

# LABORATORY SAFETY AND HEALTH STANDARDS

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## Standards

- OSHA
- Consensus
- Other

## Cal/OSHA Standards

- Group 1. General Physical Conditions and Structures (Sections 3207 - 3299)
- Group 2. Safe Practices and Personal Protection (Sections 3300 - 3416)
- Group 3. General Plant Equipment and Special Operations (Sections 3420 - 3583)
- Group 4. General Mobile Equipment and Auxiliaries (Sections 3620 - 3920)
- Group 6. Power Transmission Equipment, Prime Movers, Machines and Machine Parts (Sections 3940 - 4086)
- Group 8. Points of Operation and Other Hazardous Parts of Machinery 4184 - 4647)
- Group 9. Compressed Gas and Air Equipment (Sections 4648 - 4665)

## Cal/OSHA Standards Continued

- Group 10. Gas Systems for Welding and Cutting (Sections 4794 - 4848)
- Group 11. Electric Welding (Sections 4850 - 4853)
- Group 13. Cranes and Other Hoisting Equipment (Sections 4884 - 5049)
- Group 14. Radiation and Radioactivity (Sections 5075 - 5085)
- Group 15. Occupational Noise and Ergonomics (Sections 5094 - 5110)
- Group 16. Control of Hazardous Substances (Sections 5139 - 5223)
- Group 18. Explosives and Pyrotechnics (Sections 5236 - 5374)
- Group 20. Flammable Liquids, Gases and Vapors (Sections 5415 - 5629)
- Group 25. Federal Regulations (Sections 6000 - 6004)
- Group 26. Diving Operations (Sections 6050 - 6120)
- Group 27. Fire Protection (Sections 6150 - 6184)

### **Consensus Standards**

- NFPA 45 Fire Protection for Laboratories Using Chemicals
- NFPA 99 Health Care Facilities
- NFPA 101 Life Safety Code
- ANSI Z358.1 Showers/Emergency Water
- ANSI Z87.1-1989 Eye and Face Protection
- ANSI Z136.1/136.3 Lasers, Safe Use
- NFPA 55 Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders

### **Other**

- Guidelines - CDC
- Long Term Abatement Agreements
- Order to Take Special Action
- Special Order

### **IIPP CCR §3203**

- Responsible Person
- Sanctions/Enforcement
- Communication
- Inspections
- Investigation Procedures
- Correction Procedures
- Training
- Record Keeping

### **Hazard Communication CCR §5194**

- Written Program
- Training
- Labeling
- Storage
- MSDS Available

### **Occupational Exposure to Hazardous Chemicals in Laboratories CCR §5191**

- (e) Chemical Hygiene Plan – General  
(Appendix A (non-mandatory) provides guidance to assist employers in plan development)
1. The employer shall develop and carry out provisions of a plan where hazardous chemicals are used in the workplace
    - a. Protect employees from health hazards
    - b. Keep exposure below PELs
  2. Plan must be readily accessible to employees and others as defined

### **CCR §5191 : Chemical Hygiene Plan: Part 1**

- The plan shall include the following elements and shall indicate specific measures to ensure employee protection
  - i. Standard Operating Procedures when hazardous chemicals involved: safety and health
  - ii. Criteria to determine and implement controls, use of personal protective equipment, and hygiene practices: extremely hazardous chemical considerations

**CCR §5191**  
**Chemical Hygiene Plan: Part 2**

- iii. A requirement that fume hoods and other protective equipment are functioning properly; specific measures taken to ensure proper and adequate function of this equipment
- iv. Provision for information and training

**CCR §5191**  
**Chemical Hygiene Plan: Part 3**

- v. Describe when a particular laboratory operation requires prior approval by employer
- vi. Provisions for medical consultation and medical examinations as presented in (g)
- vii. Designate who is responsible to implement plan; chemical hygiene officer; and may use committee
- viii. Provisions for additional protection for particularly hazardous substances: if appropriate; designated areas, containment areas, procedures for removal of contaminated waste, and decontamination procedures

**Chemical Hazards**

Health Hazards  
Safety Hazards

**Health Hazards of Chemicals**

- Irritants
- Corrosives
- Sensitizers
- Carcinogens
- Target organs
- Toxic

**Safety Hazards**

- Flammable
- Explosive
- Oxidizer
- Pyrophoric
- Water reactive
- Unstable
- Organic peroxide

**Control of Chemical Hazards**

- Storage
- Handling
  - Engineer Controls
  - Administrative Controls
  - PPE

**Chemical Hazards:  
Cal/OSHA Standards**

- CCR §5191 – CHP
- CCR §5194 – HAZCOM
- Group 2 – (§3300 – §3416) PPE
- Group 16 - (§5139 – §5223) Control of Hazardous Substances
  - §5144 - Respiratory Protection.
  - §5155 - Airborne Contaminants
  - §5155 – Emergency Eyewash and Shower
  - §5164. Storage of Hazardous Substances

**Flammable and Combustible  
Hazards**

Physical Hazards of some Laboratory  
Operations/Tasks

**Flammable and Combustible Hazards:  
Liquids**

- Hazardous Conditions
  - Storage location condition
  - Use around ignition sources
  - Spills
  - Fire situation

**Flammable and Combustible Hazards:  
Liquids - Controls**

- Size of containers
- Quantity limits per NFPA and other authorities
- Storage cabinets
  - Metal cabinets
  - Plywood cabinets
  - Ventilation: When? Why?

**Flammable and Combustible:  
Cal/OSHA Standards**

- Group 18 - (§5236 – §5374) Explosives and Pyrotechnics
- Group 20 - (§5415 – §5629) Flammable Liquids, Gases and Vapors

**Compressed Gases**

Safety and Health Hazards

### **Compressed Gases: Hazardous Properties**

- Physical Pressure
- Anesthetic
- Corrosive
- Flammable
- Reactive
- Inert or radioactive
- Toxic

### **Compressed Gases: Handling Cylinders**

- Receiving Issues
- Storage
  - Cylinders can last for decades
  - Cylinders need to be tested periodically
  - Visual inspection of cylinders for damage
- Use
  - Leak testing/pressure in system/heat source structural damage/health hazard

### **Compressed Gas: Cal/OSHA Standards**

- Group 9 - (§4648 – §4665) Compressed Gas and Air Equipment
  - §4650. Storage, Handling, and Use of Cylinders.

### **Biohazards**

Organisms and Products of Organisms

### **Biohazards**

- Biohazardous agents and materials
  - Bacteria
  - Viruses
  - Fungi
  - Parasites
  - Toxins
  - Allergens

### **Biohazards**

- Hazardous exposures
  - Direct contact
  - Indirect contact
  - Vectors
  - Aerosols

**Biohazard:  
CAL/OSHA Standards**

- §5154.1. Ventilation Requirements for Laboratory-Type Hood Operations.
- §5154.2. Ventilation Requirements for Biological Safety Cabinets.
- §5193. Bloodborne Pathogens.
- §5199. Aerosol Transmissible Diseases.
- §5199.1. Aerosol Transmissible Diseases – Zoonotic
- §3362(g). General Requirements - Mold

**Radiation Safety**

Ionizing and non-ionizing radiation

**Radiation Safety:  
Types and Health Effects**

- Ionizing radiation
  - Alpha particles – cancer, internal
  - Beta particles – cancer
  - Gamma – cancer, cellular damage
  - X-ray/neutron, other – cellular damage and or cancer possible
- Non-ionizing: tissue heating
- Ultraviolet: covers both and causes burns with cancer risk

**Radiation Safety:  
Work Practice**

- Apply ALARA (as low as reasonably achievable). Contain radiation to source area by feasible controls for energy of source.
- External versus internal hazard
- Control of external radiation exposure
  - Time
  - Distance
  - Shielding

**Radiation:  
Cal/OSHA Standards**

- Group 14. (§5075 – §5085) Radiation and Radioactivity
- NRC controls access to and use of most radioactive materials and requires exposure records unless exempt quantities
- Cal/OSHA is limited in scope relative to NRC

**Laser Safety**

Focused intense energy possible of various wavelengths

**Laser:  
Classes of Lasers**

- Class 1 laser; lower energy avoid prolonged eye contact.
- Class 2; higher energy; avoid eye contact
- Class 3A eye hazard;
- Class 3B eye and skin hazard
- IV Class 4 High hazard; serious harm if not controlled

**Laser Safety:Controls**

- Operators must trained in hazards
- Never view the direct beam
- Protective eyeware when 1 watt per square centimeter and reduce to class 1 or to within the maximum exposure limit.
- Avoid aiming at occupied areas
- Laser warning signs posted and on unit for high energy
- Shield unnecessary paths; Follow containment practices

**Laser:  
Cal/OSHA  
Consensus Standards**

- ANSI Z136.1 General use of lasers; work practice and increasing levels of control to avoid exposure to the beam
- ANSI Z136.3 Medical use of lasers; Hazards of exposure and use. Generally high energy for surgical procedures and beam control essential

**Physical Hazards**

Facility, equipment, task features capable of causing injury

**Physical Hazards:Examples**

- Facility: slips, trips, falls, wounds, lighting, housekeeping
- Equipment: machine guarding
- Electrical
- Heat/cold

**Physical Hazards:Inspection**

- Floor/location plan
- Entry conditions
- Checklist of items to review
- Is there an energy control program
- What to do with information
- How are defects identified until fixed?
- Is information used to update - CHP/IIPP?

### **Physical Hazards: Cal/OSHA Standards**

- Subchapter 5. Electrical Safety Orders
  - Flexible Cords and Cables (§2500.7– §2500.25)
- Group 1. (§3207 – §3299) General Physical Conditions and Structures
  - §3214. Stair Rails and Handrails.
  - §3225. Maintenance and Access to Exits.
  - §3272. Aisles, Walkways, and Crawlways

### **Physical Hazards: Cal/OSHA Standards**

- Group 2. (§3300 – §3416) Safe Practices and Personal Protection
  - §3300. Live Steam and Air Hoses.
  - §3317. Illumination
- Group 6. (§4184 – §4647) Power Transmission Equipment, Prime Movers, Machines and Machine Parts
- Group 8. (§3940 – §34086) Points of Operation and Other Hazardous Parts of Machinery

### **Ventilation: Purpose**

- Minimize exposure to agents with health risk
- Prevent/control fires
- Contain splashes/spills
- Material reclamation
- Air quality
- Protection of environment

### **Ventilation: Exposure Control**

- Dilution ventilation
- Source control by local capture
- Pathway modification by air balance
- Isolation by glove box design

### **Ventilation: Laboratory Hoods**

- Conventional Hoods
- By-pass Hoods
- Supplied air (auxiliary air)
- Glove box, closed system

### **Ventilation: Features of Laboratory Hoods**

- Sash
- Adjustable slots
- Air foil
- Drain
- Electrical services
- Lighting
- Capture system



### **Ventilation: Work Practice**

- Minimize working behind the hazard
- Keep work at least 6 inches inside sash
- Keep sash down as far as practical during operation.
- If needed consider splash barriers to supplement the sash but monitor air balance.
- Keep liquids from flowing out of unit onto floor

### **Ventilation: Cal/OSHA Standards**

- §5154. Ventilation and Personal Protective Equipment Requirements for Open-Surface Tank Operations.
- §5154.1. Ventilation Requirements for Laboratory-Type Hood Operations.
- § 5154.2. Ventilation Requirements for Biological Safety Cabinets.

### **Personal Protective Equipment**

Protection against recognized hazards  
Use engineering controls as feasible

### **Personal Protective Equipment: Eye and Face**

- Nature of the Hazards
  - Chemical splash
  - Radiation
  - Flying Objects
- Protective Devices
  - Glasses/goggles
  - Shields- face shields/ barriers

### **Personal Protective Equipment: Respiratory**

- Limited use in typical laboratory
- Hazards airborne:  
PEL/biological/radiation
- Hazard evaluation/apply OSHA standard
- Respirator program where needed.

### **Personal Protective Equipment For Biological Safety**

- Types of equipment
  - Respirators/face masks
  - Lab coats/suits
  - Gloves
- Selection and use
  - Dependent on procedure and hazard

### **Personal Protective Equipment: Hands and Skin**

- Use chemicals with limited hazard data
- Use chemicals with limited permeation data
- Handle a variety of chemicals, may need several forms of protective gloves/clothing
- Applicable OSHA standards
- Employee acceptance of gloves/clothing

### **Personal Protective Equipment: Other**

- Occupational foot protection
- Occupational head protection
- Occupational Body
- Hearing Protection
- Ergonomics

### **Cal/OSHA Standard**

- §3382. Eye and Face Protection.
- §5144. Respiratory Protection.
- §3384. Hand Protection.
- §3385. Foot Protection.
- §3381. Head Protection.
- §3383. Body Protection.
- §5094 - §5099. Control of Noise Exposure
- §5110. Repetitive Motion Injuries.

### **Emergency Procedures**

What can happen; what is the plan;  
does everyone know what to do?

### **Emergency Procedures**

- Types of emergencies
  - External events
  - Natural events: storms/floods
- Transportation
- Construction: hot work/releases
- Other employers create

### **Emergency Procedures**

- Types of emergencies
- Result from Laboratory
  - Fire
  - Spill
  - Biohazard
  - Ventilation failure
  - Leak of compressed gas

### **Emergency Procedures: Plan/Train/Respond**

- Preparation and response to Emergency
  - Walk through facility; review laboratory activities; know conditions of locality
  - Write a plan of control/prevention
  - Training as needed
  - Necessary equipment and responses

### **Emergency Response**

- Example situations
  - Facility fire response
  - Clothing fire response
  - Chemical spill within facility
  - Chemical splash to body/clothing

### **Emergency Response Cal/OSHA Standards**

- §5192. Hazardous Waste Operations and Emergency Response.
- §3220. Emergency Action Plan.
- §3221. Fire Prevention Plan.
- §6151. Portable Fire Extinguishers.