**LABORATORY SAFETY AND HEALTH STANDARDS**

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DISTRICT MANAGER - HIGH HAZARD UNIT

Cal/OSHA

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**Standards**

- OSHA
- Consensus
- Other

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**Cal/OSHA Standards**

- **Group 1. General Physical Conditions and Structures (Sections 3307 - 3329)**
- **Group 2. Safe Practices and Personal Protection (Sections 3360 - 3368)**
- **Group 3. General Plant Equipment and Special Operations (Sections 3370 - 3385)**
- **Group 4. General Mobile Equipment and Auxiliaries (Sections 3390 - 3392)**
- **Group 5. Power Transmission Equipment, Prime Movers, Machinery and Machine Parts (Sections 3390 - 3392)**
- **Group 6. Points of Operation and Other Hazardous Parts of Machinery (Sections 3434 - 3447)**
- **Group 9. Compressed Gas and Air Equipment (Sections 4694 - 4695)**

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**Cal/OSHA Standards Continued**

- **Group 10. Gas Systems for Welding and Cutting (Sections 4704 - 4705)**
- **Group 11. Electric Welding (Sections 4830 - 4835)**
- **Group 13. Cranes and Other Hoisting Equipment (Sections 4934 - 4939)**
- **Group 14. Radiating and Radioactivity (Sections 5075 - 5085)**
- **Group 15. Occupational Noise and Ergonomics (Sections 5094 - 5101)**
- **Group 16. Control of Hazardous Substances (Sections 5139 - 5143)**
- **Group 17. Explosives and Pyrotechnics (Sections 5236 - 5274)**
- **Group 18. Flammable Liquids, Gases and Vapors (Sections 5413 - 5425)**
- **Group 25. Federal Regulations (Sections 6000 - 6004)**
- **Group 26. Diving Operations (Sections 6550 - 6128)**
- **Group 27. Fire Protection (Sections 6150 - 6184)**
Consensus Standards

- NFPA 45 Fire Protection for Laboratories Using Chemicals
- NFPA 99 Health Care Facilities
- ANSI Z258.1 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?

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 Gass: 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

- §5141. Ventilation Requirements for Laboratory-Type Hood Operations.
- §5142. Ventilation Requirements for Biological Safety Cabinets.
- §5193. Bloodborne Pathogens.
- §5199. Aerosol Transmissible Diseases.
- §51991. Aerosol Transmissible Diseases - Zoonotic
- §3362g. 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: 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

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 eyewear 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/IPP?
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
- 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

What can happen; what is the plan; does everyone know what to do?
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
- §6151. Portable Fire Extinguishers.