

# **College of Forestry 395: Laboratory Safety References**

Safety Policy & Procedure Manual  
Section 300: Laboratory Safety  
Effective: 01 January 2007  
Revised: August 2014

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## **PURPOSE**

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The purpose of this section is to provide the laboratory references for Section 300.

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## **Applicability**

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All sub-sections of Section 300 of the College of Forestry Safety Manual.

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## Reference 2

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## Reference 3

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Safety Instruction Number 18

Update 12/3/04

# Accident Recording System

## General

- Reporting, recording and evaluating accidents is an important part of OSU's safety program
- Accident records supply information to identify trends to help control conditions and acts that contribute to accidents
- Recording OSU's accident experience is the responsibility of EH&S
- EH&S has a recording system which meets OR-OSHA requirements and provides information about the types of accidents and where they occur
- Information can be combined with medical and disability cost figures from SAIF to reflect the direct cost of occupational accidents
- Managers can use information as an indicator of the financial impact of unsafe behavior and the need for loss control efforts
- Requests for information regarding OSU's accident experience or the recording system should be made to EH&S at 7-2275

## Accident Report

- The basis for all information about injury accidents or occupational illnesses that occur at OSU is the [Accident Report Form](#)
- The report is completed for all injuries or occupational illness to faculty, staff, students, volunteers, or visitors, with the exception of injuries caused by athletic activities
  - Employee report form is completed by the immediate supervisor
  - Student reports are by the instructor
  - Visitor reports are completed by the coordinator of the University activity
- Copies of this report form are available from the [Department of Human Resources](#)
- Full explanation and instruction for the Accident Report Form is found in the [Accident Investigation](#) section of the [Safety Procedures Handbook](#)

## **Accident File**

- All injuries and occupational illnesses that are reported to EH&S are entered into the data base which includes information about when and where the accident occurred, who was injured, the type of accident, and the department.
- The data can be manipulated to provide statistical information on any or all of these categories including a breakdown by location, department, or group if desired.

## **OSHA Log and Summary Report**

- All occupational injuries and illnesses that meet the definition of OSHA reportable are placed on the OSHA Log
- EH&S maintains the OSHA Log for the main campus and all off-campus facilities that employ more than 10 employees
- OSU facilities where less than 10 employees are employed are not required to maintain a separate OSHA Log and are considered as part of the main campus
- A copy of the OSHA Log along with a summary report is sent to each of these facilities monthly
- An OSHA form 200 Annual Summary of Occupational Injuries/Illnesses is also prepared by EH&S and sent to each facility to post for one month beginning February 1

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## Reference 4

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## Reference 5

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Safety Instruction Number 28

Update 12/08/2004

# Hazard Awareness Sign System

## General

- A sign system to warn visitors entering laboratories has been established at OSU
- A warning sign, depicted below, will be placed at every main entrance to each laboratory room or complex by EH&S
- **Keeping the sign up-to-date is the responsibility of laboratory personnel.**



## Sign Components

### Hazard Warning Stickers

- A hazard **warning sticker** is required if material or equipment is stored or used **at or above the amounts listed below**
- The sign has room for four stickers
- If more stickers are required to describe the hazards in the room an additional sign can be installed
- Stickers can be obtained from EH&S

## Emergency Contact

- Lower part of the sign contains a space where **names of responsible individuals** are listed
- Contact information important for **emergency incidents**
- At least **two names**, with their corresponding access information, should be listed
- A "Sharpie" permanent marker or label should be used to mark the sign
- If changes need to be made, use a 70% solution of ethanol to remove information or contact E&HS to clean or install a new sign

## Hazard Warning Sticker Definitions



### Flammable Solvents

- Room contains **10 gallons or more** of flammable liquids in a single or multiple containers
- A flammable liquid is defined as any liquid that has a flash point below 100 degrees Fahrenheit (37.8 degrees Centigrade).



### Flammable Gas

- The room contains **200 cubic feet or more** of a flammable gas in a single or multiple containers
- A flammable gas is defined as any gas that has a flash point below 100 degrees Fahrenheit (37.8 degrees Centigrade) with a container pressure of 40 psia at 100 degrees F
- An example of this would be a single large compressed gas cylinder of hydrogen.



### Toxic Chemicals

- The room contains a total of **2 pounds or more** of toxic chemicals
- A toxic chemical is any chemical considered a DOT division 6.1 poison, packing group I or II (a substance with an oral LD50 of less than 50 mg/kg)
- Liquid chemicals should be converted to pounds for this comparison



### Toxic Gas

- The room contains **any amount** of a toxic gas, DOT inhalation hazard zone A (LC50 < 200 ppm)

- includes arsine, cyanogen, fluorine, germane, hydrogen cyanide, hydrogen selenide, nitric oxide, nitrogen dioxide, nitrogen trioxide, phosgene, diphosgene, phosphine, stibene
- or the room contains 500 cubic feet or more of other toxic gases, DOT inhalation zones B-D (LC50 between 200 and 5000 ppm)
  - includes HCl, HBr, HI, HF, boron trifluoride, chlorine, chlorine dioxide, chlorine trifluoride, diborane, fluorine, hydrogen sulfide, methylbromide, nitrogen trifluoride, ozone



## Oxidizers

- **More than 20 pounds** of a class 3 oxidizer
  - class 3 oxidizer is defined as a substance that will cause a severe increase in the burning rate of combustible material
  - examples are ammonium dichromate, bromine trifluoride, potassium bromate, potassium chlorate, concentrated perchloric acid
- **More than 250 pounds** of a class 2 oxidizer
  - class 2 oxidizer is defined as a substance that will moderately increase the burning rate
  - examples are calcium hypochlorite, chromic acid, nitric acid, potassium perchlorate, potassium permanganate, sodium permanganate
- **More than 1500 cubic feet** of an oxidizing compressed gas
  - examples of an oxidizing compressed gas are oxygen, oxides of nitrogen.



## Corrosive Materials

- The room contains **more than 500 gallons or 5000 pounds** of corrosive materials in a single or multiple containers
- A corrosive material is defined as a solid caustic substance or a liquid which has a pH of greater than 12 or lower than 2
- Typical examples of corrosive materials would be acids such as chromic, hydrochloric, hydrofluoric, and sulfuric; bases such as ammonium hydroxide, calcium hydroxide, potassium hydroxide, sodium hydroxide, potassium carbonate.



## Biohazard

- The room contains a **biological agent**, capable of self-replication, which presents or may present a hazard to the health or well being of humans



- The agent is a human bloodborne pathogen or work with the agent has been assigned to be handled in a Biosafety Level 2 or above laboratory based on the guidelines established in the CDC/NIH book "Biosafety in Microbiological and Biomedical Laboratories"
- The name of the agent(s) must be entered on the hazard sticker

### Radioactive Material

- The room contains *any amount* of radioactive material.

### Radiation Area

- The room contains a *radiation source* that poses a significant external radiation hazard
- Sign issued by Radiation Safety group

### X-Ray Equipment

- This room contains a machine which **produces X-Ray radiation**

### Laser Light

- The room contains a *Class 2 or Class 3a laser* as defined by ANSI Standard Z136.1
- Under this classification a class 2 continuous wave laser in the visible range (400nm to 700nm) which can emit a power exceeding 0.4 micro Watts
- Class 4 laser installations emit power exceeding 0.5 W and require a special sign issued by EH&S.

### Restricted Area

- *Access* to the room is *restricted* to students and visitors. The restriction does not apply to custodians or Facilities Services personnel who are performing required maintenance activities.

### Cancer Suspect Agent

- The room contains *any amount* of the following High or Extreme hazard chemical carcinogens as described by the [University's Chemical Carcinogen Safety Program](#)

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## Reference 6

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Safety Instruction Number 20

Update 11/22/2005

# Respiratory Protection Program

## Policy

- This Safety Instruction defines **OSU rules** regarding the **use of respirators** for personal protection against airborne contaminants
- Before respirators are used, feasible **engineering controls** must be instituted to provide protection against airborne contaminants
- The ability for a respirator to provide adequate protection is based on **proper selection, fit and training**
- Respirators which are intended for protection against harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors must **NOT** be obtained or worn by employees without approval from EH&S and in accordance with this program
- The respirator program is **managed by EH&S** and has been established to **comply with the OR-OSHA regulations** for respiratory protection
- EH&S maintains a **supply** of different types of respirators
- Respirators should be obtained through EH&S in order to ensure the proper selection and fit
- Off campus facilities and other campus groups who have a large number of respirator users may obtain their own respirators after consultation with EH&S
- Such groups should contact EH&S at least every year to review the program and make necessary changes

## Use of Respirators

- Every employee that wears a respirator on the job, whether required to wear one or not, shall have it properly fitted prior to initial use and at all times while performing an operation in a hazardous atmosphere
- No employee shall use a respirator or be assigned to a task that requires the use of a respirator until it has been determined that the employee is physically able to perform under such conditions

## Medical Fitness Evaluation

- Process begins with the completion of a [cover page](#) AND a [medical questionnaire](#) available from this web site
- The questionnaire has been developed in accordance with OROSHA regulations
- Employee returns the questionnaire directly to OSU-Student Health Services, Occupational Health
- A physical will be conducted for those employees who indicate potential medical problems on the medical questionnaire
- After review by the Occupational Health Clinician, EH&S is notified of the employee's physical ability to wear a respirator
- Periodically, a review of the employee's health status must be made, at the frequency specified by the Occupational Health Clinician, by completing and submitting another questionnaire
- The employing department is responsible for paying all fees associated with the medical evaluation process.

## Selection

- The useful life of each respirator or cartridge will vary depending on the job duties and actual time in use
- Each respirator has limitations; for details, refer to the manufacturer's instructions and recommendations
- Air purifying respirators (disposable masks, half or full face cartridge respirators) will not be used in an environment that has less than 19.5% oxygen
- OSU is responsible for determining the "End of Service Life" for all respirator/cartridges combinations based on
  - manufacturer's tests
  - recommendations
  - chemicals used
  - usage patterns
- Consult with EH&S to choose proper respirators and determine service life

## Training of Employees

- Each respirator user will be trained on how to use, check, and maintain respirators
- A record will be kept of those employees who have been trained
- Each user must understand and be able to apply the contents of this respirator program in the daily use, care, and safekeeping of the respirators
- Training will be provided by EH&S or by other groups in consultation with EH&S and will include the following:
  1. The reasons for respiratory protection.
  2. The nature, extent, and effects of respiratory hazards to which the person may be exposed.

3. Where applicable, an explanation of why engineering controls are not being applied or are not adequate and of what effort is being made to reduce or eliminate the need for respirators.
4. An explanation of why a particular type of respirator has been selected for a specific respiratory hazard.
5. An explanation of the operation, and the capabilities and limitations, of the respirator selected.
6. Instruction in inspecting, donning, checking the seal of, and wearing the respirator.
7. An opportunity for each respirator wearer to handle the respirator and to wear the respirator, in both a normal atmosphere and a test atmosphere, for an adequate period of time to ensure that the wearer is familiar with the operational characteristics of the respirator.
8. An explanation of how maintenance and storage of the respirator is carried out.
9. Instructions in how to recognize and cope with emergency situations.
10. Instructions as needed for special respirator use.
11. Regulations concerning respirator use.

## Fitting of Respirators

- Proper fitting of respirators is essential for employees to receive the protection for which the respirator is designed
- In order to ensure a good face seal, follow the manufacturer's fitting instructions and the following instructions:
  1. The respirator and all straps should be in place and worn in the appropriate position. To adjust head bands, pull the free end tight until a comfortable and effective fit is obtained.
  2. To adjust the face-piece properly, position chin firmly in the chin cup and manually shift rubber mask until the most comfortable position is located. Make final adjustments on the headband and do not break the nasal seal. Modifications to the respirator or straps will not be made.
  3. BEARDS are not allowed. Respirators should not be worn when projections under the face piece prevent a good face seal. Note: Such conditions may be a growth of beard, sideburns, temple pieces on glasses, or a skull cap that projects under the face piece.
  4. Respirators should not be worn if scars, hollow temples, excessively protruding cheekbones, deep creases in facial skin, the absence of teeth or dentures, or unusual facial configurations prevent a good face seal.
  5. Each day, to ensure proper protection, the wearer of a respirator should check the seal of the face-piece by conducting both a positive and negative pressure test. Positive and negative pressure checks will be conducted every time the respirator is put on and prior to each entry into a hazardous atmosphere

- a. **Positive Pressure User Seal Check**
  - Close off exhalation valve with palm
  - Exhale gently
  - A small buildup of positive pressure, with no outward leaks, indicates a good face-piece fit
  - If air leakage is detected, reposition the respirator on the face, readjust the tension of the head bands, or try a different size respirator
  - Repeat the test until a satisfactory seal has been achieved
- b. **Negative Pressure User Seal Check**
  - Cover air inlets with palms or other means; if a disposable, cover the entire filtering surface
  - Gently breathe in so that face-piece collapses slightly
  - Hold breath for 10 seconds
  - If respirator remains slightly collapsed and no inward leaks are felt, the face-piece fits tight enough
  - If air leakage is detected, reposition the respirator on the face, readjust the tension of the head bands, or try a different size respirator
  - Repeat the test until a satisfactory seal has been achieved

## Required Fit Tests

- Fit tests are required on initial issuance of respirators for all employees
- Fit tests will be conducted by EH&S or other approved groups as outlined in this document
- Additional fit tests are required for each employee when a new type of respirator is issued
- Negative pressure respirators, requiring a fit factor of 100 or less, will be tested using one of the following **qualitative fit procedures**:
  1. Isoamyl Acetate Test using a fit-test tent (preferred method)
  2. Bitrex™ (Denatonium Benzoate) Solution Aerosol Test using a fit-test tent
  3. Irritant Fume Test using stannic chloride [NO TENT]
- Fit testing of respirators requiring a fit factor of greater than 100 (e.g., tight-fitting atmosphere supplying respirators, such as SCBA) will be performed with quantitative fit testing
- Contact EH&S for additional information or to arrange a test.
- Fit testing must be repeated and documented **at least annually** for all employees

## Maintenance of Respirators

- Respirators need to be maintained to ensure effectiveness and to prevent chemical and bacterial contamination
- Proper maintenance of the respirator is the responsibility of each employee

- Respirators issued for the exclusive use of one worker should be cleaned after each day's work, or more often if necessary
- Additional maintenance should be performed in accordance with manufacturer's recommendations
- Respirators used by more than one worker should be thoroughly cleaned and disinfected after each use
- Respirators stored for emergency use should be thoroughly inspected at least once a month and after each use by the responsible individual
- A copy of recent inspection records is to be maintained at the storage location.
- Self-contained air tanks must be hydro-tested at the frequency specified by the US Department of Transportation for type of tank, typically 3 or 5 years

## **Respirator Cleaning and Disinfecting Procedures**

1. Remove all covering assemblies before cleaning and disinfecting:
  - a. Filters, cartridges, canisters
  - b. Speaking diaphragms
  - c. Demand and pressure-demand valve assemblies
  - d. Head band
  - e. Any other components recommended by the respirator manufacturer
2. Wash respirator and appropriate covering assemblies as recommended by the manufacturer, in warm cleaner and disinfectant solution (49°C/120°F max. temp.). A soft cloth may be used to help remove dirt or other foreign material. A recommended disinfecting solution can be made from ordinary household bleach diluted 1:10 with clear water. A two minute immersion will disinfect adequately.
3. Rinse respirator and appropriate covering assemblies in clean, warm water (49°C/120°F max. temp.).
4. Shake respirator as needed to remove water residues and any foreign materials that may still remain.
5. Inspect parts and replace any parts found defective. Set respirator aside to air dry.
6. When dry, reassemble respirator and attach new filters, cartridges or canisters if necessary.
7. Visually inspect and, where possible, test parts and respirator assemblies for proper function.
8. After respirator has been cleaned, dried, and inspected it should be stored in a sealed, clean, sanitary container (zip-lock bag), away from any source of contaminants. Respirators should not be hung on nails. The face-piece, inhalation and exhalation valves must be in a normal position so as to prevent the abnormal "set" of elastomer parts during storage.

## Respirator Program Evaluation

- The effectiveness of the respirator program should be **evaluated at least annually** by supervisors and EH&S
- Corrective action should be taken to correct defects found in the program
- Supervisors will monitor the effectiveness of this program by:
  - Frequent unscheduled observations of employee activities throughout the work area to confirm proper respirator use and acceptance by employees.
  - Observation of and discussion with new employees to confirm proper training has been carried out.



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## Reference 7

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Safety Instruction Number 8

Update 12/02/2004

# Hazardous Waste Disposal

## General

- Hazardous waste generated at Oregon State University must be disposed of through a system managed by Environmental Health & Safety (EH&S).
- The designation "**hazardous**" refers to any substance that is
  - corrosive
  - flammable
  - reactive
  - toxic
- It does not refer to material that is only radioactive or biohazardous.
- Hazardous waste disposal is funded for University units.
- Departments are encouraged to employ waste reduction procedures to limit university costs (see [Safety Instruction No. 9](#)).
- If there are questions or unusual circumstances, please contact EH&S at 7-2273 for assistance.

## Waste Determination

- Prior to disposal of any chemical waste, OSU must perform an official hazardous waste determination to see if the waste is hazardous. EH&S performs that service for the university community.
- A short list of non-hazardous chemicals can be found on the EH&S web site; all others should be considered hazardous until the determination has been made.
- Hazardous waste is incinerated, at off-site locations, whenever possible. Departments are encouraged to employ waste reduction procedures to limit costs. Use these guidelines to prepare and request disposal of hazardous chemical waste.

## Containers

- Collect each waste in a NON-LEAKING container; match size to amount of waste. Use containers chemicals were received in
- Liquid containers must be less than 5 gallons and 45 pounds (about 3-4 gallons of typical halogenated solvent).
- Reusable solvent waste containers are available from EH&S.

- All containers must have non-leaking, tight fitting lids that are not cracked, broken, or chemically damaged.
- Paper or cardboard containers should be put into sealed plastic bags.
- Containers should be labeled as soon as waste is put into them, and must be capped at all times when not actively adding waste.

## Labels

- Chemicals in original non-leaking containers with manufacturer's label will be accepted as is.
- All other wastes require a hazardous waste label, available from EH&S, completed and attached to each waste container.
- Do not cover existing labels or markings.
- Solvent labels should be put onto string tags attached to containers. Tags are available from EH&S.
- Fill out the LOWER part of the orange label with:
  - Your name, building, room number, and department.
  - Identification of contents, including total weight or volume and percent ranges for all constituents.

## Packing

- Get boxes for the waste before pickup
- Do NOT pack materials in boxes.
- Waste containers will be examined, and EH&S will then pack waste in boxes according to compatibility.
- Boxes should be sealable and sturdy enough to transport the material.
- Boxes exceeding 45 pounds or 18 inches on a side cannot be safely handled by one person, and will not be picked up.

## Pickup

- To request waste pickup, use the [hazardous waste web form](#).
- YOU are responsible for proper containers, labels, and transport boxes.
- Do NOT package waste in boxes.
- All containers must be less than 45 pounds.

## Reference 8

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Oregon Administrative Rules  
Chapter 437 - DEPARTMENT OF  
CONSUMER AND BUSINESS  
SERVICES

### Division 2 Subdivision Z

## TOXIC AND HAZARDOUS SUBSTANCES

A-58 A-91

437-002-0360 General

437-002-0368 Deterioration

437-002-0382 Oregon Rules for Air Contaminants

1910.1001 Asbestos

1910.1002 Coal tar pitch volatiles; interpretation of term.

1910.1003 4-Nitrobiphenyl.

1910.1004 alpha-Naphthylamine.

1910.1005 [Reserved]

1910.1006 Methyl chloromethyl ether.

1910.1007 3,3'-Dichlorobenzidine (and its salts).

1910.1008 bis-Chloromethyl ether.

1910.1009 beta-Naphthylamine.

1910.1010 Benzidine.

1910.1011 4-Aminodiphenyl.

1910.1012 Ethyleneimine.

1910.1013 beta-Propiolactone.

1910.1014 2-Acetylaminofluorene.

1910.1015 4-Dimethylaminoazobenzene.

1910.1016 N-Nitrosodimethylamine.

437-002-0364 Oregon Rules for MOCA (4,4'-Methylene BIS (2-Chloro-aniline))

1910.1017 Vinyl chloride.

1910.1018 Inorganic arsenic.

1910.1025 Lead

437-002-0371 Scope and Application (for Lead)

1910.1027 Cadmium

1910.1028 Benzene

1910.1029 Coke oven emissions.

1910.1030 Bloodborne Pathogens

1910.1043 Cotton dust.

1910.1044 1,2-dibromo-3-chloropropane.

1910.1045 Acrylonitrile.

437-002-0373 Oregon Rules for Thiram.

1910.1047 Ethylene Oxide

1910.1048 Formaldehyde

1910.1050 Methylenedianiline

1910.1052 Methylene Chloride

1910.1200 Hazard communication.

1910.1201 Retention of DOT markings, placards and labels

437-002-0377 Additional Oregon Rules for Hazard Communication.

437-002-0378 Oregon Rules for Pipe Labelling.

1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories

437-002-0391 Additional Oregon Rules for Carcinogens in Laboratories.

1910.1499 Source of standards.

1910.1500 Standards organizations.

## **Technical Manual Chapter 21**

437-002-0360

**437-002-0360**

*In addition to, and not in lieu of, any other safety and health codes contained in OAR Chapter 437, the Department adopts by reference the following federal rules as printed in the Code of Federal Regulations, 29 CFR 1910, revised as of 7/1/94:*

## **TOXIC AND HAZARDOUS SUBSTANCES**

**437-002-0360(1)**

*(1) (Reserved) 29 CFR 1910.1000 Air contaminants, published 6/27/74, Federal Register, vol. 39, pp. 23540-23543; amended in the following FR publications: 5/28/75, vol. 40, pp. 23072-23073; 5/3/77, vol. 42, p. 22525; 1/17/78, vol. 43, p. 2600; 2/10/78, vol. 43, p. 5963; 3/29/78, vol. 43, p. 13563; 5/4/78, vol. 43, p. 19624; 6/23/78, vol. 43, p. 27394; 6/30/78, vol. 43, p. 28473; 10/3/78, vol. 43, p. 45809; 11/14/78, vol. 43, p. 53007; 12/8/78, vol. 43, pp. 57602-57603; 2/5/79, vol. 44, p. 7141; 6/18/80, vol. 45, pp. 12416-12417; 7/28/80, vol. 45, pp. 50328-50329; 6/19/81, vol. 46, p. 32022; 6/22/84, vol. 49, p. 25796; 1/2/85, vol. 50, p. 64; 12/13/85, vol. 50, p. 51173; 11/17/86, vol. 51, p. 41477; 9/11/87, vol. 52, p. 34562; 12/4/87, vol. 52, p. 46291; 1/19/89, vol. 54, pp. 2920-2983; 7/5/89, vol. 54, no. 127, pp. 28054-28061; 9/5/89, vol. 54, no. 170, pp. 366767-36768; 11/15/89, vol. 54, no. 219, p. 47513; 2/5/90, vol. 55, no. 24, pp. 3724; 5/9/90, vol. 55, no. 90, pp. 19258-19259; 11/8/90, vol. 55, no. 217, pp. 46948-46950; 7/1/92, vol. 57, no. 127, pp. 29204-29206. NOTE: 29 CFR 1910.1000 was repealed on 11/15/93 by OR-OSHA. In Oregon, OAR 437-002-0382 applies.*

**437-002-0382 Oregon Rules for Air Contaminants.**

**437-002-0360(2)**

*(2) 29 CFR 1910.1001 Asbestos, published 6/20/86, Federal Register, vol. 51, no. 119, pp. 22612-22790; amended 10/17/86, FR vol. 51, pp. 37002-37007; amended 5/12/87, FR vol. 52, pp. 17754-17755; amended 9/14/88, FR vol. 53, no. 178, pp. 35610-35627;*

*amended 9/23/88, FR vol. 53, no. 185, p. 37080; amended 7/21/89, FR vol. 54, no. 139, p. 30704-30705; amended 12/20/89, FR vol. 54, no. 243, p. 52028; amended 2/5/90, FR vol. 55, no. 24, pp. 3731-3732; amended 12/10/90, FR vol. 55, no. 237, pp. 50685-50687; amended 9/4/91, FR vol. 56, no. 171, pp. 43699-43700; 3/5/92, FR vol. 57, no. 44, p. 7878; 6/8/92, FR vol. 57, no. 110, p. 24330; 8/10/94, FR vol. 59, no. 153, p. 41065; 6/29/95, FR vol. 60, no. 125, pp. 33983-34002; 8/23/96, FR vol. 61, no. 165, pp. 43434-43459.*

**437-002-0366 Identification of Materials.**

**437-002-0368 Deterioration and Maintenance.**

**437-002-0360(3)**

*(3) 29 CFR 1910.1002 Coal tar pitch volatiles, interpretation of term, published 1/21/83, Federal Register, vol. 43, p. 2768.*

**437-002-0360(4)**

*(4) 29 CFR 1910.1003 4-Nitro-biphenyl 13 Carcinogens, published 3/7/96, Federal Register vol. 61, no. 46, p. 9242., published 6/27/74, Federal Register, vol. 39, p. 23502; amended by the following FR publications: 5/28/75, FR vol. 40, p. 23072; 8/20/76, FR vol. 41, p. 35184; 10/24/78, FR vol. 43, p. 49751; 5/23/80, FR vol. 45, p. 35281; 4/30/84, FR vol. 49, p. 18295; 6/30/93, FR vol. 58, no. 124, p. 35310.*

**437-002-0360(5)**

*(5) 29 CFR 1910.1004 alpha-Naphthylamine See §1910.1003, 13 Carcinogens.*

**437-002-0360(6)**

*(6) Reserved for 29 CFR 1910.1005 (Reserved).*

**437-002-0360(7)**

*(7) 29 CFR 1910.1006 Methyl chloromethyl ether See §1910.1003, 13 Carcinogens.*

**437-002-0360(8)**

*(8) 29 CFR 1910.1007 3,3'-Dichlorobenzidine (and its salts) See §1910.1003, 13 Carcinogens.*

**437-002-0360(9)**

*(9) 29 CFR 1910.1008 bis-Chloromethyl ether See §1910.1003, 13 Carcinogens.*

**437-002-0360(10)**

*(10) 29 CFR 1910.1009 beta-Naphthylamine See §1910.1003, 13 Carcinogens.*

**437-002-0360(11)**

*(11) 29 CFR 1910.1010 Benzidine See §1910.1003, 13 Carcinogens.*

**437-002-0360(12)**

*(12) 29 CFR 1910.1011 4-Aminodiphenyl See §1910.1003, 13 Carcinogens.*

**437-002-0360(13)**

*(13) 29 CFR 1910.1012 Ethyleneimine See §1910.1003, 13 Carcinogens.*

**437-002-0360(14)**

*(14) 29 CFR 1910.1013 beta-Propiolactone See §1910.1003, 13 Carcinogens.*

**437-002-0360(15)**

*(15) 29 CFR 1910.1014 2-Acetylaminofluorene See §1910.1003, 13 Carcinogens.*

**437-002-0360(16)**

*(16) 29 CFR 1910.1015 4-Dimethylaminoazo-benzene See §1910.1003, 13 Carcinogens.*

**437-002-0360(17)**

*(17) 29 CFR 1910.1016 N-Nitrosodimethylamine See §1910.1003, 13 Carcinogens.*

**437-002-0364 Oregon Rules for MOCA (4,4'- Methylene Bis (2-chloroaniline))**

**437-002-0360(18)**

*(18) 29 CFR 1910.1017 Vinyl chloride, published 10/4/74, Federal Register, vol. 39, p. 35896; amended by the following FR publications: 12/3/74, FR vol. 39, p. 41848; 3/25/75, FR vol. 40, p. 13211; 5/28/75, FR vol. 40, p. 23072; 10/24/78, FR vol. 43, p. 49751; 5/23/80, FR vol. 45, p. 35282; 6/7/89, FR vol. 54, p. 24334; 6/30/93, FR vol. 58, no. 124, p. 35310.*

**437-002-0360(19)**

*(19) 29 CFR 1910.1018 Inorganic arsenic, published 5/25/78, Federal Register, vol. 43, p. 19624; amended by the following FR publications: 6/30/78, FR vol. 43, p. 28472; 5/23/80, FR vol. 45, p. 35282; 6/7/89, FR vol. 54, p. 24334; 6/30/93, FR vol. 58, no. 124, p. 35310; 3/7/96, FR vol. 61, no. 46, p. 9245.*

**437-002-0360(20)**

*(20) 29 CFR 1910.1020 Access to Employee Exposure and Medical Records; published May 23, 1980, Federal Register, vol. 45, no. 102, pp. 35277-35281; amended September 29, 1988, Federal Register, vol. 53, no. 189, pp. 38163-38168; 3/7/96, FR vol. 61, no. 46, p. 9235; 6/20/96, FR vol. 61, p. 31427.*

**Appendix A - Sample Authorization Letter.**

**Appendix B - Availability of NIOSH RTECS.**

**437-002-0360(21)**

*(21) 29 CFR 1910.1025 Lead, published 11/14/78, Federal Register, vol. 44, p. 53007; amended by the following FR publications: 1/26/79, vol. 44, p. 5447; 3/13/79, vol. 44, p. 14554; 8/28/79, vol. 44 p. 50338; 10/23/79, vol. 44, p. 60981; 11/30/79, vol. 44, 68828; 5/23/80, vol. 45, p. 35283; 12/11/81, vol. 46, p. 60775; 11/12/82, vol. 47, p. 51117; 3/6/83, vol. 48, p. 9641; 4/30/84, vol. 49, p. 18295; 6/5/84, vol. 49, p. 23175; 6/5/84, vol. 49, p. 23175; and modified by OSHA Instruction CPL 2-2.47 published by the U. S. Department of Labor on 1/5/89. Amended 7/11/89, vol. 54, p. 29142; 1/30/90, vol. 55, no. 20, pp. 3166-3167; 2/13/90, vol. 55, no. 30, pp. 4998-4999; modification of OSHA Instruction CPL 2-2.47, published by Office of Health Compliance Assistance, OSHA, on 7/10/90. Amended 5/31/91, FR vol. 56, no. 105, p. 24686.; amended 10/11/95, FR vol. 60, p. 52956.*

**437-002-0371 Scope and Application (for Lead).**

**437-002-0360(22)**

*(22) 29 CFR 1910.1027 Cadmium, published 9/14/92, Federal Register, vol. 57, no. 178, pp. 42388-42453; corrections published 4/23/93, FR vol. 58, no. 77, pp. 21778-21787.*

**437-002-0360(23)**

*(23) 29 CFR 1910.1028 Benzene, and Appendices A, B, C, D, and E; published 9/11/87, Federal Register, vol. 52, no. 176, pp. 34562-34578.*

**437-002-0363 Oregon Amendment (for Benzene).**

**437-002-0360(24)**



*(24) 29 CFR 1910.1029 Coke oven emissions, published 10/22/76, Federal Register, vol. 41, p. 46784; amended by the following FR publications: 1/18/77, FR vol. 42, p. 3304; 5/23/80, FR vol. 45, p. 35283; 9/13/85, FR vol. 50, p. 37353; 6/7/89, FR vol. 54, p. 24334.*

**437-002-0360(25)**

*(25) 29 CFR 1910.1030 Bloodborne pathogens, published 12/6/91, Federal Register, vol. 56, no. 235, pp. 64175-64182; amended 7/1/92, vol. 57, no. 127, p. 29206.*

**437-002-0375 Oregon Effective Dates (for BBP).**

**437-002-0360(26)**

*(26) 29 CFR 1910.1043 Cotton dust, published 6/23/78, Federal Register, vol. 43, p. 27394; amended by the following FR publications: 8/8/78, FR vol. 43, p. 35035; 10/10/80, FR vol. 45, p. 67340; 12/13/85, FR vol. 50, p. 51173; 7/3/86, FR vol. 51, p. 24325; 6/7/89, FR vol. 54, p. 24334.*

**437-002-0360(27)**

*(27) 29 CFR 1910.1044 1,2-dibromo-3-chloropropane, published 3/17/78, Federal Register, vol. 43, p. 11527; amended by the following FR publications: 5/23/80, FR vol. 45, p. 35283; 4/30/84, FR vol. 49, p. 18295; 6/7/89, FR vol. 54, p. 24334; 6/30/93, FR vol. 58, no. 124, p. 35310.*

**437-002-0360(28)**

*(28) 29 CFR 1910.1045 Acrylonitrile, published 10/3/78, Federal Register, vol. 43, p. 45809; amended by the following FR publications: 5/23/80, FR vol. 45, p. 35283; 6/7/89, FR vol. 54, p. 24334; 6/30/93, FR vol. 58, no. 124, p. 35310.*

**437-002-0360(29)**

*(29) 29 CFR 1910.1047 Ethylene oxide, published 6/22/84, Federal Register, vol. 49, p. 25796; amended 3/12/85, FR vol. 50, p. 9801; amended 10/11/85, FR vol. 50, p. 41494; amended 7/10/86, FR vol. 51, p. 25053; amended 4/6/88, FR vol. 53, p. 11437; amended 7/26/88, FR vol. 53, p. 27960.*

**437-002-0361 Oregon Effective Dates (for EtO).**

**437-002-0360(30)**

*(30) 29 CFR 1910.1048 Formaldehyde, and Appendices A, B, C, D and E, published 12/4/87, Federal Register, vol. 52, no. 233, pp. 46291-46312; and amendments to 1910.1048 published 3/2/88, FR vol. 53, no. 41, pp. 6628-6629; 11/8/88, FR vol. 53, pp.*

45080-45088; 11/22/88, FR vol. 53, p. 47188; 7/13/89, FR vol. 54, no. 133, pp. 29545-29546; 8/1/89, FR Vol. 54, No. 146, p. 31765; 8/29/89, FR vol. 54, p. 35639; 9/11/89, FR vol. 54, p. 37531; 10/24/89, vol. 54, pp. 43344-43346; 6/13/90, FR vol. 55, no. 114, p. 24070; 8/10/90, FR vol. 55, no. 155, p. 32616; 12/17/90, FR vol. 55, no. 242, p. 51698; 3/12/91, FR vol. 56, no. 48, pp. 10377-8; 6/12/91, FR vol. 56, no. 113, p. 26909; 8/8/91, FR vol. 56, no. 153, p. 37650-1, 11/13/91, FR vol. 56, no. 219, p. 57593; 1/23/92, FR vol. 57, no. 15, p. 2681-2; 5/5/92, FR vol. 57, no. 87, p. 19262; 5/27/92, FR vol. 57, no. 102, pp. 22307-9; 6/10/92, FR vol. 57, no. 112, p. 24701; 6/18/92, FR vol. 57, no. 118, pp. 27160-1.

**437-002-0360(31)**

*(31) 29 CFR 1910.1050 Methylenedianiline (MDA), published 8/10/92, Federal Register, vol. 57, no. 154, pp. 35666-35681. (NOTE: 29 CFR 1910.1101 Asbestos, was repealed by Federal Register, vol. 57, no. 110, issued 6/8/92, p. 24330.)*

*437-002-0373 Oregon Rules for Thiram.*

**437-002-0360(32)**

*(32) 29 CFR 1910.1051 1,3-Butadiene, published 11/4/96, Federal Register, vol. 61, no. 214, p. 56831.*

**437-002-0360(33)**

*(33) 29 CFR 1910.1052 Methylene Chloride, published 1/10/97, Federal Register, vol. 62, no. 7, p. 1601; 10/20/97, FR vol. 62, p. 54382; 12/18/97, FR vol. 62, no. 243 p. 66275. (NOTE: 29 CFR 1910.1101 Asbestos, was repealed by Federal Register, vol. 57, no. 110, issued 6/8/92, p. 24330.)*

**437-002-0360(34)**

*(34) 29 CFR 1910.1096 Ionizing radiation, published 6/27/74, Federal Register, vol. 39, p. 23502; amended 10/24/78, FR vol. 43, p. 49746; 11/7/78, FR vol. 43, p. 51759; 4/30/84, FR vol. 49, p. 18295; 6/30/93, FR vol. 58, no. 124, p. 35309; 6/20/96, FR vol. 61, no. 46, p. 31427.*

**437-002-0360(35)**

*(35) 29 CFR 1910.1200 Hazard communication, published 8/24/87, Federal Register, vol. 52, p. 31877; amended by the following FR publications: 12/4/87, FR vol. 52, p. 46080; 4/27/88, FR vol. 53, p. 15035; 2/15/89, FR vol. 54, p. 6888; 6/7/89, FR vol. 54, p. 24334; 2/9/94, FR vol. 59, no. 27, pp. 6126-6184; 4/13/94, FR vol. 59, no. 71, pp. 17478; 12/22/94, FR vol. 59, no. 245, p. 65947; 3/7/96, FR vol. 61, no. 46, p. 9245.*

**437-002-0377 Additional Oregon Rules for Hazard Communication.**

**437-002-0378 Oregon Rules for Pipe Labelling.**

**437-002-0360(36)**

*(36) 29 CFR 1910.1201 Retention of DOT markings, placards and labels, published 7/19/94, Federal Register. vol. 59, no. 137, pp. 36699-700*

**437-002-0360(37)**

*(37) 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories, published 1/31/90, Federal Register, vol. 55 no. 21, pp. 3300-3335; corrected 3/6/90, FR vol. 55, no. 44, p. 7967; 7/1/92, vol. 57, no. 127, p. 29204.*

**437-002-0390 Oregon Effective Dates (for Labs).**

**437-002-0391 Additional Oregon Rules for Carcinogens in Laboratories.**

**437-002-0360(38)**

*(38) 29 CFR 1910.1499 Removed. Published 3/7/96, Federal Register vol. 61, no. 46, p. 9245.*

**437-002-0360(39)**

*(39) 29 CFR 1910.1500 Removed. Published 3/7/96, Federal Register vol. 61, no. 46, p. 9245.*

**These standards are available at the Oregon Occupational Safety and Health Division, Oregon Department of Consumer and Business Services, and the United States Government Printing Office.**

**Auth.: ORS 654.025(2) and 656.726(3).**

**Hist: APD Admin. Order 13-1988, f. 8/2/88, ef. 8/2/88 (Benzene).**

**APD Admin. Order 14-1988, f. 9/12/88, ef. 9/12/88 (Formaldehyde).**

**APD Admin. Order 18-1988, f. 11/17/88, ef. 11/17/88 (Ethylene Oxide).**

**APD Admin. Order 4-1989, f. 3/31/89, ef. 5/1/89 (Asbestos Temp).**

**APD Admin. Order 6-1989, f. 4/20/89, ef. 5/1/89 (Non Asbestiforms-Temp).**

**APD Admin. Order 9-1989, f. 7/7/89, ef. 7/7/89 (Asbestos & Non-Asbestiforms-Perm).**

**APD Admin. Order 11-1989, f. 7/14/89, ef. 8/14/89 (Lead).**

**APD Admin. Order 13-1989, f. 7/17/89, ef. 7/17/89 (Air Contaminants).**

OR-OSHA Admin. Order 1-1990, f. 1/11/90, ef. 1/11/90 (Formaldehyde-Temp).

OR-OSHA Admin. Order 3-1990, f. 1/19/90, ef. 1/19/90 Asbestos & Non-Asbestiforms-Temp).

OR-OSHA Admin. Order 6-1990, f. 3/2/90, ef. 3/2/90 (Formaldehyde-Perm).

OR-OSHA Admin. Order 7-1990, f. 3/2/90, ef. 3/2/90 Asbestos & Non-Asbestiforms-Perm).

OR-OSHA Admin. Order 9-1990, f. 5/8/90, ef. 8/8/90 (Labs).

OR-OSHA Admin. Order 11-1990, f. 6/7/90, ef. 7/1/90 (Air Contaminants).

OR-OSHA Admin. Order 13-1990, f. 6/28/90, ef. 8/1/90 (Asbestos-Temp).

OR-OSHA Admin. Order 14-1990, f. 6/28/90, ef. 8/1/90 (Lead).

OR-OSHA Admin. Order 1-1992, f. 1/22/92, ef. 1/22/92 (Formaldehyde).

OR-OSHA Admin. Order 19-1990, f. 8/31/90, ef. 8/31/90 (Asbestos-Perm).

OR-OSHA Admin. Order 20-1990, f. 9/18/90, ef. 9/18/90 (Lead).

OR-OSHA Admin. Order 21-1990, f. 9/18/90, ef. 9/18/90 (Air Contaminants).

OR-OSHA Admin. Order 7-1991, f. 4/25/91, ef. 4/25/91 (Air Contaminants, Asbestos, Formaldehyde).

OR-OSHA Admin. Order 13-1991, f. 10/10/91, ef. 10/10/91 (Lead, Formaldehyde).

OR-OSHA Admin. Order 15-1991, f. 12/13/91, ef. 12/13/91 (Asbestos).

OR-OSHA Admin. Order 4-1992, f. 4/16/92, ef. 4/16/92 (Formaldehyde).

OR-OSHA Admin. Order 5-1992, f. 4/24/92, ef. 7/1/92 (Bloodborne Pathogens).

OR-OSHA Admin. Order 6-1992, f. 5/18/92, ef. 5/18/92 (Asbestos).

OR-OSHA Admin. Order 10-1992, f. 9/24/92, ef. 9/24/92 (Lead-temp).

OR-OSHA Admin. Order 11-1992, f. 10/9/92, ef. 10/9/92 (Asbestos).

OR-OSHA Admin. Order 12-1992, f. 10/13/92, ef. 10/13/92 (Formaldehyde).

OR-OSHA Admin. Order 15-1992, f. 12/30/92, ef. 12/30/92 (Air Contaminants, BBP, Labs).

OR-OSHA Admin. Order 1-1993, f. 1/22/93, ef. 1/22/93 (Cadmium, MDA).

OR-OSHA Admin. Order 6-1993, f. 5/17/93, ef. 5/17/93 (Air Contaminants - Temp).

OR-OSHA Admin. Order 12-1993, f. 8/20/93, ef. 11/1/93 (remainder of 2/Z).

OR-OSHA Admin. Order 17-1993, f. 11/15/93, ef. 11/15/93 (Air Contaminants-Perm).

OR-OSHA Admin. Order 1-1995, f. 1/19/95, ef. 1/19/95 (DOT Markings, Placards and labels).

OR-OSHA Admin. Order 4- 1996 f. 6/00/96, ef 6/00/96 (Lead)

OR-OSHA Admin. Order 6-1996, f. 11/29/96, ef. 11/29/96 (Asbestos).

OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.

OR-OSHA Admin. Order 6-1997, f. 5/2/97, ef. 5/2/97.

OR-OSHA Admin. Order 8-1997, f. 11/14/97, ef. 11/14/97.

OR-OSHA Admin. Order 1-1998, f. 2/13/98, ef. 2/13/98.

**437-002-0382**

**437-002-0382 OREGON RULES FOR AIR CONTAMINANTS.**

*An employee's exposure to any substance listed in Oregon Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.*

**437-002-0382(1)**

**(1) Oregon Table Z-1.**

**437-002-0382(1)(a)**

*(a) Substances with limits preceded by "C" -- Ceiling Values. An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day.*

**437-002-0382(1)(b)**

*(b) Other substances -- 8-hour Time Weighted Averages. An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is not preceded by a "C", shall not exceed the 8-hour Time Weighted Average given for that substance in any 8-hour work shift of a 40-hour work week.*

**437-002-0382(1)(c)**

*(c) Other Substances - Excursion Limits. Excursions in worker exposure levels may exceed 3 times the PEL-TWA for no more than a total of 30 minutes during a workday,*

*and under no circumstances should they exceed 5 times the PEL-TWA, provided that the PEL-TWA is not exceeded.*

**437-002-0382(1)(d)**

*(d) Skin Designation. To prevent or reduce skin absorption, an employee's skin exposure to substances listed in Oregon Table Z-1 with an "X" in the Skin Designation column following the substance name shall be prevented or reduced to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.*

**437-002-0382(2)**

*(2) Oregon Table Z-2. An employee's exposure to any substance listed in Oregon Table Z-2 shall not exceed the exposure limits specified as follows:*

**437-002-0382(2)(a)**

*(a) 8-hour time weighted averages. An employee's exposure to any substance listed in Oregon Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Oregon Table Z-2.*

**437-002-0382(2)(b)**

*(b) Acceptable ceiling concentrations. An employee's exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable ceiling concentration for the given substance in the table at any time during an 8-hour shift except:*

**437-002-0382(2)(b)(i)**

*(i) Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. An employee's exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable maximum peak above the acceptable ceiling concentration, and shall not exceed the maximum duration for the given substance during an 8-hour shift.*

**437-002-0382(2)(c)**

*(c) Example. During an 8-hour work shift, an employee may be exposed to a concentration of Substance A (with a 10 ppm TWA, 25 ppm ceiling and 50 ppm peak) above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.*

## OREGON TABLE Z-2

			Acceptable Max. Peak Above the Acceptable Ceiling Concentration for an 8-Hour Shift	
Substance	8-Hour Time Weighted Average	Acceptable Ceiling Concentration	Concentration	Maximum Duration
Benzene (a) (Z87.4-1969)	10 ppm	25 ppm	50 ppm	10 min.
Beryllium, and beryllium compounds (Z37.29-1970)	2 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>	25 mg/m <sup>3</sup>	30 min.
Carbon tetrachloride (Z37.17-1967)	10 ppm	25 ppm	200 ppm	5 min. in any 4 hrs

*During an 8-hour work shift, an employee exposed to benzene may be exposed to an 8-hour time weighted average (TWA) of 10 ppm. Concentrations of benzene during the 8-hour work shift may not exceed 25 ppm, unless that exposure is no more than 50 ppm and does not exceed 10 minutes during an 8-hour work shift. Such exposures must be compensated by exposures to concentrations below 10 ppm so that the 8-hour time-weighted average is less than 10 ppm.*

437-002-0382(3)

*(3) Oregon Table Z-3. An employee's exposure to any substance listed in Oregon Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit give for that substance in the table.*

437-002-0382(4)

*(4) Computation formulae. The computation formula which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are included in OAR 437, Division 2/Z, Toxic and Hazardous Substances, in order to determine whether an employee is exposed over the regulatory limit is as follows:*

437-002-0382(4)(a)

(a)

(i) *The cumulative exposure for an 8-hour work shift shall be computed as follows:*

$$E = (C_a T_a + C_b T_b + \dots C_n T_n) E_8$$

*Where:*

*E is the equivalent exposure for the working shift.*

*C is the concentration during any period of time T where the concentration remain constant.*

*T is the duration in hours of the exposure at the concentration C.*

*The value of E shall not exceed the 8-hour time weighted average specified in subpart Z of 29 CFR part 1910 for the substance involved.*

(ii) *To illustrate the formula prescribed in paragraph (4)(a)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm (Oregon Table Z-1). Assume that an employee is subject to the following exposure:*

*Two hours exposure at 150 ppm*

*Two hours exposure at 75 ppm*

*Four hours exposure at 50 ppm*

*Substituting this information in the formula, we have*

$$[(2 \times 150) + (2 \times 75) + (4 \times 50)] E_8 = 81.25 \text{ ppm}$$

*Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.*

437-002-0382(4)(b)

(b)

(i) *In case of a mixture of air contaminants an employee shall compute the equivalent exposure as follows:*

$$E_m = (C_1 + L_1 + C_2 + L_2) + \dots (C_n + L_n)$$

*Where:*

*E<sub>m</sub> is the equivalent exposure for the mixture.*

*C is the concentration of a particular contaminant.*

*L is the exposure limit for that substance specified in subpart Z of 29 CFR part 1910.*

*The value of E<sub>m</sub> shall not exceed unity (1).*

(ii) *To illustrate the formula prescribed in paragraph (4)(b)(i) of this section, consider the following exposures:*



Substance	Actual Concentration of 8-hour exposure	8-hour weighted average exposure limit
B	500 ppm	1,000 ppm
C	45 ppm	200 ppm
D	40 ppm	200 ppm

*Substituting in the formula, we have:*

$$Em = (500 \div 1000) + (45 \div 200) + (40 \div 200)$$

$$Em = 0.500 + 0.225 + 0.200$$

$$Em = 0.925$$

*Since Em is less than unity (1), the exposure combination is within acceptable limits.*

**Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef. 11/1/75.**

437-002-0382(5)

*(5) To achieve compliance with paragraphs (1) through (4) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1910.134.*

**Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef. 11/1/75.**

*NOTE: Blue print (or bold on monochrome screens) identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.*

*NOTE: Some entries in the below table are followed by an ASCII 254 (þ) in OROSHA-Trieve(c). These appear in the hard copy as Registered ((R)) marks. Since there is no ASCII code for a Registered mark, the ASCII 254 (þ) appears instead.*

**OREGON TABLE Z-1 - ADOPTED VALUES (IN ALPHABETICAL ORDER)**

*NOTE: Blue print (or bold on monochrome screens) identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.*

*NOTE: PNOR means "particles not otherwise regulated"*

**FOOTNOTES:**

*(a)Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 torr.*

*(b)Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.*

*(c)The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound, measured as the metal, the CAS number for the metal is given -- not CAS numbers for the individual compounds.*

*(d)The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Oregon Table Z-2 apply. See 1910.1028 for specific circumstances.*

*(e)This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.*

*(f)All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Oregon Table Z-3.*

*(g)Usually a mixture, in general the aromatic hydrocarbon content will determine which TWA applies.*

*Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef 11/1/75.*

*WCB Admin. Order, Safety 2-1980, f. 4/17/80, ef. 8/1/80.*

*WCB Admin. Order, Safety 1-1982, f. 3/4/82, ef. 5/5/82.*

*WCB Admin. Order, Safety 6-1983, f. 5/25/83, ef. 5/25/83.*

*WCB Admin. Order, Safety 21-1984, f. 12/20/84, ef. 1/1/85.*

*WCB Admin. Order, Safety 5-1986, f. 5/20/86, ef. 6/13/86.*

*APD Admin. Order, Safety 13-1989, f. 7/17/89, ef. 7/17/89.*

**OREGON TABLE Z-2**

*Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef. 11/1/75.*

*WCD Admin. Order, Safety 12-1979, f. 12/21/79, ef. 3/1/80.*

*WCD Admin. Order, Safety 4-1986, f. 5/5/86, ef. 5/5/86.*

*APD Admin. Order 13-1989, f. 7/17/89, ef. 7/17/89.*

***NOTE: Blue print (or bold on monochrome screens) identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.***

**FOOTNOTES:**

***(a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the Benzene Standard, 1910.1028.***

***(b) This standard applies to any operations on sectors for which the Cadmium Standard, 1910.1027, is stayed or otherwise not in effect.***

**OREGON TABLE Z-3 - MINERAL DUSTS**

Substance	mppcf(a)	mg/m3
Silica:		
Crystalline		
Quartz(respirable)	250 (b)	(e)10 mg/m3
	%SiO(2)+5	%SiO(2)+2
Quartz(total dust)		30 mg/m3
		%SiO(2)+2
Crystobalite: Use 1/2 the value calculated from the count or mass formulae for quartz		
Tridymite: Use 1/2 the value calculated from the formulae for quartz		
Amorphous, including natural diatomaceous earth	20	80 mg/m3
		%SiO(2)
Silicates (less than 1% crystalline silica)		
Mica	20	

Soapstone	20	
Talc (not containing asbestos)	(C) 20	
Talc (containing asbestos)		
Use asbestos limit		
Tremolite asbestiform (see 29 CFR 1910.1001)		
Portland Cement	50	
Graphite (natural)	15	
Respirable fraction less than 5% SiO(2)		(e) 2.4 mg/m <sup>3</sup>
		%SiO(2)+2
Respirable fraction greater than 5% SiO(2)		(e) 10 mg/m <sup>3</sup>
		%SiO(2)+2
Inert or Nuisance Dust: (d)		
Respirable fraction	10	5 mg/m <sup>3</sup>
Total dust	50	10 mg/m <sup>3</sup>

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**NOTE:** Blue print (or bold on monochrome screens) identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.

**NOTE:** Conversion factors -  $mppcf \times 35.3 = \text{million particles per cubic meter} = \text{particles per c.c.}$

**FOOTNOTES:**

(a) Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

(b) The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

(c) Containing less than 1% quartz; if 1% quartz or more, use quartz limit.

(d) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Oregon Table Z-1.

*(e)Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:*

Aerodynamic Diameter (Unit Density Sphere)	Percent Passing Selector
2	90
2.5	75
3.5	50
5	25
10	0

*The measurements under this note refer to the use of an AEC (now NRC) instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 mg/m<sup>3</sup> in the table for coal dust is 4.5 mg/m<sup>3</sup>.*

*Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef. 11/1/75.*

*WCB Admin. Order, Safety 6-1978, f. 7/5/78, ef. 7/15/78.*

*APD Admin. Order 13-1989, f. 7/17/89, ef. 7/17/89.*

*. Auth.: ORS 654.025(2) and 656.726(3).*

*Hist: OR-OSHA Admin. Order 6-1993, f. 5/17/93, ef. 5/17/93 (temp).*

*OR-OSHA Admin. Order 17-1993, f. 11/15/93, ef. 11/15/93 (perm).*

*OR-OSHA Admin. Order 5-1997, f. 4/22/97, ef. 4/22/97.*

*OR-OSHA Admin. Order 6-1997, f. 5/2/97, ef. 5/2/97.*

**1910.1001**

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## Reference 9

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Safety Instruction Number 1

Update 12/02/2004

# Right-To-Know

## General

- Or-OSHA Hazard Communication Standard (HCS, Right-to-Know Act) specifies that both employees and employers know the identity and safety/health hazards of substances used in the work place, in order to reduce occupational illnesses due to harmful chemical exposures
- HCS requires manufacturers of substances that are a health or physical hazard to prepare a Material Safety Data Sheet (MSDS) and provide it to purchasers
- Employers who use these substances must retain the MSDS's and provide hazard training to all employees who may be exposed
- Exposure includes both normal work operations and emergency situations
- Most chemical products used at OSU are considered hazardous

## Exempted Products

- Tobacco and tobacco products
- Wood and wood products
- Articles, manufactured items, or products that do not release or otherwise result in exposure to hazardous chemicals under normal conditions of use
- Foods, drugs, and cosmetics (regulated by FDA) intended for personal consumption or use by the employees in the work place
- Hazardous substance while in transport regulated by DOT

## What Is On A Material Safety Data Sheet (MSDS)?

- Identity of chemicals found in the substance (chemical and trade names)
- The immediate and long term health effects of exposure
- The routes of exposure and symptoms of overexposure
- The potential for fire, explosion, and reactivity
- Emergency procedures for spills, fire, disposal, and first aid

- Appropriate protective equipment and clothing

## **Where are MSDS Kept?**

- EH&S maintains [web-accessible MSDS site](#) for non-lab chemicals
- Most lab chemical MSDS's are available through [supplier web sites](#)
- OSU maintains a paper copy file of all MSDS's in the EH&S office at Adams Hall
- Employees can request specific MSDS's from EH&S
- In an emergency, OSU employees may call Public Safety @ 7-3010 for 24 hour access to the MSDS data file

## **OSU Hazard Communication Program**

- EH&S is responsible to implement and administer the University's Hazard Communication Program
- All departments have been included in order to comply with the rule
- This written program is in the [Safety Procedures Handbook](#) section of the Administrative Policies and Procedures Manual

## **Employee Training**

- EH&S has a Right-to-Know training program that is offered to all departments
- Program covers the contents of the data sheets, the basic information about chemical toxicity, and how to avoid exposure
- Further training is performed on specific hazardous substances in each department or job classification on request

## **Your Right-To-Know**

- If you are concerned about any substance you are working with, call EH&S at 7-2273
- EH&S can provide more complete information, help interpret data sheets, and evaluate potential health effects of exposure based on your job environment.

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## Reference 15

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Safety Instruction Number 13

Updated 12/02/2004

# Laboratory Fume Hood Safety

## General

- Laboratory fume hoods are important safety devices.
- Hoods function as local exhaust ventilation that protect personnel from exposure to chemicals being handled
- Training of personnel, proper design of experiments and careful operation of equipment are equally important for lab safety
- Fume hoods cannot completely overcome poor work practices by users

## Good Fume Hood Practices

### Operation

- Before using a hood check that the **air is exhausting properly**
- If the hood is not working, notify EH&S, 7-2273
- Keep **sash openings** to a **minimum**
- Hoods are annually checked by EH&S and w are done more frequently on request
- Hood sash should not be positioned higher than the line on the "Approved Use" sticker.
- If there is a need for **safety/blast shields** within the hood, they should be obtained separately ;the sash alone should not be used as safety/blast shield.
- **Sources** of emission should be kept at least **6 inches inside the hood**
- Users should keep their **faces outside** the plane of the hood sash
- Keep **front air foil** clear - don't block with lab bench liner
- Don't block **hood exhaust openings** or room **air supply vents**; they are essential for the proper operation and capture efficiency of the hood
- Keep **hood sashes closed** when not in use
- Design experiments **NOT to exceed the hood's exhaust capacity** with anticipated experimental emissions



## **Storage**

- Keep **storage of chemicals** in a hood to a **minimum**
  - Stored chemicals may add to the seriousness of an incident such as a fire
  - Stored chemicals block exhaust openings
- **Only necessary equipment** should be placed in the hood
- **Large equipment impedes air flow** and causes air turbulence and poor capture efficiency
- Place **large equipment on spacers** to allow for air to pass underneath

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## Reference 16

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Safety Instruction Number 19

Update 12/03/2004

# Spill Response: Chemicals

## General

- It is inevitable: **spills happen**
- To effectively clean up spills, **prepare** for them beforehand
- Whenever employees work with a chemical substance, they should be aware of its characteristics, and should have **formulated plans** of what to do in case of a spill
- Chemical knowledge is critical when performing risk assessment and is available from material safety data sheets and EH&S
- Specifically, employees should know
  - **what** steps to take
  - who to call for **assistance**
  - what **personal protective equipment** is necessary
  - what **absorbent material** should be used to contain and minimize the danger of a spill
  - **where** to find such equipment and material

## Preparation

- The first steps in any chemical spill:
  - assess the **magnitude**
  - assess the **hazard**
  - assess the **risk** to responders and other
- Before attempting to fight a spill, make sure employees have proper and adequate
  - personal protective equipment
  - spill treatment materials

## OSU Spill Response Team

- EH&S has developed a hazardous chemical spill response team which is readily available on short notice for dealing with spills.
- Response team includes a vacuum designed for mercury spill cleanup
- EH&S can be contacted by calling 7-2273. Campus Security can also be reached at 7-3010
- The chemical spill response available from EH&S should not lessen the responsibility of individual labs to prepare plans to deal safely with small spills
- The preparation of spill response kits at strategic locations within labs or departments is encouraged
- EH&S will respond appropriately to reports of any size spill.

## Reporting

- DEQ regulations require OSU to submit reports for spills over certain specified amounts
- All large spills of a hazardous chemical (more than 1 gallon liquid or 1 pound solid) must be reported promptly to EH&S
- EH&S will make the report to DEQ if necessary
- Reporting smaller spills to EH&S is encouraged

## Spill Control

1. Spill control generally follows the same basic steps, regardless of the materials used, after the initial risk assessment
2. Assess the **magnitude, hazard, and risk** of the spill
3. **Get assistance** if you are unsure about your ability to control a spill
4. Acquire and put on **personal protective equipment** appropriate for the situation, which should include
  - respiratory protection
  - eye protection
  - gloves
  - impervious shoes/boots
  - body protection
5. Get **spill control materials**, available equipment in two general forms:
  - loose materials (vermiculite, cat litter)
  - spill control pillows, which are produced in various shapes and contain different types of absorbents.
  - Materials are available designed for specific types of chemical spills such as acids or solvents
6. In general, liquid materials present a much greater danger than solids, and quick response is therefore critical.
7. Contain and absorb the spill

- dike the outside perimeter with absorbent if there is danger the spill may spread
  - absorb the spill
  - contain and absorb the material first, then try any neutralization/treatment schemes - don't try "floor chemistry"
8. Collect the contaminated absorbent.
- put into an impervious container, such as a heavy cardboard box with a plastic liner
  - spill pads and pillows are much easier to collect than loose absorbents
  - close the container
9. Dispose of the material correctly - [contact EH&S](#) for waste determination and disposal

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## Reference 21

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Safety Instruction Number 30

Update 12/08/2004

# Chemical Storage Guidelines

Proper chemical storage is essential in assuring a safe work environment

## Segregate Chemicals - Store By Hazard Class

*Do Not Store Chemicals Alphabetically*, except within a hazard class. Hazard classes that should be stored separately include:

- radioactive materials
- pyrophoric materials
- flammable materials
- oxidizing materials
- water reactive substances
- oxidizing acids
- inorganic acids
- organic acids
- caustics (bases)
- poisons (general laboratory reagents separated into organic and inorganic groups)

*Provide physical segregation* (sills, curbs, trays) or separation between hazard classes.

*Keep flammable materials by themselves* in approved storage cans, cabinets, or rooms. Store oxidizers well away from flammable materials.

## Store Chemicals To Minimize The Risk From Damaged Containers

- *Store large bottles and containers* close to but not on the floor
- **Store acids and caustics below eye level**
- *Shelves should be securely fastened* to the wall and have lips or restraining cord to prevent bottles from falling
- *Secondary containment* such as polyethylene or stainless steel trays as appropriate should be provided for spill protection

# Label Chemical Containers And Storage Areas Properly

- *Chemical containers* should have the chemical name, a warning label identifying the major hazards, and information about handling precautions
- *Storage areas* should be labeled with hazard class

## Chemical Hazard Classes - Examples

### Pyrophoric - (many are also water reactive)

- phosphorous (red, white)
- methylmagnesium bromide (and other grignard reagents)
- diethylzinc
- triethylaluminum

### Oxidizing Materials

- nitrates
- perchlorates
- permanganates
- iodates
- chromium (VI) compounds
- bromine
- nitrates
- iodine

### Water Reactive

- alkaline earth metals (sodium, potassium, lithium, calcium)
- calcium carbide
- hydrides
- titanium tetrachloride
- acetic anhydride

### Flammable

- solvents
- sodium metal
- sodium sulfide
- sulfur

## **Inorganic Acids**

- hydrochloric acid
- hydroiodic acid
- phosphoric acid
- hydrobromic acid
- hydrofluoric acid

## **Inorganic Acids - Oxidizing**

- sulfuric acid
- nitric acid
- perchloric acid

## **Organic Acids**

- formic acid
- acetic acid
- propionic acid
- butyric acid

## **Caustics**

- hydroxides of sodium, potassium, calcium, lithium

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## Reference 24

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Safety Instruction Number 35

Update 12/8/04

# Safety Training

## Required Safety Training

- Many OR-OSHA, DEQ, and DOT regulations require the safety training of employees if they perform certain functions, or work in certain environments. These regulations also require that this training be documented and a training file be maintained. It is the responsibility of supervisors to identify the types of safety training required for each of their employees and to see that this training is provided. This required safety training can be divided into 1) initial employee training at the time of hire, and 2) job-specific training throughout the period of employment. Safety training can be provided by supervisors, EH&S or other OSU personnel, or by an approved outside training provider.

## Safety Training Sources

- Supervisors can give initial safety training for their new employees by using the "Acknowledgement of Safety Rules Emergency Procedures and Hazard Communication" form in combination with Safety Rules section of the "OSU Safety Procedures" Manual (section 10), and the OSU booklet "*Working Safely with Hazardous Materials: A Handbook for Employees*". To assist supervisors in identifying the required job-specific safety training, the "OSU Safety Training Identification Worksheet" has been developed (page 2). This matrix includes: prompts that indicate if an employee needs any of the required job specific training; codes listed in parentheses ( ) next to each item which indicate the training programs available and options for obtaining the training; and an asterisk (\*) if the training should be repeated annually. The form has been designed to be used in the following manner:
  - Use one form per employee.
  - Supervisor reviews the form's questions and makes a check in the space to the right of the prompter.
  - For all checked items, supervisor looks in the ( ) for a code number that corresponds to training program available through EH&S.
  - A separate list describes the training program that corresponds to the codes found in the ( ).



- Supervisor contacts EH&S; training programs and video equipment will be provided at no charge.
- When employee receives the needed training the date can be entered on the form.
- This form is designed to be kept in the employee's file.

## Record Keeping

- Documentation and record keeping is an important element of the training process. A tracking system should be used to record safety training. Forms shown below have been developed by EH&S to aid in this process. These forms need to be filled out and kept in departmental records. It is the supervisor's responsibility to document all safety training. It is important to capture all the information requested on the form for each training session.

### OSU Safety Training Identification Work Sheet [\(Printable Version\)](#)

<b>EMPLOYEE NAME:</b>	<b>SUPERVISOR:</b>
<b>DEPARTMENT/UNIT:</b>	<b>DATE:</b>

**Instructions:** Supervisor reviews this list and make checks in the space to the left of each item if the employee meets any of the listed criteria. All questions refer to conditions that the employee will encounter working at OSU. When training is completed the date of the training can be placed in the right hand space. This form can be kept in the employee's file.

Letter and numbers inside ( ) refer to programs available through EH&S; see list below. Items with \* require annual training if program or hazard changes or new chemicals are used.

<b>Will This Employee Use:</b>			
	Date of training		Date of training
Tractors or heavy ag equipment ( <i>TI</i> )		Ladder or scaffold ( <i>L2</i> )	
Fork lift ( <i>F3</i> )		Hand tools ( <i>Z1</i> )	
Power tools ( <i>P2 &amp; P3</i> )		Manlift, vehicle mounted work platform ( <i>Z1</i> )	
"Powder" actuated tools ( <i>Z2</i> )*		Industrial truck ( <i>Z1</i> )	
Welding equipment ( <i>A1 &amp; O3</i> )		Video display terminal ( <i>W3</i> )	

Fume hoods ( <i>Z1</i> )		Respirator ( <i>Z1</i> )	
Personnel-protective equipment ( <i>E2</i> )		Fall arrest system ( <i>F1</i> )	
Herbicides or pesticides ( <i>P1,H4,W2,W4</i> )*		Chemical or chemical compounds ( <i>H2</i> )*	
Eye wash or safety shower ( <i>Z1</i> )		Mechanical power press ( <i>Z1</i> )	
Signs, signals, barricades ( <i>Z1</i> )		Office equipment ( <i>O1</i> )	
Required to use fire extinguisher ( <i>F2</i> )*			
<b>Will This Employee Perform Any of the Following Tasks:</b>			
Lift, push, pull, or stand constantly ( <i>B1</i> )		Perform maintenance at greenhouse ( <i>W4</i> )	
Tree trimming ( <i>Z2</i> )		Respond to chemical spill ( <i>Z1</i> )*	
Enter a confined space ( <i>C2</i> )*		Dig trenches or excavate ( <i>T2</i> )	
Food service work ( <i>Z1</i> )		Perform first aid (In Job Description) ( <i>B3</i> )*	
Repair or install pitched roof ( <i>F1</i> )		Transport, package, hazardous waste ( <i>H3</i> )	
Recharge storage batteries ( <i>Z1</i> )		Service single or multi piece wheels ( <i>Z1</i> )	
Drive university vehicle ( <i>Z1</i> )		Package or receive hazardous materials ( <i>H3</i> )	
Work with human blood/other body fluids ( <i>B3</i> )*		Work around/with electricity ( <i>E1</i> )	
Remove lead based paint ( <i>Z1</i> )		Work on or maintain equipment that needs to be locked or tagged out to prevent accidental injury ( <i>L3</i> )*	
Diving ( <i>Z2</i> )		Remove asbestos containing material ( <i>Z2</i> )*	
<b>Will This Employee Work in an Area Containing any of the Following:</b>			
Asbestos (disturb when working) ( <i>A2,A3</i> )		Radioactive materials or radiation ( <i>R1</i> )	
Noise exceeding 80 dBA ( <i>Z1</i> )*		Laboratory chemicals ( <i>L1</i> )*	
Hazardous chemicals ( <i>H2</i> )*		Carcinogens ( <i>Z1</i> )*	
<b>Safety Training Programs Available Through OSU EH&amp;S</b>			
A1	Arc Welding: Safety & Operations - 13 min video	L1	Laboratory Safety: The OSHA Lab Standard - 28 min video

A2	Asbestos Health Hazards - Contact EH&S to Schedule Program	L2	Ladders & Scaffolds: It's up to you - 19 min video
A3	Asbestos at Oregon State University - Contact EH&S to Schedule Program	L3	LOTTO: Lockout/Tagout - 15 min video
B1	Back Care and How to Lift Properly - Contact EH&S to Schedule Program	M1	Maintenance Person Safety - 13 min video
B2	Basic First Aid - Humorous - 17 min video for Supervisor	O1	Office Safety (Risky Business) - 20 min video
B3	Bloodborne Pathogens - Videos Available; Contact EH&S for Information	O2	Operating Instructions for the Karcher Brand Power Washers - Video
B4	Brace Your Space (earthquake-proofing) - video	O3	Oxyacetylene Welding: Safety & Operations - 15 min video
B5	Brush Chipper Safety - 20 min video	P1	Pesticide Safety in the Landscape - 27 min video
C1	Chain Saw Safety - 28 min video	P2	Portable Power Tools - Contact EH&S for appropriate video
C2	Confined Space Entry Training - Contact EH&S to Schedule Program	P3	Power Hand Tools For Grounds Maintenance Workers - 30 min video
E1	Electrical Safety-Related Work Practices in General Industry - 24 min video	P3	Practicing Safe Science - 29 min video
E2	Equipped for Safety (Personnel Protective Equipment) - 9 min video	R1	Radiation Safety For Ancillary Employees - Contact EH&S to schedule program
F1	Fall Protection - video	R2	Right to Know Industrial - 39 min video
F2	Fire Extinguisher Training and Use - 15 min video	T1	Tractor Safety Begins with You - 20 min video
F3	Forklift Safety - 18 min video	T2	Trenchers - 18 min video
G1	Grinding Wheel Safety Parts I and II - videos	W1	Working Safely With HIV In The Laboratory - 20 min video
H1	Hand Tool Safety - videos	W2	Working Safely with Pesticides - 18 min Video
H2	Hazard Communication - Contact EH&S to Schedule Program	W3	Work Station Design (VDT Use) - Contact EH&S to schedule program
H3	Hazardous Materials Transportation - Compliance and Enforcement - Contact EH&S	W4	Worker protection standard - 30 min video
H4	Herbicide Safety In The Landscape - video	Z1	Contact EH&S For Training Materials
H5	HIV in the Laboratory - 28 min video	Z2	Need to use competent/certified outside training provider.

**OSU Safety Training** (Information in this document will become part of the employee's record.)

Course Name:			
Course Date(s):		Total Hours of Training:	
Name (Please Print)	Social Security Number	Department/ Phone	

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## Reference 25

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# 16: Laboratory Safety

**These concepts may apply in any areas where hazardous chemicals are used or stored.**

### GENERAL

1. Safety takes precedence over all other considerations.
2. When performing dangerous chemical procedures, be sure there is someone in the immediate vicinity you can reach in case of emergency.
3. Know the location of eyewash fountains and emergency showers. Find out how to use them properly.
4. Before beginning a procedure, take a minute to investigate hazards involved; take all necessary safety precautions.
5. Store food products in separate non-lab refrigerators specifically reserved for that use.
6. Eating, drinking, and smoking is not permitted in laboratory areas. Break rooms should be available for that use.
7. Remove unsafe equipment from service. Report unsafe facilities or behavior to your supervisor.
8. Because unattended equipment and reactions are major causes of fire, floods, and explosions, double check utility connections. Anticipate hazards that would result from failure of electrical, water, or gas supply.
9. Use hose keepers on water condenser lines.

### PERSONAL PROTECTION, CLOTHING, AND HAIR

10. Properly label all containers.
11. Wear approved eye and face protection suitable for the work at hand. Safety glasses or goggles should be worn at all times while working with chemicals at the counter or laboratory hood. A face shield should be worn when working with potentially eruptive substances.
12. Remind all visitors and non-lab staff to observe lab safety rules, including eye protection, while in the laboratory.
13. Wear protective gloves and clothing whenever handling corrosive, toxic, or other hazardous chemicals. Wear closed-toe shoes at all times in the lab.
14. Check that guards are provided on moving parts of mechanical apparatus to prevent hazardous contact.
15. Maintain lab areas reasonably neat and uncluttered.

16. Use the fume hood for all operations involving harmful gases or fumes and for flammable or explosive materials. Check the hood to see that it is operating adequately and has been inspected within the last year.
17. Use a safety shield or barrier to protect against explosion, implosion, and flash fires when performing reactions with large volume of flammable liquids or unstable material.
18. Inspect glassware for cracks, sharp edges, and contamination before using. Broken or chipped glassware should be repaired and polished or discarded.
19. Always use a lubricant (e.g., water, glycerol) when inserting glass tubing into rubber stoppers or grommets. Protect hands in case tubing breaks.
20. Broken glass should be put in impervious containers that are large enough to completely contain the glass. These containers are to be placed into the building trash dumpsters by laboratory personnel.
21. Do not handle radioactive isotopes without oversight from the Radiation Safety Office.

## **CHEMICAL HANDLING**

22. Transport dangerous or flammable liquids in a safety pail or other adequate secondary containment. Prevent containers from tipping when transporting on a cart.
23. Take extra precautions when working with large quantities of reactants.
24. Use caution when adding anything to a strong acid, caustic, or oxidant. Add slowly.
25. When adding solids (boiling chips, charcoal, etc.) to a liquid, check that it isn't hot.
26. Use a pipet filler - not mouth suction - for all pipet work
27. Keep the mouth of any vessel being heated pointed away from any person (including yourself).
28. When working with biohazardous material, guard against infection by skin contact, inhalation of aerosols, and contamination of food and beverages.
29. Known carcinogens, mutagens, and teratogens should not be used or stored in normal laboratory situations. Such substances require extreme precaution, tight security, limited access, secondary containers, and other safety procedures; see the OSU Carcinogen Safety program.
30. Flammable liquids should only be heated with steam, hot water or a grounded heating mantle. Check the area for possible flames or electrical sparks.
31. All experiments involving volatile flammable liquids (e.g., diethyl ether) should be considered fire or explosive hazards.
32. When not in use, laboratory natural gas lines should be shut off at the line valve rather than at the equipment.
33. Whenever possible, position energized electrical equipment, or other devices that may emit sparks or flame, at least six inches above the floor.
34. Properly ground electrical equipment.
35. Laboratory electrical equipment should have a three-conductor cord that connects to a grounded electrical outlet, unless the equipment is dual-insulated..

36. Electrical wiring for experiments, processes, etc. should be done neatly, and must conform to electrical code requirements.
37. Store strong oxidants (e.g., nitrates, chlorates, perchlorates, peroxides) in a dry area apart from organic materials.
38. Use a specially designed wash-down laboratory hood for heated perchloric acid digestions.

## CHEMICAL STORAGE

39. Include the word "flammable" on all flammable liquid containers.
40. Whenever possible, store flammable solvents in NFPA-approved flammable liquid storage cabinets or approved solvent storage rooms.
41. If storing more than 10 gallons of flammable liquids in a laboratory, a flammable liquid cabinet **MUST** be used.
42. Pay careful attention to peroxide-forming compounds. Organic peroxides may detonate by shock, friction, or heat. Compounds with dangerous tendencies to form peroxides by reaction with oxygen (e.g., many ethers and other chemical classes) have a limited shelf life. They should be dated on opening, and should in no case be stored for longer than one year.
43. Keep caustics stored below eye level.
44. Keep glass containers of chemicals off the floor - unless they are inside protective containers or pans that are kick-proof.
45. Inventory chemicals periodically and discard old, no-longer-needed substances through the campus hazardous waste disposal program.
46. Report chemical inventory annually to EH&S for OR-OSHA and State inventory reporting purposes.
47. See *Safety Bulletin #30* for more information on chemical storage.

## PRESSURE AND VACUUM SYSTEMS

48. Plan and provide for the possibility of explosion prior to conducting experiments that develop high pressure or vacuum.
49. Heat reactants only in a system with an approved pressure release.
50. Wait for pressure to be released before opening a pressurized vessel (autoclave, etc.).
51. Secure compressed gas cylinders in an upright position at all times to prevent from falling. Keep protective caps in place when moving or storing gas cylinders.
52. Regulators designed for specific cylinders are not interchangeable.
53. Keep flammable gas cylinders away from exits and oxygen cylinders.
54. When moving cylinders with a lift truck or hand truck, make sure there is an approved rack or securing device.
55. **STOP HERE** Never use oxygen as a substitute for compressed air. Do not use oil on gauges or regulators for oxidizing gases. Oxygen under pressure reacts violently with oil or grease.
56. Never use compressed gas from a cylinder without a reduction of pressure through a suitable pressure regulator.

57. Pressure adjusting screws on regulators shall always be FULLY RELEASED BEFORE the regulator is attached to a cylinder. Always open the valves on cylinders slowly. Do not stand in front of pressure regulator gauge faces when opening cylinder valves.
58. Do not strike valves with tools, or use excessive force in making connections.
59. Avoid mixtures of acetylene and oxygen or air prior to use except at a standard torch.
60. Cylinders not provided with fixed hand wheel valves shall have keys or handles provided on valve stems at all times when cylinders are in use.
61. Cylinders should not be dropped, bumped violently, skidded or rolled horizontally. Compressed gas cylinders are high-pressure vessels and should be handled accordingly.
62. Do not store cylinders in direct sun, or in boiler or furnace rooms.

## CONTAINER HANDLING

63. Properly label all containers. If unsure, check rule # 10 (above).
64. Before re-using any food container, first remove the original label completely.
65. Chemical transport containers are not to be used for non-compatible chemicals or for food products at any time.
66. All containers should have a lid at all times except during an active experiment.
67. Refrigeration of flammable materials must be done in spark-proof or explosion-proof refrigerators.

## CHEMICAL SPILLS AND DISPOSAL OF CHEMICAL WASTES

68. Devise a plan to deal with small spills before one occurs. POST the plan in the lab and get appropriate equipment. Quickly and thoroughly clean up any liquid or solid chemical spill in the laboratory or area of operations. If any uncertainty exists, call Environmental Health & Safety (EH&S).
69. For large spills, contact EH&S to activate OSU's chemical spill response team.
70. Dispose of chemical wastes by approved methods only. Unwanted or no-longer-useful chemicals are chemical wastes. Contact EH&S for waste disposal guidelines.
71. Reagent bottles should be thoroughly cleaned of any hazardous material prior to disposal. Clean glass reagent bottles can usually be recycled.
72. Four simple steps to help comply with hazardous waste rules:
  - Perform a waste determination on all wastes (EH&S responsibility)
  - Label all waste containers with "waste" or "used", plus a chemical description, **BEFORE** adding waste.
  - Keep all waste containers closed except when adding waste.
  - Keep the waste in the room where it was generated.