived from K062 is not a listed hazardous waste. The other exemptions from the derived-from rule for listed wastes are also quite specific and include: waste derived-from the burning of exempt recyclable fuels, biological treatment sludge derived-from treatment of K156 and K157, catalyst inert support media separated from K171 and K172, and residues from high temperature metal recovery of K061, K062, and F006, provided certain conditions are met.

DELISTING

The RCRA regulations provide another form of relief from the mixture and derived-from rule principles for listed hazardous wastes. Through a site-specific process known as "delisting," a waste handler can submit to EPA a petition demonstrating that while a particular wastestream generated at their facility may meet a hazardous waste listing description, it does not pose sufficient hazard to deserve RCRA regulation (§260.22). If EPA grants such a petition, the

particular wastestream at that facility will not be regulated as a listed hazardous waste. Because the delisting process is difficult, time-consuming, and expensive, it is not considered a readily available exception to the mixture and derived-from rules.

The hazardous waste listings, the hazardous waste characteristics, and the mixture and derived-from rules are all essential parts of the definition of hazardous waste, but these key elements are all described in different sections of the RCRA regulations. Only one regulatory section, §261.3, unites all four elements to establish the formal definition of hazardous waste. This section is entitled Definition of Hazardous Waste. Section 261.3 states that all solid wastes exhibiting one of the four hazardous characteristics defined in Part 261, Subpart C, are hazardous wastes. This section also states that all solid wastes listed on one of the four hazardous waste lists in Part 261, Subpart D, are hazardous wastes. Finally, this section explains in detail the mixture and derived-from rules and the regulatory exemptions from these rules. Thus, although §261.3 is entitled Definition of Hazardous Waste, it serves primarily as a guide to the mixture and derived-from rules. Substantive rules about the two most crucial elements of the hazardous waste definition, the listings and characteristics, are found elsewhere.

2.7 THE CONTAINED-IN POLICY

The contained-in policy is a special, more flexible version of the mixture and derived-from rules that applies to environmental media and debris contaminated with hazardous waste.

Environmental media (singular, "medium") is the term EPA uses to describe soil, sediments, and groundwater. Debris is a term EPA uses to describe a broad category of larger manufactured and naturally occurring objects that are commonly discarded (§268.2(g)). Examples of debris include:

- dismantled construction materials such as used bricks, wood beams, and chunks of concrete
- decommissioned industrial equipment such as pipes, pumps, and dismantled tanks
- other discarded manufactured objects such as personal protective equipment (e.g., gloves, coveralls, eyewear)
- large, naturally occurring objects such as tree trunks and boulders.

Environmental media and debris are contaminated with hazardous waste in a number of ways. Environmental media are usually contaminated through accidental spills of hazardous waste or spills of product chemicals which, when spilled, become hazardous wastes. Debris can also be contaminated through spills. Most debris in the form of industrial equipment and personal protective gear becomes contaminated with waste or product chemicals during normal industrial operations. Contaminated media and debris are primary examples of "remediation wastes." In other words, they are not wastestreams created during normal industrial or manufacturing operations. They are typically created during cleanups of contaminated sites and during the decommissioning of factories. Handlers of contaminated media and debris usually cannot

control or predict the composition of these materials, which have become contaminated through accidents or past negligence. In contrast, handlers of "as-generated wastes," the term often used to describe chemical wastestreams created during normal industrial or manufacturing operations, can usually predict or control the creation of these wastes through the industrial process. Examples of as-generated wastes include concentrated spent chemicals, industrial wastewaters, and pollution control residues such as sludges.

The hazardous waste identification principles you have learned, including the mixture and derived-from rules, apply to as-generated industrial wastes. EPA decided that a more flexible version of these principles should apply to the primary remediation wastes: environmental media and debris. In particular, EPA determined that strict application of the mixture and derived-from rules was inappropriate for media and debris, especially when listed wastes were involved. Applying the mixture and derived-from rules to media and debris would present certain disadvantages, as the following examples illustrate. First, under the traditional mixture and derived-from rules, environmental media and debris contaminated with any amount of listed hazardous waste would be forever regulated as hazardous. Such a strict regulatory interpretation would require excavated or dismantled materials to be handled as listed hazardous wastes and could discourage environmental cleanup efforts. Second, most spills of chemicals into soil or groundwater produce very large quantities of these media containing relatively low concentrations of chemicals. Strict application of the mixture and derived-from principles to media would therefore cause many tons of soil to be regulated as listed hazardous waste despite containing low concentrations of chemicals and posing little actual health threat. Finally, one of the main benefits of the mixture and derived-from rules is not relevant to media and debris. The mixture and derived-from principles encourage handlers of as-generated wastes to keep their listed wastes segregated from less hazardous wastestreams to avoid creating more listed wastes. Handlers of contaminated media and debris generally have no control over the process by which these materials come into contact with hazardous waste.

For all of the above reasons, EPA chose to apply a special, more flexible, version of the mixture and derived-from rules to environmental media and debris. Contaminated soil, groundwater, and debris can still present health threats if they are not properly handled and/or disposed. Therefore, EPA requires that any medium and debris contaminated with a listed waste or exhibiting a hazardous characteristic be regulated like any other hazardous waste. Media and debris contaminated with listed hazardous wastes can, however, lose their listed status and become nonhazardous. This occurs after a demonstration that the particular medium or debris in question no longer poses a sufficient health threat to deserve RCRA regulation. The requirements for making this demonstration are explained below. Once the demonstration is made, the medium or debris in question is no longer considered to "contain" a listed hazardous waste and is no longer regulated. In addition, contaminated media that contain a waste listed solely for the characteristics of ignitability, corrosivity, and/or reactivity, would no longer be managed as a hazardous waste when no longer exhibiting a characteristic (66 FR 27266, 27286; May 16, 2001). This concept that media and debris can contain or cease to contain a listed hazardous waste accounts for the name of the policy.

The contained-in policy for environmental media is not actually codified in the RCRA regulations. In legal terms, it is merely a special interpretation of the applicability of the mixture

and derived-from rules to soil and groundwater that has been upheld in federal court. These principles for the management of contaminated media are therefore known as a policy instead of a rule. The terms of the contained-in policy are relatively general. In order for environmental medium contaminated with a listed waste to no longer be considered hazardous, the handler of that media must demonstrate to EPA's satisfaction that it no longer poses a sufficient health threat to deserve RCRA regulation. Although handlers of listed media must obtain EPA's concurrence before disposing of such media as nonhazardous, the current contained-in policy provides no guidelines on how this demonstration to EPA should be made. The contained-in policy is a far easier option for eliminating unwarranted hazardous waste regulation for low-risk listed wastes than the process of delisting a hazardous waste mentioned previously. The delisting process demands extensive sampling and analysis, submission of a formal petition, and a complete rulemaking by EPA. A determination that an environmental medium no longer contains a listed hazardous waste can be granted on a site-specific basis by EPA officials without any regulatory procedure.

Debris contaminated with hazardous waste has traditionally been governed by the same nonregulatory contained-in policy explained above. In 1992, EPA codified certain aspects of the contained-in policy for debris in the definition of hazardous waste regulations in §261.3(f) (57 FR 37194, 34225; August 18, 1992). In particular, EPA included a regulatory passage that explains the process by which handlers of debris contaminated with listed hazardous waste can demonstrate that the debris is nonhazardous. This passage also references certain treatment technologies for decontaminating listed debris so that it no longer contains a listed waste. Thus, the term contained-in policy is now something of a misnomer for contaminated debris, since a contained-in rule for debris now exists.

3. REGULATORY DEVELOPMENTS

The hazardous waste identification process is subject to critical review, and adjusted accordingly to reflect technology changes and new information. The hazardous waste listings are particularly dynamic as the Agency conducts further research to incorporate new listings. The following is a brief discussion of several developments to hazardous waste identification.

3.1 THE HAZARDOUS WASTE IDENTIFICATION RULES

EPA proposed to significantly impact the RCRA hazardous waste identification process through a rulemaking effort called the Hazardous Waste Identification Rules (HWIR). The first rule, HWIR-media, was finalized on November 30, 1998, and addressed contaminated media (63 FR 65874). The second rule, HWIR-waste, was finalized on May 16, 2001, and modified the mixture and derived-from rules, as well as the contained-in policy for listed wastes (66 FR 27266). Both the HWIR-media rule, and the HWIR-waste rule, attempt to increase flexibility to the hazardous waste identification system by providing a regulatory mechanism for certain hazardous wastes with low concentrations of hazardous constituents to exit the Subtitle C universe.

The final HWIR-media rule addresses four main issues. First, the Agency promulgated a streamlined permitting process for remediation sites that will simplify and expedite the process of obtaining a permit. Second, EPA created a new unit, called a "staging pile," that allows more flexibility when storing remediation wastes during cleanups. Third, the Agency promulgated an exclusion for dredged materials permitted under the Clean Water Act, or the Marine Protection, Research, and Sanctuaries Act. Fourth, the rule finalized provisions that enable states to more easily receive authorization when their RCRA programs are updated in order to incorporate revisions to the federal RCRA regulations. The HWIR-media rule did not incorporate the provisions that would have removed low risk remediation waste from Subtitle C regulations because of fundamental disagreements between stakeholders.

On July 18, 2000, the Agency released HWIR-waste exemption levels for 36 chemicals that were developed using a risk model known as the Multimedia, Multipathway and Multireceptor Risk Assessment (3MRA) Model (65 FR 44491). EPA is currently reviewing the public comments and will decide whether further revisions to the model are necessary. After completion of independent testing, EPA submitted the model to EPA's Science Advisory Board (SAB) for review during 2003.

The May 16, 2001, HWIR-waste rule revised and retained the hazardous waste mixture and derived-from rules as previously discussed in this module. In addition, the rule finalized provisions that conditionally exempt mixed waste (waste that is both radioactive and hazardous), if the mixed waste meets certain conditions in Part 266 (66 FR 27266).

3.2 FINAL HAZARDOUS WASTE LISTING DETERMINATIONS

EPA first signed a proposed consent decree with the Environmental Defense Fund (EDF) on June 18, 1991, following a suit concerning EPA's obligations to take certain actions pursuant to RCRA. A consent decree is a legally binding agreement, approved by the Court, which details the agreements of the parties in settling a suit. The proposed consent decree, commonly known as the "mega-deadline," settles some of the outstanding issues from the case by creating a schedule for EPA to take action on its RCRA obligations. The consent decree, which has been periodically updated, requires EPA to evaluate specified wastestreams and determine whether or not to add them to the hazardous waste listings.

On November 8, 2000, EPA listed as hazardous two wastes generated by the chlorinated aliphatics industry (65 FR 67068). The two wastes are K174, wastewater treatment sludges from the production of ethylene dichloride or vinyl chloride monomer (EDC/VCM), and K175, wastewater treatment sludges from the production of vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process. For K174, EPA finalized a contingent-management listing approach which specifies that the waste will not be listed if it is sent to a Subtitle C landfill or a non-hazardous landfill licensed or permitted by the state or federal government.

On November 20, 2001, EPA published a final rule listing three wastes generated from inorganic chemical manufacturing processes as hazardous wastes (66 FR 58257). The three wastes are K176, baghouse filters from the production of antimony oxide; K177, slag from the production of antimony oxide that is speculatively accumulated or disposed; and K178, residues from manufacturing and manufacturing-site storage of ferric chloride from acids formed during the production of titanium dioxide using the chloride-ilmenite process.

EPA proposed a concentration-based hazardous waste listing for certain waste solids and liquids (K180 and K179) generated from the production of paint on February 13, 2001 (66 FR 10060). Following a review of the public comments and supplemental analyses based on those public comments, EPA determined that the paint wastes identified in the proposal do not present a substantial hazard to human health or the environment. Therefore, EPA did not list these paint production wastes as hazardous. See the April 4, 2002, final determination regarding these hazardous waste listings (67 FR 16261) for additional information.

On February 24, 2005, EPA published a final rule listing nonwastewaters from the production of certain dyes, pigments, and food, drug, and cosmetic colorants (70 FR 9138) as hazardous (K181) using a mass loading-based approach. Under the mass loading approach, these wastes are hazardous if they contain any of the constituents of concern at annual mass loading levels that meet or exceed the regulatory levels. The K181 listing focuses on seven hazardous constituents: aniline, o-anisidine, 4-chloroaniline, p-cresidine, 1,2-phenylenediamine, 1,3-phenylenediamine, and 2,4-dimethylaniline. Waste that contains less than the specified threshold levels of constituents of concern are not hazardous. The K181 listing is EPA's final obligation under the consent decree.

3.3 PROPOSED REVISION TO WASTEWATER TREATMENT EXEMPTION FOR HAZARDOUS WASTE MIXTURES

On April 8, 2003, EPA proposed to add benzene and 2-ethoxyethanol to the list of solvents whose mixtures with wastewater are exempted from the definition of hazardous waste (68 FR 17234). EPA is proposing to provide flexibility in the way compliance with the rule is determined by adding the option of directly measuring solvent chemical levels at the headworks of the wastewater treatment system. In addition, EPA is proposing to include scrubber waters derived from the combustion of spent solvents to the headworks exemption. Finally, EPA is proposing to extend the de minimis exemption to wastes listed in §§261.31 and 261.32 when released in de minimis quantities and to non-manufacturing facilities if certain conditions are met. The final rule is scheduled to be published in the Fall of 2005.

Attachment J

Blood borne Pathogens Programs



The management of Carleton College recognizes that our employees are the most valuable assets of this institution. We are furnishing and maintaining the safest work conditions possible for every employee.

Nothing is more important than maintaining on-the-job health and safety in every job or task we accomplish.

We firmly believe that we can perform our duties while maintaining the highest standard of safety for all employees.

All management personnel will be responsible and accountable for maintaining safe working conditions. Training will be provided to ensure that each employee has the skills and knowledge necessary to safely perform his/her job. We will consistently support the policy and we will be responsive to each employee's health and safety needs and concerns.

All employees will be responsible and accountable for following the guidelines outlined in this safety manual. Employees are expected to provide management with feedback or suggestions on any safety and health concern so that they may be addressed promptly and efficiently.

Carleton College Environmental Health and Safety Compliance Officer Date

Vice President Date

HEALTH AND SAFETY ADMINISTRATOR

While the overall responsibility for the effective injury and illness prevention is vested in senior management,

EHS PRERESENTATIVE

Contact Information

has the authority and responsibility to implement, coordinate and maintain this health and safety Plan.

Managers and supervisors are responsible for implementing and maintaining the health and safety Plan in their work areas. Work area managers are expected to be responsive to employee health and safety issues.

All employees, including managers and supervisors, are responsible for complying with safe and healthful work practices.

ACCOUNTABILITY for the HEALTH AND SAFETY PLAN

We will ensure that all employees comply with these practices by maintaining the following standards:

- We will inform employees of the provisions of our health and safety plan
- We will evaluate the health and safety performance of all employees
- We will recognize and commend employees who perform safe and healthful practices
- We will provide health and safety training to all employees
- We will hold employees accountable for following safe work practices as outlined in this manual
- We will take corrective action for those who fail to comply with safe and healthful practices

COMMUNICATION WORKPLACE SAFETY

In order to manage a healthy and safe environment, we are all responsible for communicating in an open and supportive manner. Our communication system encourages all staff to inform their managers or supervisors about workplace hazards. Staff should not fear reprisal for communicating workplace safety concerns.

It is extremely important that all hazards be reported immediately so that they can be addressed and minimized efficiently. All work-related injuries and illnesses must be reported to your supervisor as soon as possible and, at the latest, within 24 hours of the occurrence.

To facilitate a flow of information we are committed to the following standards:

- We will post safety new worker orientation including a discussion of health and safety policies and procedures for all new hires
- We will perform an initial review of our health and safety plan with all employees and conduct regularly scheduled safety meetings and discussions
- We will post safety information on our bulletin board and maintain the latest required labor law poster(s)
- We will maintain a system for workers to inform management about workplace hazards which will include a system for management to receive information anonymously.
- We will maintain a system for management to update employees on planned changes in response to their concerns or suggestions
- We will insert all regularly alerts in the REGULATORY ALERTS section

AN ASSESSMENT of POTENTIAL HAZARDS

A periodic review of the workplace will be performed to identify and evaluate workplace hazards. These reviews will be performed according to the following schedule:

- When we initially establish our health and safety plan
- When new substances, processes, procedures or equipment are introduced to our workplace that present a potential hazard
- When previously unidentified hazards are recognized
- When occupational injuries and illnesses occur
- Whenever workplace conditions warrant a review

WHEN ACCIDENTS HAPPEN

The Investigation

We will promptly investigate any injury or illness that is a serious nature or could lead to a serious incident. Our purpose for investigating an accident is to determine the root cause of the incident so that future occurrence is prevented.

We recognize there may be an instance when an employee not following procedure causes an accident. Our purpose for investigating is to learn from our mistakes, not to place blame. Our procedures for investigating a workplace accident include the following:

- We will interview injured workers and witnesses
- We will examine the workplace for factors associated with the accident/exposure
- We will determine the root cause of the accident/exposure
- We will take corrective action to prevent the accident/exposure from reoccurring
- We will determine and communicate lessons learned to mitigate a repeat or similar occurrence.
- We will record the findings and corrective actions

The Correction

Unsafe or unhealthy working conditions, practices or procedures in our workplace will be corrected in an efficient manner. We will follow these guidelines to ensure appropriate actions are taken to correct issues that contradict our health and safety plan:

- Whenever feasible, corrections will be made at the time a safety or health issue is observed or discovered
- When immediate correction cannot be made, interim protections will be provided
- If an imminent hazard is detected that cannot be immediately abated without endangering employee(s) and/or property, we will remove all exposed employees from the area except for personnel necessary for the correction. Employees who are required to correct the hazardous condition will have the necessary training and skills and will be provided with the necessary protection. If we cannot appropriate protection, we will evacuate all employees and wait for outside assistance.

Available Programs

All workers, including managers and supervisors, will receive training and instruction on this Health and Safety Plan. Our training will include:

- General and job-specific health and safety practices
- Hazard-specific issues mentioned in this manual including bloodborne pathogens,
- Hazard communication, etc.

Health and safety training and instruction will be provided:

- When the Health and Safety Plan is first established
- To all new workers

- To all workers given new job assignments for which training has not been previously provided
- Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard
- Whenever the employer is made of a new or previously unrecognized hazard
- To supervisors to familiarize them with the health and safety hazards to which workers under their immediate direction and control may be exposed
- To all workers with respect to hazards specific to each employee's job assignment

BLOODBORNE PATHOGENS (Exposure Control Plan [ECP])

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EXPOSURE CONTROL PLAN

Controlling Exposure to Bloodborne Pathogens

Prevention is the best course of action against exposure to bloodborne pathogens. There is much that can be done to minimize or eliminate one's exposure potential.

A primary preventive step is maintaining an Exposure Control Plan (ECP). The Carleton College ECP has been written to comply with **OSHA** regulatory mandates as presented in bloodborne pathogen standard *29 CFR 1910.1030*.

The Bloodborne Pathogens Standard applies to all workers who may have occupational exposures to blood or potentially infectious materials. Other potential infectious materials means: (1) The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all fluids in situations where it is difficult or impossible to differentiate between fluids; (2) any unfixed tissue or organ (other than intact skin) from a human (living or dead); and (3) HIV-contaminated cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs or other tissues from experimental animals infected with HIV or HBV.

Those employees who have occupational exposure to blood or other potentially infectious materials (OPIM) must comply with the procedures and work practices outlined in this ECP.

The ECP is a key element in the protection of employees. At the same time, it will assist Carleton College in ensuring compliance with the OSHA standard. This ECP includes:

- Determination of employee exposure
- Implementation of various methods of exposure control, such as
 - Universal precautions
 - Engineering and work practice controls
 - Personal protective equipment
 - Housekeeping
 - Hepatitis B vaccination
 - Post-exposure evaluation and follow-up
 - Communicating potential hazards
 - Keeping a record
 - Evaluation of records
 - Annual review of new medical devices and procedures
 - Involving employees
 - Establishing a Sharps Injury Log

IMPORTANT NOTICE: All employees, including part-time and temporary employees, who have occupational exposure to blood or other potentially infectious materials (OPIM) must comply with the procedures and work practices outlined in this ECP.

EXPOSURE CONTROL PLAN: Program Administration

ECP Coordinator

ECP Coordinator Information	Contact
-----------------------------	---------

is (are) responsible for the implementation of the ECP. This person will maintain, review, and update the ECP no less once each year. In addition, the manual will need to be reviewed and updated when new or modified and procedures are introduced.

Personal Protective Equipment Coordinator(s)

Personal Protective Equipment Coordinator Information	Contact
---	---------

Personal Protective Equipment Coordinator Information	Contact
---	---------

Personal Protective Equipment Coordinator Information	Contact
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will maintain and provide all necessary personal protective equipment (PPE), engineering controls (e.g., sharps containers) labels and red bags as required by the standard.

.....

Personal Protective Equipment Coordinator Information	Contact
---	---------

will ensure that adequate supplies of the aforementioned equipment are available in the appropriate sizes.

OSHA Compliance Coordinator

OSHA Compliance Coordinator	Contact Information
-----------------------------	---------------------

will be responsible for ensuring that all medical actions required are performed and that appropriate employee health and OSHA records are maintained.

ECP Training Coordinator

ECP Training Coordinator
Information

Contact

will be responsible for training, documentation of training and making the written ECP available to employees, OSHA and NIOSH representatives.

EXPOSURE CONTROL PLAN : Employee Exposure Determination

The following is a list of CC job classifications in which all employees have occupational exposure to bloodborne pathogens.

JOB TITLE

DEPARTMENT/LOCATION

The following is a list of job classifications in which some Carleton College employees have occupational exposure to bloodborne pathogens. Included is a list of tasks and procedures or groups of closely related tasks and procedures, in which occupational exposure may occur.

Part-time, temporary, contract and per diem employees are covered by the Bloodborne Pathogens Standard.

Those employees who are determined to have occupational exposure to blood or other potentially infectious materials (OPIM) must comply with the procedures and work practices outlined in this ECP.

METHODS of IMPLEMENTATION and CONTROL

Based on Employee Exposure Determination lists, specific precautions, controls and work practices have been developed to ensure every employee covered by the Bloodborne Pathogens Standard has a specific understanding of how to control exposure.

The following pages have been tailored to Carleton College facilities to provide a written plan on exposure control. In addition to the universal precautions and control practice noted in this document, specific occupational controls have been outlined.

Employees covered by the Bloodborne Pathogens Standard will receive an explanation of this ECP during their initial safety training orientation. It will also be reviewed in their annual refresher training. All employees have an opportunity to review this plan at any time during their work shift by contacting the ECP coordinator.

ECP Coordinator

Contact Information

DEFINITION of UNIVERSAL PRECAUTIONS

According to Code of Federal Regulations Title 29, Section 1910.1030, the application of "Universal Precautions" is an approach to infection control. According to the concept of Universal Precautions involves, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV or other bloodborne pathogens.

MAINTAINING CONTROL

One of the most important aspects of the ECP is that it is forever evolving. This is not intended to be a static program. Every time an exposure occurs, the circumstance is evaluated to determine how it could have been avoided. Therefore, the plan, policies and worker safety are improved by learning from errors.

ECP ANNUAL REVIEW

The ECP will undergo an annual review to assess the need for changes in the plan, engineering controls and/or work practices. This review is also designed to identify advances in safer medical devices. A thorough review may include an evaluation of the cause of past incidents, OSHA records, employee interviews, committee activities, literature review, etc.

Annual Review Implementation Form (copy this form for use in future reviews)

After evaluation and approval, the following updates in technology, engineering control or safe work practices were implemented: *(Year/changes)*

Faculty and staff, who are potentially exposed to injuries from contaminated sharps, were solicited for their input in identifying, evaluating and selecting more effective PPE, engineering and work practice controls.

ECP Coordinator

Contact Information

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) is an important element in controlling potential exposure. As required by regulatory statute, Carleton College provides all PPE to its employees at no cost and will ensure that all appropriate sizes are available.

PPE Training

Training on the appropriate use of PPE is provided by

Name	Location	Phone
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Our Workplace PPE

The types of PPE available to our employees are as follows:

Gloves

- Latex Exam
(powdered or powder free) circle one or both if used
- Vinyl Exam
- Sterile Surgical
- Utility gloves
- Nitrile
- Neoprene
- _____
- _____

Eye and Face Protection

- Safety Glasses
with side shields
- Splash Goggles
- Face Shield
- _____
- _____

Protective Clothing

- Lab Coats
- Gowns
- Smocks
- Booties
- _____
- _____

Respiratory Protection

- Face Masks
- Respirator
- _____

Hearing Protection (if applicable)

- Ear Plugs
- _____

Other

- _____
- _____
- _____

PPE can be found in the following location(s)

and may be obtained through:

Name	Location	Phone
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Name	Location	Phone
------	----------	-------

Name	Location	Phone
------	----------	-------

Name	Location	Phone
------	----------	-------

All employees are required to observe the following precautions when using PPE:

- Wash hands immediately or as soon as feasible after removal of gloves or other PPE.
- Remove PPE after it becomes contaminated, and before leaving the work area
- Used PPE may be disposed of in

List appropriate containers for storage, decontamination or disposal

- Whenever a potential for hand contact with blood is anticipated, OPIM or contaminated surfaces, wear gloves.
- Always replace gloves if torn, punctured, contaminated, if their ability to function as a barrier is compromised.
- Utility gloves may be decontaminated for reuse if they show no signs of cracking, peeling, tearing, puncturing, or deterioration.
- Never wash or decontaminate disposable gloves for reuse.
- Wear appropriate face and eye protection when splashes, splatters, sprays, or droplets of blood or OPIM pose a hazard to eye, nose or mouth.
- Immediately remove any garment contaminated by blood or OPIM, in such a way as to avoid contact with the outer surface

OSHA requires employers to assess the work environment to determine if hazards are present which necessitate the use of personal protective equipment, PPE. The employer is required to ensure the following:

- A hazard assessment is accomplished to identify hazards.
- The appropriate PPE is assigned to the potential hazard
- PPE is provided
- Properly fitted PPE is maintained and available
- Employees are trained on PPE usage: how to use it, when it is required and what its limitations are.
- PPE selection decisions and criteria will be communicated to employees.
- The employer must also certify that the workplace assessment and PPE selection, training and distribution have been performed.

To accomplish this,

Name	Location	Phone
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Name	Location	Phone
------	----------	-------

Name	Location	Phone
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the PPE coordinator(s) and will ensure that the above requirements are met.

HAZARD ASSESSMENT/PPE SELECTION and CERTIFICATION

TASK <i>(e.g. Drawing blood)</i>	HAZARD <i>Needle stick</i>	PPE <i>gloves, eye/face protection if needed)</i>
--	--------------------------------------	---

Certified by

Date

Handling PPE

The procedures for handling used PPE are as follows:

See Appendix

HOUSEKEEPING

Non-Sharps Regulated Waste

All regulated waste is placed in containers that can be securely closed. These containers are specifically constructed to contain its contents while preventing leakage. They can be appropriately labeled or color-coded and must be closed before removal to prevent spillage or protrusion of contents during handling.

Sharps Disposal Containers

Contaminated sharps are discarded immediately or as soon as possible in containers that can be securely closed, remain puncture resistant, leak proof on sides and bottoms and are labeled appropriately as to denote contents.

Sharps disposal containers are available at:

Location

where they are easily accessible and close to the immediate point where sharps are used.

Sharps disposal containers are to be inspected, maintained or replaced by

Name

Location

Phone

whenever necessary to prevent overfilling. Sharps containers should be reported for removal no later than three (3) days after the fill line is reached.



If an employee receives a percutaneous injury from a sharp, he/she must promptly notify his/her immediate supervisor. The exposed employee must be included in the post exposure protocols described later in this section under “Post-exposure Evaluation and Follow-up.” Also, a Sharp Injury Log must be filed and can be found in the appendix section of this plan. Employee confidentiality will be maintained as required by law.

Miscellaneous Housekeeping

Bins and pails (e.g., wash basins) are cleaned and decontaminated as soon as feasible after visible contamination.

Broken glassware, which may be contaminated, is picked up using mechanical means, such as a brush and dustpan.

Laundry

The following contaminated articles will be laundered by our designated laundry service:

- LIST LAUNDRY ITEMS

When an outside vendor provides laundry services, the vendor will provide appropriate receptacles and observe universal precautions when handling contaminated laundry.

Name of Vendor	Telephone
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Contact Information

The following laundering requirements must be met:

- Handle contaminated laundry as little as possible, with minimal agitation
- Place wet contaminated laundry in leak-proof, labeled, or color-coded containers before transport
- Wear the appropriate PPE when handling and/or sorting contaminated laundry

HEPATITIS B VACCINATION



OSHA requires Carleton College to provide workers with blood borne pathogens training upon being hired and before exposure to blood and other potentially infectious materials and annually thereafter. The training must be offered during working hours, at no cost to the employee.

Name of Licensed Healthcare Provider	Location	Phone
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will provide education to employees on hepatitis B vaccinations, addressing the safety, benefits and questions the employee may have.

Carleton College encourages the vaccination for hepatitis B unless:

1. Documentation exists that the employee has previously received the series
2. Antibody testing reveals that the employee is immune, or
3. Medical evaluation shows that vaccination is contraindicated



If an employee chooses to decline vaccination, the employee must sign a declination form within 10 days after initial assignment.

Employee who decline may request and obtain the vaccination at a later date at no cost. Documentation of refusal of the vaccination is maintained by

Name	Location	Phone
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Vaccination will be performed by

List Healthcare Professional Who Is Responsible	Location
---	----------

Following a hepatitis B vaccination, the Healthcare professional's written opinion will be limited to whether the employee requires the hepatitis vaccine and whether the vaccine was administered.

HEPATITIS B VACCINATION DECLINATION FORM

This declination form should be completed and placed in the employee's medical file.

Carleton College (CC) shall ensure that employees who decline to accept hepatitis B vaccination offered by the college, sign the following statement **as required by subsection (f) (2) (D) of [29CFR1910.1030]**.

I understand that due to my occupational exposure to blood or OPIM, I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself; however, I decline this vaccine at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If, in the future, I continue to have occupational exposure to blood or OPIM and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Employee Name

Employee Signature

Date

Social Security Number or Student I.D. Number

Date of Birth

Carleton College Administrator

Signature of Carleton College Administrator

Date

POST-EXPOSURE EVALUATION and FOLLOW-UP

Upon exposure, immediately contact

Name	Location	Phone
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An immediate available confidential medical evaluation and follow-up will be conducted by

Name of Licensed Healthcare Professional
--

a licensed healthcare professional.

Following the initial first aid (clean the wound, flush eyes or other mucous membrane, etc.), the following steps must be performed to ensure the best care is provided:

- Document the route of exposure and how the exposure occurred.
- Identify and document the source individual (unless the employer can establish that identification is not feasible or prohibited by state or local law.)
- Obtain consent and make arrangements to test the source individual as soon as possible for HIV, HBV and any other pathogens that the healthcare professional deems appropriate, i.e. hepatitis C virus.
- Ensure that the source individual's test results were communicated to the employee's healthcare provider and document that communication
- New testing need not be performed if the source individual is already known to be HIV and/or HBV positive, or tested for any other pathogens that the healthcare professional deems appropriate, i.e. hepatitis C virus.
- Provide the exposed employee with the source individual's test results. The exposed employee must also understand the information regarding applicable disclosure laws and regulations concerning the identity and infectious status of the source individual (i.e. laws protecting confidentiality).
- After obtaining consent, collect exposed employee's blood as soon as feasible after exposure incident and test blood for HBV and HIV serological status.
- If the employee does not give consent for HIV serological testing during collection of blood for baseline testing, preserve the baseline blood sample for at least 90 days; if the exposed employee elects to have the baseline sample tested during this waiting period, perform testing as soon as possible.

ADMINISTRATION of POST-EXPOSURE EVALUATION and FOLLOW-UP

An advanced copy of OSHA's Bloodborne Pathogen Standard should be sent to the chosen licensed healthcare professional (LHCP) responsible for vaccination and follow-up. Carleton College must also ensure that the healthcare professional evaluating an employee after an exposure incident receives the following:

- A description of the employee's job duties relevant to the incident
- Route(s) of exposure
- Circumstances of exposure
- If possible, results of the source individual's blood test
- Relevant employee medical records, including vaccination status

Carleton College is committed to maintaining open communication with its employees when an exposure occurs. The exposed employee deserves a swift conclusion and will be provided with a copy of the evaluating healthcare professional's written opinion within 15 days after completion of the evaluation.

INCIDENT EVALUATION

The review of all incidents will be conducted thoroughly by

Name

in an effort to determine the following factors in a timely manner.

- Were engineering controls in use at the time?
- Were CC work practices followed?
- Provide a description of the device being used
- What kind of PPE or clothing was used at the time of the exposure incident?
- Where did the incident take place?
- Was procedure followed when the incident occurred?
- Was the employee properly trained?

After careful review of the incident and the circumstances, an opportunity to make revisions to the safety plan and work practices was discovered.

Name

Location

Phone

will ensure that appropriate changes are made to this ECP.

BBP EXPOSURE INCIDENT REPORT

This report must be completely filled out after any employee incident. This report is to remain confidential and placed in employee's records and be kept under lock and key.

EXPOSED EMPLOYEE

Name _____ SSN _____

Date of Incident _____ Type of Incident _____

Employee's duties as they relate to the incident:

Description of exposure routes and circumstances under which incident occurred:

Check appropriate responses below:

- YES NO Exposed employee has been counseled as to applicable laws and regulations concerning disclosure of the identity and infectious status of the source patient.
- YES NO Exposed employee has legally consented to blood testing.
- YES NO Exposed employee has agreed to have baseline blood collection, but does not give consent at this time for HIV serological testing and understands that the sample shall be preserved for 90 days in case employee decides to complete testing.

MEDICAL ATTENTION

The exposed employee was referred to the following doctor for medical evaluation, counseling and following-up:

Name _____ Phone _____

Address _____

Date of Exam _____ Date of Follow-up _____

Exposed employee's vaccination records were made available to the attending doctor on:

A copy of the "occupational Exposure to Bloodborne Pathogens" was delivered to the attending doctor on:

A copy of the doctor's written opinion was delivered to the employee on:

SOURCE PATIENT

NAME		PHONE
ADDRESS		
CITY	STATE	ZIP CODE

Check appropriate responses below:

YES NO Source patient has legally consented to have his/her blood tested for HIV.

YES NO The legally required consent cannot be obtained.

Reason _____

YES NO Source patient is known to be infected with HBV.

YES NO Source patient is known to be infected with HIV.

YES NO Results of source patients's tests have been made to the exposed employee.

RECORD KEEPING

The following items will be maintained IN STRICT CONFIDENTIALITY and not disclosed without the employee's expressed written consent to anyone within or outside the workplace

The following records must be kept for a duration of employment plus 30 (thirty) years:

1. The employee Exposure Incident Form
2. A record of the employee's hepatitis B vaccination status including the dates of all vaccinations and any medical records relative to the employee's ability to receive vaccination
3. A copy of all results of examinations, medical testing and follow-up procedures.
4. The employer's copy of all results of the healthcare professional's written opinion
5. Identity of source patient and source patient's blood test results.

Form Completed by:

Name Title

Exposed Employee Signature Date

Employer Signature Date

ESTABLISHING SHARPS INJURY LOG

All employees who receive a percutaneous injury from a sharps must promptly notify their immediate supervisor, who will see included in the post exposure protocols described in this ECP. A log of all percutaneous injuries from sharps will be maintained by

Name	Location	Phone
------	----------	-------

The appropriate supervisor will ensure that the information needed for the Sharps Injury Log is gathered and transmitted to

Location

To be included on the log. The information recorded on the log will protect the confidentiality of the injured employee.

SHARPS INJURY LOG

Please complete a Log for each employee exposure incident involving a sharp. Check the box corresponding to the most appropriate answer. Please print and avoid touching lines

College _____ Department _____

Address _____ Page # _____ Of _____

City _____ State _____ Zip Code _____

Date filled out _____ By _____ Phone _____

Facility Injury ID# _____ Date of Injury _____ Time of Injury _____ Sex (optional) Male Female

Description of the exposure incident:

JOB CLASSIFICATION

- Faculty
- Staff
- Student
- Custodial
- Emergency Responder
- Medical Professional
- Other

DEPT./LOCATION

- Research Laboratory
- Instructional Laboratory
- Other
- Medical Clinic
- Service/Utility Area
- Other

PROCEDURE

- Injection
- Lab Accident
- Draw Blood Venous
- Draw Blood Arterial
- Other

DID THE EXPOSURE INCIDENT OCCUR

- During use of sharp
- While putting sharp into disposal container
- Between steps of a multi-step procedure
- Sharp left in inappropriate place
- After use and before disposal of sharp
- Other _____

BODY PART

- Finger
- Hand
- Arm
- Face/Head
- Torso
- Other _____

IDENTIFY SHARP INVOLVED *(if known)*

Type _____ Brand _____ Model _____

Did the device being used have engineered sharps injury protection?

- YES
- NO
- DON'T KNOW

Was the protection mechanism activated? YES-Fully YES-Partially NO

Did the exposure incident occur: Before During After Activation

EXPOSED EMPLOYEE

If sharp had no engineered sharps injury protection, do you have an opinion that such a mechanism could have prevented the injury? YES NO

Explain

EXPOSED EMPLOYEE

Do you have an opinion that any other engineering, administrative or work practice control could have prevented the injury? YES NO

Explain

EXPOSURE CONTROL PLAN EMPLOYEE TRAINING

All employees who have occupational exposure to bloodborne pathogens receive training conducted by

Name	Location	Phone
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All employees who have occupational exposure to bloodborne pathogens will receive training on the epidemiology, symptoms, and transmission of bloodborne pathogens diseases. In addition, the training program covers, at a minimum, the following elements:

- A copy and explanation of the standard
- An explanation of our ECP and how to obtain a copy
- An explanation of methods to recognize tasks and other activities that may involve exposure to blood and OPIM, including what constitutes an exposure incident
- An explanation of the use and limitations of engineering controls, work practices, and PPE
- An explanation of the types, uses, location, removal, handling, decontamination, and disposal of PPE
- An explanation of the basis for PPE selection
- Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration and the benefits of being vaccinated. Trainees will understand that the vaccine will be offered free of charge
- Information on appropriate actions to be taken and persons to contact in an emergency involving blood or OPIM
- An explanation of the procedure following an exposure incident is provided. The reporting method and the medical follow-up scenario will also be made available
- Information on post-exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident
- An explanation of the signs and labels and/or color coding required by the standard and used at this facility
- An opportunity for interactive questions and answers with the person conducting the training session

Training materials for this facility can be found by calling

Name	Location	Phone
------	----------	-------

RECORD KEEPING

TRAINING RECORDS

We file employees' training records upon completion of training. These documents will be kept for at least **ten (10) years** by

Name	Location	Phone
------	----------	-------

The training records include:

- The dates of the training sessions
- The contents or a summary of the training sessions
- The names and qualifications of persons conducting the training
- The names and job titles of all persons attending the training sessions

Employee training records are provided upon request to the employee or the employee's authorized representative within 15 working days. Such requests should be addressed to

Name	Location	Phone
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MEDICAL RECORDS

Carleton College will file and maintain records for each employee who has occupational exposure (in accordance with 29 CFR 1910.20 "Access to Employee Exposure and Medical Records"). At Carleton College

Name	Location	Phone
------	----------	-------

Is responsible for maintenance of the required medical records. These confidential records are securely kept at

Location

For at least the duration of employment plus **30 years**

Employee medical records are provided upon request of the employee or to anyone having written consent of the employee within 15 working days. Such requests should be sent to

Name	Location	Phone
------	----------	-------

OSHA RECORD KEEPING

An exposure incident is evaluated to determine if the case meets OSHA's record keeping requirements (29 CFR 1904). This determination and the recording activities are done by

Name	Location	Phone
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Attachment K

Hazardous Chemicals Requiring

Industrial Hygiene Monitoring

(Current List)

- Ionizing Radioactive Materials Monitoring
- Formaldehyde

Attachment L

Radioactive Materials Program

Carleton College - Radiation Safety Program

Section 1: Audit History.

(Enter the date of the last audit, whether any deficiencies were identified, and whether actions were taken to correct the deficiencies.)

On October 31, 2018, MDH staff conducted an inspection at Carleton College and observed the following violation: the RSO did not have a copy of his most recent DOT Training certificate. After confirming that the RSO's training was current and in order, **no corrective action** was assigned.

Section 2: Organization and Scope of Program.

(Give a brief description of the organizational structure, noting any changes in personnel. Describe the scope of licensed activities at the audited location. Check whether the Radiation Safety Officer (RSO) is the person identified in the license and fulfills the duties specified in the license.)

The scope of the licensed activity includes research and development as defined by 4731.0100 (excluding animal studies) and for student instruction. The means by which instructors and researchers will use low-level radioactive compounds is experiment dependent and will always be outlined by a standard operating procedure that is supplied, taught, and demonstrated by the licensed faculty user in question, always employing rules that are generally applicable for keeping the exposure to radiation **as low as reasonably achievable (ALARA)**:

In September 2015, the RSO responsibilities were assumed by Wayne A. Brown. Mr. Brown completed a Master of Science degree with a focus in Chemistry (organic synthesis) from Southern Illinois University at Edwardsville. He served 20 years as Chemical Hygiene and Radiation Safety Officer at Loyola University New Orleans and as an Environmental Health and Safety Manager at the U.S. Strategic Petroleum Reserve, among other industrial positions. Over the last 20 years, Mr. Brown has completed multiple 40-hour occupational radiation program safety courses through Engelhardt & Associates, Inc.

All licensed material is listed in **Table 3: Licensed Material** in Section 6. Item L. will be used for storage only. Item M. will be used in a Nuclear Chicago Model NH-3 neutron howitzer for laboratory experiments and student instruction. The possession of License material N. will be incident to the performance of irradiation experiments utilizing Pu-Be source. To be used for student instruction.

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Section 3: Training, Retraining, and Instructions.

(Ensure that workers have received the training required by **4731.1020**. Be sure that users have received training and have a copy of the licensee's safe use and emergency procedures before being permitted to use radioactive material. Note whether refresher training is conducted in accordance with licensee commitments. Ensure that each worker has a copy of the licensee's procedures, and by interview and/or observation of selected workers that he/she can implement them.)

Licensed material listed in Section 6 is authorized for use by, or under the supervision of the following Faculty/Staff for the materials and uses indicated in Table 1: Faculty/Staff Users of Licensed Material.

Table 1: Faculty/Staff Users of Licensed Material

Faculty / Staff	Radioactive Material (items # per Section 5 table)
Martha-Elizabeth Baylor, Ph.D.	A. - E., I., J., M. and N.
Chris Calderone, Ph.D.	F. - H., and K
Joseph Chihade, Ph.D.	F. - I.
Melissa Eblen-Zayas, Ph.D.	A. - E., I., J., M. and N.
Eric Hazlett, Ph.D.	A. - E., I., J., M. and N.
Stephen Zweifel, Ph.D.	A. - F. and I.

Students and technicians receive instruction in the handling of radioactive substances, their potential for health hazard, and radiation safety procedures. This is in the forms of formal course lecture, assigned reading, radiation safety video and/or individual instruction by the RSO or faculty listed in the above table. Students' work with radioactive materials are closely supervised by these qualified and authorized faculty.

An instructional handout entitled, "Safe Handling of Radioactive Materials for the Physics, Biology and Chemistry Departments" [[Moodle Training Link](#)] are included in the following pages. These instructional handouts are given to all students, technicians using radioactive sources and are also posted in the laboratories and areas of use. Furthermore, the guide contains standard and emergency procedures in line with maintaining commitment with **Appendix G (attached)** of the regulatory guide.

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Section 3: Training, Retraining, and Instructions cont.

Safe Handling of Radioactive Materials

The precautions taken when handling radioactive materials include and surpass those that are required for the use of non-radioactive chemical compounds due to the seemingly passive nature of the hazard. Although it is obvious when one has been the victim of an acid burn or contact with other such tissue reactive chemicals, a human's senses are not keen enough to detect the onset of abnormal levels of radiation. Radiation is invisible and it bears no odor; therefore, one's guard at hazard prevention may be inherently lowered. However, the threat of acute and long-range physical damage will be realized if one does not adhere to proper precautionary measures.

Radiation that passes through tissue primarily interacts with molecules of body water that are located in cells (skin, internal organs, etc.). The ions that can be released by irradiated water molecules interact with and distort the chemicals that form the cell structure. Such damaged cells may either be killed by this action or they may give rise to a series of abnormal daughter cells (i.e. the formation of a tumor). Since the dangers of radiation decrease with distance from, time in proximity to, and shielding from the radiation source, it is imperative that each of these concepts be employed to minimize exposure risks while using low-level radioactive materials.

Beta radiation possesses a weak ability to penetrate tissue, however it can deliver a significant dose of radiation to the skin and the lens of the eye. It is most hazardous internally due to its strong ability to ionize water.

Alpha particles possess an even lower ability to penetrate skin. They can be stopped by the dead outermost layer of human skin or a layer of clothing. However, they are more powerful ionizers than beta radiation once they enter the body through ingestion or inhalation (400 times more times more powerful).

While none of the sources Carleton College owns is dangerous in the sense that a short exposure might cause serious immediate effects, several are sufficiently strong to constitute potential hazards if long and/or repeated exposures are experienced. For this reason, and because the long-term and hereditary effects of even very low-level radiation are not well understood, it is important to observe a number of procedures and precautions in the handling and use of these sources:

Carleton College - Radiation Safety Program

SEALED SOURCES

1. Storage: All radioactive sources in their shielded containers are stored in room 213 of Olin Hall. This room is kept locked, and removal and return of sources will **only** be done by or in the presence of an *Authorized User*.
2. Experimental set-up: After removal from room 213, the source is to be immediately incorporated into an associated experimental set-up, with adequate warning signs placed in its vicinity. It can be left unattended **only** if the room is locked and a standard warning sign is placed on the door with instructions on whom to contact in case of emergency. Experiments will ordinarily be performed in the advanced laboratory (Olin 211); it is most important that an experiment be properly shielded, using lead bricks and checking with a survey meter, so that neither the person(s) performing the experiment nor anyone else working in the same room is subjected to radiation above background.
3. Handling of sources: This will **always** be done under the direct supervision of another Authorized User, when it involves removal of a source from its container (as opposed to simply removing the container lid to expose the source). This is the only operation where any significant dosage should occur, and sources and apparatus are designed in all cases to allow rapid handling; thus this dosage should always be far below any hazardous amount. Nevertheless, extreme care should always be exercised; always handle the source with the tools provided and never touch its surface. If any accident should occur, however minor (e.g., bumping the active area of the source against a lead brick), report it immediately to your instructor or supervisor .
4. Return to storage: After use of a source, it must be returned to room 213 by one of the above staff members. The experimental area should be surveyed with the monitor to ensure that only background radiation is present.
5. Source users are reminded that smoking is **explicitly banned** in the labs, and that food and beverages may not be consumed in a lab where radioactive sources are in use.

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Biology and Chemistry Research Compounds

All of the isotopes that Biology and Chemistry use are beta or electron emitters. **Beta radiation** possesses a weak ability to penetrate tissue, however it can deliver a significant dose of radiation to the skin and the lens of the eye. It is most hazardous internally due to its strong ability to ionize water. Work areas shielded with heavy glass and metal or heavy glass containers will be sufficient to absorb most of the radiation presented. If accidental contamination of the body surface should occur, irradiation by beta particles will be limited to superficial tissues only. Ingestion of beta emitters presents a greater hazard as the ^{14}C , ^3H or ^{32}P may be incorporated into the molecular constituents of the body's tissues. Neither of these eventualities should occur if work is performed with care, and the instructions given below are followed for the use of **BOTH sealed sources and research compounds**:

1. Never remove radioactive materials from the laboratory.
2. Radiochemical experiments should be performed only when the instructor is present, and only with the quantities provided by the instructor.
3. To effectively avoid the dangers of both types of radiation, do not sniff or waft containers of radioactive materials in order to smell them.
4. Always wear protective clothing to serve as a radiation penetration barrier. Nitrile/latex gloves, safety glasses, and laboratory coat or apron must be worn at all times while performing experiments involving radioactive materials, particularly unsealed radioactive compounds. Whenever possible, wear two pair of gloves when handling radioactive material.
5. Eating, drinking, and smoking are forbidden in all college laboratories. Do not prepare or store food or drink in an area that is designated for the use of radioisotopes.
6. Various "mindless" personal habits may result in the ingestion of radioactive material. While working with radioisotopes **DO NOT**:
 - a. Use mouth pipettes
 - b. Chew on pencil or pen

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- c. Place eyeglasses in mouth
 - d. Floss teeth
 - e. Lick labels
 - f. Hold stoppers in mouth
 - g. Open bottles with teeth
 - h. Blow bubbles with gum
 - i. Bite fingernails
 - j. Chew hair ends.
7. Tools (pipettes, test tube racks, etc.) used shall also be segregated from other common laboratory equipment. Perform all work in laboratory trays sufficient to hold more than the volume of material being handled in the event of a spill.
 8. Rinse reusable radioactive glassware thoroughly (as directed) and place in a container labeled "Radioactive Glassware."
 9. Only electronic equipment that is specifically designed and designated for use with radioactive materials shall be utilized during experiments.
 10. All preparatory work involving radioactive isotopes must be performed at the sample preparation station with a radiation shield that is situated between the radiation source and the worker. Whenever possible, all radiation sources must be separated from workers by a shield. For the greatest effect, place shielding as close as possible to the radiation source.
 11. Perform all radioisotope work according to some prearranged plan. Reassess any radiation hazards involved in departure from the plan. Think before you begin handling radioisotopes.
 12. During use, keep all radioactive stock sources for your experiment in the designated fume hood with the exhaust fans operating
 13. Note in the Radioactive Materials Log the amount, the date of use, the type (source), amount (in activity and weight or volume) and the specific container from which the material was taken.
 14. Do not pipette by mouth. Use micro pipettes with disposable tips that are fitted with plugs. These plugs prevent the micro pipette from being contaminated by

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the aspiration of liquid into the suction chamber. Carefully discard used tips into an appropriate radioactive waste container.

15. Centrifuging and shaking can produce aerosols, gases or dusts that can contaminate equipment, the surrounding air, and adjacent surfaces. Furthermore, spills and breaks are highly likely during such operations. Therefore, periodic surveys of such equipment, the air, and the adjacent workspace should be done.
16. Radioactive waste and contaminated material must be placed in containers labeled as "Dry Radioactive Waste" or "Liquid Radioactive Waste".

17. SURVEYS

An appropriate radiation survey instrument must be used to perform routine monitoring for contamination. Contamination surveys should be sufficient to identify areas of contamination that might result in doses to workers or to the public. Combined removable and fixed contamination should be surveyed using appropriate radiation detection equipment. Removable contamination can be detected and measured through a wipe test of the surface, which is counted in an appropriate counting instrument. Survey instruments can be used during and after an experiment to detect contamination. This type of survey is only appropriate when the background radiation level is sufficiently low. Low levels of radiation will not be detectable if the background level is more than three times the natural background. To check for natural background, measure the radiation level using your instrument in some location that is sure not to be influenced by nearby radiation sources.

In surveying for beta emitters, the instrument probe should be held close to the surface being surveyed (within two centimeters) and the window of the probe should be open to permit the entrance of beta particles into the detecting media of the probe. Your instrument should be sensitive enough to detect radiation activity levels of:

- a) 37 Bq at a distance of 1 cm from the surface for ^{35}S and ^{33}P .
- b) 3.7 Bq at a distance of 1 cm from the surface for ^{32}P .

In the event that the background radiation is too high, perform a smear test. "Smear" or "wipe" tests are done by wiping pieces of absorbent paper (Ex.

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Whatman #2 filter paper) over an area of approximately 100cm². Number and place the paper swipes in between the sheets of a clean note pad; note the location where the swipe was taken on a sketch of the laboratory [see **Appendix A (attached) of this guide**]. Swipes should be dried before counting. The wipes are then analyzed with the appropriate detector in an area with low background. If contamination is found, wipes should be counted again to document the contamination level; and if the instrument has a fast/slow response setting, it should be set to "slow" for this purpose.

Another situation where wipes must be taken would occur after some contaminated areas have been thoroughly cleaned and high radiation levels are still observed with the hand-held detector. In this situation wipes must be taken and counted to verify that the remaining contamination is not removable and would not be spreadable to other areas. If such a contaminated area is not easily removable, steps can be taken to seal over the area of contamination so that a subsequent survey would display readings less than 10 cpm or less than twice the background reading in cpm units.

If instrument readings for any survey indicate contamination at more than 10 cpm above background, the contaminated areas or items should be cleaned, labeled, or disposed and the area resurveyed. The surveys should be done at the end of each laboratory workday, and/or after a radioisotope spill.

All survey records will include the model and serial number of the survey instrument(s) used for each individual survey.

Survey instruments must be calibrated annually.

18. DECONTAMINATION

All decontamination/spill procedures will be in direct accordance with **APPENDIX G (attached; SAFE USE OF RADIOISOTOPES AND MODEL EMERGENCY PROCEDURES)** of the MDH Guide for Research Laboratories. Work table surfaces should be cleaned by a wet method to prevent a dust hazard. A decontaminating spray-foam is available from each respective stockroom or EHS. Use foam for surface and utensil cleaning. Small liquid spills are easily controlled through judicious use of a spreadable adsorbent and/or absorbent paper. Remember to treat solutions and absorbent materials used in the decontamination process as

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radioactive waste. In the event of fixed radionuclide contamination of a surface, a coat of paint or plastic cover may provide adequate protection.

19. WASTE

The following are those things that are to be considered radioactive wastes:

- a) Liquid or solid remnants or residues of radioactive compounds
- b) Disposable utensils that have had direct or indirect contact with radioactive material (i.e. micro pipette tips, paper towels, bench paper, filter paper, gloves, centrifuge tubes, petri dishes, tape, writing paper, etc.)
- c) Gels (polyacrylamide, agarose, etc.)
- d) Decontamination and spill clean-up wastes.

- e) Filtrate buffer solution that is collected from a gel-dryer trap.

Radioactive waste must not be mixed with normal trash or placed into ordinary waste containers. Radioactive waste receptacles should be identified with the proper warning labels. Such wastes should not be temporarily placed in hallways for pickup.

Sharps, such as glass and needles, should be placed in a strong inner package before placing into a rad. waste receptacle. Damp material, small amounts (less than 10 grams) of material that will putrefy or waste that will give off vapors or fumes must be contained in small well sealed plastic bags or containers before placing into a radioactive waste receptacle.

Wastes resulting from the use of different radioisotopes must be segregated since various radioisotopes degrade at different rates. Waste containers will be designated for each radioisotope in question.

Liquid radioactive waste will be removed from the laboratories and placed into long-term storage containers. The containers are then stored in the designated Radioactive Waste Area until it has decayed at least 10 half-lives. It may then be disposed. Solutions that are water soluble and that are not characteristically hazardous in any way may be diluted and run down a sanitary sewer drain. Total quantity of licensed material released into the sanitary sewerage system in a year does not exceed 185 GBq (5 Ci) of H-3, 37 GBq (1 Ci) of C-14, and 37 GBq (1 Ci) of all other radioisotopes combined. Each sewer disposal must be registered in

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a log to note the final disposition of the waste. The log should include: the date of "waste" designation, the date of proposed disposal, the date of actual disposal, the type of waste and the results of a radioactivity survey. If liquid waste displays a radioactivity greater than 100 cpm, then the waste will be stored until the level drops below 100 cpm. This 100 CPM from a handheld pan survey meter is supposed to represent a "very rough" survey determination point of whether short half-life waste material already held for a minimum of 10 half-lives in decay in storage (DIS) [e.g. P-32, S-35, etc.] has decayed to a level low enough to dispose in trash, unless other hazardous characteristics require proper waste disposal procedures, per [Item 11: Waste Management; Section DIS](#), of the MDH Guide for Broad Scope Licenses. A more specific survey to determine how close the decayed waste is to background levels will designate whether it must be held in the DIS area for additional time. The Waste Log will track and specify respective dates designated a waste, required time for 10 half-lives based on each respective half-life, and actual disposal dates. All survey records will include the respective model and serial numbers of the survey instrument(s).

Solid wastes that have completed the degradation process (ten half-lives), and that are not characteristically hazardous, may be discarded into a normal garbage dumpster provided all radiation signs and labeling have been removed or marked out. A notation must be made in the Solid Waste Storage Log (SWSL) as to the final disposition of the waste. The SWSL includes: the waste's origin, the type, the radioisotope half-life, the required storage time, the initial date of storage, the date of release and results of a radioactivity survey. If solid waste displays a radioactivity greater than 100 cpm, then the waste will be stored until the level drops below 100 cpm.

20. SPILLS

In the event of a spill of a small quantity of a low level radioactive compound, notify the supervisor/instructor immediately. Obtain a pair of disposable gloves and proceed as follows:

- a) Segregate the area and stop traffic in that area.
- b) It may be necessary to mark the area with appropriate signs or tape.
- c) Isolate spills using diatomaceous earth, absorbent paper, etc. Proceed to decontaminate the area by cleaning up the contaminant from the outer-most edges working toward the center (from least contamination concentrations to the heaviest concentrations).

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- d) Removed materials used in clean-up to a plastic "rad bag" which is then sealed and stored in the area designated for waste storage.
- e) Clean spill area with an appropriate cleaning medium (spray foam, cleaning solution, etc.) and place waste into designated waste container.
- f) Perform a contamination survey (done by the research advisor).
- g) Document spill with RSO.

21. PERSONAL CONTAMINATION

Except in the case of injury, persons who have left a contaminated area must remain in the vicinity until monitored for contamination. Contaminated shoes or other clothing may have to be removed. If anyone suspected of suffering an internal intake of radioactive material, notify that person's supervisor and the Radiation Safety Officer. If there is an inhalation hazard due to an accidental spill in a laboratory, all persons not involved in carrying out planned safety procedures should vacate the contaminated room immediately and the room should be closed off. Persons directly contaminated by a wet spill should immediately remove the clothing affected and thoroughly wash the contaminated areas of the body with soap and water for at least 2 or 3 minutes.

In case of contaminated small open wounds or punctures, wash immediately and encourage bleeding, rinsing the cut with a strong stream of water. Then immediately continue washing with soap and water. The danger of loose activity being eventually carried into the body is the most critical hazard. Mild decontaminating procedures should be carried out in the following manner:

- a) Warm water should be used
- b) Soap should not be abrasive or alkaline
- c) Scrub thoroughly but avoid using a brush that might break the skin.
- d) The skin should be washed only for a few minutes at a time, then dried and monitored. The degree of decontamination required will depend on the relative radio-toxicity and the chemical nature of the contaminant. Remember that some radioisotopes may be extremely hazardous in terms of skin toxicity, i.e. 1mCi (3.7×10^7 Bq) of ^{32}P spread over a 1cm^2 area of skin will deliver 20 Gy/hr or 20 J/kg/hour to that skin tissue.
- e) The use of organic solvents or acid or alkaline solutions should be avoided.
- f) Special attention should be paid to proper decontamination of creases, folds, hair, fingernails, inter-finger spaces and the outer edges of the hands. If there is a risk of spreading, mask the non-contaminated areas of the body.

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- g) After each decontamination period, the treated area should be dried with a fresh paper towel or swab and monitored. Materials used in the decontamination process should be treated as radioactive waste.
- h) To designate an individual's quarterly exposure, radiation detection badge must be worn (on the upper lapel of the wearer's laboratory coat) whenever performing a laboratory function that includes working with radioactive material including waste. The RSO will supply such badges and replace them each quarter throughout the year. The RSO will maintain on file all badge exposure information and relay such information immediately upon receipt from the badge supplier.

The only ancillary personnel whose duties may require them to work in the vicinity of any radioactive material are the custodians, maintenance staff, Campus Security officers and the Physics Department Electronics/Laboratory Manager. These employees are informed about radiation hazards and appropriate precautions to be taken when working in the areas where such materials are used or stored. This instruction is given annually on a refresher basis.

Emergency procedures:

Notices with wording as on the appended sheet will be posted on the door of the physics source storeroom (Olin 213), the laboratory where physics sources are used (Olin 211), and on the freezers in which the biology and chemistry sources are stored. The campus Security Office has been informed of the locations of radioactive sources and has instructions to contact the Radiation Safety Officer in the case of fire or other emergency. See example Emergency Notice below.

Emergency notices

Physics (on doors to Olin 211 and 213):

EMERGENCY PROCEDURES — RADIOACTIVE SOURCES

In the event of any accident, spill, or contamination, however minor, **DO NOT** try to remedy the situation. Close off the area involved, and immediately contact

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Wayne Brown [ext. 7554 or (504) 234-1826].

Biology and Chemistry (for freezers containing radioactive materials):

EMERGENCY PROCEDURES — RADIOACTIVE SOURCES

ALL incidents involving radioactive materials **MUST** be reported. In the event of any fire, accident, spill, contamination or other emergency, close off the area involved and immediately contact (faculty member in charge), or Radiation Safety Officer Wayne Brown [ext. 7554 or (504) 234-1826].

Section 4: Audits.

In June and December of each year, the RSO audits all radioactive materials. The self-audits fulfill the requirements of part 4731.2010 and requirements cited in Appendix D (attached) of the regulatory guide, are conducted in accordance with licensee commitments, and are properly documented.

Section 5: Facilities.

(Verify that the licensee's facilities are as described in its license documents.)

Licensed material shall be used or stored only at the licensee's facilities located at Carleton College. Access to all of the licensed material is restricted and stored in limited-access, locked room, locked cabinet(s), closet(s) and/or refrigerator(s) as indicated in Table 2.

#	Element-Mass #	Storage Location
A.		
B.		
C.		
D.		
E.		

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#	Element-Mass #	Storage Location
F.		
G.		
H.		
I.		
J.		
K.		
L.		
M.		
N.		

Section 6 - Radioactive Material

(Verify that the license authorizes the quantities and types of radioactive material that the licensee possesses.)

Table 3: Licensed Material

#	Element-Mass #	Form - Chemical/Physical	Max Amount on Site
A.			
B.			
C.			
D.			
E.			
F.			
G.			

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#	Element-Mass #	Form - Chemical/Physical	Max Amount on Site
H.			
I.			
J.			
K.			
L.			
M.			
N.			

Section 7 Leak Testing

(Verify that all sealed/plated foil sources are tested for leakage at the prescribed frequency and in accordance with licensee commitments. Records of results should be maintained.)

Carleton College model leak test protocol complies with the program published in [Appendix J \(attached\) - Leak Testing Sealed Sources of the MDH Regulatory Guide for Laboratory Use of Radioactive Material](#) rev. April 15, 2007.

Section 8 Inventories.

(Verify that inventories are conducted at least once every six months to account for all sources; inventory records should be maintained.)

Carleton College will inventory all radioactive material every 6 months in June and December to account for all sources, in maintaining compliance with [Appendix F \(attached\)](#) of the regulatory guide. The most current 3 years inventory records can be found in Radiation Safety Program Binder. The RSO maintains the complete inventory records history.

Section 9 Radiation Surveys.

(Verify that the licensee has appropriate, operable and calibrated survey instruments available, and that the instruments have been calibrated at the required frequency. Calibration records must be retained for 3 years after the record is made. Check that radiation levels in areas adjacent to use are within regulatory limits. Verify compliance with 4731.2090. Records of surveys must be retained for three years after the record is made.)

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Carleton College surveys its facility and maintains contamination levels in accordance with the survey frequencies and contamination levels published in **Appendix I (attached)** of the MDH Regulatory Guide for Laboratory Use of Radioactive Material rev. April 15, 2007.

Survey instruments & Calibration

Carleton College reserves the right to upgrade its survey and measuring instruments as necessary. Carleton College will use instruments that meet the radiation monitoring instruments specifications. Carleton College has been approved to calibrate the Survey Meters in house. The Carleton College calibration methods are congruent with the model survey meter calibration program published in the MDH Instrument Calibration Regulatory Guide. Calibrations will be carried out at 6-month intervals. Records will be maintained for 3 years.

Portable Survey Meters:

1. GM Survey Meter (Dosimeter Corp. model 3007/3012) measures betas and gammas, ranges 0.5, 5, and 50 mr/hr.
2. Radiacmeter or Geiger counter (U.S. Navy IM-141/PDR-27J) measures gammas (ranges 500, 50, 5, 0.5 mr/hr) and betas (ranges 5, 0.5 mr/hr).
3. Portable Geiger Counter (Ludlum model 2, with pancake detector #44-9)

Portable Survey Meters Calibration:

A Co-60 source will be used for calibration. Its strength was measured by the manufacturer in October 15, 2012 as 1.0 mCi $\pm 5\%$, traceable to the NBS; we will make corrections for its decay (5.26-yr half-life). The two most sensitive meter ranges (0.5 and 5 mr/hr) will be calibrated at half scale by placing the window of the detector an appropriate distance "d" from the source. The 500 and 50 mr/hr ranges (never used in practice) will be calibrated at 1% and 10% of full scale, respectively. (While breakdown of the point source geometry assumed will give rise to some error with the above procedures for high scales, where d must be small with the calibration source, great accuracy in calibration is not needed for Carleton's applications with relatively weak sources and anticipated exposures at near-background levels.)

**NIM modules (amplifiers, analyzers, scalers, power supplies) for use with the above detectors.

Other measuring equipment:

1. Alpha Detection

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Instrument - Scintillation detector (Nuclear Chicago XTA with probe DS-5) Instrument Calibration - Calibration - (XTA crystal in DS-5 probe): This will be calibrated with a ^{238}U source from a Nuclear-Chicago source kit SK-1. This source has a decay rate of approximately 40 disintegrations/sec, equivalent to 0.001 μCi . The detector is easily capable of measuring this source, well below the level of sensitivity needed.

2. Gamma Detection

Instrument - Nuclear-Chicago 402, 200 mr full scale Pocket Dosimeters

Instrument Calibration - Each dosimeter will be calibrated at 10% scale by placing it for one hour at an appropriate distance from the Co-60 calibration source. (As there is no way any user at Carleton will ever receive a dose greater than 10%, this should be sufficient.)

Section 10 Receipt & Transfer of Radioactive Material (Includes Waste Disposal)

(Verify that packages containing radioactive material, received from others, are received, opened, and surveyed in accordance with 4731.2350. Ensure that transfers are performed in accordance with 4731.3105. Records of surveys, receipt, and transfer must be maintained.)

Ordering sources

Before it is sent to the supplier, each order for radioactive materials will be cleared with the RSO, who will assure that it will not result in the possession limits being exceeded.

Receiving source containing packages

During normal working hours, carriers are instructed to deliver radioactive packages to the designated receiving area. During off-duty hours, security staff will accept delivery of the radioactive package in accordance with **Appendix F (attached)** - Material Receipt and Accountability of the MDH Regulatory Guide for Laboratory Use of Radioactive Material rev. April 15, 2007. Due to the nature of the material, the faculty Authorized User is required to be on campus to receive and inspect a radioactive isotope order upon notification of its arrival by the receiving representative on duty. If the investigator will not be available, then the responsibility falls upon the appropriate Sciences Department Stock Manager, then the RSO (in that order).

A marked and dedicated cabinet is located in the campus package receiving area, into which incoming packages containing radioactive materials must be immediately placed and stored for initial damage/integrity evaluation and pick-up. Once examined for obvious damage, the package is then removed to the appropriate storage/use area for opening and secondary inspection. If the faculty investigator is not immediately available to perform the secondary inspection, the package will be placed into a plastic

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"rad-bag" and put into the radioactive materials storage area to await the secondary inspection.

The faculty research investigator will perform the secondary inspection while wearing gloves, protective eye-wear, and a laboratory coat or rubber apron. A Geiger/Mueller monitor will be used to scan the opened package for contamination before and after the isotope container has been removed.

Waste Management

Radioactive Material (items # per Section 5 table)	Waste Management
A. to E. and K.	These sources are relatively long-lived. They will remain stored as described above for an indefinite period, and thus will present no waste disposal problems in the foreseeable future.
G. and H.	Wastes of ^3H and ^{14}C will be disposed of by release into sanitary sewerage.
F. and I.	Wastes of ^{35}S and ^{32}P will be stored for a minimum of ten (10) half-lives and/or until activity drops to background level.
J. and L.	Wastes of ^{22}Na and ^3H foil would be disposed of by an appropriately licensed waste handler.
M. and N.	These sources are relatively long-lived. They will remain stored as described above for an indefinite period, and thus will present no waste disposal problems in the foreseeable future.

Section 11: Transportation.

(Determine compliance with Department of Transportation (DOT) requirements. Verify that radioactive packages are prepared, marked, and labeled in accordance with 49 CFR Parts 172 and 173 requirements. Verify that shipping papers are prepared, that they contain all needed information, and that they are readily accessible during transport (49 CFR 172.200, 201, 202, 203, 204 and 177.718).

Section 12: Personal Radiation Protection.

(Evaluate the licensee's determination that unmonitored personnel are not likely to receive more than 10 percent of the allowable limits. Alternately, if personnel dosimetry is provided and required, verify that it complies with 4731.2200 and licensee commitments. Review personnel monitoring records; compare exposures of individuals doing similar work; determine reasons for significant differences in exposures. If

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any worker declared her pregnancy in writing, evaluate the licensee's compliance with 4731.2080. Check whether records are maintained as required.)

An evaluation has been conducted which determined that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10% of the allowable limits in 10 CFR Part 20. All locations surveyed by the Radiation Safety Officer have a measured level of activity below 0.04 mR/hr (the background level of the survey meter), except outside the storage room, Olin 213, where the level is between 0.05 and 0.15 mR/hr. This notwithstanding, a dosimetry badge program, is used to monitor the exposure of licensed users and members of the Carleton College community who come in regular proximity or contact with radioactive materials. The Radiation Safety Officer also maintains instructive communication about radiation safety with all technical staff, faculty, employees and students who work with or near radioactive materials.

Section 13: Auditor's Independent Measurements

The auditor surveys the locations described in Section 2 above. The surveys are conducted twice a year. Records of the surveys are recorded, and maintained. During the last formal inspection by MDH, on August 2, 2013, it was found that all of the locations were safe, in compliance with our license, and in compliance with Minnesota Department of Health regulations.

Section 14: Notification and Reports

The Radiation Safety Officer has verified compliance with the notification and reporting requirements. Records of communications with the regulatory agencies are maintained.

Section 15: Posting and Labeling

The Radiation Safety Officer will inspect all laboratories containing radioactive materials, and assure compliance with posting and labeling requirements. Hazard warning signs were posted at entry points for HULINGS 203A and Olin 211.

Section 16: Record-keeping for Decommissioning

The Radiation Safety Officer will maintain Carleton College in compliance with 4731.3080.

Section 17: Bulletins and Information Notices

The Radiation Safety Officer will maintain that the licensee receives bulletins, information notices, and all other material sent from the Minnesota Department of Health. Elisabeth Haase, Manager of Dept of EHS, currently receives this material.

Section 18: Special License Conditions or Issues.

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(Verify compliance with any special conditions on the licensee's license. If the licensee has any unusual aspect of its work, review and evaluate compliance with regulatory requirements.)

N.A.

Section 19: Evaluation of Other Factors.

(Evaluate licensee management's involvement with the radiation safety program, whether the RSO has sufficient time to perform his/her duties, and whether the licensee has sufficient staff to handle the workload and maintain compliance with regulatory requirements.)

N.A.

Note: All areas indicated in audit notes may not be applicable to every license and may not need to be *addressed during each audit*.

APPENDICES

RADIOACTIVE MATERIAL USE/SURVEY LOG

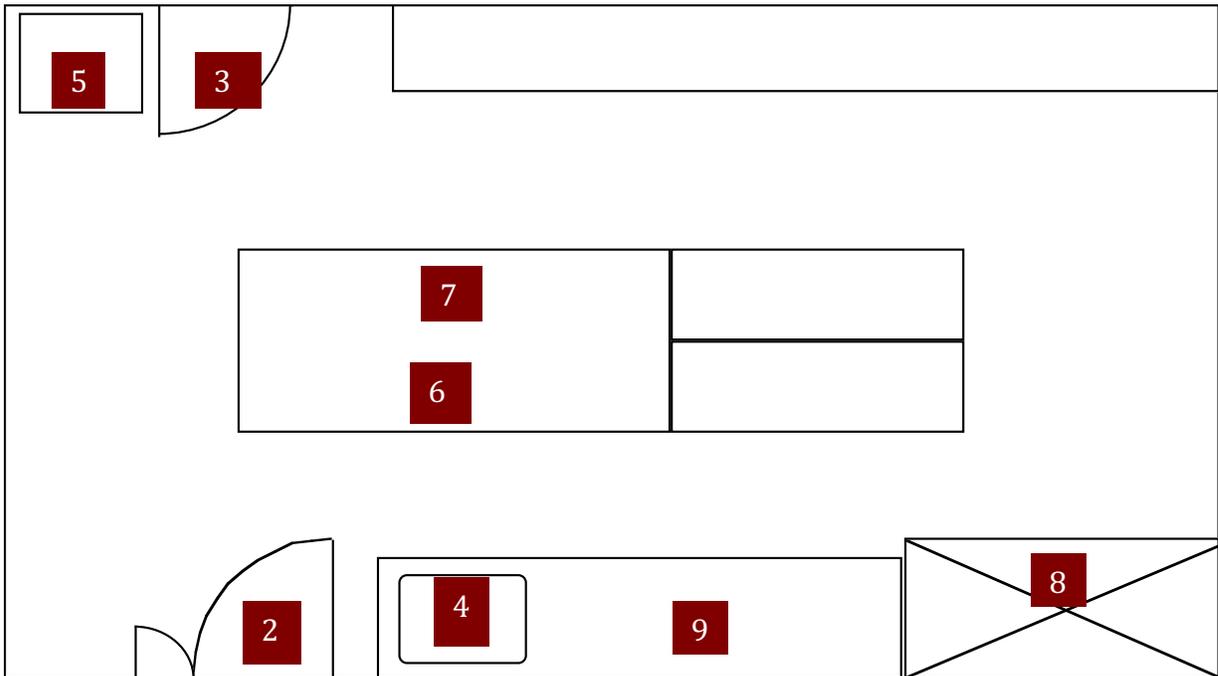
ROOM: HULINGS 203A

Name (Licensed User): _____ Nuclide: _____

Chemical Name/Form: _____ Initial Amount: _____ μCi mCi

Amount Used/Remaining : _____ μCi mCi / _____ μCi mCi Use/Survey Date: _____

Person Performing Survey: _____



Survey Location (in Counts per minute [cpm]):

- | | |
|---------------------------|-------------------------------|
| 1. BACKGROUND _____ cpm | 6. Bench A _____ cpm |
| 2. Door Knob _____ cpm | 7. Bench B _____ cpm |
| 3. Door Knob _____ cpm | 8. Hood _____ cpm |
| 4. Sink _____ cpm | 9. Incubator _____ cpm |
| 5. Refrigerator _____ cpm | 10. Waste container _____ cpm |

RADIOACTIVE MATERIAL USE/SURVEY LOG

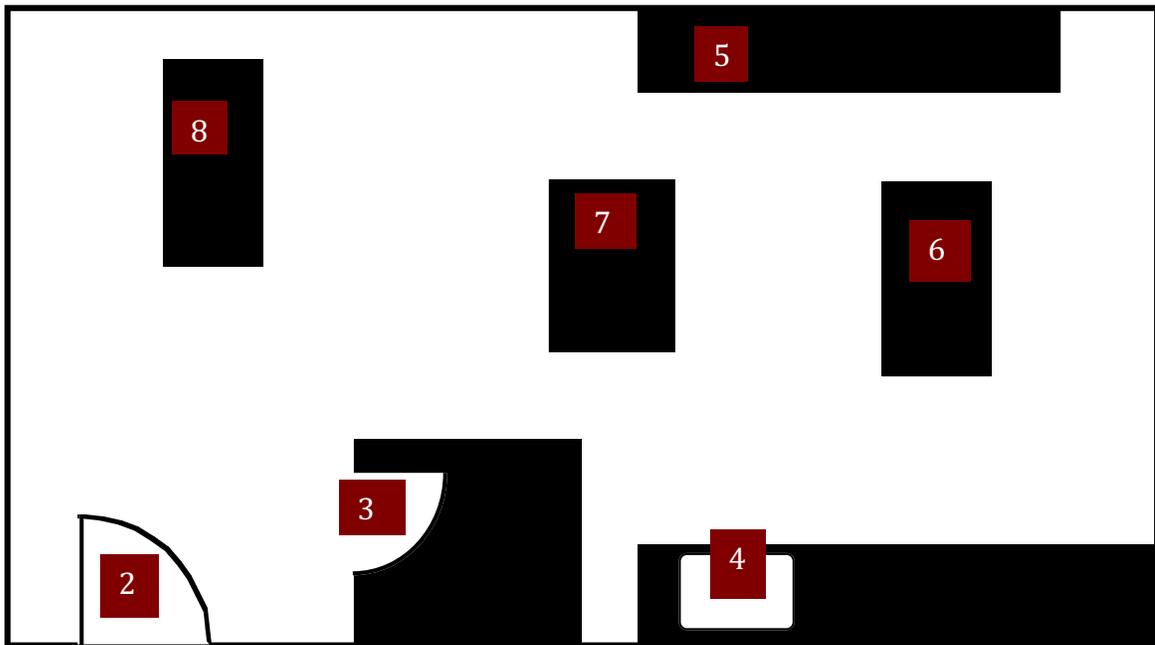
ROOM: OLIN 211/213 Sealed Source Storage Use Area

Name (Licensed User): _____ Nuclide: _____

Chemical Name/Form: _____ Initial Amount: _____ μCi mCi

Amount Used/Remaining: _____ μCi mCi / _____ μCi mCi Use/Survey Date: _____

Person Performing Survey: _____



Survey Location (in Counts per minute [cpm]):

- | | | | | | |
|------------------------|-------|-----|-------------------|-------|-----|
| 1. BACKGROUND | _____ | cpm | 6. Bench (East) | _____ | cpm |
| 2. Door Knob (211) | _____ | cpm | 7. Bench (Middle) | _____ | cpm |
| 3. Door Knob (213) | _____ | cpm | 8. Bench (West) | _____ | cpm |
| 4. Sink | _____ | cpm | 9. | _____ | cpm |
| 5. Bench (East window) | _____ | cpm | 10. | _____ | cpm |

MODEL AUDIT PROGRAM

SAMPLE AUDIT PROGRAM

An audit is conducted, in part, to fulfill the requirements for an annual review of the content and implementation of the licensee's radiation protection program. It should also identify program weaknesses and allow licensees to take early corrective actions (before an MDH inspection). During an audit, the auditor needs to keep in mind not only the requirements of MDH's rules, but also the licensee's commitments in its applications and other correspondence with MDH. The auditor should also evaluate whether the licensee is maintaining exposures to workers and the general public as low as is reasonably achievable (ALARA) and, if not, make suggestions for improvement.

Section 1: Audit History. Enter the date of the last audit, whether any deficiencies were identified, and whether actions were taken to correct the deficiencies.

Section 2: Organization and Scope of Program. Give a brief description of the organizational structure, noting any changes in personnel. Describe the scope of licensed activities at the audited location. Check whether the Radiation Safety Officer (RSO) is the person identified in the license and fulfills the duties specified in the license.

Section 3: Training, Retraining, and Instructions to Workers. Ensure that workers have received the training required by 4731.1020. Be sure that users have received training and have a copy of the licensee's safe use and emergency procedures *before* being permitted to use radioactive material. Note whether refresher training is conducted in accordance with licensee commitments. Ensure that each worker has a copy of the licensee's procedures, and by interview and/or observation of selected workers that he/she can implement them.

Section 4: Audits. Verify that audits fulfill the requirements of 4731.2010, are conducted in accordance with licensee commitments, and are properly documented.

Section 5: Facilities. Verify that the licensee's facilities are as described in its license documents.

Section 6: Materials. Verify that the license authorizes the quantities and types of radioactive material that the licensee possesses.

Section 7: Leak Tests. Verify that all sealed/plated foil sources are tested for leakage at the prescribed frequency and in accordance with licensee commitments. Records of results should be maintained.

Section 8: Inventories. Verify that inventories are conducted at least once every six months to account for all sources; inventory records should be maintained.

Section 9: Radiation Surveys. Verify that the licensee has appropriate, operable and calibrated survey instruments available, and that the instruments have been calibrated at the required frequency. Calibration records must be retained for 3 years after the record is made. Check that radiation levels in areas adjacent to use are within regulatory limits. Verify compliance with 4731.2090. Records of surveys must be retained for three years after the record is made.

Section 10: Receipt and Transfer of Radioactive Material (Includes Waste Disposal). Verify that packages containing radioactive material, received from others, are received, opened, and surveyed in accordance with 4731.2350. Ensure that transfers are performed in accordance with 4731.3105. Records of surveys, receipt, and transfer must be maintained.

Section 11: Transportation. Determine compliance with Department of Transportation (DOT) requirements. Verify that radioactive packages are prepared, marked, and labeled in accordance with 49 CFR Parts 172 and 173 requirements. Verify that shipping papers are prepared, that they contain all needed information, and that they are readily accessible during transport (49 CFR 172.200, 201, 202, 203, 204 and 177.718).

Section 12: Personnel Radiation Protection. Evaluate the licensee's determination that unmonitored personnel are not likely to receive more than 10 percent of the allowable limits. Alternately, if personnel dosimetry is provided and required, verify that it complies with 4731.2200 and licensee commitments. Review personnel monitoring records; compare exposures of individuals doing similar work; determine reasons for significant differences in exposures. If any worker declared her pregnancy in writing, evaluate the licensee's compliance with 4731.2080. Check whether records are maintained as required.

Section 13: Auditor's Independent Measurements (If Made). The auditor should make independent survey measurements and compare the results with those made or used by the licensee.

Section 14: Notification and Reports. Verify compliance with the notification and reporting requirements.

Section 15: Posting and Labeling. Check for compliance with the posting and labeling requirements.

Section 16: Recordkeeping for Decommissioning. Check to determine compliance with 4731.3080.

Section 17: Bulletins and Information Notices. Check to determine if the licensee is receiving bulletins, information notices, etc., from MDH. Check whether the licensee took appropriate action in response to MDH mailings.

Section 18: Special License Conditions or Issues. Verify compliance with any special conditions on the licensee's license. If the licensee has any unusual aspect of its work, review and evaluate compliance with regulatory requirements.

Section 19: Evaluation of Other Factors. Evaluate licensee management's involvement with the radiation safety program, whether the RSO has sufficient time to perform his/her duties, and whether the licensee has sufficient staff to handle the workload and maintain compliance with regulatory requirements.

Note: All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit.

MATERIAL RECEIPT AND ACCOUNTABILITY

MODEL PROCEDURE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

The RSO should approve or place all orders for radioactive material and should ensure that the requested material, quantities, manufacturer, and model are authorized by the license and that the possession limits are not exceeded.

During normal working hours, carriers should be instructed to deliver radioactive packages directly to the Radiation Safety Office (or designated receiving area).

During off-duty hours, security or other designated trained personnel should accept delivery of radioactive packages in accordance with the procedure outlined in the sample memorandum below:

Sample Memorandum

Memorandum for Security Personnel

From: RSO, President, Vice President, etc.

Subject: Procedures for Receipt of Packages Containing Radioactive Material

If the package appears to be damaged, immediately contact the RSO. Ask the carrier to remain at the facility until it can be determined that neither the carrier nor the vehicle is contaminated.

Any packages containing radioactive material that arrive between (state times, e.g., 4:30 p.m. and 7:00 a.m. or on Saturdays or Sundays) shall be signed for by the security guard (or other designated trained individual) on duty and taken immediately to the designated receiving area. Security personnel (or other designated trained individual) should unlock the door, place the package in the designated secured storage area and re-lock the door.

Radiation Safety Officer (RSO): _____

Office Phone: _____

Home Phone: _____

Sample Instructions to Personnel Involved in Material Receipt

Shipping and Receiving Personnel

During normal working hours, immediately upon receipt of any package of licensed material, each package must be visually inspected for any signs of shipping damage such as crushed or punctured containers or signs of dampness. Any obvious damage must be reported to the RSO immediately. Do not touch any package suspected of leaking. Request the person delivering the package to remain until monitored by the RSO.

Outside of normal working hours (e.g., nights, weekends, and holidays), deliveries will usually be handled by security personnel (or other trained individuals) as described in the above procedures. Since certain packages of licensed material will have detectable external radiation, they should be sent immediately to a designated storage area, where they will be checked for contamination and external radiation level as soon as practical. They should not be allowed to remain in the receiving area any longer than necessary, as they may be a source of exposure for receiving personnel.

If the instructions are not clear, or if there are questions regarding receiving packages containing radioactive material, please contact:

Name _____

Phone _____

MODEL PROCEDURE FOR SAFELY OPENING PACKAGES CONTAINING LICENSED MATERIALS

For packages received under the specific license, authorized individuals shall implement procedures for opening each package, as follows:

- Wear gloves to prevent hand contamination.
- Visually inspect the package for any sign of damage (e.g. crushed, punctured). If damage is noted, stop and notify the RSO.
- Check DOT White I, Yellow II, or Yellow III label or packing slip for activity of contents, so shipment does not exceed license possession limits.
- Monitor the external surfaces of a labeled package.
- Open the outer package (following supplier's directions if provided) and remove packing slip. Open inner package to verify contents (compare requisition, packing slip and label on the bottle or other container). Check integrity of the final source container (e.g., inspecting for breakage of seals or vials, loss of liquid, discoloration of packaging material, high count rate on smear). Again, check that the shipment does not exceed license possession limits. If you find anything other than expected, stop and notify the RSO.
- Survey the packing material and packages for contamination before discarding. If contamination is found, treat as radioactive waste. If no contamination is found, obliterate the radiation labels before discarding in the regular trash.
- Maintain records of receipt, package survey, and wipe test results.

- Notify MDH and the final carrier by telephone, email, or facsimile when removable radioactive surface contamination exceeds the limits of 4731.0415 or external radiation levels exceed the limits of 4731.0412.

TRANSFER POLICY STATEMENTS

Internal Transfers

Licensed materials that may be transferred from one department or laboratory or Authorized User's control to another should have prior approval from the RSO. A written transfer procedure should be developed by the RSO to ensure that transfers are done in accordance with the conditions of the license. All transfers shall be done in a way that minimizes the probability of spillage or breakage. Double containers should be used, including suitable shielding, for such transfers.

External Transfers

Licensed material shall not be transferred or shipped from one institution to another without the approval of the RSO. Such transfers/shipments must be packaged and labeled in accordance with the applicable MDH, DOT, or U.S. Postal Service Regulations.

Gifts

On occasion, licensees may be offered licensed materials by other individuals as gifts (e.g., a retiring medical practitioner donating his cesium needles to the university medical center). All such gifts of radioactive materials must be transferred to the licensee and handled in accordance with MDH requirements and the conditions of the license. In any case, the RSO should approve the gift before the transfer.

APPENDIX G

SAFE USE OF RADIOISOTOPES AND MODEL EMERGENCY PROCEDURES

GENERAL TOPICS FOR SAFE USE OF RADIOISOTOPES

Each laboratory or area where radioactive material is used or stored should have general rules so workers know what is required. Typical instructions should include:

- Wear a laboratory coat or other protective clothing at all times in areas where licensed materials are used.
- Wear disposable gloves at all times when handling licensed materials.
- After each procedure or before leaving the area, monitor hands, shoes, and clothing for contamination in a low-background area.
- Do not eat, drink, smoke or apply cosmetics in any area where licensed material is stored or used.
- Do not store food, drink or personal effects in areas where licensed material is stored or used.
- Wear personnel monitoring devices, if required, at all times while in areas where licensed materials are used or stored.
- Dispose of radioactive waste only in designated, labeled and properly shielded receptacles.
- Never pipette by mouth.
- Store radioactive solutions in clearly labeled containers.
- Secure all licensed material when it is not under the constant surveillance and immediate control of the user(s).

GENERAL SAFETY PROCEDURES TO HANDLE SPILLS

The name and telephone number of the RSO or an alternate person(s) should be posted conspicuously in areas of use, so that it is readily available to workers in case of emergencies. Licensee should have emergency equipment readily available for handling spills. Spill kits should include the following:

- Disposable gloves
- Housekeeping gloves
- Disposable lab coats
- Disposable head coverings
- Disposable shoe covers
- Roll of absorbent paper with plastic backing
- Masking tape
- Plastic trash bags with twist ties
- "Radioactive Material" labeling tape
- Marking pen
- Pre-strung "Radioactive Material" labeling tags
- Box of Wipes
- Instructions for emergency procedures
- Clipboard with a copy of the Radioactive Spill Report Form for the facility
- Pencil
- Appropriate survey instruments including batteries (for survey meters).

MINOR SPILLS OF LIQUIDS AND SOLIDS

Instructions to Workers

- Notify persons in the area that a spill has occurred.
- Prevent the spread of contamination by covering the spill with absorbent paper. (Paper should be dampened if solids are spilled).
- Clean up the spill, wearing disposable gloves and using absorbent paper.
- Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
- Survey the area with an appropriate low-range radiation detector survey meter or other appropriate technique. Check the area around the spill for contamination. Also, check hands, clothing, and shoes for contamination.
- Report the incident to the Radiation Safety Officer (RSO) promptly.
- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).

Reminders to RSO

- Follow up on the decontamination activities and document the results.
- As appropriate, determine cause and corrective actions needed; consider bioassays if licensed material may have been ingested, inhaled, and/or absorbed through the skin.
- If necessary, notify MDH.

MAJOR SPILLS OF LIQUIDS AND SOLIDS

Instructions to Workers

- Clear the area. If appropriate, survey all persons not involved in the spill and vacate the room.
- Prevent the spread of contamination by covering the spill with absorbent paper (paper should be dampened if solids are spilled), but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all personnel who may be contaminated.
- Shield the source only if it can be done without further contamination or significant increase in radiation exposure.
- Close the room and lock or otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to enter that a spill of radioactive material has occurred.
- Notify the RSO immediately.
- Survey all personnel who could possibly have been contaminated. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with a mild soap.
- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).

Reminders to RSO

- Confirm decontamination of personnel. If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.

- Supervise decontamination activities and document the results. Documentation should include location of surveys and decontamination results.
- Determine cause and needed corrective actions; consider need for bioassays if licensed material may have been ingested, inhaled, and/or absorbed through the skin.
- If necessary, notify MDH.

INCIDENTS INVOLVING RADIOACTIVE DUSTS, MISTS, FUMES, ORGANIC VAPORS, AND GASES

Instructions to Workers

- Notify all personnel to vacate the room immediately.
- Shut down ventilation system, if appropriate, to prevent the spread of contamination throughout system and other parts of facility.
- Vacate the room. Seal the area, if possible.
- Notify the RSO immediately.
- Ensure that all access doors to the area are closed and posted with radiation warning signs, or post guards (trained) at all access doors to prevent accidental opening of the doors or entry to the area.
- Survey all persons who could have possibly been contaminated. Decontaminate as directed by the RSO.
- Promptly report suspected inhalations and ingestions of licensed material to the RSO.
- Decontaminate the area only when advised and/or supervised by the RSO.
- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision and collection of bioassay samples, requested documentation).

Reminders to RSO

- Supervise decontamination activities.
- Perform air sample surveys in the area before permitting resumption of work with licensed materials.
- Provide written directions to potentially contaminated individuals about providing and collecting urine, breath, blood, or fecal samples, etc.
- Consider need for medical exam and/or whole body count before permitting involved individuals to return to work with licensed material.
- Determine cause and corrective actions needed; consider need for bioassays if licensed material may have been ingested, inhaled, and/or absorbed through the skin. Document incident.
- If necessary, notify MDH.

MINOR FIRES

Instructions to Workers

- Immediately attempt to put out the fire by approved methods (i.e., fire extinguisher) if other fire hazards or radiation hazards are not present.
- Notify all persons present to vacate the area and have one individual immediately call the RSO and fire department (as instructed by RSO).
- Once the fire is out, isolate the area to prevent the spread of possible contamination.
- Survey all persons involved in combating the fire for possible contamination.
- Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water, then washing with a mild soap.

- In consultation with the RSO, determine a plan of decontamination and the types of protective devices and survey equipment that will be necessary to decontaminate the area.
- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).

Reminders to RSO

- Supervise decontamination activities.
- If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
- Consult with fire safety officials to assure that there are no other possibilities of another fire starting.
- Determine cause and needed corrective actions; consider need for bioassays if licensed material may have been ingested, inhaled, and/or absorbed through the skin. Document incident.
- If necessary, notify MDH.

FIRES, EXPLOSIONS, OR MAJOR EMERGENCIES

Instructions to Workers

- Notify all persons in the area to leave immediately.
- Notify the fire department.
- Notify the RSO and other facility safety personnel.
- Upon arrival of firefighters, inform them where radioactive materials are stored or where radioisotopes were being used; inform them of the present location of the licensed material and the best possible entrance route to the radiation area, as well as any precautions to avoid exposure or risk of creating radioactive contamination by use of high pressure water, etc.
- Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Allow no one to return to work in the area unless approved by the RSO.
- Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).

Reminders to RSO

- Coordinate activities with facility's industrial hygienist or environmental health & safety office, and with local fire department.
- Consult with the firefighting personnel and set up a controlled area where the firefighters can be surveyed for contamination of their protective clothing and equipment after the fire is extinguished.
- Once the fire is extinguished, do not allow the firefighters to enter the radiation area until a thorough evaluation and survey are performed to determine the extent of the damage to the licensed material use and storage areas.
- Perform thorough contamination surveys of the firefighters and their equipment before they leave the controlled area and decontaminate, if necessary.
- Supervise decontamination activities.
- Consider bioassays if licensed material may have been ingested, inhaled, and/or absorbed through the skin. Document incident.
- If necessary, notify MDH.

Copies of emergency procedures should be provided to all users. Post a current copy in each laboratory or other area where radioactive material is used.

APPENDIX I

RADIATION SAFETY SURVEY TOPICS

This Appendix provides applicants and licensees with additional information on surveys, including training requirements, survey frequency, contamination limits, and bioassays.

TRAINING

Before allowing an individual to perform surveys, the RSO will ensure that he or she has sufficient training and experience to perform surveys independently.

Academic training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- Principles and practices of radiation protection
- Radioactivity measurements, monitoring techniques, and instrument use
- Mathematics and basic calculations using and measuring radioactivity
- Biological effects of radiation
- Appropriate on-the-job-training consists of the following:
 - Observing authorized personnel using survey equipment, collecting samples, and analyzing samples
 - Using survey equipment, collecting samples, and analyzing samples under the supervision and in the physical presence of an individual authorized to perform surveys.

FACILITIES AND EQUIPMENT

To ensure achieving the required sensitivity of measurements, survey samples will be analyzed in a low-background area.

A gamma counter system with a single or multi-channel analyzer can be used to count samples containing gamma-emitters (e.g., Cesium-137, Cobalt-60).

A liquid scintillation or gas-flow proportional counting system can be used to count samples containing alpha-emitters, beta-emitters, and gamma-emitters (if efficiency is great enough to achieve the required sensitivity for measurements).

AMBIENT RADIATION LEVEL SURVEYS

Dose-rate surveys, at a minimum, should be performed in locations where workers are exposed to radiation levels that might result in radiation doses in excess of 10 percent of the occupational dose limits or where an individual is working in a dose rate of 0.025 mSv (2.5 mrem/hr) or more (50 mSv/year divided by 2,000 hr/year).

The total effective dose equivalent to an individual member of the public from the licensed operation should not exceed 1 mSv (0.1 rem) in a year. The dose in any unrestricted area from external sources should not exceed 0.02 mSv (2 mrem) in any one hour.

The frequency of ambient surveys depends on the quantity and use of radioactive materials, as well as the specific protective facilities, equipment, and procedures that are designed to protect the worker and members of the public from external exposure to radiation. While the regulations do not specify a specific survey frequency, the licensee is required to ensure that the dose rate limits are not exceeded.

CONTAMINATION SURVEYS

Licensees' contamination surveys should be sufficient to identify areas of contamination that might result in doses to workers or to the public. Combined removable and fixed contamination should be surveyed using appropriate radiation detection equipment. Removable contamination can be detected and measured through a wipe test of the surface, which is counted in an appropriate counting instrument, such as a liquid scintillation counter, a sodium iodide or germanium gamma counter, or a proportional alpha/beta counter.

Contamination surveys should be performed:

- To evaluate radioactive contamination that could be present on surfaces of floors, walls, laboratory furniture, and equipment.
- After any spill or contamination event.
- When procedures or processes have changed.
- To evaluate the potential contamination of users and the immediate work area, at the end of the day or prior to leaving the area of use, when licensed material is used.
- In unrestricted areas at frequencies consistent with the types and quantities of materials in use but generally not less frequently than quarterly.
- In areas adjacent to restricted areas and in all areas through which licensed materials are transferred and temporarily stored before shipment.

CONTAMINATION SURVEY FREQUENCY

Personnel should survey for contamination in locations where individuals are working with an unsealed form of radioactive material. These surveys should be done at a frequency appropriate to the types and quantities of radioactive materials in use. If the activity used is greater than or equal to the smallest annual limit on intake (ALI) (for either inhalation or ingestion) as identified in 4731.2750, then documented surveys should be performed at least daily.

The following table indicates the suggested contamination survey frequencies based on ALIs. The suggested frequency of surveys is based upon the amount of licensed material in use at any one time at any particular location. If licensed material it has not been used for a period greater than the required survey frequency, then it is considered not in use.

Suggested Contamination Survey Frequency			
	< 0.1 ALI	≥ 0.1 ALI < 1.0	≥ 1.0 ALI
In Use	Monthly	Weekly	Daily
Not in Use	Every 6 Months		

ALTERNATE SURVEY FREQUENCY

An example alternate survey frequency is described below. The objective is to determine how often to survey the laboratory. To do this, multiply the activity range for the appropriate group under LOW, MEDIUM, and HIGH survey frequency by the appropriate Modifying Factor to construct a new set of mCi ranges for LOW, MEDIUM, and HIGH survey frequency. For instance, if 30 millicuries of Iodine-131 is used in the hot laboratory, the survey frequency for the hot laboratory would be daily; since the group for Iodine-131 is Group 1, the survey frequency category for an activity of greater than 10 millicuries is high, and the modifying factor is 1.

Licensees should survey daily at the end of use to monitor the spread of contamination from radionuclides not listed in the following table.

Grouping of Radioisotopes for Alternate Survey Frequency						
Group 1	Co-60	Cs-134	Cs-137	Eu-152 (13 y)	Eu-154	I-125
	I-126	I-131	I-133	Ir-192	Sr-90	Tl-204
Group 2	Au-198	C-14	Co-57	Co-58	Cr-51	Dy-165
	Eu-152	Eu-155	F-18	Fe-59	Gd-153	Hg-197
	In-115m	Lu-177	Mo-99	Na-24	P-32	Pd-103
	Rh-105	S-35	Se-75	Sm-153	Sn-113	Sr-85
	Tc-99	Tl-201	Y-90	Yb-175		
Group 3	Cs-134 ^m	H-3	In-113 ^m	O-15	Rb-87	Rh-103 ^m
	Tc-99 ^m	Xe-133				

Classification of Laboratories for Alternate Survey Frequency			
Survey Frequency Category			
Group	Low	Medium	High
Group 1	<1 mCi	1 mCi to 10 mCi	>10 mCi
Group 2	<100 mCi	100 mCi to 1 Ci	>1 Ci
Group 3	<10 Ci	10 Ci to 100 Ci	>100 Ci

Survey Frequency:

- Low – Not less than once a month;
- Medium – Not less than once per week;
- High – Not less than once per normal working day.

Proportional fractions are to be used for more than one isotope.

Modifying Factors for Alternate Survey Frequency	
Modifying Factors	Factors
Simple storage	x 100
Very simple wet operations (e.g., preparation of aliquots of stock solutions)	x 10
Normal chemical operations (e.g., analysis, simple chemical preparations)	x 1
Complex wet operations (e.g., multiple operations, or operations with complex glass apparatus)	x 0.1
Simple dry operations (e.g., manipulation of powders) and work with volatile radioactive compounds	x 0.1
Exposure of non-occupational persons (including patients)	x 0.1
Dry and dusty operations (e.g., grinding)	x 0.01

CONTAMINATION IN UNRESTRICTED AREAS

Contamination found in unrestricted areas should be immediately decontaminated to background levels. When it is not possible to get to background levels, the licensee must ensure that the amounts do not exceed the contamination levels listed in the following table.

Acceptable Surface Contamination Levels for Equipment

Nuclide ^a	Average ^{b, c}	Maximum ^{b, d}	Removable ^{b, e}
I-125, I-129	1.7 Bq*/100 cm ² (100 dpm/100 cm ²)	5.0 Bq/100 cm ² (300 dpm/100 cm ²)	0.3 Bq/100 cm ² (20 dpm/100 cm ²)
I-126, I-131, I-133, Sr-90	16.7 Bq/100cm ² (1,000 dpm/100 cm ²)	50.0 Bq/100cm ² (3,000 dpm/100 cm ²)	3.3 Bq/100cm ² (200 dpm/100 cm ²)
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	83.3 Bq*/100 cm ² (5,000 dpm/100 cm ²)	250 Bq/100 cm ² (15,000 dpm /100 cm ²)	16.7 Bq/100 cm ² (1,000 dpm/100 cm ²)

^a Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

^b As used in this table, dpm (disintegration per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

^c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

^d The maximum contamination level applies to an area of not more than 100 cm².

^e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

When equipment or facilities that are potentially contaminated are to be released for unrestricted use, the table above provides the maximum acceptable residual levels for equipment. The following table provides screening values for building surface contamination. To the extent practical, it is appropriate to decontaminate to below these levels. Surface contamination surveys should be conducted for both removable and fixed contamination before equipment or facilities are released from restricted to unrestricted use, to ensure that they meet these limits.

A standardized method for smear testing of a relatively uniform area should be used to aid in comparing contamination at different times and places. A smear taken from an area of about 100 cm² is acceptable to indicate levels of removable contamination.

Screening Values for Building Surface Contamination¹

Radionuclide	Symbol	Screening levels for unrestricted release (dpm/100 cm ²)
Hydrogen-3 (Tritium)	H-3	1.2 x 10 ⁸
Carbon-14	C-14	3.7 x 10 ⁶
Sodium-22	Na-22	9.5 x 10 ³
Sulfur-35	S-35	1.3 x 10 ⁷
Chlorine-36	Cl-36	5.0 x 10 ⁵
Manganese-54	Mn-54	3.2 x 10 ⁴
Iron-55	Fe-55	4.5 x 10 ⁶
Cobalt-60	Co-60	7.1 x 10 ³
Nickel-63	Ni-63	1.8 x 10 ⁶
Strontium-90	Sr-90	8.7 x 10 ³
Technetium-99	Tc-99	1.3 x 10 ⁶
Iodine-129	I-129	3.5 x 10 ⁴
Cesium-137	Cs-137	2.8 x 10 ⁴
Iridium-192	Ir-192	7.4 x 10 ⁴

¹ Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1. For cases when the fraction of removable contamination is undetermined or higher than 0.1, users may assume, for screening purposes, that 100 percent of surface contamination is removable; and therefore the screening levels should be decreased by a factor of 10. Alternatively, users having site-specific data on the fraction of removable contamination (e.g., within 10% to 100% range) may calculate site-specific screening levels using DandD Version 1.

The table for Screening Values for Building Surface Contamination does not include screening values for radionuclides that emit alpha particles, or for soil contamination. The MDH staff is assessing current screening approaches for sites with alpha emitters and for soil contamination. For such sites, licensees are encouraged to use, in the interim period, site-specific dose assessment based on actual site physical and environmental conditions.

Units are disintegrations per minute per 100 square centimeters (dpm/100 cm²). 1 dpm is equivalent to 0.0167 Becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in 4731.2110. For radionuclides in a mixture, the sum of fractions rule applies.

SURVEY RECORD REQUIREMENTS

Each survey record should include the following:

- A diagram of the area surveyed
- A list of items and equipment surveyed
- Specific locations on the survey diagram where wipe test was taken
- Ambient radiation levels with appropriate units
- Contamination levels with appropriate units

- Make and model number of instruments used
- Background levels
- Name of the person making the evaluation and recording the results and date.

Licensees should record contamination levels observed and procedures followed for incidents involving contamination of individuals. The record should include names of individuals involved, description of work activities, calculated dose, probable causes (including root causes), steps taken to reduce future incidents of contamination, times and dates, and the surveyor's signature.

AIR MONITORING IN THE WORKPLACE

Air sampling can be used to do the following:

- Determine whether the confinement of radioactive materials is effective
- Measure airborne radioactive material concentrations in the workplace
- Estimate worker intakes of radioactive material
- Determine posting requirements
- Determine what protective equipment and measures are appropriate
- Warn of significantly elevated levels of airborne radioactive materials.
- If bioassay measurements are used to determine worker doses, air sampling may be used to determine time of intake and to determine which workers should have bioassay measurements. The use of engineering controls and a good air sampling program may eliminate need for bioassays.

AIRBORNE EFFLUENT RELEASE MONITORING

When practicable, airborne radioactive effluents should be released from monitored release points (e.g., monitored stacks, discharges, vents) to provide accurate measurements to estimate public exposure. Licensees should verify the performance of effluent monitoring systems by regular calibration (at least annually) to ensure their reliability.

For release points where monitoring is not practical, the licensee should estimate the magnitude of the unmonitored effluents. These unmonitored releases will occur anytime unsealed material is handled outside a fume hood or other device that will control the releases. The licensee should include these estimates when demonstrating compliance with dose limits and ALARA goals. Unmonitored releases may be estimated based on the quantity of material used in these areas or the number of procedures performed or other appropriate methods. The unmonitored effluents should not exceed 30 percent of the total estimated effluent releases or ten percent of the permissible air effluent concentrations found on column 1 of Table 2 in 4731.2750, whichever is greater.

BIOASSAY MONITORING

Frequency of Required Bioassay Measurements

Determining the appropriate frequency of routine bioassay measurements depends upon the exposure potential, the physical and chemical characteristics of the radioactive material, and the route of entry to the body. Consider the following elements:

- Potential exposure of the individual
- Retention and excretion characteristics of the radionuclides
- Sensitivity of the measurement technique
- Acceptable uncertainty in the estimate of intake and committed dose equivalent.

Bioassay measurements used for demonstrating compliance with the occupational dose limits should be conducted often enough to identify and quantify potential exposures and resultant intakes that, during any year, are likely to collectively exceed 0.1 times the ALI. The ten percent ALI criterion is consistent with 4731.2210, which requires licensees to monitor intakes and assess occupational doses for exposed individuals who are likely to exceed ten percent of the applicable limit (i.e., intakes likely to exceed 0.1 ALI for adults).

Separate categories of bioassay measurements, routine measurements and special measurements further determine the frequency and scope of measurements.

Routine Measurements

Routine measurements include baseline measurements, periodic measurements, and termination measurements. These measurements should be conducted to confirm that appropriate controls exist and to assess dose. The method of bioassay selected (for example, whole body counting, urinalysis, etc) and the samples collected will vary according to the radionuclide and the compound to which it is attached. Sample collection procedures should be developed to ensure that appropriate types, sizes, and numbers of samples are collected that will provide appropriate physiological information for the dose assessment. An individual's baseline measurement of radioactive material within the body should be conducted before beginning work that involves exposure to radiation or radioactive materials for which monitoring is required.

In addition to the baseline measurements, periodic bioassay measurements should be performed. The frequency of periodic measurements should be based on the likelihood of significant exposure of the individual. In determining the worker's likely exposure, consider such information as the worker's access, work practices, measured levels of airborne radioactive material, and exposure time. Periodic measurements should be made when the cumulative exposure to airborne radioactivity is > 0.02 ALI (40 DAC hours). Noble gases and airborne particulates with a radioactive half-life of less than 2 hours should be excluded from the evaluation, since external exposure generally controls these radionuclides.

At a minimum, periodic measurements should be conducted annually. Periodic measurements provide additional information on any long-term accumulation and retention of radioactive material in the body, especially for exposures to concentrations of airborne radioactive material below monitoring thresholds. When an individual is no longer subject to the bioassay program, because of change in employment status, a termination bioassay measurement should be made.

Special Monitoring

Because of uncertainty in the time of intakes and the absence of other data related to the exposure (e.g., physical and chemical forms, exposure duration), correlating positive results to actual intakes for routine measurements can sometimes be difficult. Abnormal and inadvertent intakes from situations such as a failed respiratory protective device, inadequate engineering controls, inadvertent ingestion, contamination of a wound, or skin absorption, should be evaluated on a case-by-case basis. When determining whether potential intakes should be evaluated, consider the following circumstances:

- The presence of unusually high levels of facial and/or nasal contamination
- Entry into airborne radioactivity areas without appropriate exposure controls
- Operational events with a reasonable likelihood that a worker was exposed to unknown quantities of airborne radioactive material (e.g., loss of system or container integrity)
- Known or suspected incidents of a worker ingesting radioactive material
- Incidents that result in contamination of wounds or other skin absorption
- Evidence of damage to or failure of a respiratory protective device

APPENDIX J

LEAK TESTING SEALED SOURCES

You may use the following model procedure to leak test sealed sources. If you, or the contractor, follow the model procedure, you may state on your application, "We will establish and implement the model procedure for leak testing sealed sources published in Appendix J to the MDH Regulatory Guide for Research and Development, Laboratory and Industrial Use of Small Quantities of Radioactive Material."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of Minnesota Rules. Say on your application, "We have developed a leak test procedure for your review that is appended as Appendix J" and submit your leak test procedure.

MODEL PROCEDURE FOR TAKING TEST SAMPLES

1. Make a list of all sources to be tested. This should include at least the isotope, the activity on a specified date, and the physical form.
2. If you will be testing sources stronger than a few millicuries, set out a survey meter, preferably with a speaker, so you can monitor your exposure rate.
3. Prepare a separate wipe sample for each source. A cotton swab, injection prep pad, filter paper, or tissue paper is suitable. Number each wipe so you will know for which source it is to be used. Samples should be taken as follows:
 - a. For small sealed sources, it may be easier to wipe the entire accessible surface area. Pay particular attention to seams and joints. However, do not wipe the port of beta applicators.
 - b. For larger sealed sources and devices (survey meter calibrator), take the wipe near the radiation port and on the activating mechanism.
 - c. If you are testing radium sources, they should also be checked for radon leakage. Submerging the source in a vial of fine-grained charcoal or cotton for a day can do this. Then remove the source and analyze the absorbent sample as described below. A survey should be done to be sure that sources are adequately shielded during the leak test period.

MODEL PROCEDURE FOR ANALYZING TEST SAMPLES

The samples will be analyzed as follows:

1. Select an instrument that is sufficiently sensitive. For beta sources, a proportional flow counter, liquid scintillation counter, or thin-end-window GM survey meter may be appropriate. For gamma sources, a GM instrument or a scintillation detector with a ratemeter or scaler may be appropriate. Dose calibrators used in nuclear medicine are not sufficiently sensitive.
2. To estimate the detection efficiency of the analyzer used to assay the wipe samples, assay a certified check source that has the same isotope as the sealed source. If one is not available, it will be necessary to use a certified check source with a different isotope that has a similar spectrum. If calculations demonstrate that the instrument is not sufficiently sensitive to detect 0.005 microcuries for beta or gamma emitters or 0.001 microcuries for alpha emitters, a different instrument must be used.

3. Assay the wipe sample. It must be in the same geometry relative to the detector as was the certified check source.
4. Record the wipe sample in counts per minute. Then calculate and record the estimated activity in microcuries on the wipe sample.
5. Continue the same analysis procedure for all wipe samples.
6. If the wipe sample activity is 0.005 microcurie or greater, notify the RSO. The source must be withdrawn from use to be repaired or disposed of in accordance with MDH rules.
7. Record model number and serial number (if assigned) of each source tested, radionuclide and estimated activity, measured activity of each test sample in microcuries, description of method used to test each sample, date of test, and signature of RSO. Maintain these records for five (5) years.

Attachment M

MNOSHA Enforcement Procedure

For

Occupational Exposure to Formaldehyde

OSHA[®] FactSheet

Formaldehyde

Formaldehyde is a colorless, strong-smelling gas often found in aqueous (water-based) solutions. Commonly used as a preservative in medical laboratories and mortuaries, formaldehyde is also found in many products such as chemicals, particle board, household products, glues, permanent press fabrics, paper product coatings, fiberboard, and plywood. It is also widely used as an industrial fungicide, germicide and disinfectant.

Although the term formaldehyde describes various mixtures of formaldehyde, water, and alcohol, the term “formalin” is used to describe a saturated solution of formaldehyde dissolved in water, typically with another agent, most commonly methanol, added to stabilize the solution. Formalin is typically 37% formaldehyde by weight (40% by volume) and 6-13% methanol by volume in water. The formaldehyde component provides the disinfectant effects of formalin.

What Employers Should Know

The OSHA Formaldehyde standard (29 CFR 1910.1048) and equivalent regulations in states with OSHA-approved state plans protect workers exposed to formaldehyde and apply to all occupational exposures to formaldehyde from formaldehyde gas, its solutions, and materials that release formaldehyde.

- The permissible exposure limit (PEL) for formaldehyde in the workplace is 0.75 parts formaldehyde per million parts of air (0.75 ppm) measured as an 8-hour time-weighted average (TWA).
- The standard includes a second PEL in the form of a short-term exposure limit (STEL) of 2 ppm which is the maximum exposure allowed during a 15-minute period.
- The action level – which is the standard’s trigger for increased industrial hygiene monitoring and initiation of worker medical surveillance – is 0.5 ppm when calculated as an 8-hour TWA.

Harmful Effects on Workers

Formaldehyde is a sensitizing agent that can cause an immune system response upon initial exposure. It is also a cancer hazard. Acute

exposure is highly irritating to the eyes, nose, and throat and can make anyone exposed cough and wheeze. Subsequent exposure may cause severe allergic reactions of the skin, eyes and respiratory tract. Ingestion of formaldehyde can be fatal, and long-term exposure to low levels in the air or on the skin can cause asthma-like respiratory problems and skin irritation such as dermatitis and itching. Concentrations of 100 ppm are immediately dangerous to life and health (IDLH).

Note: The National Institute for Occupational Safety and Health (NIOSH) considers 20 ppm of formaldehyde to be IDLH.

Routes of Exposure

Workers can inhale formaldehyde as a gas or vapor or absorb it through the skin as a liquid. They can be exposed during the treatment of textiles and the production of resins. In addition to healthcare professionals and medical lab technicians, groups at potentially high risk include mortuary workers as well as teachers and students who handle biological specimens preserved with formaldehyde or formalin.

How Employers Can Protect Workers

Airborne concentrations of formaldehyde above 0.1 ppm can cause irritation of the respiratory tract. The severity of irritation intensifies as concentrations increase.

Provisions of the OSHA standard require employers to do the following:

- Identify all workers who may be exposed to formaldehyde at or above the action level or STEL through initial monitoring and determine their exposure.

- Reassign workers who suffer significant adverse effects from formaldehyde exposure to jobs with significantly less or no exposure until their condition improves. Reassignment may continue for up to 6 months until the worker is determined to be able to return to the original job or to be unable to return to work – whichever comes first.
- Implement feasible engineering and work practice controls to reduce and maintain worker exposure to formaldehyde at or below the 8-hour TWA and the STEL. If these controls cannot reduce exposure to or below the PELs, employers must provide workers with respirators.
- Label all mixtures or solutions composed of greater than 0.1 percent formaldehyde and materials capable of releasing formaldehyde into the air at concentrations reaching or exceeding 0.1 ppm. For all materials capable of releasing formaldehyde at levels above 0.5 ppm during normal use, the label must contain the words “potential cancer hazard.”
- Train all workers exposed to formaldehyde concentrations of 0.1 ppm or greater at the time of initial job assignment and whenever a new exposure to formaldehyde is introduced into the work area. Repeat training annually.
- Select, provide and maintain appropriate personal protective equipment (PPE). Ensure that workers use PPE such as impervious clothing,

gloves, aprons, and chemical splash goggles to prevent skin and eye contact with formaldehyde.

- Provide showers and eyewash stations if splashing is likely.
- Provide medical surveillance for all workers exposed to formaldehyde at concentrations at or above the action level or exceeding the STEL, for those who develop signs and symptoms of overexposure, and for all workers exposed to formaldehyde in emergencies.

Recordkeeping Requirements

Employers are required to do the following regarding worker exposure records:

- Retain exposure records for 30 years.
- Retain medical records for 30 years after employment ends.
- Allow access to medical and exposure records to current and former workers or their designated representatives upon request.

Additional Information

For more information on this, and other health-related issues affecting workers, visit OSHA’s web site at www.osha.gov.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; the teletypewriter (TTY) number is (877) 889-5627.

For assistance, contact us. We can help. It’s confidential.



Attachment N

Formaldehyde

(OSHA Quick Facts)

SUBJECT: Enforcement Procedure for Occupational Exposure to Formaldehyde.

Purpose: This instruction provides uniform inspection procedures and guidelines to be followed when conducting inspections and issuing citations for workers potentially exposed to formaldehyde.

Scope: This instruction applies OSHA-wide.

References:

1. Field Compliance Manual (FCM).
2. Federal OSHA Online Chemical Sampling Information
http://www.osha.gov/dts/chemicalsampling/data/CH_242600.html last revised 10/4/2012
3. Federal OSHA Instruction TED 01-00-015A dated February 11, 2014, "OSHA Technical Manual." http://www.osha.gov/dts/osta/otm/otm_toc.html
4. Federal OSHA Instruction CPL 02-02-052 (formerly known as CPL 2-2.52) dated November 20, 1990: "Enforcement Procedure for Occupational Exposure to Formaldehyde".
5. Federal OSHA fact sheet "Formaldehyde" dated April 2011.

Cancellation: This instruction supersedes CPL 2-2.52, "Enforcement Procedures for Occupational Exposure to Formaldehyde", dated August 3, 2010.

Background: Following the publication of the final rule, the standard was challenged in the U.S. Court of appeals by both industry and labor. It was the court's belief that the standard was not set low enough to eliminate risk from employees. In response to the court an amendment to the final rule was issued by OSHA which reduced the permissible exposure limit to 0.75 parts formaldehyde per million parts of air (0.75 ppm) for the 8 hour TWA.

On November 22, 2006 federal OSHA published Assigned Protection Factors for respiratory protection in completion of the revisions to 1910.134. Included in the APF amendment were changes to the respiratory protection paragraphs of several substance-specific standards, such as 1910.1048(g).

Action:

A. **Occupational Exposure to Formaldehyde:**

Formaldehyde Uses. Formaldehyde is a reactive chemical with many uses.

1. The major consumers of formaldehyde are the manufacturers of compressed wood products. Formaldehyde is consumed in resins that are used as glues in the production of particle board, plywood, and fiberboard. These wood products in turn are used in the construction, furniture, and mobile home manufacturing industries.
2. The plastics industry is the second largest user of formaldehyde-based resins. Molding compounds containing melamine, phenolic, or acetyl resins are capable of releasing formaldehyde when subjected to heat and/or pressure in the molding process. The final product, however, contains little free formaldehyde and has little potential for depolymerization, so that potential exposure to formaldehyde from use of the plastic product is minimal. Typical of plastics made from formaldehyde-based resins are lawn

and garden equipment, plumbing fixtures, melamine tableware, and electrical insulation parts.

3. Formaldehyde-releasing resins are used to add wrinkle-free and durable press characteristics to synthetic and natural-fiber textiles. These resins leave residual formaldehyde in the product which can result in exposure to formaldehyde in the apparel industry. A dimethyloldihydroxyethyleneurea (DMDHEU)-based resin system is most commonly used.
4. Formaldehyde-bearing resins are used in the coating industry primarily as modifiers in alkyd and acrylic coating systems. Urea-formaldehyde resins are used in clear coating for wood furniture, primer coats for automobiles, baked enamels for appliances, and can coatings. Melamine-formaldehyde resins are generally used where outdoor exposure or contact with detergents require improved chemical resistance. Melamine-formaldehyde resins also have some application where corrosion resistance is important.
5. Paper products may be treated with formaldehyde derivatives (e.g., melamine- or urea-formaldehyde) to add a desired finish or wet-strength quality. Melamine resins can be inactivated by a high sulfate concentration, and this problem is overcome by addition of excess formaldehyde.
6. Formaldehyde is an important constituent of embalming and preserving fluids because it performs two essential functions--disinfection and preservation. In mortuaries, embalming fluids may be injected in concentrated form to preserve the organs in the visceral and thoracic cavities. Arterial fluids are prepared by diluting the concentrate and are injected into the arterial system through a hose. Formaldehyde's properties as a tissue preservative also account for its use in anatomy, histology, and pathology laboratories. Although the term formaldehyde describes various mixtures of formaldehyde, water, and alcohol, the term "formalin" is used to describe a saturated solution of formaldehyde dissolved in water, typically with another agent, most commonly methanol, added to stabilize the solution. Formalin is typically 37% formaldehyde by weight (40% by volume) and 6-13% methanol by volume in water.
7. Formaldehyde-based chemicals are used in textile waterproofing, as accelerators in the production of rubber products, and in photographic developing. Foundries use formaldehyde-based resins in molds in the production of ferrous and non-ferrous goods.
8. Formaldehyde is used in the production of industrial chemicals including pentaerythritol, 1,4-butanediol, and trimethyl-*o*-propane.
9. Some detergents, fertilizers, explosives and abrasive products are also manufactured with formaldehyde. Because formaldehyde is an effective bactericide, it is contained in cosmetic products, shampoos, and hair sprays. It is used in the manufacture of some pharmaceutical products and germicides, and it is used to clean dialysis equipment.

B. Formaldehyde Exposure:

1. Formaldehyde exposure can occur in three ways:
 - a. Exposure to liquid or solid formaldehyde (paraformaldehyde) and the accompanying vapors (inhalation and skin absorption);
 - b. Exposure to formaldehyde during primary processing of formaldehyde resins and other chemicals manufactured from formaldehyde; and
 - c. Exposure to formaldehyde released from products that contain formaldehyde-based resins.

2. Occupational exposures to formaldehyde can occur during heat and/or pressure processing of products made from or including formaldehyde bearing resins. Examples of such exposures include the pressing of wood products, extrusion or injection molding of plastics, heat-setting of pleats on apparel, and casting of molds in foundry processes. In addition, healthcare professionals, medical lab technicians, mortuary workers as well as teachers who handle biological specimens preserved with formaldehyde or formalin are at high risk of exposure.
3. Occupational exposures to formaldehyde occur when a finished product contains residual formaldehyde or when hydrolysis--that is, the chemical break-down of formaldehyde-containing materials to produce formaldehyde gas prompted by warm and humid work environments--occurs. The EPA has described this phenomenon as "pseudoconsumptive use" of formaldehyde; i.e., chemical identity is changed but not irreversibly. Examples of "Pseudoconsumptive" uses are:
 - a. urea-formaldehyde resins in fiberboard, particleboard, plywood, laminates, urea-formaldehyde foams and insulation products, molding compounds, and protective coatings;
 - b. urea-formaldehyde concentrates used to produce time-release fertilizers; and
 - c. hexamethylenetetramine.

C. Operations:

Specific operations that cause employee exposure to formaldehyde include:

1. Formaldehyde transfer operations,
2. Reactor or vessel cleaning,
3. Fugitive emissions in chemical plants,
4. Exposure to articles that have been treated with formaldehyde based resins before curing,
5. Exposure to articles containing cured resins during transit from curing operations to storage or further processing,
6. Exposure to stored articles containing cured resins, and
7. The application of formaldehyde-based resins.

NOTE: Short-term exposures occur during batch operations such as mixing and during periodic cleaning and maintenance activities. Concentrated formaldehyde solutions (37% or greater) are often diluted for sale or use by chemical distributors or end-users, such as hospitals. In addition, short-term exposures occur in mortuaries and laboratories (anatomy, histology, pathology, environmental testing, and school biology).

D. Health Effects:

Based on the best available evidence in the agency's record on formaldehyde, Federal OSHA determined that formaldehyde is genotoxic, showing properties of both a cancer initiator and promoter. When inhaled, formaldehyde is a carcinogen in rats. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.

1. Formaldehyde is highly irritating to the upper respiratory tract and eyes. Concentrations as low as 0.1 to 2 ppm may irritate the eyes, nose, and throat of some individuals. Formaldehyde has an odor threshold of less than 1 ppm. Concentrations of 3 to 5 ppm cause tearing of the eyes, and the severity of the effects becomes intolerable to some persons. Concentrations of 10 to 20 ppm cause difficulty in breathing, burning of the nose and throat, coughing, and heavy tearing of the eyes. Concentrations over 25 ppm can cause severe respiratory tract injury that can lead to pulmonary edema and pneumonitis. OSHA considers a concentration of 100 ppm as immediately dangerous to life or health (IDLH) for formaldehyde. NIOSH considers 20 ppm to be IDLH.
2. Some persons have developed asthma or bronchitis following exposure to formaldehyde; usually a single exposure to high concentrations of formaldehyde as the result of an accidental spill appeared responsible for the onset of symptoms.
3. Formalin (37% formaldehyde) is a skin irritant and sensitizer. Formalin solutions splashed in the eye have resulted in blindness. Less concentrated solutions can also injure the eyes and skin. The severity of the effect depends on the concentration of formaldehyde in solution and whether the affected tissue is flushed with water immediately after the accidental splash. Contact with formalin causes a white discoloration, pain, drying, cracking, and scaling of the skin. Prolonged and repeated contact can cause numbness and a hardening or "tanning" of the skin.
4. Previously exposed persons may react to exposure with an allergic eczematous dermatitis or hives. Employees in industries where there is direct skin contact with formaldehyde-releasing resins (e.g., textiles) tend to have a higher than normal incidence of dermatitis. When patch tested, these persons sometimes show sensitization to formaldehyde.

E. **Clarifications of the Formaldehyde Standard (29 CFR 1910.1048):**

1. Paragraph (a) Scope and Application.
 - a. Formaldehyde refers solely to the chemical defined by Chemical Abstracts Services Registry Number 50-00-0. This chemical is formaldehyde gas which, per se, is not available commercially. Most exposures are to formaldehyde gas which is emitted at various concentrations from numerous products made from formaldehyde-bearing resins. Various mixtures of formaldehyde, water, and alcohol (sometimes referred to as "formalin") are also included in CAS #50-00-0. Paraformaldehyde, a solid polymeric form of formaldehyde, also serves as a source of formaldehyde gas.
 - b. The formaldehyde standard applies to all occupational exposures to formaldehyde. This includes general industry, and by cross-reference, maritime and construction. The scope of the formaldehyde standard is not affected in most cases by the laboratory standard. The laboratory standard, 29 CFR 1910.1450, specifically does not apply to formaldehyde use in histology, pathology, and human or animal anatomy laboratories; however, if formaldehyde is used in other types of laboratories which are covered by the laboratory standard the employer needs to comply with 29 CFR 1910.1450.
2. Paragraph (c) Permissible Exposure Limit.

The 8 hour TWA permissible exposure limit is 0.75 parts formaldehyde per million parts of air (0.75 ppm).

Where there are measurable concentrations of other regulated contaminants which affect the same body systems as formaldehyde, citations should be issued per MNOSHA STD 1-4.1 "Citation Guidelines for Air Contaminant Overexposure", paragraph (B)(2). This instruction references paragraph 29 CFR 1910.1000(d) of the Air Contaminants standard for use in cases where there are potential additive and synergistic effects. The Air Contaminants standard, 29 CFR 1910.1000(d), contains a formula which has the effect of proportionally reducing the PEL of each regulated toxic element of the multiple exposures. Paragraph (d) requires employers to meet these adjusted PELs where there is an exposure to a mixture of air contaminants regulated by Subpart Z. The body system primarily affected by formaldehyde is the respiratory system (upper and lower). The immune system may also be affected. (Formaldehyde is a sensitizer which provokes an IgE (immunoglobulin) mediated response.) The OSHA Technical Manual contains guidance for calculating the adjusted PELs and SAEs (sampling and analytical errors). The adjusted PEL should apply only to enforcement of paragraphs (c) Permissible Exposure Limit and (f) Methods of compliance. The STEL and AL should not be adjusted for mixtures for compliance evaluations.

3. Paragraph (d), Exposure Monitoring.

Paragraph (d) of the formaldehyde standard requires employers to determine their employees' exposure to formaldehyde if any mixture or solution present in the workplace contains 0.1 percent or more of formaldehyde, or if materials capable of releasing formaldehyde into the workplace air result in employees being exposed to formaldehyde at concentrations reaching or exceeding 0.1 ppm. The OSHI should verify the employee exposure via bulk or air samples.

- a. **Objective Data.** The exposure determination must consist of actual measurements unless the employer can produce objective data to document that no employee will be exposed to formaldehyde at concentrations exceeding the 0.5 ppm (TWA) action level (AL), or the 2 ppm STEL under foreseeable conditions of use. Industry-wide studies or generic exposure estimates may be a source of objective data; however, the use of such data must accurately characterize actual employee exposures. For exposures less than the AL or STEL, area samples may also be used as the basis for exposure determinations, if they represent those exposures.
- b. **Medical Complaints.** Regardless of employee exposure level, if there are employee health complaints, the employer is required to take action to determine employee exposure.
- c. **Exception.** If mixtures or solutions composed of 0.1 percent or less of formaldehyde are used, employee exposure is below 0.1 ppm, and there are no employee health complaints then an employer should not be cited for not monitoring. (See 29 CFR 1910.1048(d)(1)(ii) (A).)
- d. **Repeat Monitoring.** If there is a change in production, equipment, process, personnel, or control measures, which may result in a new or additional exposure to formaldehyde, the initial monitoring shall be repeated. For example, apparel manufacturers and other producers/users of formaldehyde resin finished fabrics may need to repeat initial determinations with different fabric lots.
- e. **Sampling Methods.** As long as the method selected for sampling and analysis meets the criteria for precision and accuracy set out in the formaldehyde standard, the employer is free to choose from many methods available for monitoring exposure to formaldehyde.

Among the methods available are the chromotropic acid method which relies on use of a midjet impinger, gas chromatographic methods which collect formaldehyde in a specially prepared tube, passive diffusion badges, and handheld monitors.

4. Paragraph (e), Regulated Areas

Regulated areas must be established where exposure to formaldehyde exceeds either the TWA or the STEL. Signs must be posted at all entrances to this area and only people trained to recognize the hazards of formaldehyde may enter this area. On multi-employer worksites the location of any regulated area must be communicated to the other employers on the site.

5. Paragraph (f), Methods of Compliance

Engineering and work practice controls shall be used to reduce employee exposure below the TWA or STEL. If the feasible engineering controls are not adequate to reduce the employee exposure below the TWA or STEL, they must still be implemented to reduce employee exposure to the extent possible. If, after implementing feasible engineering controls the exposure still exceeds the TWA or STEL, the employees shall be provided with appropriate respiratory protection.

6. Paragraph (g), Respiratory Protection

The employer shall provide appropriate respiratory protection as described in Table 1 of 29 CFR 1910.134(d)(3)(i)(A) when employee exposure exceeds the TWA or STEL and in emergency situations. The employer must comply with all elements of 1910.134 except paragraph (e) medical surveillance, because this is addressed in 1910.1048 (l).

If an employer provides an air purifying respirator with canisters or cartridges, the canisters or cartridges must be changed:

- 1) in accordance with its end of service life indicator (ESLI), or
- 2) if no ESLI, according to the employer's change out schedule as described in 1910.134 (d)(3)(iii), or at least daily, as described in 1910.1048 (g)(2)(ii).

7. Paragraph (h), Protective Equipment and Clothing.

This section addresses the selection and maintenance of protective equipment and clothing, including aprons, goggles, face shields, and suits. The OSHI should evaluate potential formaldehyde hazards and use professional judgment in enforcing the general requirements of 29 CFR 1910.132 and 29 CFR 1910.133, which are incorporated into the formaldehyde standard by reference. Violations of these general requirements should be cited under 29 CFR 1910.1048(h). Some PPE requirements are specified by the formaldehyde standard, and violations of these requirements should be cited under 29 CFR 1910.1048(h)(1).

- a. Solutions containing greater than 1-percent formaldehyde are damaging to the skin and severely damaging to the eyes. Consequently, protective equipment adequate to prevent contact with such solutions must be provided to employees, and the equipment must be kept in good repair and free of formaldehyde contamination.
- b. Some solids that release formaldehyde and solutions that contain less than 1-percent formaldehyde can also pose a hazard to employees. Paragraph (h)(1)(iii) requires the employer to provide protective clothing or equipment, as needed, in accordance with the general standards for protective equipment and clothing (29

CFR 1910.132 and 29 CFR 1910.133) to prevent contact with irritating or sensitizing materials.

- c. Formaldehyde gas poses little hazard from dermal contact, although there are a few reports in the literature that indicate sensitization from high airborne concentrations. At the IDLH concentration, the standard requires whole body protection, essentially equivalent to Level A protection, to prevent potential sensitization.
- d. Butyl and nitrile glove materials provide the greatest permeation protection. Greater thicknesses of other materials (natural rubber, PVC, polyethylene) may be suitable for shorter immersion periods, but gloves may have to be changed more frequently due to degradation. All these materials are generally suitable for splash protection. Appendix B to this instruction summarizes the permeation data available for formaldehyde. Barrier creams are not regarded as effective protection for formaldehyde, since there is no data demonstrating their efficacy.

8. Paragraph (i), Hygiene Protection.

- a. Emergency Showers. Because of the severe dermal effects that can occur when employees have skin contact with concentrated solutions of formaldehyde and because of the relative irreversibility of dermal sensitization to formaldehyde, the employer is required to provide conveniently located quick drench showers for employees who become splashed with solutions of 1 percent or greater formaldehyde as the result of equipment failure, improper work practices, or other emergencies. Whether or not the employee is wearing protective clothing does not affect the need for quick drench showers since the employee must be able to remove PPE splashed with formaldehyde in a safe manner. The availability of emergency showers should also help to lower any potentially serious inhalation hazard when an employee has been splashed with a formaldehyde solution.
- b. Eye Wash Facilities. Liquid formaldehyde can also cause severe damage to the eyes. Thus, the standard requires employers to provide appropriate eye wash facilities within the immediate work area for emergency use by any employee whose eyes are splashed with solutions containing 0.1 percent or more of formaldehyde.
- c. The degree of sophistication of the emergency shower and/or eyewash station varies with the size of the potential splash. The use of portable units or hand-held fixtures should be carefully evaluated. Such use should be limited to small spills (generally less than 8 oz.), provided that all possible affected body parts can be flushed continuously for 15 minutes. (For this reason, bottle-type eyewashes are not acceptable.)

9. Paragraph (k), Emergencies.

Paragraph (k) ensures that the employer will prepare for any situation where equipment failure, spill or rupture of containers, or failure of control equipment would result in an uncontrolled release of formaldehyde that could result in injury or loss of life. If such circumstances could occur in an accident, the employer must establish procedures for evacuation and access to emergency medical care, obtain needed equipment for evacuation and reentry into the area, and establish procedures for equipment repair, spill cleanup, decontamination, and waste disposal. Paragraph (k) violations should be grouped with any applicable violations under 29 CFR 1910.120. The threshold quantity

for formaldehyde for evaluation of catastrophic potential under 29 CFR 1910.119 Process Safety Management is 1000 lbs. (See OSHA Instruction CPL 2-2.45.)

- a. There is not a specific exposure level that triggers the emergency provisions. When determining if there is a need to provide for emergencies, the employer should consider whether employees' lives or health could be jeopardized in the worst reasonably predictable accident (i.e., the worst outcome of any possible scenario) unless employees are promptly evacuated from the area.
- b. A 30-minute exposure to 100 ppm is potentially fatal, and pulmonary edema has been seen after exposures of 50 ppm. These levels can be generated by relatively small spills (a pint or less), even in ventilated areas.

10. Paragraph (l), Medical Surveillance.

- a. The provisions of paragraph (l) establish an approach to medical surveillance based on an employee's exposure potential.
 1. All employees who are exposed to formaldehyde at concentrations at or above the AL or exceeding the STEL must fill out a medical disease questionnaire, such as the optional form contained in Appendix D to the formaldehyde standard, on an annual basis. (Note: The employer is required to administer the questionnaire, a process which is required to be under the supervision of a licensed physician, and involves assisting the employee as necessary to complete the questionnaire.) These persons must then be offered a physical examination and a pulmonary function test.
 2. All employees who are exposed to formaldehyde at concentrations between the action level and the 0.75 ppm TWA limit (but not over the STEL) must be given the opportunity to participate in a medical surveillance program on an annual basis by filling out a medical disease questionnaire. If an employee exposed between the action level and the 0.75 ppm TWA limit is showing signs and symptoms that may be formaldehyde-related, the employer must administer to the employee a medical disease questionnaire without delay. If the physician determines, on the basis of the medical disease questionnaire, that it is necessary to examine the employee, the employee would then be sent to the physician for further examination.
 3. If exposures are less than 0.5 ppm but the employee is showing signs and symptoms that may be formaldehyde-related, the employee must be evaluated via a medical disease questionnaire, and further surveillance would be conducted on the basis of the physician's determination, as it is for concentrations between 0.5 and 0.75 ppm.
- b. Paragraph (l)(3)(ii) requires the physician to make a determination, based on evaluation of the medical disease questionnaire, as to whether additional medical surveillance specified in paragraph (l)(4); i.e., a medical examination, is necessary to ensure the employee is not being placed at increased risk of material impairment of health from exposure to formaldehyde. In some cases, the physician will require additional information from the medical examinations before a final written opinion can be given. When the physician does not require additional information to reach a determination about the employee's health, the determination made in paragraph (l)(3)(ii) must be provided to the employer in

writing, and a copy given to the employee within 15 days of its receipt by the employer.

- c. Emergencies pose a very different situation from routine surveillance. If the employer has determined that an emergency situation could occur, then there must be a prior arrangement with a physician or hospital to ensure that any employee acutely exposed to formaldehyde in an emergency receives proper medical intervention, as required by paragraph (k). The emergency plan must also specify what information should be given to emergency care providers, per the requirements of paragraph (l)(6), and how it is to be transmitted.

11. Paragraph (m), Hazard Communication.

Paragraph (m) references the Hazard Communication standard which will not be enforced in its entirety in Minnesota until June 1, 2016. Most other subparagraphs may be cited as described below.

- a. (m)(1)(i) – cite ERTK until May 31, 2016, and 1910.1200 thereafter
- b. (m)(1)(ii) – cite ERTK until May 31, 2016, and this paragraph thereafter
- c. (m)(1)(iii) – cite ERTK until May 31, 2016, and 1910.1200 thereafter
- d. (m)(1)(iv) – informational, do not cite
- e. (m)(1)(v) – informational, do not cite
- f. (m)(2)(i) – cite if labels do not comply with 1910.1200(d), or do not contain the hazard statement: “May Cause Cancer”
- g. (m)(2)(ii) – cite if there are label deficiencies

12. Paragraph (n), Employee Information and Training.

- a. All employees exposed to formaldehyde at concentrations at or above 0.1 ppm or to solutions containing greater than 0.1 percent or more of formaldehyde must receive initial training upon hire.
- b. All employees exposed at or above the action level or the STEL must be trained annually.
- c. Appendix A to the formaldehyde standard provides general information which is appropriate for a training program. This outline would need to be supplemented by plant specific information.

F. Inspection Procedures:

The following procedures shall be followed in addition to the guidance in the FCM, and MOOSE

- 1. Authorization to Review Limited Medical Information. Appropriately qualified compliance personnel are authorized to review medical disease questionnaires and medical opinions mandated by the formaldehyde standard when the appropriate limitations and procedures are followed. See FCM, Ch. 1 for further discussion on obtaining permission to view medical information.
- 2. In MOOSE Inspection tab, fill in item 42 as follows: Type: N; ID: 16; Value: Form.

Appendix A: Triggering Events

Distribution: OSHA Compliance and WSC Director

NOTICE: Minnesota OSHA Directives are used exclusively by MNOSHA personnel to assist in the administration of the OSHA program and in the proper interpretation and application of occupational safety and health statutes, regulations, and standards. They are not legally binding declarations and they are subject to revision or deletion at any time without notice.

Appendix A
Formaldehyde Standard Triggering Events

Part I: Airborne Levels

- A. Below AL and STEL But Above 0.1 ppm.
 - 1. Exposure Determination.
 - 2. Recordkeeping.
 - 3. Training (initial & annual).
 - 4. Medical Surveillance for Signs and Symptoms.
- B. Above AL or STEL.
 - 1. Initial Monitoring.
 - 2. Periodic Monitoring.
 - a. At or Above AL ... Every 6 months.
 - b. At or Above STEL ... Once a year.
 - 3. Medical Surveillance.
 - 4. Training (annual).
 - 5. Applicable provisions in A. above.
- C. Above TWA or STEL.
 - 1. Regulated Areas.
 - 2. Methods of Compliance.
 - 3. Respiratory Protection.
 - 4. Applicable provisions are in A., B. above.
- D. Greater than 100 ppm.
 - 1. Full Body protection.
 - 2. Applicable provisions are in A., B., and C. above.

Part II: Eye or Skin Contact.

- A. Greater than or Equal to 1% Formaldehyde Solution.
 - 1. PPE – eye or skin.
 - 2. Hygiene protection.
 - a. Change Rooms.
 - b. Quick Drench Shower.
- B. Greater than or Equal to 0.1% Formaldehyde Solution.
 - 1. Eye Wash Facilities.
- C. Irritating or Sensitizing Formaldehyde Materials.
 - 1. PPE.
 - 2. Change Rooms.

Part III: Liquid or Gas.

- A. Housekeeping
 - 1. Leak Detection.
 - 2. Preventative Maintenance.
 - 3. Spill Clean-up.

Part IV: Possibility of Emergency.

- A. Emergencies
- B. Respiratory Protection.
- C. Medical Surveillance.
- D. Training.