Hazardous Waste Operations and Emergency Response
-HAZWOPER-

Student Manual

Developed by:

Labor Occupational Safety and Health Program
University of California at Los Angeles
Western Region Universities Consortium

www.losh.ucla.edu

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UCLA-LOSH, lead agency for the Western Region Universities Consortium (WRUC).

Members of our Consortium include:

UC Berkeley's Labor Occupational Health Program,
University Extension at UC Davis,
Arizona State University, and
University of Washington.

UCLA-LOSH complies with 29 CFR 1910.120, Appendix E Training Curriculum Guidelines. These guidelines were established in order to provide the best possible learning environment for hazardous waste workers and emergency response personnel.

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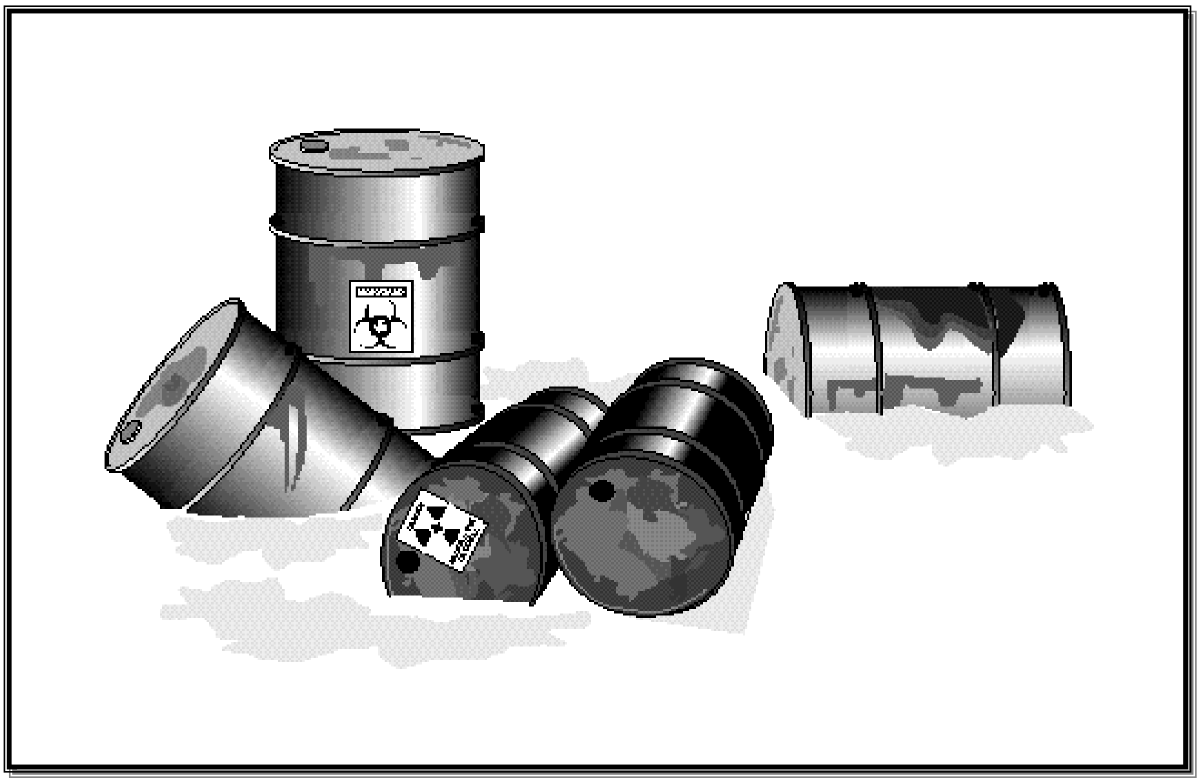
MODULE 1

Introduction to Hazardous Waste



Module 1
Introduction to Hazardous Waste

OUTLINE

I. Hazardous Substances

II. Components That Define Chemicals as Hazardous

- Toxic
- Reactive
- Ignitable
- Corrosive

OBJECTIVES

At the end of this session, participants will be able to:

1. Define the term "hazardous waste" according to the California Health and Safety Code.
2. Classify different types of hazardous wastes based on four characteristics: toxic, reactive, ignitable, corrosive.
3. Analyze a worksite and identify hazards to which workers may be exposed.

I. HAZARDOUS SUBSTANCES

A hazardous substance is a generic term used to describe hazardous materials, hazardous chemicals, and hazardous waste. The following chart gives a brief overview of regulatory agencies and requirements that govern these three categories of hazardous substances.

Coverage	Hazardous Materials	Hazardous Chemicals	Hazardous Waste
Source of regulations	DOT - 49 CFR	OSHA - 29 CFR	EPA - 40 CFR DOT - 49 CFR OSHA – 29 CFR
Required information	Shipping papers, placards, labels, packaging and markings	Right-to-know, Hazard Communication, MSDS, labels, And markings	Listed waste, characteristics, H.W. manifest, and markings
Jurisdictions	Transportation	Worker-in-workplace	Disposal

CFR = Code of Federal Regulations

Definition of Hazardous Waste: Any solid, liquid, or contained gaseous material for disposal or recycle that poses significant potential harm to human health or environmental quality (RCRA, 1976; see also California Health and Safety Code sections 25117, DTSC Title 22 chapter 11 article 2 66261.10, and EPA Title 40 CFR 261.10)

A waste is **hazardous** if:

1. It is listed as such by a regulatory agency (EPA in 40 CFR 261 or Cal-EPA, Department of Toxic Substance Control (DTSC) in CCR Title 22, section 66261.10. DTSC is more stringent than the federal regulations in characterizing hazardous waste.

2. It has one or more of the following characteristics
   Toxic, Reactive, Ignitable, and/or Corrosive (TRIC):

   a. **T**oxic is poisonous (e.g. heavy metal, pesticides).

      persistent and bio-accumulative - metals and chemicals that do not break down when released into the environment (such metals and chemicals as: Cadmium, Lead, DDT (Dichloro diphenyl trichloroethane), Dioxins, PBB,s (polybrominated biphenyl), PCB's (Polychlorinated biphenyls).

b. **R**eactive unstable, may react with water, air or other chemicals (e.g. wastes containing cyanides or chlorine).

c. **I**gnitable easily combustible or flammable (e.g., paint wastes, solvents)

d. **C**orrosive dissolves metal, other materials, or burns skin (e.g., acids, caustics)

Generators of waste must determine if the waste is "hazardous" according to the criteria above.

II. COMPONENTS THAT DEFINE CHEMICALS AS HAZARDOUS

A. TOXICITY - is defined as the ability of a chemical or other substance to harm you when you touch, breathe, or swallow it. This term also refers to substances that affect systems and/or organs in a body. In addition, some hazardous waste can bio-accumulate and be persistent in the body. A material's toxicity usually depends on the dose of the substance.

Example of Toxic substances may kill fish when water quality is good and no infectious disease is apparent. Producers must investigate a fish problem by going through a process of elimination that involves careful investigation of water quality, infectious disease and toxic substances. The first step is to look at water quality.

Examples of Toxic Wastes

Following is the Toxicity Characteristics Leaching Procedure (TCLP):

1. Runoff from irrigation may carry toxic or poisonous substances that can harm living systems.

   The following pesticides can damage nerve cells (called neurotoxins):

   - **DDT**
   - **Chlordane**
   - **Parathion**

2. Chemical wastes from industrial operations contain many different toxic substances.

3. Many heavy metals used in industrial processes are toxic and very persistent in the environment. For example:

   - **Lead** (a neurotoxin, damages the nervous system)
   - **Chromium** (a carcinogen, causes cancer)
   - **Mercury** (a neurotoxin, damages the nervous system)

Persistent and Bio-accumulative

1. A waste is persistent if it does not biodegrade or break down easily in the environment.

2. A waste is considered bio-accumulative if it accumulates or builds up I living things.

3. Lists of persistent and bio-accumulative substances are found in California Code of Regulations (CCR) Title 22 section 66261.24.

Examples of Persistent or Bio-accumulative Substances

- Lead, lead compounds
- Chromium, chromium compounds
- DDT (Dichloro-Diphenyl-Trichloroethane – insecticide)
  DDE (Dichlorodiphenyldichloroethylene – breakdown of DDT)
- Heptachlor
- Chlordane
- PCBs
- Dioxin
- Trichloroethylene
- Asbestos (Friable)

B. REACTIVE WASTES

1. These involve an unstable chemical that reacts with water, air or other chemicals to ignite, produce heat or release hydrogen or oxygen that enhance combustion.

2. Some reactive chemicals, called pyrophoric, are capable of self- ignition.

3. Other reactive chemicals, while not self-igniting (under normal conditions), can still react to produce heat, which can make it easier to ignite other combustibles in a waste mixture.

4. CCR Title 22 section 66261.23 has reactivity criteria under which various substances are classified.

Examples of Reactive Substances

1. Caustic soda (sodium hydroxide or "lye"), potassium hydroxide, and water react to produce intense heat.

2. Carbides (sodium and potassium carbide) and water react to produce heat and flammable gases.

3. Calcium oxide (quicklime) and water react to produce heat (can ignite paper or wood).

4. Concentrated solution of hydrochloric (hydrogen chloride) and some common metals react to produce flammable hydrogen gas.

5. Hydrofluoric acid and some metals react to produce toxic hydrogen gas.

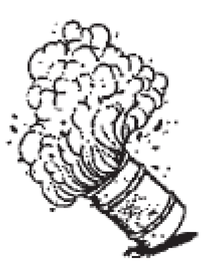
6. Concentrated solution of nitric acid and metal powders and/or turpentine (mineral spirits) reacts to produce an explosion.

7. Cyanide salts and water and/or acid react to produce toxic and flammable hydrogen cyanide gas.

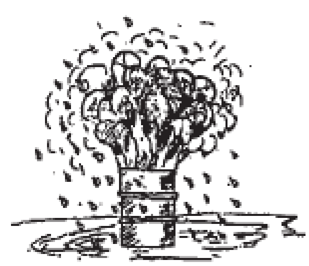
8. Perchloric acid is a strong oxidizing agent which can cause fire and explosions.

9. Some solvents, e.g., some ethers, are unstable over time, and degrade into explosive compounds.

10. Silane, a gas, is used extensively in the e semiconductor industry, but is a well – recognized fire hazard as it will ignite spontaneously when exposed to air.



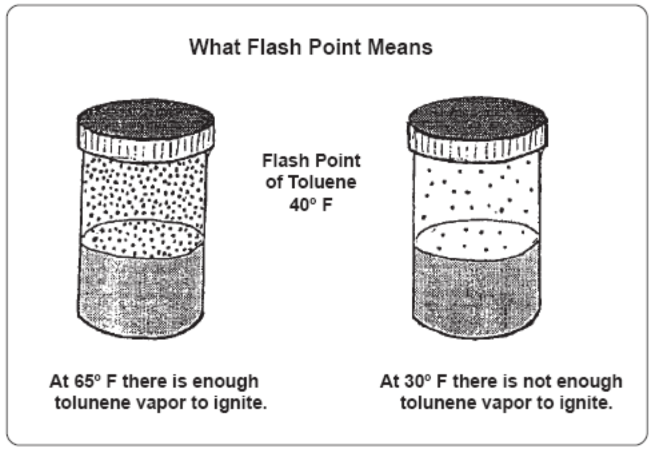
undergo sudden violent change



react violently with water

form a toxic gas when mixed with water

C. IGNITABLE WASTES

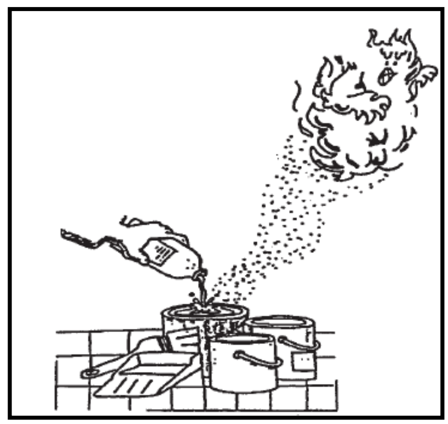


Ignitability is measured in terms of the lowest temperature (or energy) required for a material to ignite. The temperature required for a material to ignite is called flashpoint.

A flammable material can be solid, liquid, or gas. A flammable liquid is a liquid that has a flash point if 140°F or lower.

A combustible material can be solid or liquid. A combustible liquid is a liquid that has a flash point greater than 140°F

Examples of Ignitable Hazardous Wastes



1. Paint sludge and spent organic chemicals

   - Commercial painting
   - Paint manufacturing
   - Auto body shops

2. Solvents such as alcohols, acetones, methyl ethyl ketones (MEK), petroleum-based solvents

3. Flammable and combustible dusts such as particulates, metal, plastic, and wood dusts. Ignition is possible only with high airborne concentrations

4. Chemical wastes

   a. Most organic chemicals are ignitable and will readily burn.

   b. Organic chemicals present in waste streams (sludge) may ignite if ignition source is present.

5. Oxidizers

   a. Chemicals that produce oxygen when heated (e.g., nitric acid, chromic acid, permanganate, peroxide).

   b. Oxidizers can increase ignitability of combustible materials.

D. CORROSIVE WASTES

A corrosive is a chemical that causes visible destruction of or permanent changes in living tissue at the site of contact. Many hazardous wastes are corrosive.

EPA defines any solution with a pH less than **2 (extremely acidic)** or greater than **12½ (strong alkaline)** as a corrosive.

Examples of Strong Acids and Bases

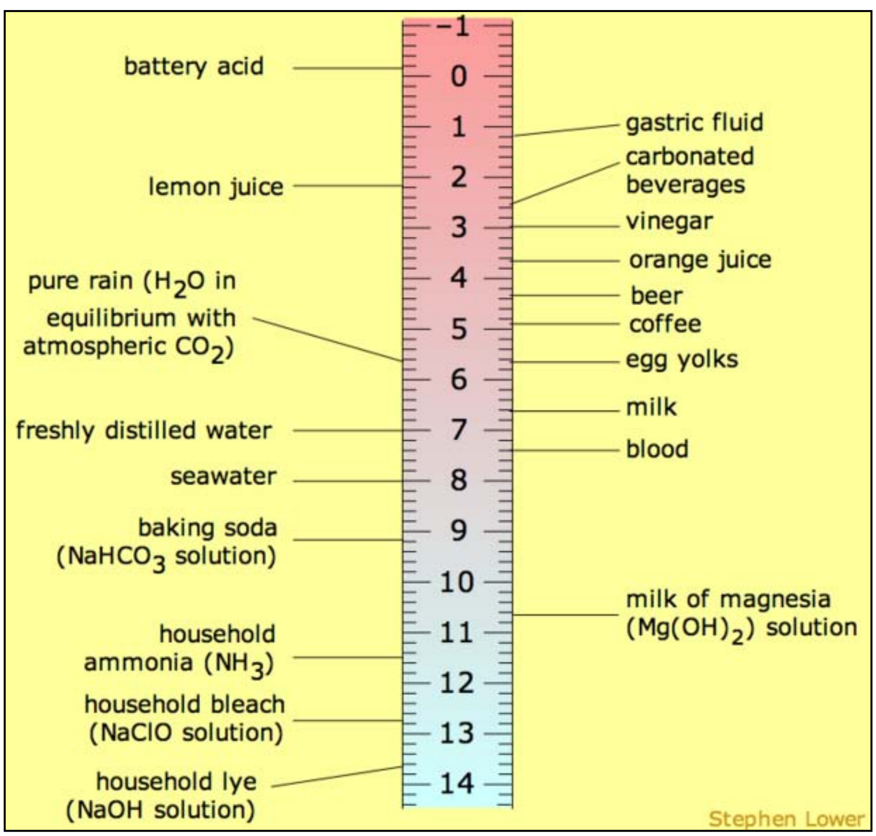
A. Acids (pH 0 - 2)

- Sulfuric Acid
- Nitric Acid
- Hydrochloric Acid
- Hydrofluoric Acid

B. Bases (pH 12½ - 14)

- Sodium Hydroxide (lye, caustic soda)
- Potassium Hydroxide (caustic potash)

Acids are products with a pH of less than 7, bases of greater than 7.
Examples above are for strong acids and bases for the definition of hazardous



Examples of Hazardous Wastes Generators:

Waste Generators	Waste Type
Chemical Manufacturers	• Strong Acids and Bases • Spent Solvents, Cyanides, Ignitable Reactive Wastes
Automobile Maintenance/Repair Shops	• Heavy Metal Paint Wastes • Ignitable Wastes • Used Lead Acid Batteries • Spent Solvents
Photo Processing Printing Industry	• Heavy Metal Solutions • Organic Chemical • Ink Wastes, Cyanide • Spent Solvents, Ammonium, Nitrate • Liquids • Ink Sludge/Containing Heavy Metals
Leather Products Manufacturing	• Waste Toluene and Benzene
Paper Industry	• Paint Wastes Containing • Heavy Metals • Ignitable Solvents • Strong Acids and Bases
Construction Industry	• Ignitable Paint Wastes, Asbestos • Spent Solvents, Lead • Strong Acids and Base
Cleaning Agents and Cosmetics Manufacturing	• Heavy Metal Dusts • Ignitable Wastes • Flammable Solvents • Strong Acids and Bases
Furniture and Wood Manufacturing and Refinishing	• Spent Solvents, Adhesives • Ignitable Wastes, Resin
Metal Manufacturing	• Paint Wastes Containing Heavy Metals • Strong Acids and Bases • Cyanide Wastes • Sludge Containing Heavy Metals

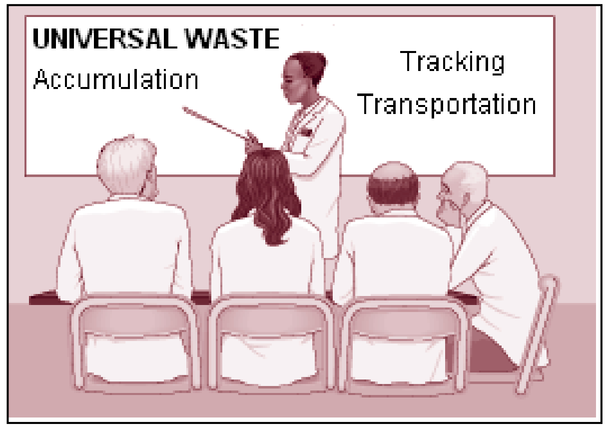
The California Hazardous Waste Classification System
Definition of Waste (22 CCR Section 66621.2) *Use the acronym TRICLE

Toxicity (22 CCR Sec 66261.24	• Toxicity characteristic contaminants • Inorganic persistant and bioaccumulative substances • Acute oral toxicity • Acute dermal toxicity • Acute inhalation toxicity • Acute aquatic toxicity • Listed carcinogens • General toxicity
Reactivity (22 CCR Sec 66261.23)	• Normally unstable • Water reactive • Potentially explosive mixtures with water • Generates toxic gases when mixed with water • Cyanide or sulfide bearing waste • Capable of an explosive reaction under confinement • Capable of an explosive reaction at standard temperature and pressure
Ignitability (22 CCR Sec 66261.21)	• Ignitable liquids (Flash point of less than 140°F) • Ignitable non-liquids • Ignitable compressed gas • Oxidizers
Corrosivity (22 CCR Sec 66261.22)	• Aqueous waste • Liquid wastes • Non-aqueous wastes • Non-liquid wastes
Listed and Identified Wastes	**RCRA Listed Wastes** (22 CCR Div 4.5 Chap 11 Art 4) • Non-specific sources (“F” List) • Specific source (“K” List) • Discarded products, intermediates and residues thereof (“P” and “U” List) **Identified Wastes** (22 CCR Sec 66261.3) • Mixtures of listed or characteristic wastes • Wastes derived from listed or characteristic wastes • Used oil (CA Health and Safety Code 25250-25250.25)
Extremely Hazardous Wastes (22 CCR Sec 66261.110-113)	• Acute oral toxicity (EH) • Acute dermal toxicity (EH) • Acute inhalation toxicity (EH) • Listed carcinogens and Water reactive (EH) • Persistent and bioaccumulative toxic substances (EH)

Universal Waste

Small and large businesses that generate hazardous waste in the federal universal waste categories can use the more streamlined requirements under the Universal Waste Rule. The rule eases the regulatory burden on businesses that generate these wastes. Specifically, the universal waste rule has streamlined requirements for:

- Notification
- Labeling/marking
- Prohibitions
- Accumulation time limits
- Response to releases
- Offsite shipments
- Tracking
- Exports
- Transportation
- Employee training



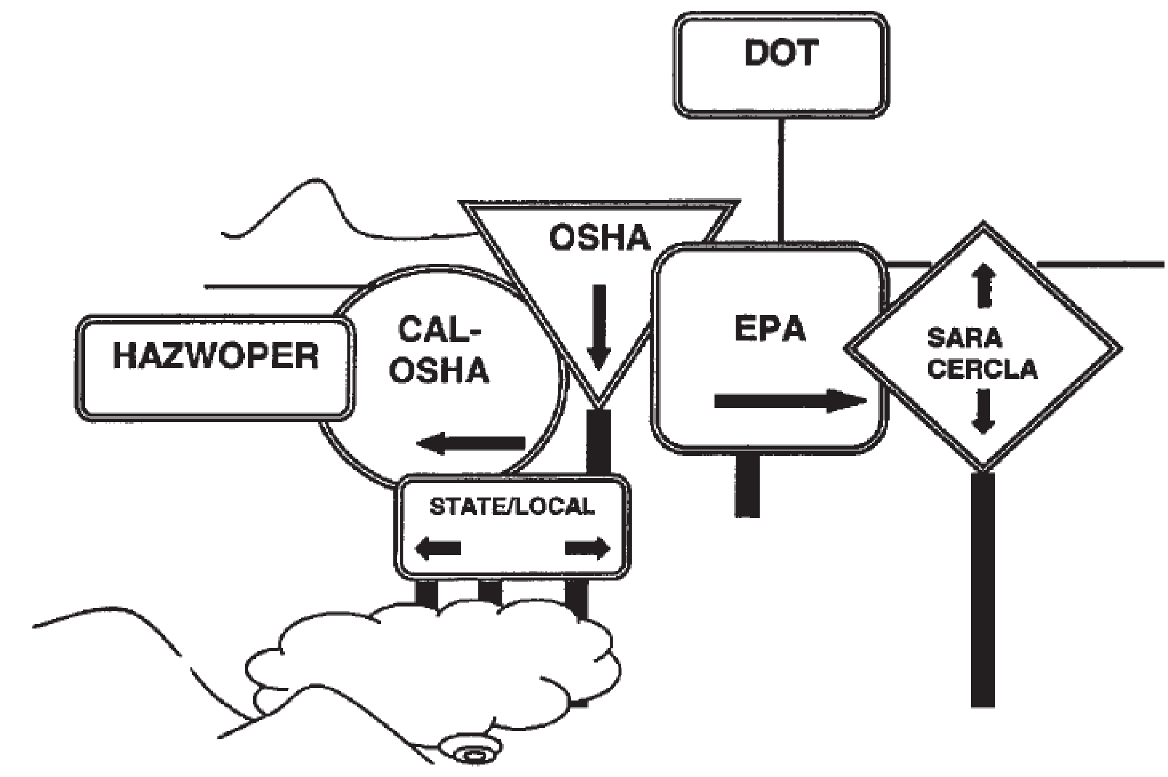
Universal wastes are common household or business waste items that require special care in disposal to prevent harm to people or the environment. California's universal waste regulations allow individuals and businesses that use, collect, transport, and recycle universal wastes to follow reduced requirements compared to those for most hazardous wastes.

Types of Universal Wastes and What makes them Hazardous

Batteries	Includes all batteries, AAA, AA, C, D, button cell, 9-volt, and all others, both rechargeable and single use -- Cadmium, Copper and (In older batteries) Mercury
Cell Phones	Antimony , Arsenic, Beryllium, Cadmium, Copper, Lead, Nickel, Zinc
Computers and Monitors	Arsenic, Cadmium, Lead, PCBs
Electronic Devices	Lead
Fluorescent Lamps	Mercury
Mercury wastes	Thermometers and toys
Non-empty Aerosol Cans	Propane, Butane, Pesticides
Televisions	Arsenic, Cadmium, Lead, PCBs

MODULE 2

Compliance and Enforcement



Module 2
Compliance & Enforcement

OUTLINE

I. Key Regulatory Agencies

- Occupational Safety and Health Administration (OSHA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Department of Transportation (DOT)

II. Key Compliance Associations

- National Institute (NIOSH)
- American Conference of Industrial Hygienists (ACGIH)
- National Fire Protection Association (NFPA)
- American National Standards Institute (ANSI)

III. Laws Preceding OSHA Hazardous Waste Regulation:

- Resource Conservation & Recovery Act (RCRA)
- Comprehensive Environmental Response Compensation & Liability Act (CERCLA)
- Superfund #2: Superfund Amendments and Reauthorization Act (SARA)

IV. Regulation for Hazardous Waste Operations And Emergency Response (HAZWOPER)

OBJECTIVES

At the end of this module, trainees will be able to:

1. Describe the major hazardous waste laws and determine which regulations apply to their workplace.
2. Identify the employer requirements and worker's rights under the Cal/OSHA hazardous waste standard (Cal/OSHA GISO 5192).
3. List training requirements under HAZWOPER regulation.

I. KEY REGULATORY AGENCIES

1. Worker Health and Regulatory Agencies

Occupational Safety and Health Administration (OSHA)
www.osha.gov

OSHA was created in 1970 to protect the safety and health of workers. This agency develops and enforces workplace health and safety regulations and provides outreach and training. The regulations require employers to provide a workplace free of health and safety hazards. OSHA has jurisdiction over federal employees and over private sector workers in states that do not have their own state OSHA, and monitors states that choose to have their own OSHA (e.g. California; see Cal/OSHA below).

OSHA regulations are located in Title 29 of the Code of Federal Regulations (CFR). OSHA 29 CFR 1910.120 (q) contains the emergency response requirements of the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation.

California Occupational Safety and Health Administration (Cal/OSHA)
www.dir.ca.gov

It has three main divisions which, together, protect the health and safety of workers in California, develop and enforce regulations, and provide information and assistance such as consultations.

- The Standards Board Division - Establishes health and safety standards (also known as regulations) to protect workers from hazards on the job. For example: Cal/OSHA has regulations to protect against exposure to chemicals, fire and explosion hazards, noise, hot outdoor environments, and unsafe equipment. Regulations are in Title 8 of the California Code of Regulations (CCR).

- The Compliance Division – Enforces regulations by citing and fining employers who are in violation. Employers have the right to appeal the citations.

- The Consultation Division – Provides technical assistance and educational material to employers in order to help them comply with Cal/OSHA regulations. Workers and unions can also obtain information and handouts.

Cal/OSHA General Industry Safety Order (GISO) 5192 is the California equivalent of Federal OSHA HAZWOPER regulation.

2. Environmental Regulatory Agencies

Environmental Protection Agency (EPA)
www.epa.gov

EPA was established in 1970 to protect human health and the environment. The EPA and its regional offices:

- Implement and enforce federal environmental laws such as the Clean Air Act, Clean Water Act, and Superfund.
- Conduct research and risk assessments on environmental chemicals.
- Develop regulations for hazardous substance use, transport, storage, and disposal, as well as for industrial pollution control.
- Initiate and manage hazardous waste cleanup and certify state Treatment, Storage and Disposal Facility (TSDF) permitting programs.

EPA regulations are in Title 40 of the CFR.

California Environmental Protection Agency (Cal/EPA)
www.calepa.ca.gov

Cal/EPA was created in 1991 and has similar responsibilities to federal EPA. It is an umbrella agency for several California programs that enforce federal and state environmental laws.

Department of Toxic Substances Control (DTSC)

The Mission of the Department of Toxic Substances Control is to provide the highest level of safety, and to protect public health and the environment from toxic harm.

The Department of Toxic Substances Control (DTSC) regulates hazardous waste, cleans-up existing contamination, and looks for ways to reduce the hazardous waste produced in California. Approximately 1,000 scientists, engineers, and specialized support staff make sure that companies and individuals handle, transport, store, treat, dispose of, and clean-up hazardous wastes appropriately.

DTSC regulates hazardous waste in California primarily under the authority of the federal Resource Conservation and Recovery Act of 1976, and the California Health and Safety Code. Other laws that affect hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup and emergency planning.

DTSC is committed to establishing and implementing protective and consistent cleanup programs and standards. Some of these are "brownfields," sites that often sit idle or underused, contributing to both urban blight and urban sprawl. DTSC cleans-up or oversees approximately 220 hazardous substance release sites at any given time and completes an average of 125 cleanups each year.

Pollution Prevention (P2) focuses on source reduction - eliminating or reducing the toxicity of a hazardous pollutant. Source reduction is preferable to recycling and treatment options because it avoids waste costs and management liability. It also provides the best protection for public health and the environment. The Hazardous Waste Source Reduction and Management Review Act requires hazardous waste generators to seriously consider source reduction as the preferred method of managing hazardous waste. DTSC uses this and other tools to motivate generators to consider and implement pollution prevention options.

3. Transportation Regulatory Agencies

Department of Transportation (DOT)
www.dot.gov

DOT was established in 1966 to ensure a safe and efficient transportation system. The DOT is a federal agency that:

- Regulates the movement of hazardous materials by air, highway, rail, water or pipeline.
- Restores highways and railroads after hazardous materials spills and/or releases.
- Governs hazardous material communication i.e. -- signs, labeling, marking, placarding, packaging, documentation, hauling equipment and licensing of haulers.

DOT requirements for transportation of hazardous materials are in 49 CFR Parts: 100-180.

II. KEY COMPLIANCE AGENCIES

National Institute for Occupational Safety & Health (NIOSH)

NIOSH is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH helps assure safe and healthful working conditions for workers by providing research, information, education, and training in the field of occupational safety and health.

NIOSH operates programs in every state to improve the health and safety of workers. As part of these State Activities, NIOSH:

- Evaluates workplace hazards and recommends solutions when requested by employers, workers, or state or federal agencies;
- Builds State worker safety and health capacity through grants and cooperative agreements;
- Funds occupational safety and health research on a wide variety of topics at universities and other organizations; and supports occupational safety and health training programs.

American Conference of Governmental Industrial Hygienists (ACGIH®)

ACGIH is a member based organization that advances occupational and environmental health. This organization provides timely, objective, and scientific information to occupational and environmental health professionals.

ACGIH establishes the Threshold Limit Values (TLVs) for chemical substances and physical agents and Biological Exposure Indices (BEIs), which are developed as guidelines to assist in the control of health hazards. These recommendations or guidelines are intended for use in the practice of industrial hygiene, to be interpreted and applied only by a person trained in this discipline.

National Fire Protection Association (NFPA)

The mission of the international nonprofit NFPA, established in 1896, is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education.

The world's leading advocate of fire prevention and an authoritative source on public safety, NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks.

NFPA membership totals more than 81,000 individuals around the world and more than 80 national trade and professional organizations.

American National Standards Institute (ANSI)

ANSI coordinates development and use of voluntary consensus standards in the United States and represents the needs and views of U.S. stakeholders in standardization forums around the globe.

The Institute oversees creation, promulgation, and use of thousands of international norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment, from dairy and livestock production to energy distribution, and many more. ANSI is actively engaged in accrediting programs that assess conformance to standards - including globally-recognized cross-sector programs such as the ISO 9000 (quality) and ISO 14000 (environmental) management systems.

ANSI facilitates the development of American National Standards (ANS) by accrediting the procedures of standards developing organizations (SDOs). These groups work cooperatively to develop voluntary national consensus standards. Accreditation by ANSI signifies that the procedures used by the standards body in connection with the development of American National Standards meet the Institute's essential requirements for openness, balance, consensus, and due process.

American Society of Mechanical Engineers (ASME)

Founded in 1880, today's ASME is a 120,000-member professional organization focused on technical, educational and research issues of the engineering and technology community. ASME conducts one of the world's largest technical publishing operations, holds numerous technical conferences worldwide, and offers hundreds of professional development courses each year. ASME sets internationally recognized industrial and manufacturing codes and standards that enhance public safety.

III. LAWS PRECEDING OSHA HAZARDOUS WASTE STANDARD

A. Resource Conservation and Recovery Act (RCRA)

1. Enacted in 1976 by the United States federal government. The Environmental Protection Agency (EPA) is the federal agency that implements and enforces RCRA. States can operate their own hazardous waste management (RCRA) program by agreement with the U.S. EPA. RCRA focuses only on active and future facilities and does not address abandoned or historical sites.

2. Provisions:

   - Regulates solid waste disposal; encourages recycling and alternative waste management technologies.

   - Establishes a system to identify and track hazardous waste from generator, to transporter, to treatment, long-term storage, and/or ultimate disposal (commonly referred to as **"cradle-to-grave"**).

   - Sets technical performance and record-keeping standards for facilities that receive hazardous waste for treatment, storage, or disposal **(TSD)** and sets standards for state-run RCRA programs.

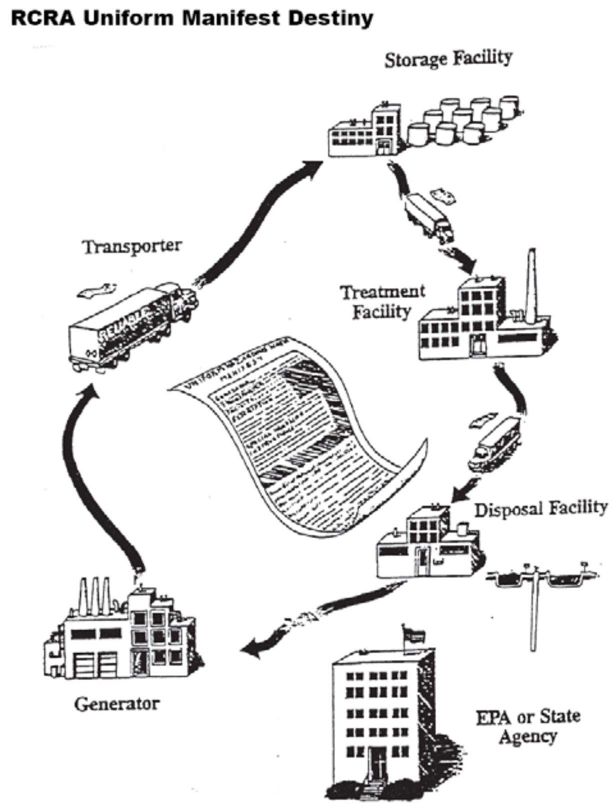
   - Requires licenses for transporters; registration for generators; and extensive, detailed permits for treatment, storage and disposal facilities.

3. RCRA was amended in 1984 to create the Hazardous and Solid Waste Amendment Act **(HSWA)**, which:

   - banned bulk hazardous liquid waste disposal in landfills and restricted waste oil incineration.

   - brought underground storage tanks under regulation, including requirements for proper tank installation; leak monitoring; notification and record-keeping; tank design; tank removal; and cleanup of contaminated sites.

   - added new requirements for small-quantity hazardous waste generators (those who generate 100 kg-1,000 kg per month) and increased EPA enforcement authority.



A one-page manifest must accompany every waste shipment.

The resulting paper trail documents the waste's progress through treatment, storage, and disposal.

A missing form alerts the generator to investigate, which may mean calling in the state agency or EPA.

Who Is Covered by RCRA?

1. **Generators** of hazardous wastes

    - small-quantity generators: 100 kg - 1,000 kg per month
    - large-quantity generators: > 1,000 kg per month

2. **Transporters** must be licensed (by EPA) to haul hazardous waste and must use a Uniform Manifest for every shipment of hazardous waste from the point of generation through treatment, recycling, or ultimate disposal.

3. Treatment, Storage, and Disposal Facilities treat, store, or dispose of hazardous waste. A ***treatment facility*** chemically or physically treats hazardous waste to make it less hazardous. A ***storage facility,*** stores large amounts of hazardous waste, which may produced on or off-site, or elsewhere. A ***disposal facility*** provides permanent containment or destruction of waste materials. Landfills and incinerators are examples of disposal facilities. These facilities can be operated only under federal or state permit. Facilities subject to permit requirements include those that:

    - accept hazardous waste for treatment (including recycling, resource recovery, stabilization, neutralization, solidification, incineration, or another process;

    - store a minimum quantity (100 kg) of hazardous wastes for > 180 days or 1,000 kg for > 90 days (with certain restrictions); or

    - accept hazardous waste for ultimate disposal on-site.

B. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund (1980-1985)]

The CERCLA, commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Over five years, $1.6 billion was collected and the tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. CERCLA:

- established prohibitions and requirements concerning closed and abandoned hazardous waste sites;
- provided for liability of persons responsible for releases of hazardous waste at these sites; and
- established a trust fund to provide for cleanup when no responsible party could be identified.

The law authorizes two kinds of response actions:

- Short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response.

- Long-term remedial response actions, that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions can be conducted only at sites listed on EPA's National Priorities List (NPL).

CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL.

Authority – CERCLA gives EPA authority to respond to releases of hazardous substances into the environment and to direct and oversee cleanup of old and abandoned waste sites that pose a threat to the public or environment.

Money – CERCLA established a fund or “superfund” to pay for clean up of dangerous hazardous waste sites when the responsible party cannot be located or refuses to pay the costs. This fund is financed primarily by a tax on certain industries.

Priority List – CERCLA creates a ranking system call the National Priorities List for the hazardous waste sites that are deemed most hazardous to public health and the environment. The sites highest on the list are given priority for clean up.

C. Superfund Amendments and Reauthorization Act (SARA) (1986-1991)

SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) on October 17, 1986.

SARA reflected EPA's experience in administering the complex Superfund program during its first six years and made several important changes and additions to the program. SARA:

- stressed the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites;
- required Superfund actions to consider the standards and requirements found in other State and Federal environmental laws and regulations;
- provided new enforcement authorities and settlement tools;
- increased State involvement in every phase of the Superfund program;
- increased the focus on human health problems posed by hazardous waste sites;
- encouraged greater citizen participation in making decisions on how sites should be cleaned up; and
- increased the size of the trust fund to $8.5 billion.

SARA also required EPA to revise the Hazard Ranking System (HRS) to ensure that it accurately assessed the relative degree of risk to human health and the environment posed by uncontrolled hazardous waste sites that may be placed on the National Priorities List (NPL).

Training

- OSHA must create health and safety training requirements for hazardous waste workers and emergency response personnel (result in OSHA 1910.120).

- Funds set aside for training workers, to be given to nonprofit organizations nationwide.

Emergency Planning (SARA Title III)

- State and Local Emergency Planning Committees must be established.

- Plans for emergency response, emergency notification, and evacuation procedures must be drawn up.

- Facilities and transportation routes for extremely hazardous substances must be identified.

Community Right to Know (SARA Title III)

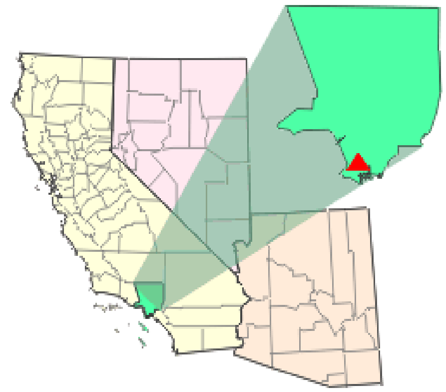
- Companies that produce, store or use extremely hazardous substances must notify state and local Emergency Planning Committees of the chemicals they use.

- Large companies (greater than 10 employees) must submit a list to the EPA and state officials of the hazardous substances that they routinely release into the air, water and soil.

EPA and local officials must be immediately notified of any accidental release of a hazardous substance by a company. Emergency notification by a facility with an accidental release of a hazardous substance must include the following information:

- The name of the chemical
- Whether it is known to be acutely harmful
- An estimate of the quantity released
- The time and duration of the release
- Where the chemical was released (air, water, land)
- Known health risks and necessary medical attention
- Proper precautions, such as evacuation
- The name and telephone number of a contact person at the facility where the release occurred
- A follow-up notice is required after the emergency which updates the initial information and describes the actions taken.

Superfund Sites



November 2006: EPA announced that it reached a major milestone: the completion of construction at the 1,000th site under Superfund, the federal government program that cleans up abandoned hazardous waste sites.

Construction is complete or construction is in progress at 95 percent of all Superfund sites listed by EPA. Currently, 550 sites are ready to be or have already been returned to communities for productive users.

One local example of a successful cleaning up is Del Amo Superfund Site in Los Angeles, California. The area was formerly used to dump industrial waste from the synthetic rubber plant that had operated there from 1943 to 1972. The 280-acre operation consisted of a styrene plant operated by Dow Chemical Co., a butadiene plant operated by Shell Oil Co., and a synthetic rubber plant operated by US Rubber Co., Goodyear Tire & Rubber Co.

Wastes were dumped into six unlined pits and three evaporation ponds. Environmental investigations revealed that the waste had contaminated the surrounding soil and groundwater with volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

In 1997, the EPA began cleaning-up the Del Amo Superfund site, starting with a multi-layer impermeable cap over the waste pits and installation of the soil-vapor extraction wells. In September, 2002, the Del Amo facility was placed on the EPA's National Priorities' List of the most contaminated sites in the US.

At the waste pits, where the contaminated materials were removed, EPA joined with Shell Oil to facilitate the relocation of 32 families and demolish houses that were near the contaminated area. Shell is considering turning these acres into a community center or public open space.

IV. REGULATION FOR HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE (HAZWOPER)

OSHA: 29 CFR 1910.120

CAL/OSHA: 8 CCR 5192

The purpose of the HAZWOPER standard is to protect the health and safety of people who work with hazardous waste by requiring their employers to develop and implement workplace health and safety programs.

Who is covered under the standard?

1. Hazardous Waste Site Workers:

    a. at federal or state Superfund sites

    b. at hazardous waste sites designated for cleanup by other government agencies, including during the initial site investigation stage

    c. at sites where the company or "responsible party" is voluntarily cleaning up a site recognized by a government agency as an uncontrolled hazardous waste site

    d. at RCRA-permitted sites with waste areas in need of "corrective action."

2. TSD Facility Workers:

Workers at federal/state permitted treatment, storage and disposal (TSD) facilities (under RCRA).

3. Emergency Response Workers:

Anyone involved in on-site or off-site emergency response activities. How the standard applies to your facility varies, depending on whether or not you are an emergency responder, and if so, at what level of response you are involved.

General Industry Safety Orders (GISO) 5192

Hazardous Waste Operations and Emergency Response Standard

1. Effective March 6, 1990. Cal/OSHA has the authority to enforce this standard.

2. The standards requires: (Look at the HAZWOPER Quick Reference at the end of the module)

   - site health and safety program, including a written, site-specific health and safety plan
   - site characterization for health and safety planning, site control, and decontamination
   - training
   - medical surveillance: baseline, periodic and termination examinations
   - engineering controls, safe work practices, and personal protective equipment - respirator selection, written PPE program
   - air monitoring: to identify the kind and amount of chemical exposure
   - drum handling: as required by Cal-EPA and EPA standard operating procedures
   - special requirements for TSDF workers and for emergency response workers: lines of communication and authority, planning, notification, training for emergency responders
   - sanitation, illumination: as required by construction industry standards
   - new technology development for worker protection

3. Compliance with GISO 5192 does not exempt employers from compliance with any other applicable state or federal standards.

How to Read a Standard

A typical Cal/OSHA standard is subdivided into various sections as follows:

- Lower case letters (a, b, c,…) refer to major sections;
- Then a number (1, 2, 3,…) for subsections of major sections;
- Subsections of that subsection use lower case Roman numerals (i, ii, iii…);
- Then a capital letter (A, B, C…) for the last subdivision of the subsections.

For example, the HAZWOPER section that requires employers at General Sites to provide training is listed at **8 CCR 5192 (e) (3) (A)**:

8	CCR	5192	(e)	(3)	(A)
Title 8: Industrial Relations	California Code of Regulations	Hazardous Waste Operations & Emergency Response	Training	Initial Training	General Site Workers "...shall receive a minimum of 40 hr of instruction off the site, and a minimum of 3 days actual field experience..."

HAZWOPER Training Requirements Cal/OSHA GISO 5192

Hazardous Waste Cleanup Workers

- 40 hours of general training before site entry (or 24 hours for occasional hazardous waste workers)
- 3 days of supervised on-site training after initial 40 hours (or 1 day for occasional workers)
- 8 hours of annual refresher
- 8 hours of special training for supervisors
- special training for members of emergency response teams: unspecified hours

Treatment, Storage and Disposal (TSD) Site Workers

- 24 hours of general training
- 8 hours annual refresher
- Special training for members of emergency response teams: unspecified hours
- General emergency awareness training for all facility employees

Emergency Response Personnel: Five Levels of Training

- First responders at the **"awareness level**" (FRA)
- First responders at the **"operations level"** (FRO)
- Hazardous materials **technician** (HAZMAT Tech.)
- Hazardous materials **specialist** (HAZMAT Spec.)
- On-scene commander (**Incident Commander**)
- All levels: Workers must be given annual refresher training

HAZWOPER quick reference

¶	Subject
(a)	**Scope, Application, and Definitions –** operations covered by the standard
(b)	**Health and Safety Plan –** requirements of a written program
(c)	**Site Characterization and Analysis –** evaluation of hazardous waste sites
(d)	**Site Control –** control of employee and public exposure before clean up begins
(e)	**Training -** requirements according to job function and responsibility
(f)	**Medical Surveillance –** employees covered and program requirements
(g)	**Engineering controls, Work Practices, and PPE –** protection of employees with emphasis on PPE Program
(h)	**Monitoring –** procedures to assure proper selection of engineering controls, PPE, and work practices based on monitoring results
(i)	**Informational Programs –** communicate with employees, contractors, and subcontractors regarding possible exposures
(j)	**Handling Drums and Containers –** handling, transporting, labeling, and disposing
(k)	**Decontamination –** removal of contaminants from personnel and equipment
(l)	**Emergency Response by Employee at Uncontrolled Hazardous Sites –** planning prior to start of a hazardous waste operation
(m)	**Illumination –** lighting requirements
(n)	**Sanitation at Temporary Work Places –** water and toilet facilities
(o)	**New Technology Programs –** introduction and evaluate of new technologies and equipment
(p)	**Operations Conducted under RCRA –** operations at TSD facilities
(q)	**Emergency Response to Hazardous Substance Release –** response, containment

Activity - Environmental and Occupational Laws, Regulations, and Agencies

Find Someone Who…

Find someone in the class who has information or experience about an issue in one of the boxes. Find out as much information as you can from the person – you will have to report what you learn.

#1 Find someone who has ever had any contact with Cal-OSHA.	#2 Find someone who knows under which Act the community "Right-to-Know" was created.	#3 Find someone who knows what government agency enforces the Clean Air Act	#4 Find someone who knows what CERCLA is and what it established.
#5 Find someone who knows what department within Cal-EPA is responsible for research and hazardous waste site clean up.	#6 Find someone who knows what Act established "Cradle-to-Grave" tracking of chemicals.	#7 Find someone who knows what standard is relevant to HAZWOPER and what government agency it is associated with.	#8 Find someone who has used the orange DOT guidebook.

MODULE 3

Workers' Rights

Module 3
Workers' Rights

OUTLINE

I. Cal/OSHA's Role in Workers' Rights

II. Structure of Cal/OSHA

III. Employer and Employee Responsibility

IV. Important Health and Safety Laws

- **"Right to Know"** About Workplace Hazards
- **"Right to Protection"** from Workplace Hazards
- **"Right to Act"** to Improve Workplace Health and Safety

V. Steps for Resolving Health and Safety Problems

OBJECTIVES

Trainees will be able to:

1. Explain the employer's responsibility under the Cal/OSHA General Duty Clause.
2. Describe at least four rights provided by Cal/OSHA regulations.
3. Identify at least three steps that can be taken to resolve health and safety problems.
4. Identify the steps workers should take if they must refuse to perform unsafe work.

I. Cal/OSHA'S Role in Workers' Rights

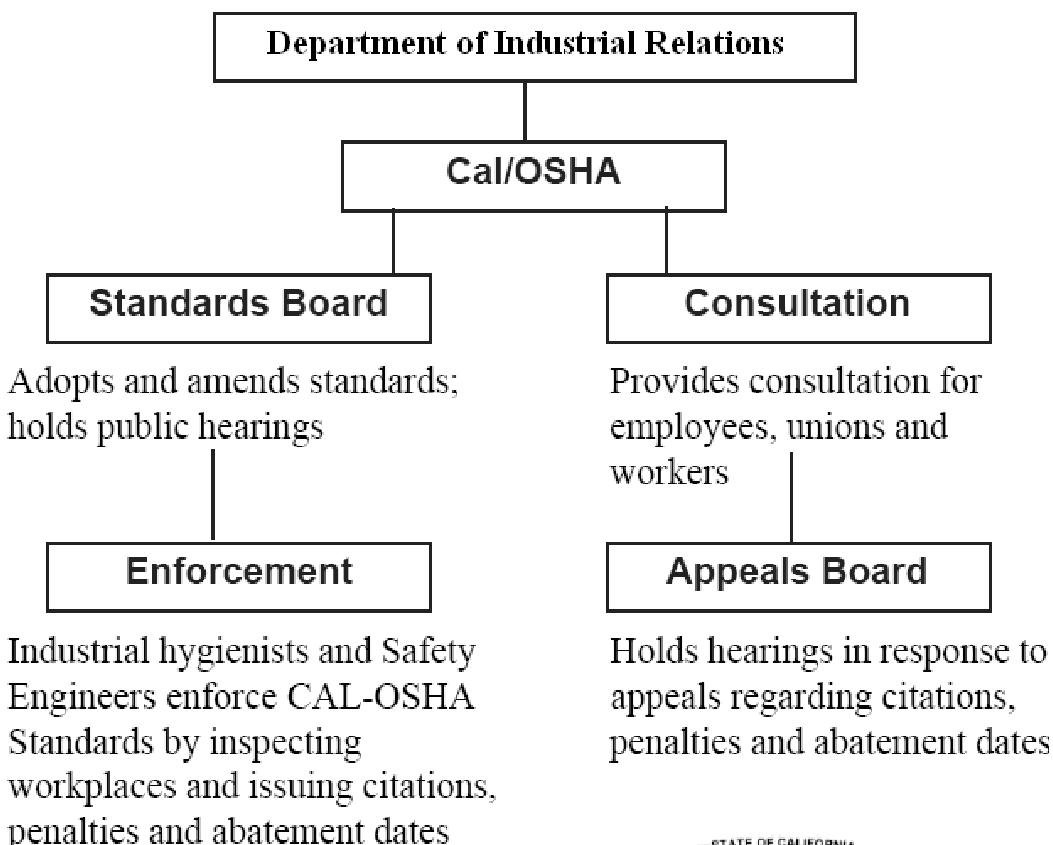
The Occupational Safety and Health Act (OSHAct) is the law that provides health and safety protection for private sector workers throughout the country. OSHA (Occupational Safety and Health Administration) is the agency responsible for enforcing the law.

States can also administer their own occupational health and safety programs, but they must be at least as protective as federal OSHA. State agencies can also provide protection for public sector workers (city, county, and state workers) as well as private sector workers.

In California, Cal/OSHA covers private and public sector workers and offers workers more protection than federal OSHA.

To assist employers in meeting their responsibility to provide a safe workplace, Cal/OSHA Standards are compiled in the California Code of Regulations (CCR) Title 8 (Industrial Relations). Many of the safety standards fall under the General Industry Safety Orders (GISO).

II. Structure of Cal/OSHA



III. EMPLOYER AND EMPLOYEE RESPONSIBILITY

Federal and California laws require employers to provide safe and healthful employment (Federal OSHA: Public Law 91-596, General Duty Clause and California Labor Code, Division 5, Part 1, Chapter 3).

In California, it is the employer's responsibility to provide a safe and healthful work environment. This should include:

6400 Every employer shall furnish employment and a place of employment that are safe and healthful for the employees therein.

6401 Every employer shall furnish and use safety devices and safeguards, and shall adopt and use practices, means, methods, operations and processes that are reasonably adequate to render such employment and place of employment safe and healthful.

Every employer shall do every other thing reasonably necessary to protect the life, safety, and health of employees.

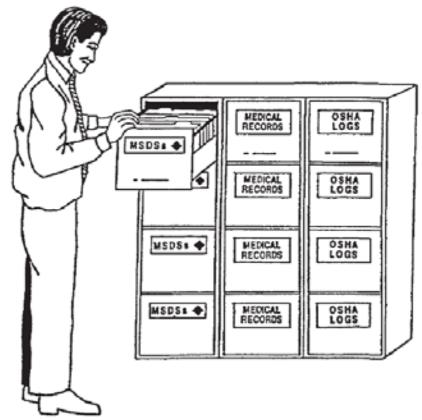
Cal/OSHA can't fine or cite a worker for failure to work safely; employees still have a duty to do so. Employee responsibilities include:

- Comply with all state safety and health regulations.
- Report hazardous conditions to your employer immediately.
- Report any work-related injuries and illnesses to your employer.
- Notify co-workers immediately of any serious hazards.
- Report defective equipment and machines.
- Follow the safety and health rules of your employer.

IV. IMPORTANT HEALTH AND SAFETY LAWS

Many of the laws and regulations that provide workers with the right to a safe workplace fit into the following categories:

1. "Right to Know" about Workplace Hazards
2. "Right to Protection" from Exposure to Workplace Hazards
3. "Right to Act" to Improve Workplace Health and Safety



RIGHT TO KNOW ABOUT WORKPLACE HAZARDS

"Right to Know" regulations include:

1. Hazard Communication Standard (GISO 5194)
2. Access to Medical and Exposure Records Standard (GISO 3204)
3. OSHA Log 300 of Injuries and Illnesses (Division of Labor Statistics and Research, Section 14301)

HAZARD COMMUNICATION STANDARD

The Hazard Communication Standard (GISO 5194) gives you the right to information that can answer the following questions:

1. What is hazardous in this material?
2. How can this affect my health?
3. What other hazardous materials are used at my workplace?

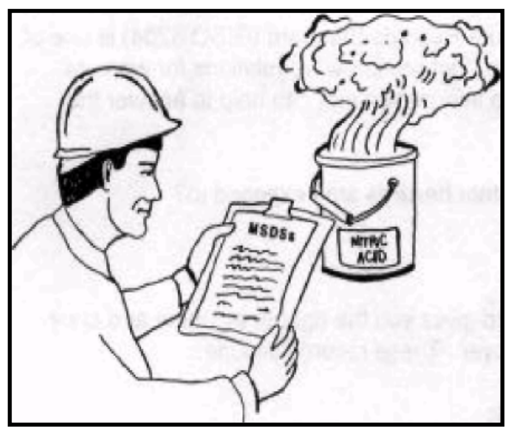
Federal and state OSHA programs give workers the right to know what hazardous materials they could be exposed to by requiring employers to set up a "Hazard Communication Program," including:

- **LABELS** on all hazardous materials
- **MSDSs (Material Safety Data Sheets)** for all hazardous materials
- **TRAINING** for all employees

Labels must include:

- Name of the hazardous substance (the same name as on the MSDS).
- Specific warnings about potential hazards and short/long term health effects.
- Name and address of the chemical manufacturer, importer, or other responsible party.

MSDSs must include:



- product name and ingredients.
- physical and chemical characteristics.
- fire, explosion, and reactivity hazards.
- health hazards: symptoms, routes of exposure, potential to cause cancer.
- legal exposure limits.
- precautions for safe handling and use.
- protective control measures and personal protective equipment.
- emergency, first aid measures, spill and leak procedures.

Training must include:

- physical and health effects of the hazardous substances.
- methods used to detect the presence or release of hazardous chemicals.
- measures employees can take to protect themselves from hazards (including how to read and use labels and MSDSs to protect themselves).

"RIGHT TO KNOW"

ACCESS TO MEDICAL AND EXPOSURE RECORDS STANDARD

The Access to Medical and Exposure Records Standard (GISO 3204) is one of the most important, yet least known, "right-to-know" regulations for workers. This standard gives you the right to information that can help to answer the following questions:

1. What types of chemicals and other hazards am I exposed to?
2. Do these chemicals or hazards affect my health?

The "Access to Records" standard gives you the right to examine and copy certain records kept by your employer. These records include:

- your own medical records
- all workplace exposure records

The "Access to Records" standard does not require your employer to conduct medical tests or monitoring, but it does require employer to give you access to these records. It also requires your employer to keep the records for **30 or more years.** Your employer must let you see and copy the records you request within 15 days of receiving a written request.

Access can mean one of three things:

1. free copy provided by your employer
2. use of copying facilities
3. loan of the record for you to make a copy at your own expense

Medical Records

Although not required by the standard, your medical records should include all of the following, whether done in-house or contracted out:

- medical history and questionnaires
- results of laboratory tests results of medical exams
- employee medical complaints
- medical opinions, diagnoses and recommendations
- originals of X-rays and interpretations
- description of treatment and prescription

Workplace Exposure Records

Your exposure records should include all of the following, whether done in-house or contracted out:

- monitoring information from personal, area, grab, wipe, or other forms of samples for chemicals, noise, heat, radiation, biological hazards.

- results of tests on blood, urine, breath, hair for toxic chemicals.

- Material Safety Data Sheet (MSDS). In the absence of MSDSs, you should be given any other record that reveals the identity of a toxic substance or physical hazard.

Confidentiality

Medical records are confidential. You have the right to sign a release to let your doctor or union representative see your records. Exposure records are not confidential. Union representatives can request all environmental monitoring (exposure) records. They can also request summaries of medical tests, without names, to look for trends (for example, hearing loss among a group of workers).

"RIGHT TO KNOW"

Cal/OSHA Standard Log 300 of Injuries and Illnesses

Under this Cal/OSHA regulation, every employer with 10 or more employees (except for those in the exemption list) must record an occupational fatality, injury, or illness if it meets one of the general recording criteria: death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, loss of consciousness, or is a significant injury or illness diagnosed by a physician or other licensed health care professional.

- The log must be kept at the local worksite. When employees do not work at a fixed worksite, as in construction, the worksite is the home base office or station where the employees are supervised.

- Workers have a right to get a copy of the Log 300, the Annual Summary (Form300A), and Incident Report (Form 301) by the end of the next business day.

- Employers must record all needle stick and sharps injuries involving contamination with another person's blood or other potentially infectious materials.

- The Annual Summary must be posted for 3 months, from February 1 to April 30 of each year.

Why is the Cal/OSHA Log Important?

- Although the Log 300 does not list all injuries and illnesses in the workplace, it can provide valuable information about serious hazards and problems that need to be corrected.
- Cal/OSHA reviews these forms when conducting an inspection.
- False or incomplete information can result in large penalties for the employer.

RIGHT TO PROTECTION FROM WORKPLACE HAZARDS

There are several Cal/OSHA standards that protect workers, including hazardous waste workers. The following standards (found in the General Industry Safety Orders - GISOs of the California Code of Regulations, Title 8) are summarized in this section:

1. Hazardous Waste Operations and Emergency Response (GISO 5192)
2. Injury and Illness Prevention Program (GISO 3203)
3. Confined Space Operations (GISO 5156, 5157, and 5158)
4. Respiratory Protection Standard (GISO 5144)
5. Airborne Contaminants Standard (GISO 5155)
6. Aerosol Transmissible Disease (GISO 5199) (Infectious Airborne Diseases)

Other Cal/OSHA standards may apply to specific hazards at your workplace. Also, the California Corporate Criminal Liability Act, effective January 1991, is enforced by the district attorney's office of each county.

"RIGHT TO PROTECTION"

Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard

The Cal-OSHA Hazardous Waste Operations and Emergency Response Standard (GISO 5192) gives you the right to:

1. inspect a written site safety and health plan provided by your employer that addresses the safety and health of each phase of site operations, including: requirements and procedures for employee protection.
2. be informed of specific risks at a particular site, including: any information concerning chemical, physical and toxicological properties for each substance known or expected to be present on site.
3. receive health and safety training.

4. receive medical exams where appropriate and without cost.
5. have access to the results of medical exams and monitoring data.
6. inspect a written emergency response plan or emergency action plan provided by your employer.

Injury and Illness Prevention Program (IIPP)

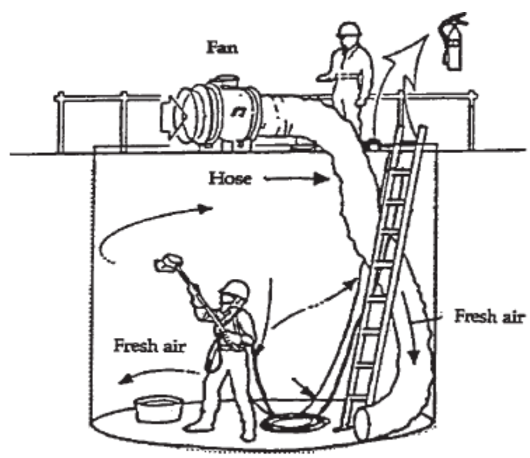
The Cal/OSHA Injury and Illness Prevention Program (GISO 3203) use to be called the Accident Prevention Program. It was updated and renamed in July, 1991 as a result of Senate Bill 198. The standard now requires every employer to establish, implement and maintain an effective injury and illness prevention program which is in writing and:

1. identifies person(s) responsible for the program.
2. provides a system for ensuring employee compliance (recognition, training, disciplinary actions).
3. includes a system for communicating with employees (including meetings, trainings, postings, written communications and/or labor/management safety and health committees).
4. includes procedures (including inspections) for identifying and evaluating workplace hazards.
5. includes procedures to investigate occupational injury/illness.
6. includes methods for correction of unsafe/unhealthful conditions, work practices or procedures in a timely manner.
7. provides training and instruction in the appropriate language.
8. maintains records of scheduled inspections, action taken to correct problems, and types, dates, and providers of trainings.

Confined Space Operation Standard

The Confined Space Standard (GISO 5157) applies to workers who enter and work within a confined space in which air contaminants (chemicals) are present and/or there is not enough oxygen (<19.5% O_2).

(See Module 12 for more information on the Confined Space Standard.)



Respiratory Protection Standard (GISO 5144)

This standard requires that:

1. Respiratory protective equipment is worn when it is not possible to remove harmful dusts, mists, vapors, or gases from the air or when emergency protection against relatively brief exposure is needed.

2. Only Mine Safety Health Administration (MSHA) - or NIOSH- approved respiratory equipment be used.

3. Employees are trained in the use and limitations of the equipment they are expected to use.

4. Employers provide, repair, replace, inspect, sanitize, and properly store all respiratory protective equipment that employees may have to use.

5. Breathing air meets specific medical or breathing oxygen requirements.

6. A written respiratory protection program include: procedures for selection, instruction, cleaning, inspection, and maintenance of respiratory protective equipment.

7. A Physician Licensed Health Care Professional (PLHC) determines the ability of a person to wear a respirator (see Module 8C for detailed information on respirator protection).

Airborne Contaminants Standard (GISO 5155)

This standard lists legal limits for the amount of chemicals that may be present in the air at work. It also states whether chemicals can be absorbed through the skin. It lists the Permissible Exposure Limits (PELs) and Ceiling Limits for approximately 700 chemicals.

The standard also defines various exposure limit terms (including PEL, Ceiling Limit, and Excursion Limit) according to Cal/OSHA. These values are found in Section 5155, Table AC-1 (www.dir.ca.gov/title8/5155.html)

OTHER SAFETY REGULATIONS

In addition to the Cal/OSHA regulations summarized above, many others may apply to hazardous waste work. Cal/OSHA has standards on machine guarding, welding, operation of equipment, electrical hazards, construction safety, radiation, noise and many others.

California Corporate Criminal Liability Act (California Penal Code, Section 387)

The California Corporate Criminal Liability Act (SB 198) went into effect in January, 1991. It allows for the prosecution of corporations and/or their representatives in the criminal courts under the jurisdiction of the District Attorney's office if the corporation or manager:

1. has actual knowledge of a serious concealed danger that is subject to regulatory authority.

2. fails to take the following action:

    a. correct the hazard, or

    b. inform Cal/OSHA and affected employees of the hazard.

If the hazard creates an imminent risk of bodily harm or death, the above action must be taken immediately; otherwise action must be taken within 15 days. Under this law, failure to notify Cal/OSHA and affected employees can result in criminal prosecution leading to imprisonment and/or fine.

RIGHT TO ACT TO IMPROVE WORKPLACE HEALTH AND SAFETY

You have a right to information and protection according to Cal-OSHA, the National Labor Relations Board (NLRB), and the California Labor Code. You also have the right to discuss health and safety problems with your supervisor or others at your workplace without fear of discrimination.

Rights that are grouped under the "Right to Act" include:

- right to union representation (under the NLRB).
- right to file a health and safety complaint with OSHA.
- right to refuse unsafe work (under the California Labor Code, Section 6311).
- right to claim workers' compensation.
- right to file a complaint for discrimination or retaliation.

RIGHT TO UNION REPRESENTATION

The NLRB oversees federal labor laws. These laws describe responsibilities and rights of employers, employees and unions. Many of these rights can be used to identify and eliminate health and safety hazards.

Right to Health and Safety Information: The NLRB gives unions the right to health and safety information in order to bargain intelligently about working conditions.

Unions have requested a wide range of health and safety information, including names of chemicals, MSDS, monitoring data, group summaries of medical tests, death and pension records, and written company health and safety plans and policies.

If there is a violation of a health and safety contract, it may be faster to ask the union for help rather than OSHA or the NLRB.

Right to an Outside Industrial Hygienist: The NLRB also gives unions the right to bring in a union-designated industrial hygienist to inspect a facility.

Right to Representation without Discrimination: The NLRB requires an employer to bargain in good faith with the representative of the employees: the union. The union must represent fairly and without discrimination all of the employees covered by the contract. This is referred to as "duty of fair representation."

RIGHT TO FILE A COMPLAINT WITH OSHA - CAL/OSHA

You have the right to file a complaint and request an inspection of your workplace by Cal/OSHA without anyone knowing who made the request. Cal/OSHA responds more quickly to serious hazards and if it knows you have made an attempt to resolve the problem before calling.

In order to request an inspection from Cal/OSHA, call or file a written complaint with one of the Cal/OSHA compliance (enforcement) offices listed below:

Regional Offices:

Los Angeles	Tel. (213) 736-4911
Anaheim	Tel. (714) 939-0145

Cal/OSHA District Offices:

Santa Ana	Tel. (714) 558-4451
San Bernardino	Tel. (909) 383-4321
Los Angeles	Tel. (213) 576-7451
San Diego	Tel. (619) 767-2280
Van Nuys	Tel. (818) 901-5403
Ventura	Tel. (805) 654-4581
Oakland	Tel. (510) 622-2916
Torrance/ Long Beach	Tel. (310) 516-3734
San Francisco	Tel. (415) 972-8670

Cal/OSHA Consultation Offices:

In California, Cal/OSHA Consultation is also available to provide technical assistance to employers and groups of workers. Cal/OSHA consultation services are free of charge. In order to obtain Cal/OSHA consultation services, call one of the following offices in your area:

Cal/OSHA Consultation toll-free Number 1-800-963-9424

Central Valley	Tel. (209) 454-1295
Los Angeles	Tel. (310) 944-9366
San Bernardino/Orange	Tel. (909) 383-4567
San Fernando Valley	Tel. (818) 901-5754
San Diego	Tel. (619) 767-2060
Northern California	Tel. (916) 263-0704

RIGHT TO REFUSE UNSAFE WORK (California Labor Code, Section 6311)

The California Labor Code, Section 6311, says workers can refuse to do unsafe work:

1. If doing the work would create a real and apparent hazard, and

2. If doing the work would violate a Cal/OSHA standard or an order of the California Labor Code.

You have the right to refuse unsafe work, but using this right can be risky if you are not covered by a union. If you lose your job or are otherwise discriminated against after refusing unsafe work, you can complain to the labor commissioner. However, cases that go to the Labor commissioner can take two to three years to resolve. Refusing work is not something to do "lightly." Refuse work only in an immediately dangerous situation.

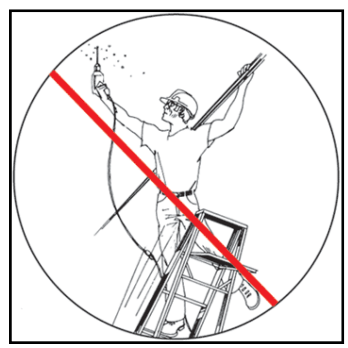
Before you refuse to do an unsafe job, take the following steps:

1. Consult with your co-workers to be sure you are in agreement and that you will not be the only person stating that the job creates a serious hazard.

2. Tell your employer about the unsafe condition and ask him/her to correct the problem before work is done. State that you believe the unsafe condition creates a serious hazard.

3. Contact your union representative.

4. Request an immediate Cal/OSHA inspection.



When you refuse to do an unsafe job:

1. Clearly explain to your employer the reason for refusing to do the work. Make it clear that danger was the only reason for your refusal.

2. Explain to your employer that you are willing to do the work once the correction(s) have been made. Meanwhile, ask to be assigned to work in a safer area.

3. Stay at or near the job site unless ordered to leave by management.

RIGHT TO CLAIM WORKERS' COMPENSATION

What is workers' compensation?

It is a no-fault insurance program for compensating workers and supervisors for work-related injuries, illnesses, and deaths regardless of pre-existing medical conditions. It is financed by employers and administered by the State Division of Workers' Compensation and the Workers' Compensation Appeals Board.

What is covered by workers' compensation?

All employers are required to carry workers' compensation insurance. Nearly every worker in California is covered by the law. (Railroad, maritime and federal government workers have separate programs with varying benefits).

How and when should I file a claim?

First, get medical help. Then, notify your supervisor and union, even if you do not have any lost time from work. Generally, you have 30 days to file a claim for an injury, and one year for work-related disease (one year from when you first suffered disability and either knew or should have known it was work-related).

What benefits can I get if I am injured on the job?

California law gives you five kinds of benefits depending on the nature, date and severity of the worker's injury:

1. **Medical treatment:** fully paid by the employer for work-related injuries or illnesses. This includes the costs of hospitalization, X-rays, lab studies, and reasonably related transportation expenses.

2. **Payments to replace lost wages:** benefits are calculated based on whether you qualify for temporary or permanent disability, and are set by state law. The benefits are generally designed to replace two-thirds of your average weekly earnings, up to a maximum of $728 per week (after a 3-day waiting period for most injuries.) Public safety officers, however, (and those covered by some collective bargaining agreements), may be eligible for full-salary benefits for a certain time period.

   Permanent disability benefits are payable after your condition stabilizes. The amount of benefits is subject to your permanent disability rating, which is determined by your injury, your age and occupation, and your ability to gain employment.

3. **Vocational rehabilitation services:** (for injuries before Jan 1, 2004) available to eligible workers whose disability prevents them from being employed in their usual and customary occupation or the position they occupied at the time of injury, and who can be expected to benefit from a rehabilitation program.

4. **Supplemental job displacement benefit:**
   (for injuries on or after Jan 1,2004)

   This is a nontransferable voucher for education-related retraining or skill enhancement, or both. To qualify for this benefit, the injury must result in permanent disability, the injured employee does not return to work within 60 days after temporary disability ends, and the employer does not offer modified or alternative work.

5. **Death benefits** and burial expenses for eligible dependents.

Choosing Your Own Doctor

You have the right to use your own health care provider (with expenses paid by your employer), but you must file a notice with your employer before you are injured. Your employer must notify you of this right. If you have not filed this notice, the employer can select the doctor you see for the first 30 days of treatment. After that time, you can choose your own physician.

RIGHT TO FILE A COMPLAINT FOR DISCRIMINATION OR RETALIATION (California Labor Code, Section 6310)

You have the right to file a complaint if you believe that your employer has punished or discriminated against you because you made a complaint to Cal/OSHA or used any other rights under Cal/OSHA law. Discrimination or retaliation might include: firing, taking away your seniority, taking away your benefits, transferring you to an undesirable job or shift, threatening you or harassing you for using your Cal/OSHA rights.

If this has happened to you, contact the nearest office of the California Labor Commissioner (Department of Industrial Relations - Division of Labor Standards Enforcement) for assistance. When you make this complaint, be prepared to explain:

- What your employer has done to punish or discriminate against you for your job safety and health activities.

- Names and addresses of people involved or witness to the punishment. Also, show any documents, letters, or other material that relates to the incident.

When calling the California Labor Commission about filing a complaint, ask to be sent a form or list of information to include in your complaint.

If the labor commissioner finds that your employer has punished you for making a complaint to Cal/OSHA or using any other rights granted to you under Cal/OSHA law, the commissioner will order your employer to return you to your job and to give you any pay or benefits that are due to you.

V. STEPS FOR RESOLVING HEALTH AND SAFETY PROBLEMS

Using these laws and rights to your advantage is not easy. You must be organized and persistent, pressing the company as well as the government to fulfill their legal responsibilities. Here are some tips.

1. Identify the problem and build a strong foundation for your case by gathering information in writing to document the problem and requesting your medical and exposure records and records of past accidents or illnesses. It is advice to document your attempts to get management to correct the problem (notes of meetings, grievances).

2. Know what problem you want to correct and have a timetable by developing an outline of demands (it can include: bringing in outside technical experts like Cal/OSHA Consultation Services).

3. Involve other workers and keep them informed to have a base of support for advice and direction; this will help you determine which problem(s) affect most people and what solutions are needed.
   Work with the union if there is one at your workplace.

4. Bring in a government agency as a last resort. First, try to solve the problem through direct negotiation with the company; it's faster, easier and there is more control over the outcome. Decide which government agency to call based on careful research to determine the odds of the agency helping you solve your problem.

5. Persistent follow-up by participating in all meetings between the company and the agency; and keep co-workers informed.

Activity 1. How well do you know your legal health and safety rights?

Directions: Mark each question as indicated.

1. The following people and/or organizations are required to provide a safe and healthful workplace under the OSH Act (check all that apply):

- □ A. the employer
- □ B. the union
- □ C. the worker
- □ D. OSHA
- □ E. all of the above

2. Which of the following is not a worker's right under the OSH Act (check all that apply):

- □ A. to have a workplace free of health and safety hazards
- □ B. to file a complaint with the OSHA and remain anonymous if so desired.
- □ C. to inspect your workplace immediately when an unsafe or unhealthy condition is suspected.
- □ D. to see publicly posted notices of OSHA citations for health and safety violations in the workplace.

3. Legal protection under the OSH Act makes employer reprisals against workers who complain about unsafe or unhealthful conditions illegal.

□ True □ False

4. A worker who files an OSHA or Cal/OSHA complaint must be directly affected by the hazard in question.

□ True □ False

5. An OSHA inspection involves the following steps: (a) opening conference, (b) walk around, and (c) closing conference.

□ True □ False

6. CAL/OSHA can make a state standard that is more lax than the federal standard.

□ True □ False

7. Only a company representative can accompany an OSHA inspector on an inspection.

□ True □ False

8. Workers have the following rights under the Hazard Communication Standard:

□ A. Right to work with containers that have appropriate warning labels.
□ B. Right to updated, accurate Material Safety Data Sheets.
□ C. Right to employee training.
□ D. Right to organize a union for better working conditions.
□ E. all of the above

9. The employer must provide training on every new chemical introduced into the work area.

□ True □ False

10. Workers have the right to see all their exposure results and medical records.

□ True □ False

11. The company is required to keep all medical and environmental monitoring records only as long as workers work at the company.

□ True □ False

12. Employees have to pay for the first copy of their medical records.

□ True □ False

13. If a worker refuses work when she or he thinks the assigned job is extremely dangerous to life or health, his or her job is theoretically guaranteed by law.

□ True □ False

14. There is a law that requires hazardous waste facilities to notify certain agencies about the health hazards of hazardous chemicals and their amounts emitted into the air, water and soil.

□ True □ False

Activity 2. Case Study: Workers' Rights

Noah Kantbreathe is an operator at the on-site treatment plant at a hazardous waste site in Southern California. About twice a week, Noah has to open one of the sewage water lines and clean out the filters which become clogged with waste residues. Almost every time he does this task, Noah becomes nauseous and nearly passes out. Later in the evening, he usually has a headache. Other workers who do similar jobs also get some of Noah's symptoms, but none are as severely affected.

Noah has complained several times to management about his concerns. His supervisor, I. Dontcare, has told him that industrial hygiene monitoring results show no violations of any OSHA laws and that medical surveillance results for workers at this site have revealed no problems. Mr. I. Dontcare did issue Noah a respirator, which he wears, but he says it doesn't help.

ROLES:

- I. Dontcare - The Supervisor
- Noah Kantbreathe - The Worker

What are Noah's rights?

MODULE 4

Medical Surveillance

Module 4
Medical Surveillance

GISO 5192 (f) & (q)(9)

OUTLINE

I. Introduction

II. Illness Prevention and Your Health

III. Medical Surveillance Program

IV. Medical Monitoring Tests

- The history is everything
- Physical examination
- Laboratory tests: medical and biological monitoring
- Limitations of lab tests

OBJECTIVES

Trainees will be able to:

1. Describe what parts of the OSHA HAZWOPER standard's medical surveillance provisions apply to them.

2. Describe the difference between primary, secondary and tertiary disease prevention as it relates to workplace medical surveillance.

3. Identify their rights and responsibilities as patients in terms of confidentiality, access to records, and reporting of medical exam results.

4. Describe 3 steps they can take to receive proper medical diagnosis for work-related injuries and illnesses.

I. INTRODUCTION

A. Workplace medical surveillance programs are designed to:

- detect job-related health problems as early as possible
- uncover their causes
- lead to actions which prevent occupational illnesses and injuries

B. Medical surveillance programs guard the health of:

- individuals by one-on-one medical evaluations
- the whole workforce by monitoring trends or patterns in the health of the Group.

These programs can check to see if workplace control measures are really preventing overexposure.

C. To make a medical surveillance program work requires:

- informed workers
- concerned and knowledgeable health care providers
- safety conscious employers

D. What occupational medical surveillance programs are not substitutes?

Other employer-sponsored medical programs—drug testing, employee assistance, health promotion—have their benefits, but are NOT substitutes for medical surveillance programs for occupational illness and injuries.

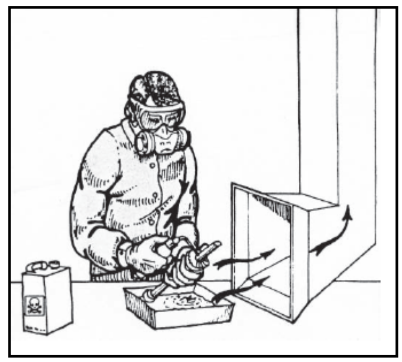
II. ILLNESS PREVENTION AND YOUR HEALTH

At a hazardous waste site, prevention of illness is made more difficult by the unpredictable nature of the exposures (in many cases), the lack of engineering controls, and the lack of appropriate Personal Protective Equipment (PPE).

Why is Prevention Important?

Modern medicine has the ability to detect some diseases early and to cure and control them. But many of the serious occupational diseases we face cannot be treated at all. Even if test detects the disease early, the disease may not be reversible. Our goal must always be to stop the exposure before it starts the disease. We usually speak of three levels of prevention:

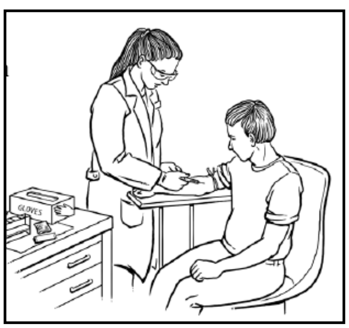
1. Primary Prevention



Prevention of exposure in the first place.

Examples are a protective barrier (e.g., engineering controls, work practices, and, to a lesser degree, protective clothing) between you and the toxic substance, encapsulation of the toxic substance, source reduction, etc.

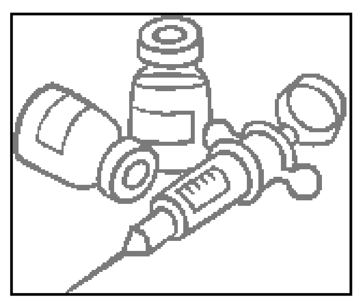
2. Secondary Prevention



It is known for screening and early detection of effects before they become irreversible.

Examples are blood screening for lead levels, testing for liver function abnormalities among solvent-exposed workers, etc.

3. Tertiary Prevention



Treatment and rehabilitation of workers once a disease has already developed to prevent further complications and disability.

Examples are surgery to remove a tumor, or drug therapy to stop a disease once it has begun.

Based upon this hierarchy, it is clear that primary prevention is far preferable, because it favors health to the greatest extent and gives one the best chance of staying healthy.

III. MEDICAL SURVEILLANCE PROGRAM

A Medical Surveillance Program should be developed for each site based on specific needs, location, and potential exposures of employees. The program should be designed by an experienced occupational health physician or another qualified consultant with the Site Safety Officer. This program is part of overall site Health and Safety Plan.

The requirements, as a minimum, of a Medical Surveillance Program are:

- Workers covered
- Frequency of medical examinations and consultations
- Content of medical examinations and consultations
- Examination by a physician and costs
- Information provided to the physician
- Physician's written opinion
- Recordkeeping

Who are covered?

- Workers who may be or are exposed to concentrations above the permissible exposure limits for 30 or more days per year. Respirator usage is not part of this criterion.
- Workers who wear a respirator for 30 or more days per year or those who wear a respirator as a result of OSHA requirements.
- Worker who exhibit signs or symptoms of injury, illness, or possible overexposure to hazardous substances or health hazards.
- Members of HAZMAT team

Who Conducts the Exam? Who Pays?

These medical exams must be conducted by a licensed physician, or under the physician's supervision. Some employers have their own medical staffs who give the exams. Others hire outside doctors or clinics.

The employer must pay for all exams. Also, you should not have to lose any of your own pay to take time off for an exam. OSHA says that each exam should be given at a reasonable time and place.

At the exam, the physician is required to take your medical and work history. The physician must give special emphasis to symptoms which might be related to the hazardous substances found on your own job. The physician decides which tests should be done.

Not all doctors are qualified to evaluate job-related illnesses. **A doctor who is Board Certified in Occupational Medicine should be in charge of the company's medical surveillance program.** (Unfortunately, this is not legally required. Also, relatively few physicians are Board Certified in Occupational Medicine, and most company doctors are not.)

Your employer provides the physician information on:

- Your job duties.
- Hazardous substances found at your work site.
- The exposure to hazardous substances.
- What personal protective equipment (PPE) you use (respirators, chemical suits, goggles).
- Your previous medical exams (if the employer has the results, and they are not readily available to this doctor).
- A copy of the HAZWOPER standard and appendices.

Also, the employer must give the physician a copy of OSHA medical surveillance rules. After the exam, the doctor must tell your employer about:

- Any medical conditions (work-related) which could put you at increased risk at your worksite.
- Any recommendations for restricting your use of respirators or other personal protective equipment (PPE).

You are entitled to get the physician's written opinion. It must include the detected medical conditions, recommended limitations to assigned work, results of the examinations, and a statement that the worker has been informed. You can authorize the company to turn over your medical records to a physician of your choice.

Making Medical Surveillance Work for You

1. Understand the purpose and limitations of the medical surveillance program. Learn the terms that are used in such programs.

2. Identify the list of exposures you are likely to have.

3. Ask about the qualifications of the person designing and/or performing the examinations.

   - What is his or her training?
   - Does he or she have board certification for occupational medicine? (Not required)

4. How closely does the person work with the industrial hygienist or site safety personnel?

IV. MEDICAL MONITORING TESTS

The issue of medical monitoring tests is particularly difficult for hazardous waste workers. Because worker exposures are often low-level and chronic (effects are not seen immediately), it is difficult to relate specific exposures to a negative health outcome. Medical monitoring programs attempt to address this concern for hazardous waste workers. **It is highly recommended that workers maintain their own records of all medical examinations and exposures.** In addition, workers should be assertive when dealing with physicians to ensure adequate medical testing and treatment.

Pre-Employment Screening

Fitness for Duty – Workers at hazardous waste sites are often required to perform strenuous tasks while wearing PPE that may cause heat stress and other problems, The pre-employment screening focuses on the worker's occupational and medical history, physical examination, and ability to work while wearing PPE.

Baseline Medical Data – Pre-employment screening data can later be compared to check the effectiveness of worker protection programs. Initial testing may include both medical and biologic test. However, there are no clear guidelines for deciding on specific test. The following types of tests may be requested:

- A series of tests based on the worker's past work, medical history, and a review of potential exposures

- Standard testing for specific toxic substances such as lead, cadmium, and arsenic in situations where workers may receive exposure

- Where applicable, pre-employment blood specimens and serum frozen for later testing

Periodic Medical Examinations

Periodic medical examinations should be performed and compared with previous reports to determine trends that may show early signs of health effects. Generally, medical examinations have been recommended at least yearly. Some of the **recommended examinations** are:

- Physical examination with vision Medical and work history
- Testing
- Spirometry (breathing test)
- Audiometric test
- Laboratory tests including a chemistry panel and complete blood count
- Physician's evaluation

Source: http://phs.ucdavis.edu/MedSurv/OHServ.php

More frequent examinations may be necessary, depending on the worker's unique experience.

Medical Records - proper recordkeeping is essential at hazardous waste sites due to the nature of the work and risks involved. For example, workers may work at different sites during their careers and health effects may not be known for many years. OSHA AND Cal-OSHA regulations require the employer to:

- Maintain and preserve medical records on exposed workers for 30 years after they leave employment, if they worked on the site one year or more
- Make available to workers, their authorized representatives, and authorized health and safety inspectors the results of the medical testing, full medical records, and analysis
- Maintain the records of occupational injuries and illnesses and post a yearly summary report

1. Medical History

- personal illness and chronic diseases
- family health problems
- reproductive history
- lifestyle (e.g., smoking, drug use)
- history of reaction to specific chemicals and drugs

2. Occupational History

Be certain that this is not neglected in favor of a medical history - they are separate.

- descriptions of all jobs held, including military service
- work exposures
- symptoms or illnesses among other workers at previous jobs
- personal protective equipment used

3. Physical Examination

- Complete system review: such as cardiovascular, pulmonary, musculoskeletal, neurologic and lymphatic.
- Eyes, ears, nasopharynx, abdomen, skin
- Evaluation of susceptibility (obesity, smoking) to exposures and physical problems (heat stress, noise)

4. Lab Test

- Hematocrit (Hct)—to exclude severely anemic individuals from heat stress
- Respirator use
- Pulmonary Function Test
- Audiometry—if working in a high noise area
- Freeze a serum sample—to compare with future blood tests

For workers using respirators Add the following to the above list.

1. Chest X-Ray
2. Electrocardiogram (EKG)
3. Treadmill (if using PPE Levels A or B and/or if heat stress is a possibility)

For workers in extreme heat

1. Treadmill (if over age 40)
2. Hematocrit

The Down Side of Lab Tests in Occupational Medicine

Recognizing the Symptoms of Occupational Disease Can be Difficult.

1. Few tests are sensitive; many don't detect problems until it is too late.
2. Few tests are specific; many other diseases unrelated to work place hazards can cause the same abnormalities.
3. Few tests have been fully evaluated for their reliability and validity in detecting occupational disease.
4. Some organ systems have no specific test to assess the impact of a workplace hazard.
5. All tests require selection, performance, and interpretation by skilled professionals.

Termination Examination

At the end of employment, all workers should have a medical termination examination. This examination may be less than a full examination if:

- The last full medical examination was within the last six months
- There has been no exposure since the last examination
- No symptoms associated with exposure have occurred since last examination

Limitations of Medical Surveillance Programs

1. Only diagnoses problems that presently exist with your health.
2. Available tests may be invasive, expensive, potentially harmful, and insensitive.
3. Each program depends upon the proper selection, performance, and interpretation of medical tests by qualified and trained personnel.
4. Each program depends on the correct assessment of the types of exposures that workers are likely to receive. If you are not looking for a specific biologic change, effect, or outcome, it is likely to be missed in a "shotgun" screening approach.
5. Analysis of group results is often lacking, but such analysis is key to early detection of effects.
6. It has a high potential for abuse (e.g., discrimination, breaches of confidentiality.

Medical Exams

Part of Body	Test	Could Detect
Nose, mouth, throat	General physical exam	Chemical irritation
Skin	General physical exam	Chemical irritation
Eyes	Visual acuity	Vision loss or change
Ears	Audiogram	Hearing loss or change
Lungs	Breathing tests (including spirometry)	Obstructive lung disease (emphysema) Restrictive lung disease (asbestosis orsilicosis) Fitness for respirator use
Lungs	Chest x-ray	Lung cancer Asbestos-related diseases
Heart	Electrocardiogram (EKG), or Exercise testing	Rhythm abnormalities Coronary artery disease
Kidneys	Kidney function tests (blood sample) Urinalysis (urine sample)	How well the kidneys get rid of toxins and waste Kidney disease or damage
Liver	Liver function tests (blood sample)	How well the liver works Hepatitis Liver disease or damage
Digestive system	Hemoccult (stool sample)	Bleeding in the intestine may be due to polyps or cancer
Blood	CBC (complete blood count)	Anemia Leukemia Infection
Nervous system (peripheral)	Nerve conduction studies	Nerve damage
Nervous system (central)	Neuropsychologic testing	Memory loss Personality change
Reproductive system	Semen analysis (semen sample) Pregnancy test (blood or urine sample)	Pregnancy Hazard from chemicals due to pregnancy

Medical Monitoring.

The need for medical monitoring guidelines is heightened by the pressures placed on workers by their supervisors, peers, and their own individual motivations, to continue working even when it is no longer safe for them to do so. Fortunately, OSHA requirements specify medical monitoring as a component of the Site Safety Plan. This reduces the chances that individuals may exceed their physical limitations due to inappropriate motivations. However, we must also recognize that medical monitoring has certain implications. It may shorten the work time for each individual, which requires that additional trained workers be available to continue the assigned work or allow rest time. Medical monitoring may also increase the time between entries, and increase the times needed for rehydration, rest periods and temperature recovery - again increasing the number of trained workers. These two factors illustrate the need to better prioritize the objectives for personnel working in the various zones.

California Occupational Health Clinics

The following University-based clinics specialize in the treatment of occupational health conditions. All are members of the Association of Occupational and Environmental Clinics (AOEC) and have doctors Board-Certified in Occupational Medicine.

General services provided include:

- diagnosis and treatment
- medical screening
- asbestos surveillance
- industrial hygiene evaluations
- medical surveillance
- medical-legal evaluations
- pre-placement evaluations
- health education

Most common diagnoses seen at the clinics:

Asbestos Disease, Contact Dermatitis, Asthma, Lead Exposure, Musculoskeletal Conditions, Solvent Exposures, Pesticide Exposures and Indoor Air Pollution

University of California, Irvine
Center for Occupational and Environmental Health
Phone: (949) 824-8641
Fax: (949) 824-2345

University of California, Los Angeles
Occupational/Environmental Medicine Clinic
Phone: (310) 794-8144

University of California, San Francisco
Occupational Health Services
Phone: (415) 885-7580
Fax: (415) 771-447

University of California, San Diego
Occupational Health Center
(619) 471-9210

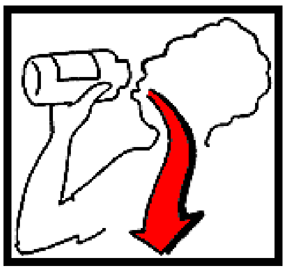
How Chemicals Can Affect Your Health

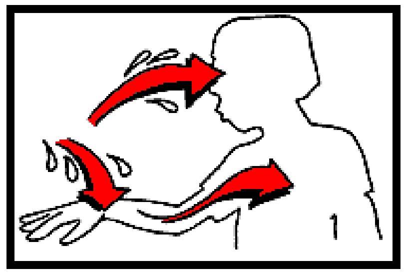
These symptoms may be caused by chemicals or other conditions at work:

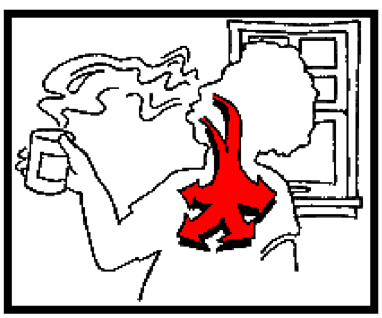
Symptom	Common Causes
HEAD Dizziness, headaches	Solvents, paint, ozone, smoke (including tobacco)
EYES Red, watery, irritated, grainy feeling	Smoke, gases and vapors, fumes, dusts, ultraviolet (UV) radiation, paint, cleaners
NOSE and THROAT Sneezing, coughing, sore throat	Smoke, ozone, solvents, dust, paint, cleaners
CHEST and LUNGS Wheezing, coughing, shortness of breath, lung cancer	Metal fumes, dust, smoke, solvents, paint, cleaners
STOMACH Nausea, vomiting, stomach ache	Some metal fumes, solvents, paint, long-term lead exposure
SKIN Redness, dryness, rash, itching, skin cancer	Solvents, radiation, chromium, nickel, detergents and cleaners, paints
NERVOUS SYSTEM Nervousness, irritability, sleeplessness, tremors	Long-term solvent exposure, long-term lead exposure
REPRODUCTIVE SYSTEM For men: low sperm count, damage to sperm. For women: irregularities in menstruation, miscarriage, damage to egg or fetus	Lead, toluene and some other solvents, radiation, ethylene oxide

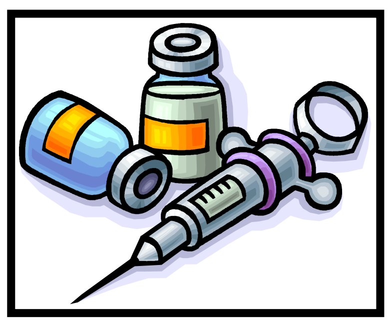
MODULE 5

Chemical Hazards


Ingestion


Absorption


Inhalation


Injection

Module 5
Chemical Hazards

OUTLINE

I. Key terms
II. Routes of Exposure
III. Health Effects
IV. Types of Toxic Effects on the Body
V. Physical and Chemical Properties of Hazardous Substances
VI. Chemical Exposure Limits to Protect Worker Health

OBJECTIVES

At the end of this session, trainees will be able to:

1. Identify the main routes of exposure through which chemicals enter the body and the three physical states of hazardous substances.

2. Describe the difference between acute and chronic health effects.

3. Identify different types of toxic effects that can commonly be caused by chemicals on the job.

4. Use the NIOSH Pocket Guide to Chemical Hazards to find hazard information such as PEL, TLVs, physical and chemical properties, and health effects regarding a chemical substance in their workplace.

I. KEY TERMS

Chemical hazards: are agents that can make you sick. They can get into the body through the nose, mouth, or skin and cause harm.

Toxicology: is the study of the adverse effects of chemicals on living organisms.

Toxicity: is the ability of a substance to cause harmful health effects when the chemical has reached a sufficient concentration at a certain site in the body. Descriptions of toxicity (e.g. low, moderate, and severe) depend on the amount needed to cause an effect or the severity of the effect.

Hazard: is the probability that this concentration in the body will occur.

Toxic Effects: undesirable changes in the body because of an exposure to a chemical or other material. The severity of response depends on the dose received.

Dose: the amount of the chemical you receive over a certain period of time.

Dose = Chemical Concentration x Length of Time of Exposure

Dose/Response Relationship

An exposure is the amount of chemical that is in the air you breathe, on your skin or on the food you eat. The dose is the amount of the substance you actually absorb into your system. With most chemicals, it is easier to measure the exposure than the dose.

In general, as the exposure increases, dose also increases; therefore, the higher the exposure, the greater the number of people who experience symptoms. This is called a dose/response relationship. Small doses may cause milder symptoms such as headaches or respiratory irritation, while higher doses may cause life-threatening damage to vital organs.

Examples of the dose/response concept:

Dose (Concentration Taken in)	x	Time	=	Response
1 quart of 12% ethanol (alcoholic beverage)	x	15 mins	=	neurological side effects ("drunk")
1 quart of 12% ethanol	x	daily annually	=	chronic organ damage
1 quart of 12% ethanol	x	annually	=	no observed effect

The simplest toxicological study relates the percentage of lab animals that die (mortality) to the dose given. The dose is usually expressed in mg/kg (for ingestion or inoculation), in mg/m^2 (for skin exposure), or in mg/m^3 (for inhalation). The response is expressed in percent (%) of lab animals that have died.

After this information is found, the **LD_{50}** (lethal dose: 50%) can be determined. LD_{50} is the dose of a substance that causes the death of 50% of a group of animals. The important thing to note for hazard awareness is that lower LD_{50} values indicate that the chemical is more toxic.

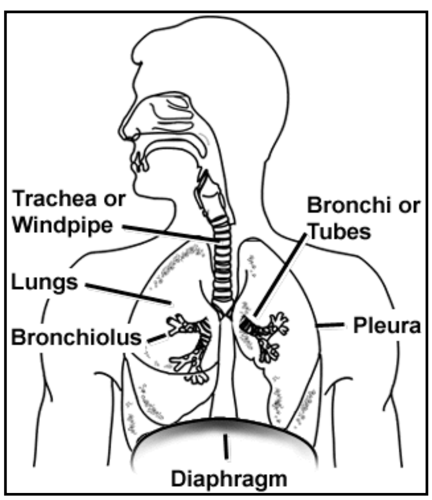
II. ROUTES OF EXPOSURE

Various forms of chemicals and hazardous substances may enter your body through:

1. Your Nose: by inhalation (breathing in).
2. Your skin: by direct contact or absorption through the skin into the body.
3. Your digestive tract: by ingesting (swallowing) substances into the body.
4. Injection.

Inhalation (Lungs)

Inhalation, or breathing through the respiratory system, is the most common exposure route in the workplace. The respiratory system includes the nose and mouth, airways to the lungs. When the toxic material is inhaled, the respiratory system tries to clear it out.



Absorption (Skin and Eyes)

Contact with a chemical by the skin may cause the following effects:

1. **Local effects on the skin.** Three types of local effects on the skin are:

   a. Irritation: Many chemicals cause an immediate reddening, rash, or other irritation to the skin upon contact. Cresols, mercury, and formaldehyde can cause irritation.

   b. Tissue damage: Chemicals such as acids, caustics, or corrosives break down the skin or eyes and cause damage to the tissue layers. These effects can be seen as scars, burns, or ulcers. Solvents can cause dryness and cracks.

   c. Allergic effects: Some chemicals, such as nickel, chromic acid, beryllium, and isocyanate, cause the skin to become hypersensitive after repeated exposures. This is called **sensitization dermatitis.** The effects can be seen as rash, redness, blisters or swelling.

2. **Systemic (internal) effects from absorption through the skin.** Many solvents are absorbed through the skin, circulated through the bloodstream, and then cause damage within the body. Chemicals that are noted for their systemic (internal) effect upon absorption by the skin are marked with an "S" in the TLV Booklet.

Ingestion (Digestive Tract)

In the workplace, many people may eat or drink harmful chemicals without knowing it. Toxic (poisonous) materials are then absorbed from the digestive tract into the blood. Consequently, personal hygiene is essential in the workplace. This requires:

a. Washing Facilities. Your employer is required to provide clean washing facilities (see OSHA Standard 29 CFR 1910.141 and California GISO 3366). Always wash up before eating or smoking.

b. Clean, Eating and Drinking Areas. Your employer is required to provide a clean area (with no toxic materials) for eating and drinking (see 29 CFR 1910.14 and GISO 3368). Always eat and drink in clean areas only.

c. Smoking is not advised for those who work with chemicals. Smoking has compounded side effects.

The cells that line your upper respiratory tract (bronchia, throat) have small hairs called cilia. These cilia beat back and forth to carry mucus from the lungs up into the throat, where it may be swallowed or spit out. Dusts that you breathe can be trapped in the mucus and moved by the cilia to your mouth, where you can swallow them. This is a problem, for example when inhaling, lead fumes in radiator shops, coughing them up and swallowing.

Generally, **ingestion** is the least common route - as long as personal hygiene is maintained and facilities are provided by the employer to help maintain personal hygiene.

Injection

Although infrequent in the industry, a substance can be injected into some part of the body. There is increasing attention to prevention of skin puncture and injection injuries associated with bloodborne pathogens (hepatitis B/C and HIV).

III. HEALTH EFFECTS

Toxic substances can have two general types of effects: acute and chronic. An **acute effect** occurs when one feels symptoms within a short time, such as within minutes or hours. Examples of acute effects include:


dizzy


watery eyes


headaches

In contrast, a **chronic effect** or illness develops slowly and may last for a long time. Chronic poisoning is usually due to continued exposure of a harmful chemical for months or years. Examples of chronic effects include cancer, sterility, kidney, and liver damage.

In short: Be aware of both the acute and chronic effects of a hazardous substance.

IV. TYPES OF TOXIC EFFECTS ON THE BODY

There are five types of toxic effects that hazardous substances may have on the body. A single hazardous substance can, of course, have more than one type of effect at the same time.

1. Asphyxiants

A **simple asphyxiant** displaces the oxygen in the environment necessary to maintain life. Examples are carbon dioxide, ethane, helium, hydrogen, methane, and nitrogen.

A **chemical asphyxiant** prevents the uptake of oxygen by the cells of the body. Examples are carbon monoxide, hydrogen cyanide, and hydrogen sulfide.

At high levels, all asphyxiants can cause collapse, unconsciousness, or death.

2. Irritants

An irritant is a material that causes inflammation to a part of the body by direct contact. The two types are respiratory irritants and irritants to the skin.

a. Respiratory irritants cause injury to the nose, mouth, throat and lungs. Materials that are very water-soluble affect mainly the nose and throat (e.g., ammonia, formaldehyde). Less water soluble materials act deeper in the lungs (e.g., nitrogen dioxide, phosgene).

   Examples of chemicals that affect both the upper and lower lung are chlorine and ozone. Respiratory tract irritation can be minor, such as a tightening of the chest or bronchitis. However, it may also be very serious, as in the case of pulmonary edema and death.

b. Skin irritants may cause contact dermatitis, redness, itching and drying of the skin.

   Examples are organic solvents and detergents. Very corrosive agents, such as chromium and nickel, can cause skin ulcers and destroy tissue.

3. Allergic Sensitizers

After repeated exposures to certain chemicals, some individuals experience an allergic (or immune) reaction. Allergic sensitizers generally affect the skin and respiratory tract. The symptoms are often the same as those caused by irritations such as dermatitis or bronchitis. As with irritations, the response may be very serious, and may even cause death.

Examples include isocyanates, formaldehydes, phenol resins, and epoxy resins.

4. Systemic Toxicant Materials (Internal Poisons)

Toxicants	Description
Blood System (Hemolytic)	Damage blood cells or interfere with blood cell formation. **Examples:** methylene chloride, arsine, phosphorus, and naphthalene.
Nervous System (Neuro)	Damage the nervous system. Typical symptoms include dullness, muscle tremor, restlessness, convulsions, etc. **Examples**: mercury, insecticides, hexachlorophene, and lead.
Liver (Hepato)	Cause liver damage, including jaundice and liver enlargement. **Examples**: alcohol, carbon tetrachloride, and nitrosamines.
Kidney (Nephro)	Damage the kidney, causing swelling and increased serum proteins in the urine. **Examples**: halogenated hydrocarbons.
Reproductive Cell (Gameto)	Damage the reproductive cells (egg and sperm) or interfere with their formation. **Examples**: lead, cadmium, cellosolves, and vinyl chloride.

5. Carcinogens cause cancer. Cancer is the uncontrolled growth of malignant (harmful) cells at any site in the body. The development of cancer may be delayed for 20 to 30 years.

Examples include vinyl chloride, asbestos, ethylene dibromide, and acrylonitrile.

6. Teratogens cause physical defects in a developing embryo or fetus. In the 1960s, methyl mercury was the first industrial chemical shown to be a teratogen.

Other examples include thalidomide, anesthetic gases, and ionizing radiation.

7. Mutagens cause a change (mutation) in your genetic material. Mutation of the reproductive cells may cause birth defects in future children. Mutation of other cells in the body may cause cancer or defects in developing embryos or fetuses.

Examples include ethylene oxide (a sterilizing chemical used in hospitals), benzene, hydrazine, and ionizing radiation.

V. PHYSICAL AND CHEMICAL PROPERTIES OF HAZARDOUS SUBSTANCES

A. Physical Properties can be observed or measured without changing the composition of matter. Some of these properties are appearance, texture, color, odor, melting point, boiling point, density, solubility, and many others.

As with any substance on Earth, a chemical hazard may take the form of a solid, a liquid, or a gas. As a substance is cooled or heated, it may change from one form to another. The hotter the workplace (or the more heat used in the process), the more a liquid solvent will evaporate and give off harmful vapors. Metal particulates can also be emitted as fumes from extremely hot processes such as welding.

1. Solids

Solids most dangerous to your health are dusts, fibers, and fumes. These types of solids are so small that they can be inhaled directly into the lungs, where they may damage the lungs or pass into the bloodstream to harm other parts of the body.

Dusts are solid particles made by handling, blasting, crushing, or grinding materials such as rock, metal, coal, wood, or grain. Any process that creates dusts should be considered hazardous until industrial hygiene monitoring proves it safe.

Fibers are particles whose shape is long and narrow rather than rounded. If the length is three or more times the width of a particle, it is called fiber. The most well known fiber in industry is the asbestos fiber.

Fumes are tiny solid particles produced by heating metals. Fumes are mainly produced in industrial high-heat operations such as welding, melting, and furnace work. Fumes are often mixed with hazardous gases, such as ozone and nitrogen oxides, which are inhaled by the lungs at the same time.

Aerosol is the general term for any airborne particle, whether solid or liquid.

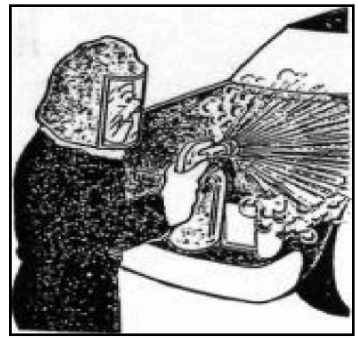
Particle size is important in determining how harmful a particle is to your health. Particles range in size from 0.1 to 25 micrometers. Only particles of less than five micrometers stay suspended in the air long enough to be inhaled. **These fine particles cannot be seen without a microscope, but they are the most dangerous to your health because they penetrate into your lungs.**

2. Liquids

Liquid aerosols, mists, or sprays are fine liquid droplets suspended in air.

Any liquid splash or spill can also enter the body through the skin, and then enter the bloodstream to do damage. The finer the aerosol sprays, the easier it is to inhale and the more damage it does. Most mists, such as paint spray, are mixtures of several ingredients - solvent, pigment, stabilizing agents, and propellants.

Examples are:



- oil mist produced during cutting and grinding operations
- acid mist from electroplating/ paint spray mist
- acid or alkali mists from plating operations

3. Gases and Vapors

A **gas** is a fluid that expands quickly to fill the space that contains it. Many gases are highly flammable; many are very reactive, both chemically and within the body.

A **vapor** is the technical name for the gaseous form of a liquid that always exists above that liquid - just as water vapor always exists over water.
The closer a liquid is to its boiling point, the more it vaporizes. Liquids with boiling points just above room temperature vaporize readily, and are called volatile.

A **Physical Change** takes place without any changes in molecular composition. The same element or compound is present before and after the change. Physical changes are related to physical properties since some measurements require that changes be made.

- **Melting Point:** As solid matter is heated, it eventually melts or changes into a liquid state at the melting point. For example, sodium hydroxide melts at 605°F (NIOSH Pocket Guide p.284)

- **Freezing Point:** As liquid matter is cooled, it eventually freezes or changes into a solid state at the freezing point. For example, acetone freezes at -140°F (NIOSH Pocket Guide p.3)

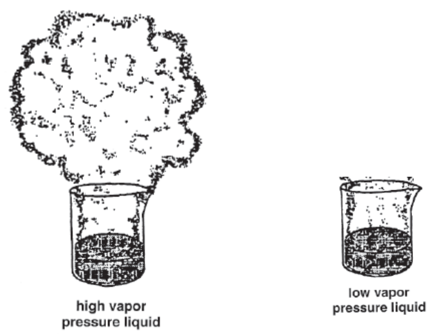
- **Boiling Point:** As the liquid matter is heated, it eventually boils or vaporizes into a gas at the boiling point. For example, acetone boils at 133°F (NIOSH Pocket Guide p.3)

- **Sublimation:** Direct passage of a substance from solid to vapor without appearing in the intermediate (liquid) state. For example, carbon dioxide sublimes at -109°F (NIOSH Pocket Guide p.53)

Vapor Pressure (VP)

Vapor pressure is a measure of how easily a vapor is released from a liquid at a given temperature. It is measured in millimeters of mercury (mmHg) and atmosphere (atm).

If the VP is in atm, the value can be converted to mmHg by using the following equation:



$$\text{VP in atm x } \frac{\text{760.0 mmHg}}{\text{atm}}$$

A chemical with a high vapor pressure releases a lot of vapor at a given temperature. A substance with a high vapor pressure at normal temperatures is often referred to as **volatile**.

The higher the vapor pressure of a given chemical, the greater the chemical's potential as a fire and/or health hazard. Following are examples of chemicals that have high vapor pressure (more than 10 mm Hg), medium vapor pressure (between 1 and 10 mm Hg), and low vapor pressure (less than 1 mm Hg):

Measured at 68°F - **Source:** NIOSH Pocket Guide to Chemical Hazards

Chemical Name	**VP**	
Sulfuric Acid	.001 mm Hg	Low Vapor Pressure
Isoamyl Acetate	4 mm Hg	Medium Vapor Pressure
Acetone	180 mm Hg	High Vapor Pressure

Volatility is a measure of the tendency of a substance to vaporize. It has also been defined as a measure of how readily a substance vaporizes. At a given temperature, substances with higher vapor pressures will vaporize more readily than substances with a lower vapor pressure.

Density is the quality or condition of being dense. It is described as the mass per unit volume of a substance under specified conditions of pressure and temperature.

- **Relative Gas Density (RgasD)** also known as vapor density (VD)

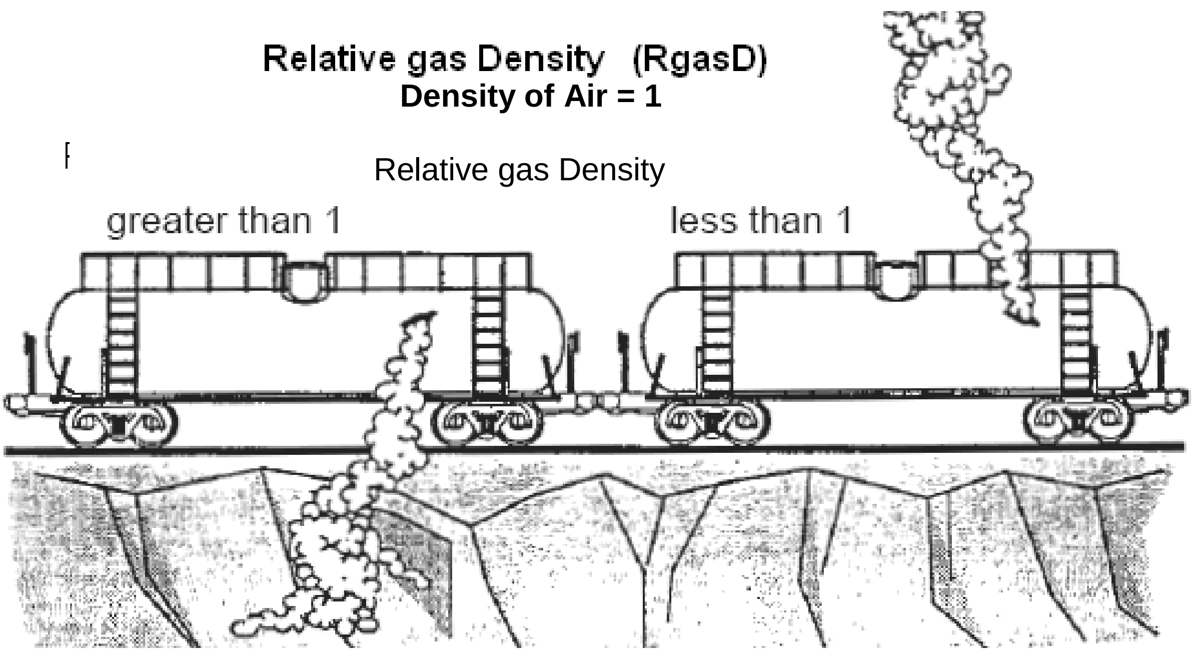
The density of a vapor is similar to the "heaviness" of that vapor in comparison to air. The relative gas density of air is 1. If the RgasD is greater than 1, the vapor or gas is heavier than air and will concentrate in low places.

Relative gas density is important in determining whether a vapor will tend to rise to the ceiling (density less than 1, "light") or sink to the floor or bottom of a tank (density greater than 1, "heavy").

RgasD > 1		**RgasD < 1**	
n-Butane	2.11	Ammonia	0.60
Chlorine	2.47	Acetylene	0.91

Source: NIOSH Pocket Guide to Chemical Hazards

Note: If you don't know the vapor density (RgasD) of a chemical you can look up its molecular weight (MW) in the NIOSH Pocket Guide. If the MW is more than 29, its vapor is heavier than air.



You should be cautious when working with vapors with high vapor density ("heavy" vapors) for the following reasons:

- These vapors or gases may remain close to the floor and settle in low areas. They may displace oxygen in the environment, leading to asphyxiation (or suffocation).

- They can be flammable. They can travel far from the liquid source and ignite very easily. Gasoline is a vapor that moves quickly along the ground and ignites easily, far from the liquid source.

Specific Gravity (Sp. Gr) is the heaviness of a substance compared to that of water, and it is expressed without units.

The specific gravity of water is 1. If the liquid you are comparing will float on water it has a specific gravity of less than one (<1). If it sinks into the water the specific gravity is greater than one (>1).

Solubility is the ability or tendency of one substance to blend uniformly with another, for example, solid in liquid, liquid in liquid, gas in liquid.

Viscosity

Viscosity is a measure of the resistance of a fluid, which is being deformed by either shear stress or extensional stress. In general, terms it is the resistance of a liquid to flow, or its "thickness". Viscosity describes a fluid's internal resistance to flow and may be thought of as a measure of fluid friction. Thus, water is "thin"; having a lower viscosity, while vegetable oil is "thick" having a higher viscosity.

B. Chemical Properties are properties that do change the chemical nature of matter. Some examples of chemical properties are pH balance, reactivity against other substances, flammability, toxicity, etc.

Incompatible Substances -- What do we mean by “incompatibility”? This term describes *undesirable* and *unplanned* reactions between two or more chemicals or materials. Many dangerous chemicals can cause violent reactions when mixed with water, the air, other chemicals, or materials such as wood or paper.

There are also some chemicals that are highly reactive, even in the absence of other chemicals. In the case of these materials, there is usually some condition, such as air, moisture, or heat, which initiates the incompatibility reaction.

So, what happens when incompatibility reactions occur? The most common outcomes are:

- Heat or pressure is produced
- Fire
- Explosion
- Formation of toxic gases and vapors
- Formation of flammable gases

The particular outcome and intensity of the outcome depend on the chemical reaction, the quantity of the chemicals involved, the temperature, and the pressure.

It is very important to know which substances are incompatible. This information lets you know how to manage and store chemicals without explosions, fires or toxic gases and vapors.

Some Incompatible Substances – Never store "**A**" near "**B**"		
A	**B**	**Result**
Acids or bases (Corrosives)	**Reactive metals** such as Aluminum, Calcium, Potassium, or magnesium **Other acids or bases**	
Cyanide such as Acetonitrile and Sulfurs	**Acids** such as Sulfuric, Acetic, or Formic acids	
Cyanide such as Hydrogen Cyanide	**Acids** such as Sulfuric, Acetic, or Formic acids	 **Toxic Vapor or Gas**
Water or alcohols	**Acids** such as Sulfuric and Acetic acid **Bases** such as Sodium or Calcium hydroxide **Metals** such as Calcium, lithium, or Sodium	
Strong oxidizers such as: Chlorine, or Strong Peroxides	**Organic acids** such as Acetic and Citric acids **Reactive metals** such as Sodium and Potassium	
Solvents or reactive materials	**Acids** such as Sulfuric, Acetic, or Formic acids **Bases** such as Sodium, or Ammonium hydroxide	
Solvents	**Fertilizers** such as Ammonium Nitrate	

Ionization Potential (IP) measures the minimum energy required to remove an electron from an atom. The minimum amount of energy needed to remove the outermost (highest energy) electron from a neutral atom in the gaseous state. Photo Ionization Detectors (PID), uses IP to determine if meter can detect chemical. IP found in NIOSH Pocket Guide.

Corrosive Hazards

Corrosives are alkaline and acidic. If these materials contact your skin, they will cause severe chemical burns. The longer the contact time the greater the damage that will occur.

- Alkaline referred to as bases or caustics.
- Acidic referred to as acid.

The pH scale (power of hydrogen) is a simple way to define acids and bases. This scale assigns a number from 0 to 14 to a solution.

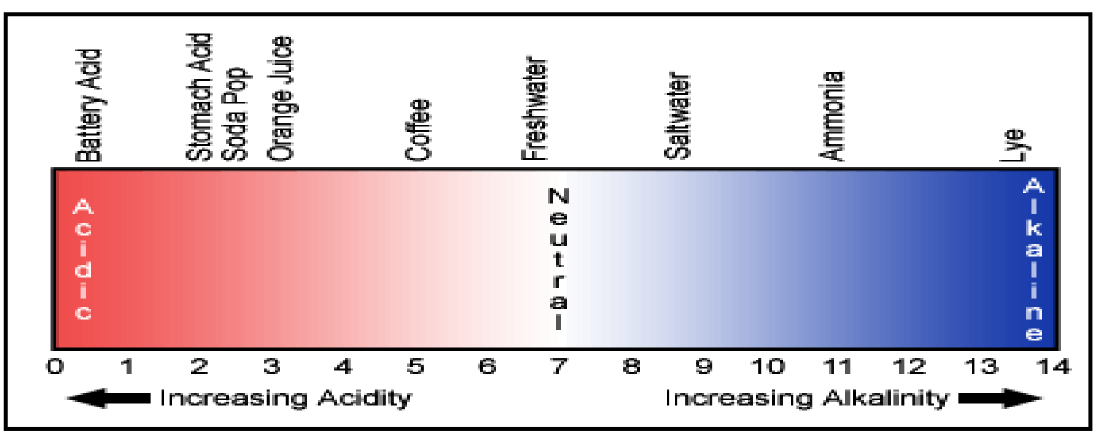
EPA defines any solution with a pH less than 2 (extremely acidic) or greater than 12½ (strong alkaline) as a corrosive.
Pure water is the standard used for pH scale and is expressed by saying that pure water has a pH of 7.

The corrosiveness of an acidic or basic solution depends upon its concentration. Solutions diluted with a large amount of water may not be corrosive. Concentrated solutions are the most dangerous.

Examples of Acids and Bases

A. Strong Acids (pH 0 - 2)
Sulfuric Acid - Nitric Acid - Hydrochloric Acid - Hydrofluoric Acid

B. Strong Bases (pH 12½ - 14)
Sodium Hydroxide (lye, caustic soda) - Potassium Hydroxide (caustic potash)



Fire and Explosion Hazard

Fires and explosions can result when incompatible substances are stored together or mixed.

The Fire Triangle helps to explain how fires start and how to prevent them. For fire to burn, there must be at least four things: oxygen, heat, fuel and chemical, exothermic reaction. The fire triangle includes the possibility of a chemical reactivity occurring which can create its own heat, fuel and oxygen.

Combustible/Fuel

Heat  **Oxygen**

Each of the fire's components must be present in the right amount. In most instances, if only two of the legs of the triangle are present, a fire cannot start or be maintained.

a. Fuel can be present as gases, liquids, or solids.

Examples:

Gases	Liquids	Solids
propane methane acetylene	gasoline kerosene xylene	grain dust magnesium filings aluminum dust

In fact, even if a fuel is present as liquid or solid, it is the vapor form of the liquid or solid that burns.

b. Oxygen

The most common source of oxygen is air, which contains about 21% oxygen at sea level. Oxygen can also come from chemicals called oxidizers, which can make fires burn much more vigorously.

The practice of using an inert gas, such as nitrogen, to blanket the vapor space above a flammable liquid in a tank keeps oxygen out and prevents the fire triangle from forming.

c. Ignition Source or Heat

Common sources of ignition include an open flame, a lit cigarette, an electric current, static electricity, a welding torch, and sparks. As mentioned earlier, some chemical reactions produce heat. This heat may be sufficient to ignite a fuel, even without a source of ignition.

The ability of a material to serve as a fuel source is predicted by two factors: **FLASH POINT** and **FLAMMABLE RANGE**. The flashpoint and flammable range are specific for each chemical. You can find them on Material Safety Data Sheets, in the NIOSH Pocket Guide to Chemical Hazards, and in other resources listed at the end of this section.

Flash Point — is the minimum ***temperature*** at which a liquid gives off enough vapor to form an ignitable mixture with air. Remember, it is the vapor that burns.

Chemical	Flash Point (^{0}F)
gasoline	- 45
toluene	40
xylene	90

Source: NIOSH Pocket Guide

If a liquid has a flash point, it must be considered a potential source of fuel.

In general, if a liquid does not have a flash point, it will not act as a fuel. When the flash point of the liquid is lower than room temperature or the temperature at which you work with the liquid, the potential for the buildup of vapor and the initiation of a fire is greater.

Flammable Range — is the minimum and maximum ***concentration*** of a flammable vapor that allows the spreading of a flame on contact with an ignition source.

This concentration is given as a percentage (%) of the vapor to air by volume.

L.E.L. or L.F.L. (Lower Explosive Limit or Lower Flammable Limit) — is the minimum concentration (%) of a flammable vapor which will burn in air.

U.E.L. or U.F.L. (Upper Explosive Limit or Upper Flammable Limit) — is the maximum concentration (%) of a flammable vapor which will burn in air.

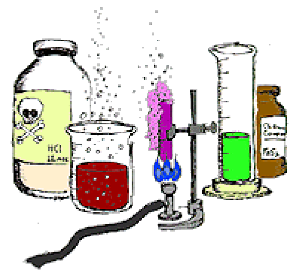
Chemical	L.E.L (%)	U.E.L. (%)
gasoline	1.4	7.6
acetone	2.5	12.8
methanol	6.0	36.0

Source: NIOSH Pocket Gide

In order to burn, the concentration or % of the flammable vapor must be between the L.E.L. and the U.E.L. If the concentration is too low, the air vapor mixture is too "lean." If the concentration is too high, the air-vapor mixture is too "rich".

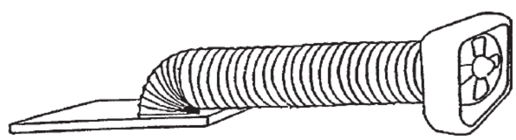
There are three ways to prevent a fire:

1. Limit the amount of "fuels" or combustibles



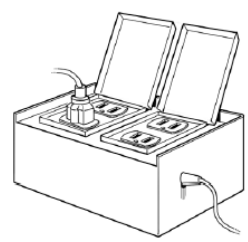
- Keep only necessary chemicals or materials on site (in approved containers).
- At your work location, keep only those substances that are needed for the present job (in approved containers).
- Limit accumulation of hazardous wastes at the facility with proper administrative controls.

2. Provide proper ventilation



Remember that a very high oxygen level in the air can lead to an explosion with the presence of a spark.

3. Control and inspect for "sparks" and other heat sources. Ground and bond all work and ignition-proof equipment.



VI. CHEMICAL EXPOSURE LIMITS TO PROTECT WORKER'S HEALTH

Exposure to airborne chemicals (dusts, vapors, fumes) can be measured by using monitoring instruments that take a sample over a period of time to determine the amount of substance in the air. Chemicals are measured in:

- **Parts per million (ppm)**. 5 ppm of benzene, for example, means that there are five parts of benzene in a total of 1 million parts of air. The ppm is used for gas and vapor contaminants.

- **Milligrams per cubic meter (mg/m^3)**. This parameter is also used to measure particulate contaminants.

- **Fibers per cubic centimeter ($fiber/cm^3$)**. This parameter is used when monitoring aerosols with solid fibers such as asbestos.

FIVE TYPES OF ENFORCED EXPOSURE LIMITS

a. Time Weighted Average

Average concentration over a given time that workers can be exposed to which it is believed that nearly all workers may be repeatedly exposed without adverse effects.

b. Permissible Exposure Limit (PEL)

The Occupational Safety and Health Administration (OSHA) have set PELs, which are legally enforceable for worker exposures to chemicals found in their workplace.

In 1971, OSHA used the 1968 list of threshold limit values (TLVs) for its PELs. These have been updated periodically, but this must be done through the rulemaking process, which can take years to complete. TLVs are updated more easily than legal PELs, consequently, PELs are generally outdated and less stringent than current TLVs.

PEL is a maximum permitted 8-hour time-weighted average (TWA) concentration of an airborne contaminant. The 8-hour TWA is established, according to ACGIH, for "a normal 8-hour work day during a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without effect".

c. Short-Term Exposure Limit (STEL)

The STEL is a 15-minute time-weighted average exposure that should not be exceeded at any time during a workday even if the 8-hour time-weighted average is below the PEL.

d. Ceiling Limit
The ceiling limit is the maximum concentration of an airborne contaminant to which an employee may be exposed at any time. In the literature, a ceiling is sometimes designated as "C." The ceiling is different from the STEL, because the ceiling is not a time-weighted average, and should never be exceeded. ACGIH, OSHA, and NIOSH set ceiling limits for some chemicals.

e. Immediately Dangerous to Life or Health Concentrations (IDLH)
IDLH values are the maximum concentration of a chemical from which one could escape within 30 minutes without irreversible health effects. This includes any severe eye or respiratory irritation, which could prevent escape without permanent injury.

The IDLH guideline is used in the decision-making process for respirator selection developed by NIOSH/OSHA, but is not a legally enforceable standard.

The IDLH is important for site workers to know, particularly when responding to a spill in a confined space or low-lying area where vapors may accumulate. A site that has exposures above the IDLH requires maximum protective measures.

Other Exposure Limits

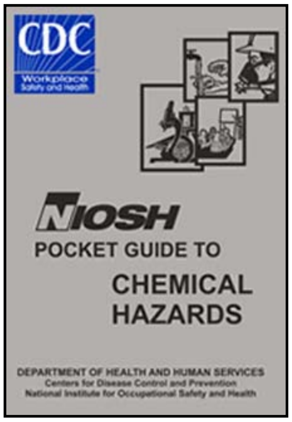
- **ACGIH Exposure Limit (recommended guidelines): TLV**

The American Conference of Government Industrial Hygienists (ACGIH), a private, professional organization, has established recommended airborne exposure limits known as TLVs.

- **NIOSH Recommended Exposure Limit: REL**

The National Institute of Occupational Safety and Health (NIOSH) recommended exposure limits, or RELs, are time-weighted average concentrations for up to a 10-hour workday during a 40-hour workweek. The RELs are usually more protective than the OSHA or ACGIH limits. NIOSH has a REL, a STEL, and a ceiling REL.

NIOSH Pocket Guide to Chemical Hazard
The data in the Pocket Guide includes physical and chemical properties, OSHA exposure limits, NIOSH recommended exposure limits, IDLH values, health effects, and information about measuring and controlling exposures.



All exposure limits are best used as guidelines. The effects of exposure to a substance depend on dose, rate, and physical state of the substance, temperature, site of absorption, diet, and general state of a person's health.

Summary: PELs, TLVs, RELs

PEL: Permissible Exposure Limit

- Based on a healthy worker.
- An 8-hr time weighted average concentration of a contaminant that is not to be exceeded.
- Most OSHA PELs were based on the 1968 TLVs - until 1989, when Federal OSHA adopted the 1987 TLVs.
- OSHA enforceable standards
- Generally Cal/OSHA PELs are more stringent than Fed PELs.

TLV: Threshold Limit Value

- An 8-hr time weighted average concentration of a contaminant that should not be exceeded.
- Considers toxicity, type of health effect, epidemiological data, industrial use data, and technological feasibility.
- Intended to protect nearly all healthy or average workers for a work-lifetime exposure.
- Issued by the American Conference of Governmental Industrial Hygienists (ACGIH) and are updated bi-annually.

REL: Recommended Exposure Limit

- A time weighted average concentration up to 10 hour work day over a 40 hour work week.
- Does not have to take technical and economic feasibility into account is health-based.
- Many are more protective than OSHA PELs or ACGIH TLVs.
- RELs are updated on a case-by-case basis and are issued by NIOSH.

The following table shows the key elements to be considered when evaluating a health hazard.

Will a Worker Get Sick? It Depends on . . .	**Examples**
How **toxic** the chemical is	The more toxic, the more likely it will cause health problems, even in small amounts. Methyl alcohol, which can cause blindness, is more toxic than ethyl alcohol, which is used in alcoholic beverages. Methylene chloride and acetone are both solvents, but methylene chloride is much more toxic.
The **amount** of chemical that a worker is exposed to (that is in the air he or she breathes, or that comes in contact with the skin or mouth	Acetone is an industrial solvent that is also found in nail polish remover. It is more dangerous to the worker who uses larger amounts of it than the person who uses a small amount of nail polish remover.
How long the worker is exposed to the chemical	Someone may work with a chemical for half an hour per day, while another person is exposed 8 hours a day. Also, someone may be exposed for one month, while another person may have 20 years of exposure.
How the chemical get into the person's body **(route of entry)**	Some chemicals, like pesticide, are very toxic whether they are absorbed, inhaled or ingested. On the other hand, asbestos is most harmful when inhaled. For example, a house may have asbestos insulation, but unless the asbestos is disturbed and becomes a dust in the air, it cannot be inhaled, so it will not cause harm.
Individual factors (e.g. heredity, body size, age, whether he or she smokes or drinks, allergies, sensitivities, exposures to other toxic chemicals)	Lead is much more harmful to small children than adults because it affects their developing brain and central nervous system. If two people work with asbestos and one of them smokes, the one who smokes is more likely to develop asbestos-related lung cancer than the nonsmoker.

Toxicology Worksheet

As a group, use the NIOSH to research the two chemicals listed in the front of the classroom:

1. Name of material ______________________________

2. Is the material: Toxic ☐ Reactive ☐ Ignitable ☐ Corrosive ☐

3. What is the usual physical form of the material? ______________________

4. Is the material known or suspected to cause cancer? YES ☐ NO ☐

5. What are the following exposure limits?

PEL	________	NIOSH REL	________
IDLH	________	STEL	________

6. Which route of exposure do you think workers should be most concerned about?

   ____

7. What are the target organs for this material?

   ____

8. What is:

   the vapor pressure? ________________

   the vapor density? ________________

   the lower explosive limit? ________________

   the upper explosive limit? ________________

   is this a volatile material? YES ☐ NO ☐

9. Are there any other hazards associated with this material? (other than toxic hazards)

   ____

   ____

10. Recommended personal protective equipment for routine work (non-emergency)?

    ____

    ____

11. Incompatible or reactive concerns?

    ____

    ____

MODULE 6

Biological Hazards

Module 6
Biological Hazards

OUTLINE

I. Introduction

II. Bloodborne Pathogens

III. Animal-borne Diseases

IV. Air-borne Diseases

V. Water-borne Diseases

OBJECTIVES

At the end of this module, trainees will be able to:

1. Define the term biological hazards and give examples of the diseases they cause.
2. Describe how workers can be exposed to bloodborne pathogens in the workplace through contact with infected human blood and body fluids.
3. Explain universal precautions and other strategies to protect against exposure to biological hazards at work.

I. INTRODUCTION

Biological hazards are those related to workers' exposure to biological agents at work. "Biological agents" refers to micro-organisms, including genetically modified ones, cell cultures, and human endo-parasites which may be able to cause any infection, allergy, or toxicity. They also include bacteria, viruses, and fungi (yeasts and moulds).

Most of the identified bio-hazardous agents belong to the following groups:

- Microorganisms and their toxins (viruses, bacteria, fungi, and their products): infection, inflammatory disease, or allergic reaction.
- Arthropods (crustaceans, arachnids, and insects): bites or sting resulting in skin inflammation, systemic intoxication.
- Protein allergens from vertebrate animals (feces, urine, hair, saliva): hypersensitivity and inflammatory disease.
- Lower plants and invertebrate animals other than arthropods

Biological agents can cause three types of disease: infections, allergies, and poisoning or toxic effects. Pathogenic micro-organisms can enter the human body by penetrating damaged skin, needle stick injuries, or bites, or by settling on mucous membranes. They can also be inhaled or swallowed, leading to infections of the upper respiratory tract or the digestive system. The essential difference between biological agents and other hazardous substances is their ability to reproduce. A small amount of a micro organism may grow considerably in a very short time under favorable conditions

Wastes from hospitals and research facilities may contain disease-causing organisms that could infect site personnel. Like chemical hazards, etiologic agents may be dispersed in the environment via water and wind. Other biologic hazards that may be present at a hazardous waste site include poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and respiratory equipment can help reduce the chances of exposure. Thorough washing of any exposed body parts and equipment will help protect against infection.

II. BLOODBORNE PATHOGENS

Bloodborne pathogens are microorganisms in the blood or other body fluids that can cause illness in people. These microorganisms can be transmitted through contact with contaminated blood and body fluids such as:

- blood
- semen
- vaginal secretions
- cerebral spinal fluid
- any other body fluid contaminated with blood

Common Diseases: There are many diseases caused by bloodborne pathogens such as herpes, syphilis, malaria, arboviral infections (viruses transmitted by arthropods such as mosquitoes and ticks). However, AIDS and hepatitis are the bloodborne diseases that cause most concern in occupational settings.

Hepatitis B (HBV)	Hepatitis C (HCV)	HIV/AIDS
■ Leading cause of liver cancer.	■ It causes cirrhosis of the liver (inflammation and hardening).	■ Attacks the immune system, allowing other diseases to develop.
■ Extremely infectious; can stay alive in dried blood for up to a year.	■ May also cause liver cancer.	■ Transmitted primarily through sexual contact.
■ Vaccine available.	■ No vaccine available.	■ No vaccine available.

How do you get exposed?

Professions at risk of exposure include all which require contact with someone bleeding or responsible for the cleanup of blood and other infections materials. Bloodborne pathogens can enter the body and cause infection by an accidental injury with a sharp object contaminated with infectious materials such as needles, glass, or anything which can pierce, puncture, or cut skin. Transmission may also occur by transferring the infectious material to the mouth, eyes, nose, or open skin.

If exposure happens, the employer must take action.

- Make notes of the route of exposure.
- Identify the source individual and whether he/she has HIV / HBV (unless it can't be done or prohibited by law).
- Testing to determine if employee has been infected with HIV and/or HBV
- Counseling and safe and effective treatment.
- Record and keep records of exposures. This includes recording when syringes are found. The records must be kept for 30 years.

Bloodborne pathogens are ***NOT*** transmitted:

- touching an infected person,
- by through coughing or sneezing or
- by using the same equipment, materials, toilets, water fountains or showers as an infected person.

Universal precautions

All blood, body fluids, and sources of potentially infectious human body fluids including sewage **shall be considered infectious** until proven otherwise. Do not pick up broken pieces of glass or sharps with gloved or bare hands. The following are examples of universal precautions:

- Use barriers to prevent contact
- Proper hand washing
- Cleaning and sanitizing

Regulation/Standard

Cal/OSHA has established a bloodborne pathogen standard, General Industry Safety Orders **GISO 5193,** which requires precautions in dealing with materials that may have been contaminated by body fluids (including blood and tissues) that may spread infections.

This GISO standard applies **only** to employees that may reasonably have occupational exposure to blood or other potentially infectious materials. The purpose of the standard is to instruct employer to reduce the risk for exposure to a bloodborne infection by first evaluating the hazards you face on the job.

If there is a possibility that you may sometime be at risk, then your employer must:

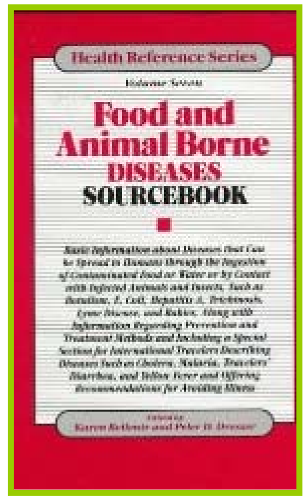
- Develop an exposure control plan.
- Give you training so that you learn how to avoid getting exposed to these diseases.
- Provide you with personal protective equipment (such as gloves or mass) that will allow you to do your job with little risk of infection.
- Provide you with a vaccination against HBV if you are in a job where there is a risk of exposure, or if you have been exposed.

III. ANIMAL- BORNE DISEASES

Rabies is a fatal infection of the central nervous system caused by the bite of a rabid animal, or by the animal's saliva contaminating an open wound. Any mammal can carry rabies. Canine rabies has been almost eliminated by vaccination programs – now wild raccoons, bats, foxes, and skunks are the most common carriers of rabies. The best method of prevention is to avoid contact with strange animals.

Warning signs that an animal may be rabid include:

- Finding a nocturnal animal, like a bat, during the day
- A wild animal that has lost its fear of humans
- Abnormally aggressive behavior
- Drooling, foaming at the mouth



Anyone bitten by a strange animal not available for examination must take anti-rabies treatment.
The treatment is effective, but involves a series of injections over several weeks, is expensive, and involves some risk. If a wild animal unexpectedly approaches, the best course of action is to retreat.

Hantavirus also known as "Muerto Canyon Virus" is a rare disease carried by rodents. It is usually spread when humans inhale airborne material contaminated by the urine of infected wild mice. Because the disease is flu-like in its first symptoms, it is difficult to diagnose. Hantavirus progresses rapidly to a type of pneumonia which is frequently fatal. If hantavirus is known to be present in the area, state and local health departments can provide information about the extent of the problem and necessary preventive measures.

Dead animals' carcasses can be a hazard to the environment and other animals so they require special handling. To minimize soil or water contamination and the risk of spreading disease, guidelines for proper carcass disposal must be followed. Disposal options include calling a licensed collector to remove dead stock or burial in an approved Animal Disposal Pit. Alternatives include incineration and composting. Composting avoids the air contamination associated with burning mortalities and is economical.

IV. AIRBORNE DISEASES

Airborne diseases are spread when droplets of pathogens are expelled into the air due to coughing, sneezing or talking. They hang in the air much like invisible smoke. They can travel on air currents over considerable distances. These droplets are loaded with infectious particles.

Many of these diseases require prolonged exposure for infection to occur, posing only minimal threat to emergency responders. However, there are preventive measures, such as wearing masks or maximizing ventilation, that help reduce these risks.

Legionnaires' disease is caused by inhaling airborne water droplets containing bacteria causing the illness. The symptoms include pneumonia, fever, and muscle aches. The bacteria are found in air conditioning cooling towers, plumbing system, hot water tanks, and whirlpool spas. Chest x-ray of people with Legionnaires' disease often shows pneumonia, and without knowing of a worker's occupational exposure, doctors might mistake the disease for simple pneumonia.

Tuberculosis (TB) The disease is spread when a TB carrier coughs or sneezes near someone. Tuberculosis damages the lungs and other parts of the body, and is a potentially fatal but treatable illness. The risk of being exposed to TB is greater in hospitals, nursing, home, jails, prisons, and facilities for the homeless.

What you can do:

- Most important: Wash your hands well with clean water and soap before you eat or smoke and after work.
- Do not touch your nose, mouth, eyes, or ears with your hands, unless you have just washed. Most of the time, people get these diseases when they have germs on their hands and they touch their mouth or nose or eyes.
- Keep your fingernails short; use a stiff soapy brush to clean under your nails.
- Wear waterproof gloves when you clean pumps or screens and when you handle wastewater, sludge, or grit.
- Always wear gloves when your hands are chapped or burned or you have a rash or a cut.
- Shower and change out of your work clothes before you leave work.
- Do not keep your soiled work clothes with your other clothes.
- Report any injury or illness you think you got from work right away.

V. WATER-BORNE DISEASE

Communicable disease outbreaks of diarrhea and respiratory illness can occur when water and sewage systems are not working and personal hygiene is hard to maintain as a result of a disaster.

- Local authorities will tell you if tap water is safe to drink or to use for cooking or bathing.
- If the water is not safe to use, follow local instructions to use bottled water or to boil or disinfect water for cooking, cleaning, or bathing.
- Because some water-borne diseases can be contracted through contact with contaminated standing water, it is important to wear waders and waterproof gloves when coming into contact with flood water; wash thoroughly with soap and water if skin comes into contact with flood water; and make sure flood water does not get in your mouth.
- If you develop a high fever OR, nausea, vomiting, diarrhea, jaundice or flu-like symptoms, seek medical attention immediately.

Common Water-borne Infections:

Salmonella:	Symptoms include abdominal pain, diarrhea, and vomiting
E.Coli:	Very common cause of diarrhea
Giardiasis:	Symptoms include persistent diarrhea, weight loss, and fatigue
Hepatitis A:	It is a serious liver disease. The symptoms include jaundice, fatigue, abdominal pain, loss of appetite, diarrhea.

MODULE 7

Physical Hazards

Module 7
Physical Hazards

OUTLINE

I. Extreme temperatures

II. Radiation

III. Noise

OBJECTIVES

At the end of this session, trainees will be able to:

1. List the risks, symptoms, first-aid, and prevention of heat-related illnesses.
2. List the risks, symptoms, first-aid, and prevention of coldness-related injuries.
3. Describe ionizing radiation and its health effects.
4. Explain why hearing loss may occur over the years and some of the controls.

INTRODUCTION

From the industrial hygiene perspective, a physical hazard is a factor in the environment that can harm the body without necessarily touching it. This module will describe some of the physical stressors such as extreme temperatures; radiation; noise; and vibration, to which a worker might be exposed to at different work sites. It is important that the employer, supervisor, workers, and those responsible for safety and health be alert to these hazards because of possible immediate or cumulative effects on the health of workers.

I. EXTREME TEMPERATURES

Extremes of temperature affect the amount of work people can do and the manner in which they do it. When the body is too hot or too cold, mental ability drops as brain function is disrupted. Both heat stress and cold stress are dangerous both decrease alertness and judgment.

Heat Stress

The human body keeps a constant internal temperature of about 98.6°F. When we work in very hot areas, our bodies automatically get rid of excess heat by:

- sweating (perspiration)
- increasing blood circulation
- increasing the blood flow to the skin
- radiating heat off the body

When the body cannot get rid of heat quickly enough, various forms of heat illness can develop. These include heat exhaustion and heat stroke and can cause death if not treated immediately.

Using PPE adds weight and bulk and reduces your ability to cool yourself. Wearing PPE increases the risk of developing heat illnesses, including heat stroke. Factors that contribute to heat illness, especially when using PPE, include:

Environmental Factors	Working Conditions	Personal Factors
• high humidity • direct sunlight or other heat source • lack of air movement	• long work days • infrequent rest breaks • no access to drinking water	• dehydration • lack of experience wearing PPE • being overweight or underweight • alcohol or drug use • medical condition • medication use

To prevent heat illnesses (especially when using PPE), it is very important to take frequent breaks and drink plenty of liquids to replace lost fluids.

Heat Illnesses

	Symptoms	Treatment
Heat Rash	• skin remains wet (especially in hot, humid environments) • sweat ducts become plugged and rash develops	• keep skin clean and dry • remove any Personal Protective Equipment • rest in a cool area • change clothes regularly to stay dry
Heat Cramps	• early sign that the body's ability to cope with heat is being exceeded • painful muscle cramps, usually in the legs and near the stomach caused by losing too much salt trough sweating	• stop activity • drink liquids to replace water loss • rest in a cooler place • remove any Personal Protective Equipment • if possible, lay the worker down and give light massage
Heat Exhaustion	• excessive loss of water and salt occurs (**the worker may be dehydrated**). The person may become tired, weak, dizzy, and have wet/damp (clammy) skin/ This is a serious condition	• have worker rest in a cool area and drink water if worker is not nauseous • Look for medical aid
Heat Stroke	• the body is unable to control its core temperature. This is a **life-threatening** condition in which the core temperature rises above 105°F (41°C) and vital functions break down, including mental functions. The person may have high body temperature, absence of sweating, with hot red or flushed dry skin, rapid pulse, difficulty breathing, confusion, coma	• **Medical Emergency** – call 911 • remove unnecessary clothing • help the victim cool off and rest in a cool place. Offer shower or sponge with cool water • medical treatment is necessary

Precautions and Control Measures to Reduce Heat Illnesses

Appendix CCR's GISO 3395 – Heat Illness Prevention

1. **Engineering**: methods such as ventilation, spot cooling, fans and heat shields, can reduce excessive heat stress or isolate the worker from it.

2. **Protective Clothing**: wearing light weight and/or breathable clothing.

3. **Scheduling and Rest Breaks**: some jobs may be rescheduled to be done during the cool parts of the day, or they may be rescheduled to provide rest periods which allow the body to get rid of some of its heat.

4. **Water**: because the thirst mechanism may not adequately stimulated by loss of fluid in the sweat, it is important that a supply of cool, fresh and clean water is available during the 8 hr shift.

5. **Education**: workers should be taught to recognize the symptoms of heat illnesses and the appropriate first aid measures. New Cal/OSHA standard requires that workers are trained in why heat illnesses occur and what can be done to prevent them, how to contact emergency medical services and give directions to their work location, and the importance of acclimatization.

6. **Acclimatization**: this is the process by which the body gradually adjusts itself to deal with heat. Employees returning to work after prolonged absences, illnesses or recently moving from a cool to a hot climate need to be acclimatized.

Heat Illness Regulation - Passed by OSH Standards Board in 2006.
www.dir.ca.gov/title8/3395.html

Regulation GISO 3395 is an important first step in protecting workers from heat related illness. All employers with outdoor worksites are required by Cal/OSHA to take 4 basic steps to prevent heat illness:

- Provide heat illness prevention training to all employees, including supervisors
- Provide enough water so that each employee can drink at least 1 Quart (4 cups of water) per hour if they want to, and encourage them to do so
- Provide access to shade for at least 5 minutes of rest when employee believes he or she needs a preventative recovery period
- Develop and implement written procedures for complying with the heat illness prevention standard

Education, enforcement, and determining whether the regulation is successful are vital. Cal/OSHA must track whether or not the regulation is effective in preventing heat-related illness and deaths.

Cold Stress

Generally, the answer to a cold work area is to supply heat where possible, except for areas that must be cold, such as food storage areas.

Hypothermia: is an acute problem resulting from prolonged cold exposure and heat loss. The major causes of hypothermia are cold temperatures, improper clothing and equipment, and wetness. There are a number of other contributing factors such as fatigue, exhaustion, dehydration, hunger and alcohol intake.

	Symptoms	Treatment
Mild to Moderate hypothermia (96°F – 98.6°F)	• Uncontrollable shivering and problems with some complex functions	• stop heat loss – move to shelter, change from wet to dry clothing,
Mild to Moderate hypothermia (96°F – 98.6°F)	• Slurred speech and irrational behavior	add layers of clothing or wrapping in a blanket • drink hot liquids
Severe hypothermia (< 92°F)	• It is a **life-threatening** condition. • Shivering stops and muscles are rigid • Pulse and breathing are very slow or undetectable	• move victim to shelter • remove any wet clothing • use multiple sleeping bags, wool blankets, wool clothing to create a thickness around the victim • use chemical heat packs, hot water bottles, or hot compresses

Frostbite: the skin is white and the skin tissues freeze. Deep frostbite can include freezing of muscle and bone, and is very difficult to re-warm without some damage occur. Some of the symptoms are pale, waxy-white skin color, the skin becomes hard and numb, and it usually affects extremities. To re-warm severe frostbite, move person to warm and dry area; place person in warm water; do not rub affected area; and get medical attention.

Trench Foot: is an injury caused by prolonged exposure of the feet to cool, wet conditions, causing blood vessels in the feet to constrict, shutting off circulation. Some of the symptoms include numbness, tingling, blisters, and discoloration. Trench Foot should be treated by carefully washing and drying the feet, and re-warming them gently. The victim should not walk because this may cause further injury. Prevention is simple – keep the feet dry.

Precautions to Reduce Cold Injuries

- Be prepared: know the conditions to which the worker will be exposed by tracking temperature and air movement and link to action program. Track the windchill chart to monitor low temperatures and strong winds.

- Seek warmth: a warm break area and hot meal help the body when working in the cold. Make sure you establish work/warm-up schedule and have breaks at least 20 minutes.

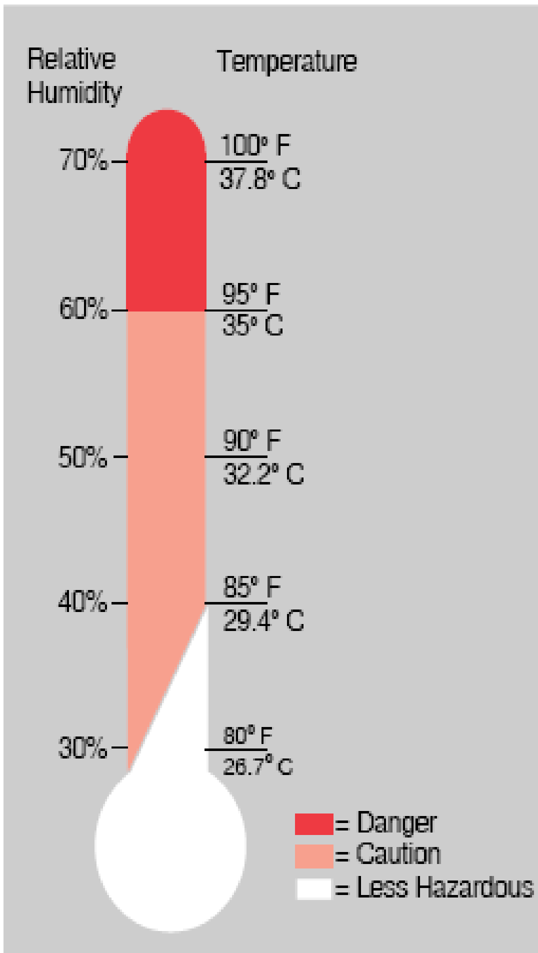
- Dress for the cold: dress in layers, using under-layers that keep moisture away from the body. Wear a hat or hood. Fabrics like wool, fleece, and down provide good insulation. Wear outer clothing that provides wind barrier. Keep dry –protect with rain clothes or a poncho.

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

THE HEAT EQUATION

HIGH TEMPERATURE + HIGH HUMIDITY + PHYSICAL WORK = HEAT ILLNESS

When the body is unable to cool itself through sweating, **serious** heat illnesses may occur. The most severe heat-induced illnesses are **heat exhaustion** and **heat stroke.** If actions are not taken to treat heat exhaustion, the illness could progress to heat stroke and possible **death**.

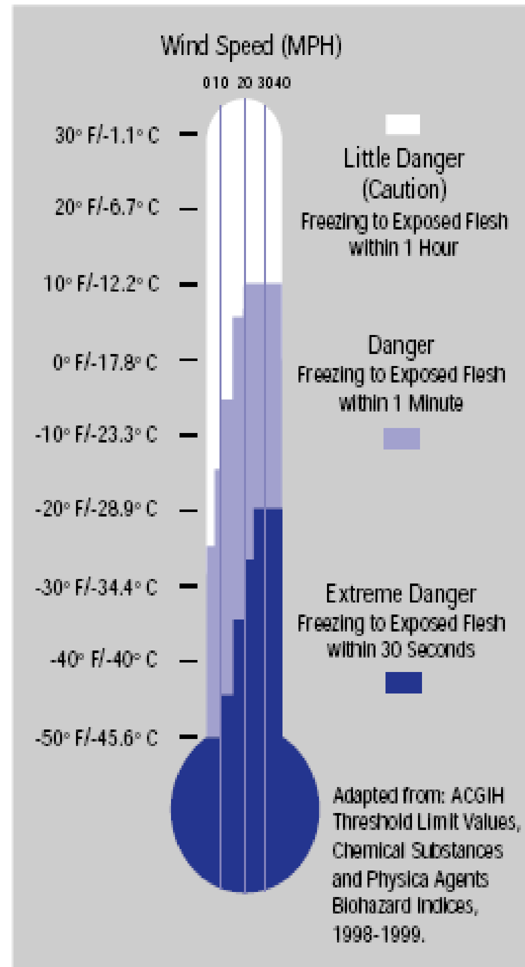


OSHA 3154
1998

THE COLD STRESS EQUATION

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result. **Hypothermia** can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.



OSHA 3156
1998

II. RADIATION

California Code of Regulations – 10 CFR Part 20 and 17

This section was written as a basic guide to prepare workers for an environment containing ionizing radiation. It does not substitute special radiation training that may be required. Any worker assigned to a radiological area will require more training and will assume greater responsibilities for their actions in a radiological setting.

None of the five senses; seeing, hearing, smelling, touching or tasting, can detect the presence of radiation. Radiation detectors include survey instruments and personal dosimeters. Both can be used to obtain direct readouts of the total amount of radioactivity. Radiation meters display readings in counts per minute (cpm) or milliroentgens per hour (mR/hr).

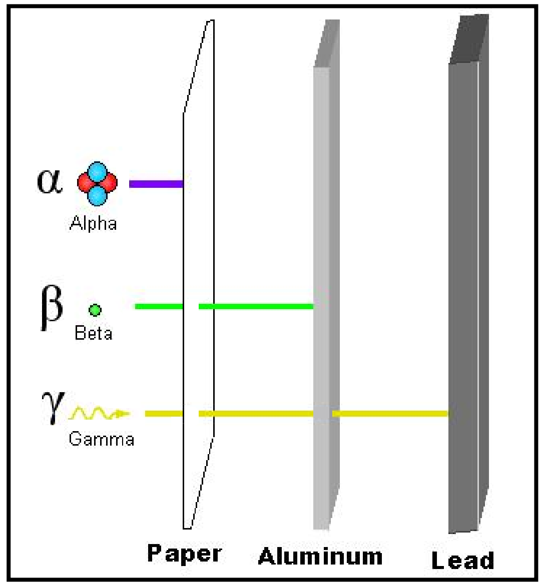
The most accurate method of detecting radiation dosage is the film badge. The film badge is worn while operating in the effected zone. The badge is then sent to a radiologist, where the film is developed and a dosage is estimated. This method, though the most accurate, doesn't provide immediate feedback during initial scene survey.

There are two types of radiation – ionizing and nonionizing. Four types of ionizing radiation are alpha, beta, gamma and x-rays, and neutrons. Nonionizing radiation refers to radar waves, microwaves, visible and UV light. The following information will focused on ionizing radiation.

Type of Radiation	Description
Alpha (α) i.e., Plutonium	It is the least penetrating of the four types of radiation. It can be stopped by clothing, a sheet of paper, or the outer layer of skin.
Beta (β) i.e., Strontium-90	Particles are electrons that usually penetrate tissue. It can be stopped by plastic faceshields, thin plywood, or sheet metal
Gamma (γ) and X-rays i.e., cobalt-60	They are waves of energy. Gamma rays are usually strong to penetrate the body. It can be reduced by placing lead, steel, or concrete shielding around the source of radiation.
Neutrons	Particles without electrical charge. Neutron radiation can normally be found near operating nuclear reactors, accelerators, or special selected sources.

Radioactive materials that emit x-rays, gamma-rays, or neutrons are external hazards. These materials can be located some distance from the body and emit radiation that produces ionization (damage) as it passes through the body.

Alpha and Beta-emitters are generally considered internal hazards. Inside the body they cause damage because there is no a thick barrier in the lungs, stomach, or an open wound to serve as a shield. Once in the body they continue to irradiate tissues.



Key Concepts

- Radioactive material is a physical material that emits ionizing radiation
- Radiation is energy in the form of waves or moving particles emitted by a material
- Contamination is radioactive material in an unwanted place. This material can enter the body by the mouth and nose. A less common route by which radioactive material enters the body is through open skin.

Basic Safety Factors

Three methods of exposure reduction consistent with keeping exposure **as low as reasonably achievable (ALARA)** are **time, distance, and shielding**.

- Time – reduce the time spend in a radiation area so that the radiation dose will be reduced. Only the minimum necessary exposure should be planned for a work task.
- Distance – increase distance from a radiation source to decrease radiation levels. If possible, move the work needed to be done to a low radiation area.
- Shielding – is commonly used to protect against radiation from radioactive sources. The more mass that is place between a source and a person, the less radiation the person will receive. Request temporary local shielding when working with high dose rates and never begin removing the shielding unless directed by a competent person.

Work practices

- Obey the posted, oral, and written instructions and procedures including instructions on radiation work permit (RWP). The RWP is a method to control work in areas involving exposure to radiation and other radiation hazards such as contamination, high radiation, and airborne radioactivity.

- Keep track of personal radiation exposure and avoid exceeding limits.

- Be alert for possibilities that the work of other may change surrounding radiological conditions.

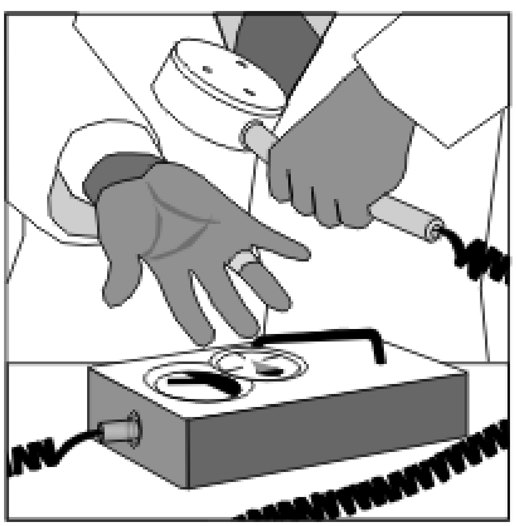
- Do not take breaks, eat, drink, or smoke in radiation controlled areas.

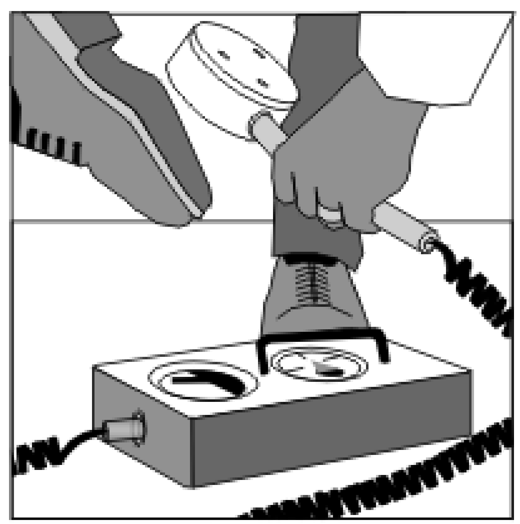
- Do not touch a contaminated surface or allow clothing to do so.

- Use a radiation-detecting device to search for contamination of personnel. Assume that you are contaminated.

- Be especially careful when removing protective clothing, especially gloves and shoe covers. Whole body assessment is required when leaving contaminated areas where protective clothing has been worn.

- Using the probe from a survey meter workers can “frisk” for radioactive contamination. Commonly used during the decontamination process at a site where radioactive materials may be present.





- Do not mix hazardous waste with radioactive waste, creating mixed waste.

For more information, please contact the U.S. Nuclear Regulatory Commission

www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v21/

III. NOISE

What is Noise? Is conversation with friends and family noise? Is music noise? Is a factory machine running at high-speed noise?

The only difference between music and factory sounds is whether the sound is desired. In most cases the music is wanted sound and the factory noise is unwanted sound.

There are many sources of noise in the workplace. These include machinery which has moving parts and metal-on-metal contacts.

However, even the most desired music can be just as damaging to the human ear as the worst factory noise. The health effects depend on the loudness of the sound, not whether the sound is wanted or not.

How Much is "Too Much" Noise?

The best way to determine your true noise exposure is to quantify it via noise monitoring equipment.

Simple ways listed here can help determine whether there may be elevated sound pressure levels, but many are subjective:

- if you have to yell or speak loudly to be understood at an arm's length away from someone else
- if your ears are ringing when you leave the area
- if you have difficulty hearing a normal conversation after work
- if you get headaches or feel dizzy from the noise

- if any of your co-workers also have these problems or have been diagnosed by a doctor with hearing problems

Sources of noise at the work site

- Diesel engines, construction and excavation equipment
- Electrical motors, generators, fans, blowers
- Drilling rigs, air rotary/percussion
- Vacuum trucks

Health Effects of Noise

High levels of noise can have both immediate and long-term effects on hearing. High noise levels can cause:

- Hearing loss, both temporary and permanent.
- Headaches.
- Dizziness.
- High blood pressure.
- Nervousness and stress leading to stomach ulcers, sleeping problems, heart disease.
- Loss of concentration.
- Accidents if warning alarms or shouts are not heard.

The level of damage to the ear can be determined by hearing tests called “audiograms”. Loss of hearing in the range of sound where human speech occurs (between 2,000 and 4,000 Hertz) has temporary and permanent effects.

Problems: There are several problems that can result from too much noise. They include:

1. Temporary Hearing Loss - Hearing can be lost for a few hours after exposure to continuous or brief noise (more than 80 decibels, approximately). With temporary hearing loss, hearing returns usually after several hours.

2. Permanent Hearing Loss - This type of hearing loss usually occurs after exposure over a long time. Some permanent, irreversible loss occurs. High-frequency noise is more harmful to hearing than low frequency. Continuous noise is more harmful than brief (intermittent).

3. **Interference with Communications** - Too much noise can make it difficult to communicate with those around you. Safety problems, stress, and annoyance can result.

Other Noise Hazards

A Noisy Work Environment Contributes to Accidents

Cal/OSHA Noise Standard is set to protect workers from permanent hearing loss. However, noise levels below OSHA permissible limits can impact people's ability to carry out an assigned task, by causing anxiety or fatigue.

Noise can increase human error, contributing to accidents by:

- "masking" audible alarms, verbal messages, etc.
- increasing worker fatigue and anxiety
- harder to process complex info for difficult tasks
- harder to monitor and interpret unusual events, by narrowing the span of attention.

Measuring Noise Levels: What Are Decibels?

Decibels

Noise is measured in units called "decibels" which is a measure of how much pressure is created by the sound wave producing the sound. The range of decibels is from 0 to about 140, or from the smallest sound human ears can hear to the sound level that will do immediate and permanent damage to the ear.

The word "decibels" is abbreviated as "dB" and there are three scales – A, B and C – but the scale closest to human hearing is the A scale or "dBA".

0 dB —— Minimum level needed to hear a sound

10 dB——A whisper; leaves blowing in the wind

40 dB——A quiet office

70 dB——A traffic jam

90 dB——Heavy machinery

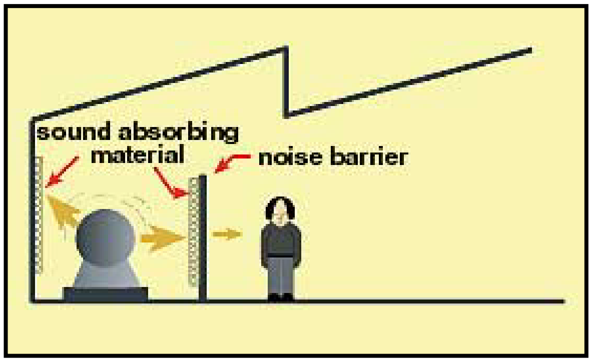
130 dB——A jet engine at 10 meters

Solutions to noise hazards at the work site

If noise levels are found to be above 85 dBA for an 8-hour shift, 40-hour work week, the employer is required by law to reduce the noise levels.

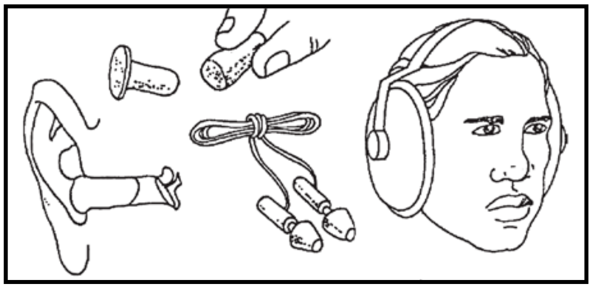
Engineering controls at the source of the noise are the most effective means of reducing noise levels. The controls should always reduce the loudest source of the noise first. Engineering controls include:

- re-designing equipment to reduce the speed or impact of moving parts; to install mufflers on intakes and exhausts; to replace old equipment with newer, better designed equipment.
- servicing and maintaining equipment to replace worn parts and to lubricate all moving parts.
- isolating equipment either by distance, by enclosures or by barriers.
- damping and cushioning noise sources by using rubber pads to reduce vibration and noise coming from metal parts; reducing the drop height of objects falling into bins or onto belts.
- installing absorptive baffles in work areas to absorb sounds generated there.



Administrative controls for noise reduction include rotating workers in and out of areas with high noise levels, and providing training to workers about noise hazards and ways to reduce noise exposures and protect hearing.

Personal protective equipment (PPE) for noise reduction includes ear plugs and ear muffs. Like all PPE, this control depends on selecting the correct equipment for the specific noise levels, and proper use and care of the equipment.



It is important to recognize that the noise is still present, and that the PPE (if used correctly) simply reduces the amount of noise reaching the inner ear.

For more information, please contact the Occupational Safety and Health Administration

Standard 29 CFR 1910.95 www.osha.gov

Cal-OSHA Standard GISO 5097 www.dir.ca.gov/Title8/5097.htm

MODULE 8

Safety Hazards

Module 8
Safety Hazards

OUTLINE

I. Introduction

II. Common Safety Hazards

- Trip/Fall Hazards
- Electrical Hazards
- Falls from Elevation Hazards
- Trenching Hazards

OBJECTIVES

At the end of this session, trainees will be able to:

1. Identify potential safety hazards at a worksite.
2. Describe what precautionary measures can be taken to avoid injuries and/or fatalities at the job site.

I. INTRODUCTION

A safety hazard is the potential for harm. In practical terms, a hazard often is associated with a condition or activity that, if left uncontrolled, can result in injury, illness, or death. (OSHA 3071)

The health hazards involved with a hazardous waste site are a major concern to everyone. But according to OSHA, employers report that safety hazards are far more common than those health hazards and cause most of the OSHA recordable injuries (which OSHA defines as “an occupational injury or illness that requires medical treatment more than simple first aid and must be reported”).

The first step in preventing injuries, illnesses and fatalities at your work site is to identify the job hazards. Identifying and becoming aware of job hazards will allow one to control or, if possible, eliminate safety hazards as early as possible, thus greatly reducing workplace injuries, illnesses, and fatalities.

II. COMMON SAFETY HAZARDS

- **Trip and Fall Safety Hazards**

Trip and fall may seem like minor hazards when compared to the hazards associated with hazardous materials, but they are still hazards that can cause severe injuries such as broken bones, back injuries, or head injuries.

Be Aware of Your Surroundings - You probably will not have to look for too long before finding a trip or fall hazard somewhere in a worksite. Some indicators of trip or fall hazards include:

- Poor housekeeping
- Improperly stored tools, equipment or supplies
- Uneven ground or flooring
- Wet or oily surfaces
- Poor visibility
- Open Drawers
- Cords in walkways

Trip and fall hazards, although common, are often avoidable. There is a possibility of injury with trips and falls, but that possibility can be greatly reduced if not wholly eliminated when the proper precautionary measures are taken. Here are a few simple yet effective precautions that can be taken In order to avoid trips and falls:

- Create and maintain good housekeeping habits.
- Be sure to clean up any spills and mark wet areas to avoid slipping.
- Make sure to have adequate lighting around the work site.
- Be aware of and use caution around uneven ground or flooring by clearly marking those hazards with signs or other markers.
- Make sure that all cords and other clutter are removed from walkways.

- Store all tools and equipment when through using them and close all drawers when not using them.
- Take caution to eliminate, rather than create, trip and fall hazards.

Electrical Safety Hazards

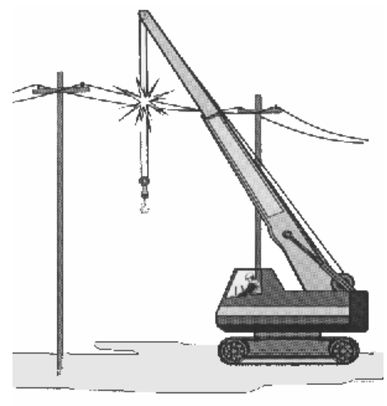
Among the most common safety hazards found at a hazardous material or waste worksite are hazards that have to do with electricity.

Electrical hazards have the potential to cause serious injury or death. In fact, OSHA reports that there are approximately 350 fatalities a year attributed to electrical incidents. However, although the danger of serious injury or death due to electrical hazards exists, that danger can be minimized through education.

Learning what constitutes an electrical safety hazard, how to prevent those hazards, and how to operate around the electrical hazards that cannot be eliminated from the workplace will go along way in preventing workers from falling victim to electrical safety hazards.

Recognizing Electrical Safety Hazards

There are many electrical safety hazards on a given worksite. Electricity is dangerous when not harnessed correctly, so any electrical instrument (wire, power tool, power line, etc.) is a potential safety hazard. That is not to say that all electrical equipment is a serious hazard, but that the improper upkeep or use of electrical equipment can make that equipment quite dangerous. Some examples of common electrical safety hazards include:



- Contact with underground or overhead power lines (directly or through machinery such as cranes or backhoes, or through other metallic objects)
- Improper use of flexible cords (e.g. cords threaded through walls)
- Damaged cords
- Cords missing ground prongs
- Unlabeled circuit breakers
- Missing doors on electrical panels or misuse of electric testing equipment
- Refer to the minimum set-back distances required for boom-type or lifting equipment from overhead energized lines found on 8 CCR 2946 Table II.

Prevention

One may not be able to completely eliminate the dangers associated with working around electricity, but taking the necessary precautions can prevent electrical safety hazards from becoming incidents that result in worksite injuries or fatalities. Here are some precautionary measures that can be taken to reduce the risk of electricity-related incidents:

- Electrical cords should be regularly inspected to ensure that they are not showing sips of damage such as cracks or missing ground prongs.
- Repairs or alterations to electrical cords should be made by qualified electricians.
- Label all circuit breakers.
- Avoid contact with power lines.
- Use equipment from non-conductive materials such as wood when working near power lines (e.g. wooden ladders).
- Always be aware of any underground power lines before performing any type of excavation.

- Conduct regular inspection of all electrical equipment including seemingly low voltage equipment such as power tools.

- Refer to module 12 for more information on Lock out/Tag out and review the standards 8 CCR 2320.4 and 8 CCR 3314 for more details.

- **Falls from Elevation Hazards**

One major safety hazard found at many worksites including sites that contain hazardous materials/waste is the hazard of falling from elevations. Year after year, falling from elevation continues to be a leading cause of occupational fatalities. OSHA reports that from 1995 to 1999, there was an average of 362 fatal falls a year, with the trend on the increase. It is important then to recognize the danger of falling when working at an elevation. But the hazard is not limited to extremely high elevations. Whether you are working on a 200 foot high scaffold or a 6 foot high ladder, a fall from any elevation can cause serious injury or even death.

Recognizing Fall from Elevation Hazards

Fall from elevation safety hazards are present at nearly all jobsites. Some of those hazards are more obvious than others, but recognizing all fall from elevation hazards on a worksite is essential in preventing incidents. Here are some examples of common fall from elevation hazards:

- Misuse use of portable ladders.
- Lack of posted signs around ledges or sudden drops.
- Improper scaffold construction.
- Unprotected sides, wall openings, and floor holes.

Prevention

Recognizing and becoming aware of where fall from elevation safety hazards exist is vital in preventing those hazards. But simply recognizing hazards is not always enough to ensure safety at the workplace. Some precautions that need to be taken include: (OSHA)

- Post readily visible signs around ledges or sudden drops.
- Before each use inspect ladders for cracked or broken parts.
- Position ladders safely before use.
- Do not apply more weight on the ladder than it is

designed to support, and make sure that the weight on the ladder will not cause it to slip off its support.

- Construct all scaffolds according to the manufacturer's instructions and install guardrail systems along all open sides and ends of platforms.
- Use a guardrail, safety net, or personal fall arrest system (body harness, vertical lifeline, horizontal lifeline, anchorage, etc) whenever working at an elevation above 6 feet.

If something seems unsafe to work on or around, take the time to ensure that you and everyone else are not in danger. When dealing with falls from elevation it is better to err on the side of caution, for any other errors can very likely be fatal.

▪ Trenching/Excavation

Excavation is a part of many jobsites, and worksites that contain hazardous waste/materials often have trenches throughout the site. These trenches, as well as the excavation process itself, are potential safety hazards to anyone who works with or around them if the necessary safeguards are not put into place.

There are many hazards associated with excavation and trenching. Here are some of the safety hazards one must keep in mind when working with trenches:

- The possibility of collapse or cave-in
- Underground utility lines (e.g. natural gas lines)
- Working with the heavy machinery needed in the excavation process
- Electrical hazards from overhead and underground power-lines

The Cal/OSHA Excavation Regulations are 8 CCR 1540 and 1541. It is important to notify the Regional Notification Centers two working days prior to initiating sub-surface activities.

Prevention

Although the hazards associated with excavation and trenching cannot be completely eliminated, the proper safety measures greatly reduce the risk of those hazards causing harm. Here are some safety measures that, if enacted, can make work during trenching/excavation as safe as possible:

- Before excavation or entering a trench, know where the utility lines are and take extreme caution when digging around them.

- Use caution when working with or around heavy machinery such as excavators. In addition to the danger of being injured by heavy machinery directly, the use of heavy machinery around trenches can cause loose soil to collapse, endangering those who are working inside the trench. It is important to have functional warning methods in accordance with the requirements of 8 CCR 1592.

- Always be aware of any power lines, above ground as well as in the underground area of excavation. Accidentally cutting an electric wire with a shovel or excavator can cause serious injury.

- Monitor air conditions inside the trench before entry.

The possibility of a collapse or cave-in is the most prevalent hazard when dealing with excavation/trenching. According to NIOSH, there was an average of 54 fatalities per year that can be attributed to trench collapses between 1992 and 2001. With such a looming threat to worker safety, it is extremely important to take all possible precautions when dealing with trenches.

There are a few different trench protective systems that can be used in order to prevent collapses. But in order to plan an excavation correctly you must know the the type of soil in the area that you wish to excavate. Because soil stability can vary, **the protective system is designed based on the type of soil being excavated**. OSHA classifies soil in three categories. The categories define the soil's ability to stay together without breaking apart under pressure (cohesiveness). The more cohesive the soil is, the more stability it will have, and not cave-in or break apart as easily as less stable soil.

- **Soil Type A** (most stable) is hard packed soil and rock, cemented resisting penetration. Based on OSHA and Cal/OSHA standards, no soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.

- **Soil Type B** (less stable than Type A) includes silt, silt loam, and sandy loam. It has medium stability and has been previously disturbed. According to OSHA and Cal/OSHA standards, no soil is Type B if it is submerged or if it is a soil from which water is freely seeping.

- **Soil Type C** (less stable than A and B) includes gravel, sand, loamy sand, and submerged soil. It may have been previously disturbed.

Once you have determined the soil type of the area of excavation, you are able to figure out what types of trench protective systems to use (i.e., sloping, benching, shoring, etc) and how to use them.

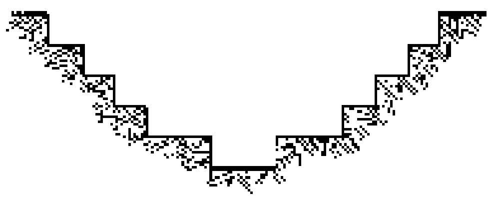
Sloping - consists of the cutting back of the trench wall at an angle inclined away from the excavation. OSHA specifies a maximum slope ratio for each soil type (width: height).

Sloping

Type of Soil	Ratio (width: height)
A	¾ : 1
B	1 :1
C	1 ½ : 1

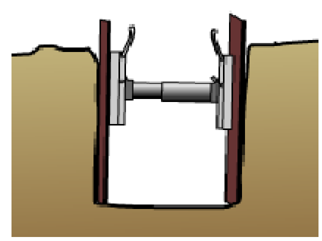
Source: www.cdc.gov/niosh/docs/2006-133d/flash/index.html

Benching - is a process in which the sides of a trench are excavated to form one or more horizontal levels or steps. OSHA has different basic designs for Type A, Type B, and Type B cohesive soils.

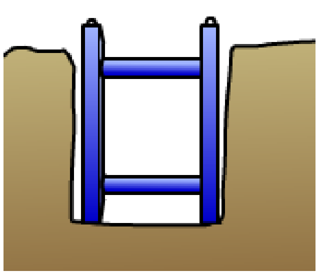


Benching

Shoring - is also a trench protective system. Shoring systems basically consist of plating held firmly in place with expandable braces. The braces work with the plating to essentially hold the trench walls in place in order to prevent a cave in.



Shoring



Shielding

Shielding (also known as trench boxes) **-** although shielding comes in many different shapes and sizes, it generally consists of two heavy steel or aluminum panels held apart by steel cylinders at both ends. It may take heavy equipment to install or move shielding, but the need to use that equipment pays off in the long run.

MODULE 9

Chemical Identification

Module 9
Chemical Identification

OUTLINE

I. Identification Methods

1. Material Safety Data Sheets

2. NFPA Placards and Labels (storage and firefighting)

3. HMIS Hazardous Materials Identification System
   (compliance with the Hazard Communication Standard)

4. Hazardous Waste Container Label
   - EPA Hazardous Waste Label
   - Universal waste

5. DOT Hazard Communication Standard (transportation only)
   - Placards and Labels
   - Shipping Papers
   - Container Shapes

6. Military Markings

OBJECTIVES

At the end of this session, trainees will be able to:

1. Name at least two sources of information that can help workers learn about the hazards of chemicals they work with.

2. Recognize each resource and explain the type of information that can be found in MSDS.

3. Describe the purpose of the four sections of the National Fire Protection Association (NFPA) Hazard Diamond.

4. Classify, by the Department of Transportation (DOT) hazard classification system, several chemicals commonly encountered when working with hazardous waste.

I. IDENTIFICATION METHODS

Identifying hazardous materials is important in order to avoid fires, explosions, and harmful health effects. The most common ways to characterize a hazardous substance are through:

- MSDS
- NFPA Placards
- Hazardous Material Identification System
- Hazardous Waste Container Labels
- DOT Hazard Communication Standard

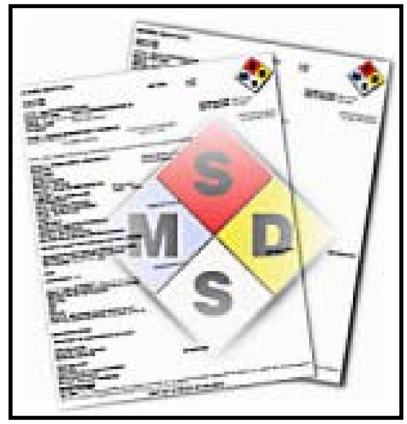
1. MSDS

The purpose of Material Safety Data Sheets is to provide the information necessary to safely use chemicals that can cause illness, injury, or death. They are written in a specific format, so that precise information is quickly accessible to anyone who knows how to use an MSDS. The HazCom Standard requires the following information:

Manufacturer's Information	Identity as shown on label. How to contact the manufacturer
Hazardous Ingredients	Names of chemicals, PELs, TLVs, and percentages of each chemical in the product
Physical and Chemical Characteristics	Weight, odor, color, vapor pressure, etc
Fire and Explosion data	Flammability and combustibility, LEL, UEL, and flash point
Reactivity Data	Reactions with other substances
Health Hazard Data	Effects on health including symptoms
Precautions for Safe Handling	Spills, leaks, and disposal
Control Measures	Ventilation, PPE, and work practices

While some MSDSs present information more completely and are easier to understand than others. Although MSDSs are extremely useful, just making them available does not discharge the employer's responsibility to provide any information and equipment required to minimize exposure.

Limitations of MSDSs



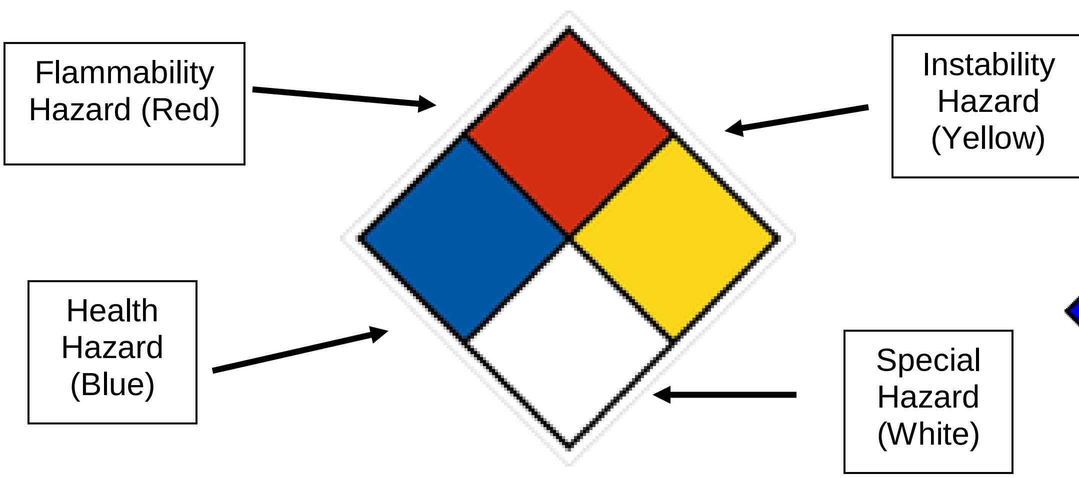
Some MSDSs can tell you a lot about the hazards of a chemical. They may be the only source of information about chemicals at a workplace. Yet, many MSDSs are missing valuable information. They may use many technical words and can be hard to understand. Others are out of date or contain inaccurate information.

Remember, not all MSDS's are created equal. Do not rely on the MSDS sheets alone. Try using other sources of information as well.

2. NFPA Hazard Identification System Overview

NFPA 704 is a standardized system, which uses numbers and color signs to define the basic hazards of special materials. Health, flammability, and instability are identified and rated on a scale of 0 (no hazard) to 4 (high hazard) depending on the degree of hazard present.

This identification system is a recommendation unless local jurisdictions require it.



This system is designed to provide advanced warning to emergency responders to the highest level of hazard within a designated area. This identification system may provide information on more than one chemical within the designated area, displaying the highest hazards of the chemicals on the sign.

The ratings for individual chemicals can be found in the NFPA Fire Protection Guide on Hazardous Materials. The following table describes what is meant by each level of hazard, 0 through 4, found on the NFPA 704 Hazard Diamond.

Health Hazard **(blue in color)**		**Fire Hazard** **(red in color)**		**Instability Hazard** **(yellow in color)**	
4	Materials that, under emergency conditions, can be lethal.	**4**	Materials that rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn.	**4**	Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperature and pressure.
3	Materials that, under emergency conditions, can cause serious or permanent injury.	**3**	Liquids and solids that can be ignited under almost all ambient temperature conditions.	**3**	Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation.
2	Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.	**2**	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	**2**	Materials that readily undergo violent chemical change at elevated temperatures and pressures.
1	Materials that, under emergency conditions, can cause significant irritation.	**1**	Materials that must be preheated before ignition can occur.	**1**	Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures.
0	Materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials.	**0**	Materials that will not burn under typical fire conditions.	**0**	Materials that in themselves are normally stable, even under fire conditions.

Special Hazard **(white in color)**		
	Fire Protection guide to Hazardous Materials recommends the following for Special Hazards identification.	
	Materials that react violently or explosive with water identified by “W” with horizontal line through the center.	~~W~~
	Materials that posses oxidizing properties shall be indentified by the letters “OX”	**OX**
	Cities, counties, individual companies and organization may use other symbols to identify a special hazard	
	Radiation	
	Corrosive	**Cor**
	Polymerization	**P**

3. Hazardous Materials Identification System (HMIS)

The Hazardous Materials Identification System can be seen in many workplaces. It provides limited information on protective equipment needed for handling the chemical and rates the health, flammability, and reactivity hazards similar to the NFPA ratings. It must be supplemented by training and may require more specific labeling by the Hazard Communication Standard (Haz Com).

This system differs in some ways from NFPA and the EPA. Although the colors are the same as the NFPA 704 diamond (health, flammability, and reactivity) the hazard ranking may differ. Also, note that the PPE Index differs from the EPA Levels of Protection.

This system has no uniform format, normally identification systems are purchased through a hazardous materials supply company. These signs are used to identify one chemical in one container and normally are not used to identify hazards in an area.

Employer's health and safety official or committee will determine the hazard rating by utilizing the MSDS, NFPA Hazardous Materials Handbook, and other references.

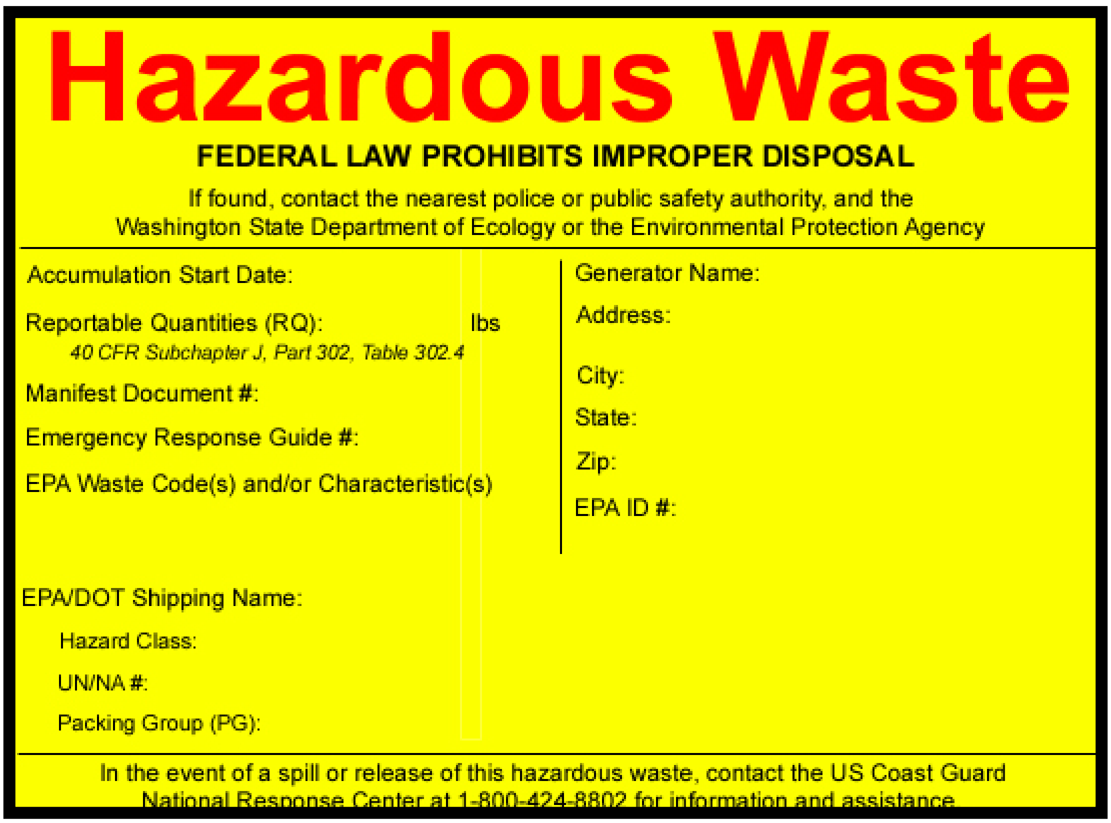
Hazardous Materials Identification Guide (HMIG) is a chart located in the facility to identify information found on the HMIS.

4. Hazardous Waste Container Label

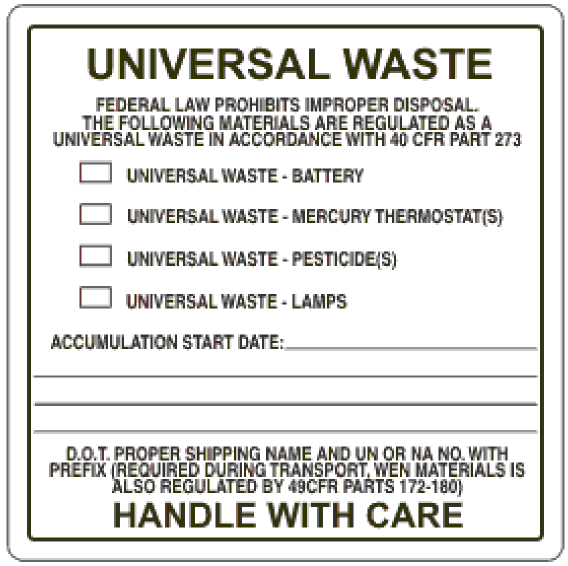
EPA Hazardous Waste Labels

When hazardous waste has been generated, EPA requires that it be identified with a hazardous waste label, yellow in background with black lettering. This label needs to be completely filled out and placed on the container along with other regulated labels, such as DOT's red flammable liquid label on a flammable liquid waste.

The EPA Hazard Communication Program requires labeling of containers that contain hazardous materials.



Universal Waste



The federal universal waste regulations are set forth in 40 CFR part 273. States can modify the universal waste rule and add additional universal waste(s) in individual state regulations so check with your state for the exact regulations that apply.

Regulations went into effect in 2003 to expand California's Universal Waste regulations to include certain products that have added lead or mercury. Both lead and mercury are toxic to people and to wildlife. If people improperly dispose of items that contain lead or mercury, the metals can contaminate soil and water. Under these regulations, people who handle some common waste items that contain lead or mercury may do so under the universal waste requirements. The Act say that items called universal waste should not be placed in the trash.

What Are the Labeling/Marking Requirements for Universal Waste Batteries? 40 CFR 273.14

A small quantity handler of universal waste must label or mark the universal waste to identify the type of universal waste as specified below:

Sources for More Information

The Code of Federal Regulations Title 40 part 273.

California Code of Regulations Title 22, Division 4
www.dtsc.ca.gov/hazardouswaste/universalwaste

Office of Solid Waste: www.epa.gov/osw

5. DOT Hazard Communication Standard

A material, which poses a risk (e.g. flammable liquid) in transportation, is considered a hazardous material. The U.S. Department of Transportation (DOT) uses several methods to help identify hazards on packages and vehicles when hazardous materials are moved across the nation or around the world. The USDOT communication system is recognized by OSHA as an Employee Right- to- Know recognition method.

DOT's hazard classification system has nine hazard classes (or groups). In order to be a USDOT hazardous material, it must meet the definition in 49 Code of Federal Regulations (49CFR). Chemicals are grouped into these classes according to their hazards.

Information about chemicals in each of these hazard classes can be found in the DOT Emergency Response Guidebook. This book provides information about the main hazards of each chemical, evacuation distances, classes, and identification numbers.

The DOT uses **placards and labels** to identify the hazards of various materials, which are hazardous. Both placards and labels have several design elements to identify the hazard. Each has a colored background to give a quick identification. At the top may be a symbol to warn of the hazard such as bursting ball to indicate an explosive material. The name of the hazard may be displayed, such as “RADIOACTIVE”. Finally, the hazard Class or Division number is at the bottom.

Hazard Class – 1 through 9 -

1) ***Explosives*** - Example: Trinitrotoluene.
   (six Division)

2) ***Gases*** - Example: Liquefied Petroleum Gas,
   Compressed Nitrogen, Chlorine gas
   (three Division)

3) ***Flammable Liquids*** - Example: Gasoline, Toluene, Acetone

4) ***Flammable Solids*** - Example: Naphthalene flakes, Magnesium (three Divisions)

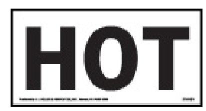
5) ***Oxidizers*** - Example: Hydrogen Peroxide, Ammonium Nitrate (two Divisions)

6) ***Toxic and Infectious Substances*** - Example: Arsenic (two Divisions)

7) ***Radioactive Material*** - Example:
Thorium, Uranium

8) ***Corrosives*** - Example: Sulfuric Acid, Nitric Acid

9) ***Misc. Hazardous Materials*** - Example: Sulfur, PCBs
Molten materials



Mixed Loads or (Unknown)

Information about chemicals in each of these hazard classes can be found in the DOT Emergency Response Guidebook. This book provides information about the main hazards of each chemical, evacuation distances, classes, and identification numbers.

DOT placards are in the shape of a diamond and are about 10 square inches in size. The placards are used to identify hazardous materials on transport vehicles (trucks), freight containers, and rail cars. Placards may also display the four-digit identification number of the material being transported.

DOT **labels** are also diamond shaped, but they are smaller (about 4 square inches). They are used to identify smaller containers of hazardous

materials such as drums, bottles, boxes and other portable containers.

Another method of communicating the hazard and giving workers information is marking of the name of the hazardous material, the four-digit identification number, emergency contact phone number, and other required information. Markings are placed on transport vehicles, rail tank cars, and small packages such as boxes or drums.

Common identification numbers found on transport vehicles and rail cars:

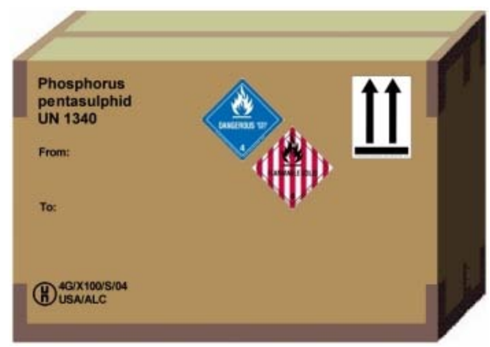
Gasoline:	UN 1203	Fuel oil/Diesel fuel:	UN 1993
Aviation fuel:	UN 1863	Sulfur, molten:	UN 2448
Kerosene:	UN 1223	Corrosive liquid:	UN 1760

A package may have the following marking:

Dichlorodifluoromethane, 2.2, UN 1028 **or**

Corrosive liquid n.o.s, **or**
(Nitric and sulfuric acid), 8, UN 1760, PGII

or Phosphorus pentasulfide, UN 1340



IMPORTANT: Both NFPA and DOT identification systems are good to use as guides to the potential hazards of a chemical. Neither gives a complete picture of the hazards. They should be used for warning systems until further information can be obtained.

For more detailed hazard information, you should always read the MSDS for the specific chemicals with which you work. Always use several forms of reference. If you get conflicting information, always use the most severe warnings to protect yourself and others.

Department of Transportation Shipping Papers.

A critical document to aid the emergency responder at a transportation incident involving hazardous materials is the shipping paper. Each mode of transportation has its own title for the document, but all contain the same information as required by regulation.

The shipping description of a hazardous material on the shipping paper must include:

1. Proper shipping name.
2. Hazard classification.
3. Four-digit identification number.
4. Packing groups.
5. Type of package.
6. Total quantity of material by weight or volume.

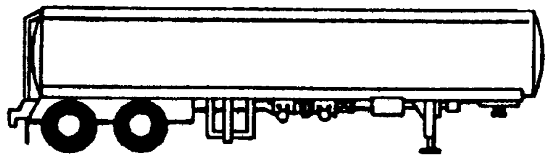
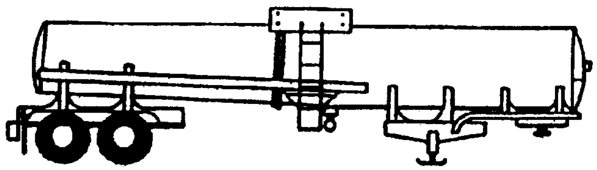
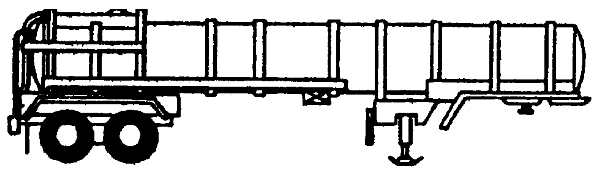
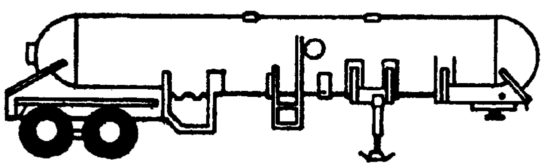
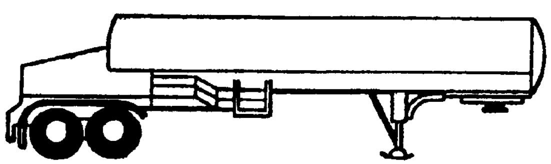
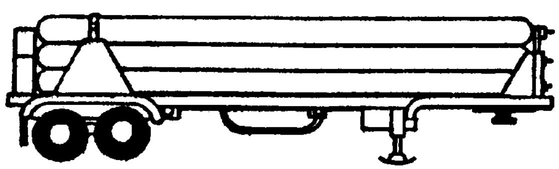
Certain commodities will require additional shipping paper entries. The letters “RQ” (reportable quantity) must be shown either before or after the basic shipping description entry if the material is a hazardous substance as defined by EPA. Any release of a material above its “RQ” must be reported to the National Response Center.

Listed below are the names of the shipping papers, their location and the person responsible for them.

Table 7-5: Shipping Paper Information

MODE OF TRANSPORT	TITLE OF SHIPPING PAPER	LOCATION OF SHIPPING PAPER	RESPONSIBLE PERSON
HIGHWAY	BILL OF LADING	CAB OF VEHICLE	DRIVER
RAIL	WAYBILL CONSIST	WITH CREW	CREW
WATER	DANGEROUS CARGO MANIFEST	WHEEL HOUSE OR PIPELIKE CONTAINER ON A BARGE	CAPTAIN OR MASTER
AIR	AIRBILL	COCKPIT	PILOT

Cargo Tank Trucks

Container Type	Container Shape	Description	Contents
MC-306 Atmosphere Pressure Cargo Tank Trucks		Oval cross section indicates non-pressurized tank (less than 3 psi). Usually single-shell. Aluminum construction. Older steel tanks may be found. Generally 9,000 gallons maximum capacity.	Petroleum products (gasoline, fuel oil), and Class B poisons.
MC-307 Low Pressure Chemical Cargo Tank Trucks		Circular cross section with pressures up to 25 psi. Circular shell construction with insulation the most common. Insulated tanks may not appear circular in cross section. One or two compartments with overturn protection. Generally 5,000 to 6,000 gallons maximum capacity.	Flammable and combustible liquids, mild corrosives, most chemicals, etc.
MC-312 Corrosive Cargo Tank Trucks		Circular cross section. Smaller diameter with external reinforcing ribs often visible. May also be found in double shell configuration. Insulated tanks may not appear circular in cross section. Overturn and splash protection at dome cover/valve locations. Generally 5,000 to 6,000 gallons maximum capacity.	Strong corrosives.
MC-331 High Pressure Cargo Tank Trucks		Circular cross section with rounded ends or heads. Single shell, non-insulated tank. Upper two-thirds painted white or highly reflective color. Capacity ranges from 2,500 (“Bobtail” delivery truck) to 11,500 gallons (Cargo Tank Truck).	LPG gases and anhydrous ammonia (particularly in the spring).
MC-338 Cryogenic Liquid Tank Trucks		Well-insulated “thermos bottle” design with flat tank ends. Double shell tank with relief protection. Often have vapors discharging from relief valves.	Cryogenic liquids (i.e. LOX, liquid nitrogen, liquid argon and liquid carbon dioxide).
Compressed Gas Trailer		Often referred to as a “tube trailer.” Cylinders are stacked and manifolded together. Manifold at rear. Pressures range from 3,000 to 5,000 psi. Often found at construction and industrial sites.	Compressed gases (i.e. oxygen, nitrogen and hydrogen).

6. Military Markings - DOD Hazard Identification System.

The Department of Defense (DOD) established a standard firefighting hazard identification system for all DOD facilities. This system classifies fires involving ammunition or explosives into four divisions according to the hazard they present to emergency responders. (Note: Use of these symbols is at the discretion of the base commander. Under some conditions, security considerations may make it undesirable to identify storage locations of munitions.)

Fire Division Class 1	**Hazard**	**Symbol Shape**
Division 1	Mass Explosion 	Octagon
Division 2	Explosion with fragment hazard 	Cross
Division 3	Mass fire 	Inverted triangle
Division 4	Moderate fire 	Diamond
No Water		
Wear Protective Mask		

Activity 1. Hazard Identification – Labels (1)
Improper Labeling Causes Injury from Acid Spray

A researcher was preparing a sample for microscopy. After he had cleaned the sample with isopropanol, he poured the extra isopropanol into a container for unwanted chemicals labeled "isopropanol." There was an immediate chemical reaction that caused the plastic container to rupture and spray the mixture around the area. He was later surprised to learn that the container actually held concentrated nitric acid in the form of spent "copper etchant".
The researcher was startled and called for help. Other researchers promptly came to his assistance and called 911. When he felt a burning sensation on his skin, he washed his body and face in the nearby emergency eyewash and safety shower for approximately five minutes. The Police Department, the Fire Department, and the Office of Environment, Health & Safety (EH&S) responded. However, the researcher did not wait for these emergency personnel and was escorted by a colleague on foot across the laboratory to the Health Service to be medically evaluated. The researcher was later released after being treated for acid burns.

Unwanted chemical bottle that blew its top spraying nitric acid on researcher.

Notice that the plastic waste container is tinted blue and labeled 2-propanol. The blue tint is from "copper etchant." Nitric acid was in the unwanted chemical container, not 2-propanol

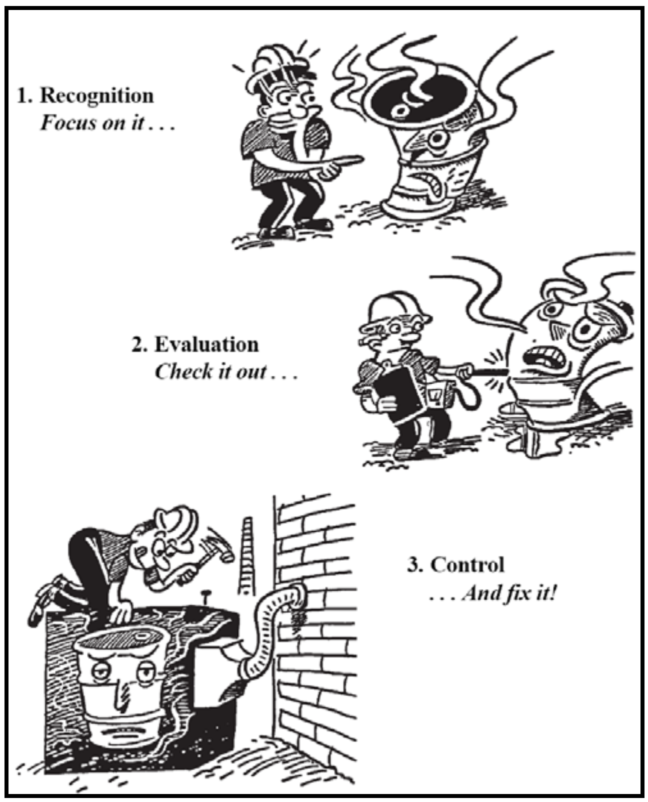
Answer the following questions:

1. What was the cause?

2. How can incidents like this be prevented?

MODULE 10

Air Monitoring and Controls



Module 10
Air Monitoring and Controls
GISO 5192 (h)

OUTLINE

I. General Principles
II. Air Monitoring
III. Sampling Methods
IV. Types of Monitoring Instruments
- Combustible Gas Indicator (CGI)
- Photoionization Detector (PID)
- Flame Ionization Detector (FID)
- Oxygen Meter/ Toxic Gas Meters
- Colorimetric Tubes
- Radiation Survey Meter

V. Hazard Controls

OBJECTIVES

At the end of this session, trainees will be able to:

1. Distinguish between "grab" (instantaneous) and "composite" (integrated) sampling methods.
2. Identify types of monitoring equipment, and describe when to use each one.
3. Interpret the meaning of air monitoring results.
4. Identify and evaluate different methods for reducing or eliminating hazards.

I. GENERAL PRINCIPLES

Occupational health problems can be solved by a three step approach:

1. **ANTICIPATION of hazards**

Understand the nature of changes in the process, products, environments, and workforces of the workplace and how those changes may affect health and safety. This ranges from reasonable expectations to mere speculations.

2. **RECOGNITION of the problem**

The second step in recognizing potential problem areas is to become familiar with the particular operations in the plant. Study the process and the equipment used. Review process flow sheets and previous industrial hygiene surveys.

3. **EVALUATION of the environment factors**

Conduct a walkthrough survey to note all aspects of the work operation. Then perform air monitoring to measure the levels of exposure to each toxic substance. Finally, compare the air monitoring results to the existing standards (PELs and TLVs), and interpret the results to take into account the specific workers and work process involved.

4. **CONTROL measures**

Now the problem must be fixed. For each hazardous material, the amount of exposure to each worker must be eliminated or reduced below the PEL.
The 3 types of controls are:

a) Engineering Controls—specific changes in the work process and physical work environment. These include: substitute safer chemicals, redesign the process, enclose the process, mechanize the process, erect barriers or berms, local exhaust ventilation, general ventilation, and housekeeping.

b) Administrative Controls/Work Practices—removing all non-essential employees from potential exposure, wetting down dusty operations and locate upwind of possible hazards; reduce the length of time that each worker is exposed to a chemical by changing his or her work assignments.

c) Personal Protective Equipment—requires each worker to wear a respirator if necessary, protective clothing, goggles, earplugs, or other protective device as required.

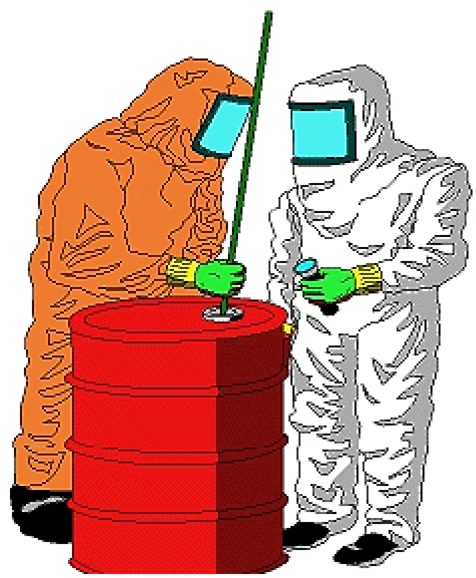
II. AIR MONITORING

Purposes

- Identify and quantify airborne contaminants
- Identify potentially life-threatening situations
- Determine whether controls and protective equipment are needed
- Analyzing health effects
- Determining medical monitoring
- Monitor compliance with health and safety standards

Conditions to monitor at hazardous waste sites

- O2 deficiency
- IDLH concentrations of airborne contaminants
- potential radiation hazards
- confined spaces, excavations, trenches
- drums, other containers
- new work locations - before initial entry into exclusion zone (start of each day)
- new work operations
- drilling
- liquid sampling
- drum opening



Important Aspects of Industrial Hygiene Monitoring

- All forms of chemicals (gas, vapors, liquids, solids, fumes) can be monitored.
- Each chemical has its own method for monitoring that requires specific equipment.
- The instrument used to monitor chemical exposures must be regularly calibrated and maintained in good working order.
- Samples can be taken for different lengths of time:
  Short-term (15 minute) and Full-shift (8 hours or more).
- Different types of samples can be taken:
  - "area" samples of the exposures in a given area or work station
  - "personal breathing-zone" samples for specific workers wearing the monitoring equipment
- Different "strategies" for sampling can be done:
  - "random" samples of all job tasks or operations
  - "worst-case" samples of the worst job tasks or operation in the department

Measurements and Personal Monitoring

Factory inspectors (government, insurance company, "monitors" of company "codes of conduct") may or may not conduct industrial hygiene monitoring during their inspections of the plant. However, the **employer should have conducted** this kind of monitoring to determine the level of hazards faced by the workers, and to control the hazards that are found.

It is important to understand how monitoring can be done and what the results of the monitoring means.

There are two types of monitoring that can be done:

(1) Immediate measurements of the worker exposure at the moment the test is done

(2) Full-shift measurements of the work exposure over the entire length of the shift (8 hours, 10 hours, 12 hours, or whatever length the shift is).

Immediate monitoring is done using “direct-reading” instruments. These instruments detect only a few specific contaminants and are rarely sensitive enough to measure smaller concentrations. Thus, **Full-shift monitoring** is done using various types of air-sampling pumps, passive dosimeters, and other equipment.

Some examples of hazards and monitoring equipment are:

Hazard	Immediate “direct-reading” equipment	“Full-shift” monitoring equipment
Chemicals	Detector tubes; gas meters, vapor meters	Air pumps, tubes and filters of many different types
Noise	Sound Level Meters	Personal dosimeters
Heat stress	“WBGT” meters	
Ventilation	Smoke tubes, flow rate meters of different types	

The evaluation of airborne chemical hazards is complicated and it requires trained personnel to do the monitoring correctly so the results actually represent the chemical exposures of the workers. However, this kind of monitoring **can be done** and it is the responsibility of the employer to do enough monitoring to know what hazards the workers are exposed to on the job.

The employer needs to hire trained and experienced personnel to perform the monitoring according to government regulations and the “best practices” of the industrial hygiene profession.

Area sampling:

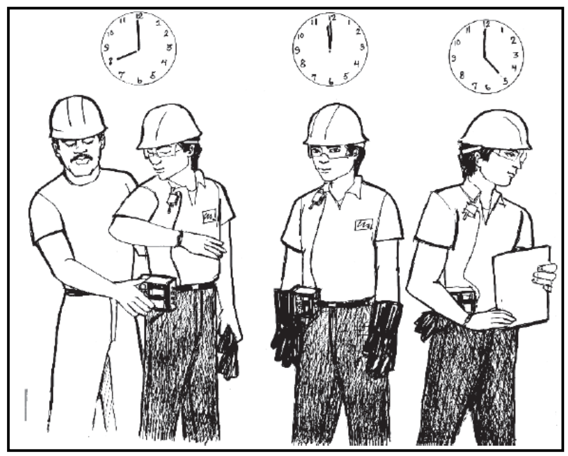
- helps determine the concentrations of contaminants in the entire work area
- helps determine where site cleanup and decontamination zones can safely be established and the level of protection needed in each zone

III. SAMPLING METHODS

1. Instantaneous or "grab" sampling:

   - Used to obtain a quick and rough estimate of the work environment.
   - Collection of air sample over short period - approximately 1-5 minutes.
   - It only represents the contaminant concentration at one moment in time.
   - Must be interpreted with caution, since conditions change frequently.
   - Monitoring instruments used: colorimetric tubes (Dräeger pump/tubes), direct-reading instruments.

2. Integrated or "composite" sampling:



   - Use to measure the amount of a contaminant to compare with established exposure limits.
   - Collection of a known volume of air over a longer recorded time.
   - Sampling period is determined by lab analytical sensitivity or by the need to comply with standards set on the basis of a time-weighted average (TWA), i.e., 8 hours or 15 minutes.
   - Results represent the total accumulated dose over the entire period of sampling and are used to determine the average exposure over the sampling time.

PERSONAL monitoring as opposed to area monitoring:

The collection device is placed in the worker's breathing zone (a hemisphere in front of the shoulders with a radius of 6-9 inches), so that the data collected closely approximates the concentration inhaled.

COLLECTION of samples as opposed to direct reading:

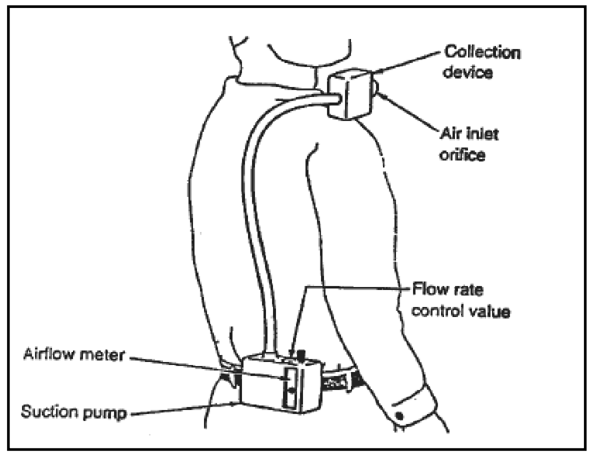
Sample collection does not provide an immediate measurement. Instead, sample collection devices collect a sample of air that is later analyzed or weighed at a laboratory.

INTEGRATED sampling as opposed to grab sampling:

Integrated sampling is used to measure a worker's 8-hour or 15-minute exposure. It integrates all of the various concentrations to which the worker has been exposed during the sampling period. The time-weighted-average concentration is equal to the mass of the contaminant collected divided by the volume of air that passed through the collection device.

SAMPLING SYSTEM consists of:

- Collection device
- Air inlet orifice
- Flow rate control valve
- Airflow meter and Suction pump



IV. TYPES OF MONITORING INSTRUMENTS

Direct Reading Instruments

1. Combustible Gas Indicator (CGI)

The CGI, or explosimeter, is used to detect flammable atmospheres. It will detect flammable vapors and gases and give a reading in percent of the LEL. (Some units will give the value in parts per million.)

When concentrations are between the LEL and the UEL, the meter will indicate greater than 100%. When the concentration is above the UEL the instrument will either register at the maximum value or quickly return to zero.

Most CGIs have audio and/or visual alarms that can be set well below the LEL by the operator. You should not work in areas where flammable vapors may ignite or explode.

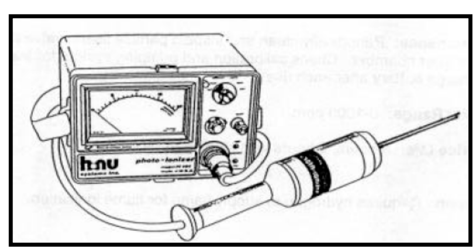
Advantages	Disadvantages
• General purpose detector for most combustible hydrocarbons. • Accurate over most of its range. • Indicates total combustibles present. • It can be combined with toxic or oxygen meters.	• Nonspecific. • Requires oxygen (air) for operation. • Not recommended for chlorinated hydrocarbons or tetraethyl lead containing compounds. • Adjust reading to calibration gas conversion table.

When a CGI reads more than 10 percent of the LEL, an extremely hazardous condition may exist. When flammable vapors make up more than 10 percent of the LEL, concentrations may be increasing rapidly. They could be much higher in nearby areas where the gases and vapors tend to collect due to poor ventilation. The 10% action level is also required by standard 5157.

Field conditions, such as temperature, can also reduce the accuracy of the CGI. The meter should be properly maintained or calibrated to reduce error.

It is important that the evacuation action guideline be strictly adhered to. A CGI reading above 10 percent of the LEL requires caution while monitoring because a flammable atmosphere may be nearby.

2. Photoionization Detector (PID)



A PID uses an ultraviolet (UV) light source to ionize a gas or vapor sample and detect its concentration. UV lamp energies are typically on the order of 10-11 eV, but others are available. It detects organic compounds and has some utility for inorganic compounds suchs has nitric and sulfuric acids, hydrogen sulfide, arsine, and phosphine.

Application: To determine relative concentrations of air contaminants. Information gathered with the PID can be used to establish levels of protection as recommended by

EPA action guides. PIDs have been traditionally been area/survey instruments, but personal PIDs are now commercially available.

Calibration: The instrument is factory-calibrated to isobutylene. The calibration should be checked before and after use with a calibration, check gas as recommended by the manufacturer. This should be done to make sure that readings are accurate and consistent. Once calibrated, the span setting can be changed.

The PID should not be used in humid environment and it does not read methane.

3. Flame Ionization Detector (FID)

An FID uses hydrogen-air flame to ionize the sample gas and detect its concentration. The hazards monitored are flammable organic vapors and gases that can be burned. The FID responds to carbon chain length and is useful for measuring natural gas.

Application: In survey mode, detects total concentrations of gases and vapors. In Gas Chromatograph (GC) mode, it can identify and measure specific compounds; however, it requires experience to interpret results correctly.

Readout: Depending on the make and model of the instrument, the meter can usually be read from 0ppm to 10000ppm.

Calibration: The instrument is factory calibrated to methane.

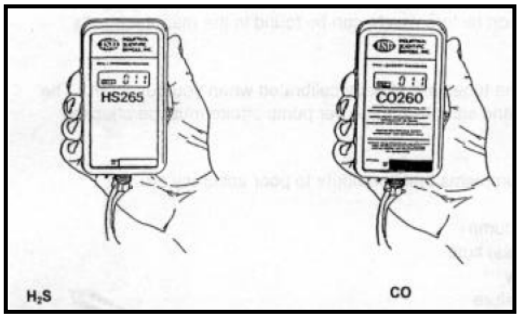
Caution: Requires hydrogen to supply flame for flame ionization. Compounds such as chlorine and sulfur in the vapor phase will depress the response.

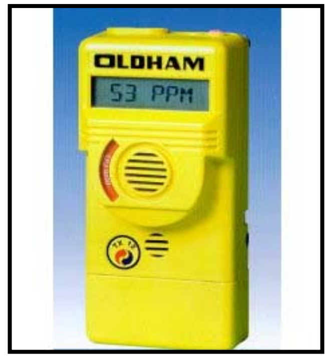
4. Oxygen Meter – Toxic Gas Meters

An oxygen meter is used to measure the concentration of oxygen in the atmosphere. This instrument usually gives the concentration in percent. The range is from 1-25%. Oxygen meters are often combined with a CGI in a single instrument. This allows the user to determine if there is enough oxygen for the CGI to operate.

Oxygen meters are **affected by temperature and pressure.** Oxidizers can cause high readings. Carbon dioxide can reduce instrument sensitivity.

Carbon monoxide (CO) and hydrogen sulfide (H_2S) meters are two of the types of toxic gas meters available. These meters are similar to oxygen meters; they are designed to provide accurate response to specific gases. Some toxic gas meters are combination meters.





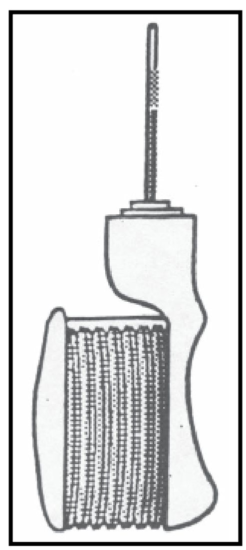
Both of these types of instruments have a detector that operates by chemical reaction with the gas or vapor. Like the oxygen meter, other gases and vapors can interfere with the readings on these meters. They are also affected by environmental conditions such as temperature and pressure. When using these meters, operating instructions must be reviewed carefully.

5. Colorimetric Detection

pH or litmus paper

Litmus is a water-soluble mixture of different dyes extracted from lichens, especially *Roccella tinctoria*. The resulting piece of paper or solution with water becomes a pH indicator (one of the oldest), used to test materials for acidity. **Neutral litmus paper is purple in color. Blue litmus paper turns red under acidic conditions and red litmus paper turns blue under basic (i.e. alkaline) conditions, the color change occurring over the pH range 4.5-8.3 (at 25°C).**

Colorimetric Detector Tubes



A colorimetric detector tube is a glass tube filled with a solid material gel that has been impregnated with an indicator chemical. When the detector tube is used the ends are broken off and the tube is inserted into a bellows or piston pump. An arrow on the tube indicates which end of the tube to insert into the pump orifice.

A predetermined volume of air is pulled through the pump. The contaminant of interest reacts with the chemical in the tube. This reaction produces a stain in the tube with a length proportional to the concentration of the contaminant.

Use: To sample specific gas or vapor concentration in the workplace. They are convenient for qualitative and semi-quantitative evaluation of toxic hazards in industrial atmospheres and for rapid evaluation of spills of hazardous materials. Detector tubes have been used to evaluate and monitor permeation of chemicals through chemical-protective clothing.

Read-out: Percent concentration is indicated by color change or length of color stain.

Precautions:

- Not very accurate—within 20-35% of the real value at best.
- Pump must be checked for leaks and calibrated.
- Tubes have a limited lifetime, so the expiration date on the container should be checked before use.
- Results are affected by temperature and humidity.
- User must be trained in reading the scales on the tubes used.

- User must follow specific pump stroke requirements.

The new generation spot-check detection device is easy to operate and have sampling accuracies of ± 4 to 10%. The instrument does not required calibration, has a digital display of results and on-board data recorder.

6. Radiation Survey Meter

Hazards Monitored: The worker needs to understand which instrument should be used, and why. Alpha radiation can only be detected by certain instruments. Most beta instruments can also detect gamma radiation.

Application: Determines the presence and level of radiation. This information can be used to establish control measures to reduce or prevent exposure.

Readout: The readout is usually in mR/hour. The instrument measures the dose rate in the area. One thousand milliroentgen (mR) equals one roentgen.

Instruments used to detect alpha may read in counts per minute.

Calibration: The instrument must be factory calibrated at least annually. The instrument is normally calibrated to one probe allowing direct measurement of the source.

Dosimeters: instruments used to determine the full-shift exposure a worker has received from ionizing radiation. You can find a Thermoluminiscent Dosimeter (**TLD**) which records the radiation dose received by the worker. They are required to be worn in most controlled areas and should be worn on the upper portion of the body.

The **Pocket Dosimeter** gives an estimate of radiation received by the worker. The instrument is designed to measure gamma and x-ray radiation.

GENERAL CONSIDERATIONS FOR ALL MONITORING INSTRUMENTS

- For accurate measurements, calibrate or check calibration before use.
- Use more than one instrument and take more than one measurement.
- Monitor periodically in both the worker's breathing zone and the work area.
- Record readings in detail.
- Use conservative judgment in interpreting readings.
- Consider inherent safety and instrument certification.

When and Where Should I Monitor?

HAZWOPER sections (c) and (h) require that air monitoring be conducted:

- Before and upon initial site entry;
- When work begins on a different part of the site;
- When you start handling chemicals that weren't found before;
- At the start of a different operation, such as opening drums instead of well drilling;
- When you are handling leaking drums or working with liquid contamination, such as a spill or a lagoon.

The complexity of the air monitoring schedule will depend upon the chemicals and conditions at the site.

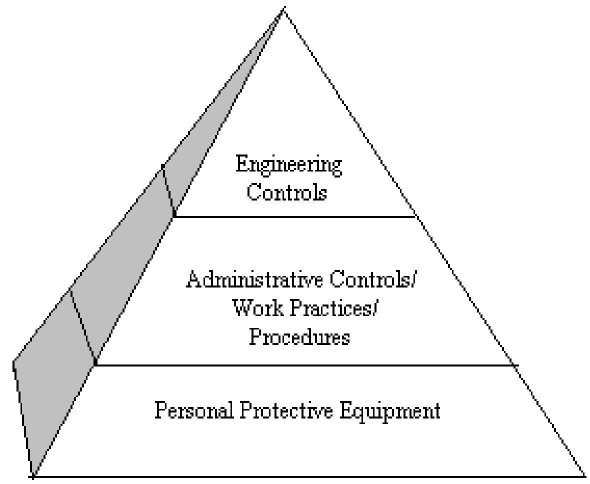
Guidelines for Some Atmospheric Hazards – The table below provides some basic guidelines for decision-making

Hazard	Monitoring Equipment	Measured Level	Action
Explosive atmosphere	Combustible gas indicator	<10% LEL >10%LEL	Continue investigation. Explosion hazard may occur as higher levels might be encountered. Withdraw from area immediately.
Oxygen	Oxygen concentration meter	<19% 19.5%-23.5% >23.5%	Monitor wearing SCBA. Continue investigation with caution. Other substances may be present. Fire hazard potential. Discontinue investigation. Consult a fire safety specialist.
Inorganic and Organic gases and vapors	Colorimetric tubes Chemical-specific instruments –H_2S, NH_3-CO	Depends on chemical	Consult manuals or standard references for air concentration and toxicity data. PEL, TLV or REL.
Organic gases and vapors	Portable photo ionizer Organic vapor analyzer	Depends on chemical and instrument	Consult manuals or standard references for air concentration and toxicity data. PEL, TLV or REL.
Radiation (alpha, beta, gamma)	Radiation survey equipment	≤ 1mrem/hr > 1mrem/hr	Radiation above background levels signifies the possible presence of radiation source. Consult with a health physicist. Potential radiation hazard. Evacuate site.

Source: NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

V. HAZARD CONTROLS

Once hazards are identified, there are various methods that can be used to protect workers. These are called hazard controls. You should take into account that not all controls are equally effective.



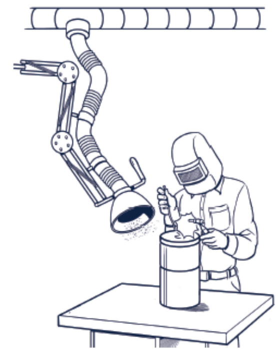
The most effective solutions are the engineering controls. Below these solutions are those that only reduce or limit worker's exposure. Often a combination of methods is needed to get the best protection.

A written workplace hazard control program should outline which methods are being used to control the exposure and how these controls will be monitored for effectiveness.

What are the main ways to control a hazard?

Engineering Controls directly address the hazard and do not depend on worker's actions to be effective. These controls include the following methods:

- Elimination: remove the hazards from the workplace.
- Substitute safer products for hazardous ones: use chemicals that are less toxic or dangerous.
- Redesign the process: involves changing the way a job activity or process is done to reduce the risk. Monitoring should be done before and as well as after the change is implemented to make sure the changes did result in lower exposures.
- Enclosure and Isolation: these methods aim to keep the chemical "in" and the worker "out" (or vice versa). An enclosure keeps a selected hazard physically away from the worker. For example, enclosure on noisy equipment or glove boxes when working with dangerous substances. The enclosure must be well maintained to prevent leaks.



- Isolation places the hazardous process away from the majority of the workers. Common isolation techniques are to create a contaminant-free booth either around the equipment or around the employee workstations.

- Ventilation removes chemicals from the air that workers breathe. Local exhaust ventilation is very adaptable to almost all chemicals and operations.

  The design of a ventilation system is very important and must match the particular process and chemical or contaminant in use.

Administrative Controls when the hazard cannot be eliminated altogether, another option is to set rules that will limit workers' exposure to the hazard. These control measures have many limitations because the hazard itself is not actually removed or reduced.

Methods of administrative control include:

- Rotate workers between a hazardous task and non-hazardous task so that the length o exposure is reduced.

- Increase the number of breaks to reduce the time of exposure

- Change the work schedule

- Scheduling maintenance and other high exposure operations for times when few workers are present (such as evenings, weekends)

- Good housekeeping reduces the chance of accidents and fires, to protect tools and equipment, to prevent build-up of toxic materials, and to prevent slips, trips, and falls.

- Work practices are also a form of administrative controls. In most work places, even if there are well designed and well maintained engineering controls present, safe work practices are very important. These include:

  - developing and implementing standard operating procedures
  - Training and education of employees about the operating procedures as well as workplace training

  - Preparing and training for emergency response for incidents such as spills, fire or employee injury

- Improve personal hygiene facilities and practices. Provide a way for workers to wash their hands and faces before eating and drinking. Prohibit eating in work areas. Set up facilities for showering after the shift, and leaving contaminated clothes at the workplace.

Personal Protective Equipment (PPE) is the final item on the list for very good reasons:

- PPE does not get rid of the hazard itself. It simply reduces the amount of exposure by placing a barrier between the hazard and the worker.

- Workers may not want to wear it because it can be uncomfortable and hot, and may make it hard to communicate.
- PPE has to be the right for the particular hazard such as the right respirator cartridge or glove for the chemical being used.
- Workers must know and remember how to use PPE properly AND it depends on human action to be effective.

USE A COMBINATION OF METHODS

Sometimes you may need a combination of methods to control a hazard. While engineering controls may be the most effective method, you also need to have training programs and good workplace policies to supplement them. There may also be situations where PPE is essential. For example, workers should always wear a hard hat on a construction site or respirator (SCBA) when working with unknown contaminants at hazardous waste sites no matter what other controls exist.

It is important to generate and evaluate as many ideas for solutions as possible before settling on a strategy for controlling hazards.

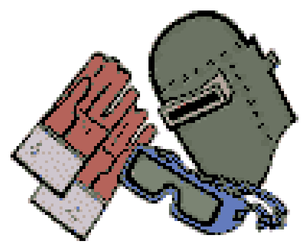
MODULE 11A

Introduction to Personal Protective Equipment

Module 11A
Introduction to Personal Protective Equipment

GISO 5192 (g)

OUTLINE



I. Overview of a Personal Protective Equipment (PPE)

II. EPA Levels of Protection

OBJECTIVES

At the end of this session, the trainees will be able to:

1. Recognize and prioritize three approaches to controlling exposures.
2. Identify under what conditions personal protective equipment should be worn.
3. List the four EPA levels of protection.

I. OVERVIEW OF PERSONAL PROTECTIVE EQUIPMENT

What is a Control?

A control is any device, procedure, or piece of equipment that is used to keep vapors, fumes, dusts, etc., being generated by a work process, from getting into the air or onto the ground. The following is a list of the major controls used in the chemical industry in order of priority-beginning with the best controls. (We should always insist on the best controls, rather than settling for less adequate ones.)

OSHA and Cal-OSHA require that engineering control measures be given priority over the use of personal protective equipment.

Personal Protective Equipment (PPE)

PPE includes all protective devices that workers use on the job. These devices include respirators, safety equipment, and chemical protective clothing. **PPE is the least effective method** of control, but it should be used:

- when effective engineering controls are not feasible;
- while engineering controls are being implemented;
- when there are no other means to control hazards and prevent exposure in emergencies.

Safety equipment often includes protective clothing designed to protect against abrasions, temperatures, water, and falling objects. Generally, this clothing is not designed to protect against hazardous chemicals.




Personal Protective Equipment Program

Written standard operating procedures for the use of PPE must be established as part of the site safety and health plan for work on all hazardous waste sites. This written program should include procedures for:

- Selection of PPE according to hazards
- Explaining the use and limitations of PPE
- Training in wearing PPE
- Inspection prior to, during, and after use
- Work duration while in PPE
- Donning and doffing procedures
- Decontamination and disposal procedures
- Medical considerations such as heat stress
- Evaluation of the effectiveness of the PPE program

Responsibility for performing the hazard assessment should not fall solely on one person or even one part of the organization. Collaboration is more likely to result in proper identification and assessment of hazards.

Before you select PPE, first decide if PPE is the proper and only solution. Ask the following questions:

- Can the hazard be removed by substitution or elimination of an ingredient or task?
- Can the hazard be mitigated by guards or redesigning the equipment?
- Can work practices, procedures, or administrative controls be put in place to decrease the problem?

Once the appropriate PPE is selected for the work environment, the employer must communicate that decision to affected workers. Then, workers must be properly sized and trained. Relying on sizing charts is not enough, **How well a garment fits can be impacted by the type of job, whether additional PPE is worn over or under the garment, and the size and shape of the wearer.**

Employers must verify that workers know, understand, and follow their PPE training. **Employers must retrain a worker if there is a change in work assignment change in PPE, or if improper use is detected.**

Personal Protective Accessories

Type	Protection	Use Considerations
Hard hat	• Protects the head from impact	• Helmet should meet safety specifications. • Limited to no chemical protection
Hood	• Protects against chemical splashes, particulates, and rain	• Compatibility with hazards present
Faceshield	• Protects against chemical splashes	• Must be supported to prevent shifting and exposing portions of face • Limited eye protection
Safety glasses	• Protect eyes against large particles and projectiles	• Wear special protective lenses if lasers are used to survey site • Must have side shields • Compatibility with hazards present
Ear plugs and muffs	• Protect against physiological damage and psychological disturbance	• Compatibility with other safety equipment • Both can interfere with communication • Limited to no chemical protection
Gloves and sleeves	• Protects hands and arms from chemical or physical contact	• Wear jacket cuffs over glove cuffs to prevent liquid from entering the glove • Compatibility with hazards present
Safety boots	• Protect from contact with chemicals • Protect from compression, crushing, or puncture by falling, moving, or sharp objects • Limited electrical protection	• Must meet safety specifications • Provide good traction • Compatibility with hazards present

II. EPA LEVELS OF PROTECTION

Personnel in the hazardous waste field must wear protective equipment when activities involve known or suspected chemical, physical, or biological hazards. Equipment ensembles that protect the body against contact with known or anticipated toxic and hazardous chemicals have been divided into four categories according to the degree of protection afforded:

> **LEVEL A** Should be worn where the highest level of respiratory, skin and eye protection is needed.
>
> **LEVEL B** Should be worn where the highest level of respiratory protection, but a lesser degree of skin protection is needed.
>
> **LEVEL C** Should be worn when less respiratory protection is required and some skin protection is needed.
>
> **LEVEL D** Should be worn when there are no respiratory hazards and minimal skin protection is needed.

In hazardous waste operations, levels of protection will be based on the measure of atmospheric concentration of the chemical substance and its toxicity. Other considerations include potential exposure to splashes of liquid, or other direct contact with material due to the work being done.

As additional data become available, a decision to move up or down a level may be made. **In general, it is best to start with a higher level of protection and downgrade as better information dictates**.

Level A Protection provides the maximum level of protective clothing and respiratory protection. It is designed to prevent contact of skin and body parts with hazardous vapors, liquids, and solids.

Conditions that warrant Level A include:

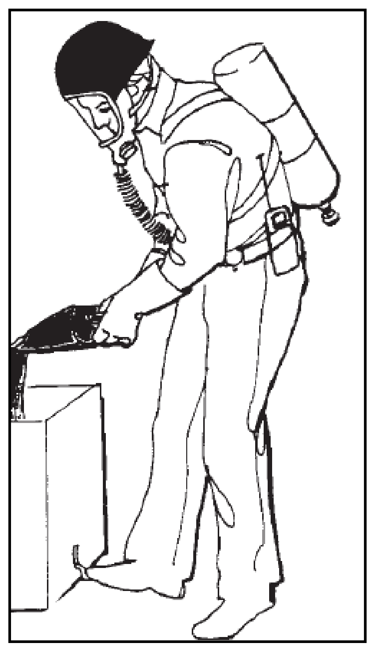
- High potential for splash or immersion, or potential exposure to gases or vapors that can be absorbed through the skin
- Potential exposure to unknown vapors, gases, some particulates
- Direct skin and eye contact
- Potential for exposures above IDLH
- Effects of substance on skin are unknown

Personal Protective Components of Level A

- Positive pressure SCBA
- Fully Encapsulating “Gas Tight” Suit
- Gloves:
  - Inner chemical-resistant glove
  - Outer chemical-resistant glove
- Chemical-resistant boots with steel toe and shank
- Light, cotton clothing under CPC*
- Hard hat*
- Disposable boot covers*
- Disposable Tyvek outer suit*

Level B Protection provides maximum respiratory protection. It is designed to minimize or prevent contact of skin and body parts with hazardous substances. It will not prevent skin absorption of gases or vapors, or from extensive contact.

Level B is the minimum level of protection that you should wear to enter a site where the hazards have not yet been identified.



Conditions that warrant Level B include:

- Limited direct skin and eye contact of hazardous contaminants which will not result in severe damage or irreversible effects
- Work function involving the potential for minor chemical contact, excluding total body splashes or immersion
- Potential exposure to IDLH or oxygen-deficient atmospheres

Level B can be used for Initial Entry:

- Use Level B when off-site investigations and observations do not indicate highly toxic compounds
- Downgrade or upgrade as contaminants are identified
- Limit activity in the hot zone

Personal Protective Components of Level B

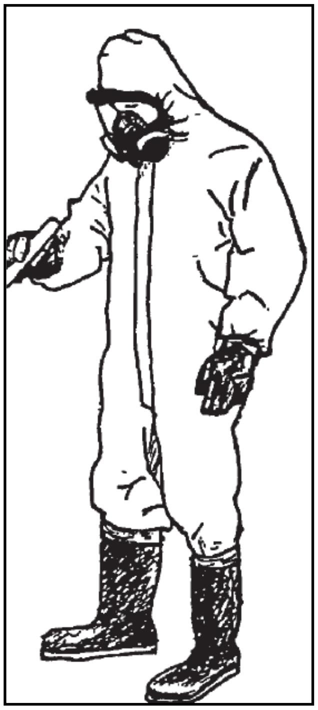
- Positive pressure SCBA
- Hooded chemical resistant clothing
- Inner and outer chemical-resistant gloves
- Chemical-resistant boots with steel toe and shank
- Hard hat*
- Light cotton clothing under protective clothing*
  *Optional, as applicable.

Level C Protection Should be worn when the criteria for air-purifying respirators are met, and some skin protection is needed. It is designed for minimum contact with many hazardous substances.

Level C provides the same skin protection as Level B, but less respiratory protection.

Conditions that warrant Level C include:

- Limited direct skin and eye contact with hazardous compounds or air contaminants that will not result in severe damage or irreversible effects
- Work function involves potential for only minor splashes and excludes total body splashes or immersion
- Conditions appropriate for air-purifying respirator



Personal Protective Components of Level C:

- Hooded chemical resistant clothing
- Air-purifying respirator
- Chemical-resistant inner & outer gloves
- Hard hat, Face shield, Escape mask *
- Light, cotton clothing under protective clothing*
- Chemical-resistant boots with steel toe and shank*
  *Optional, as applicable.

Level D Protection provides minimal worker protection with no respiratory protection. It is designed to protect workers from common workplace safety hazards.

Conditions that warrant Level D include:

- The atmosphere contains no known hazards or unexpected respiratory hazards
- Job tasks preclude splashes or immersion

Personal Protective Components of Level D

- Work clothes
- Boots/shoes, leather or chemical-resistant, steel toe and shank
- Gloves*, hard hat*, splash glasses or goggles*
- Escape mask*
- Face shield*

*Optional, as applicable.

Reasons to **upgrade** the current level of protection are:	Reasons t**o downgrade** the current level of protection are:
o Known or suspected presence of hazards to the skin	o New information indicating that the situation is less hazardous than was originally thought
o Occurrence or likelihood occurrence of gas or vapor emission	o Change in site conditions that decrease the hazard
o Change in work task that will increase contact or possible contact with hazardous materials	o Change in work task that reduces contact with hazardous materials

MODULE 11B

Chemical Protective Clothing

Module 11B
Chemical Protective Clothing
GISO 5192 (g)

OUTLINE

I. Selecting Chemical Protective Clothing

II. Chemical Form and Exposure

III. Chemical Resistances of CPC

IV. Physical Characteristics of Work

OBJECTIVES

At the end of this session, trainees will be able to:

1. Distinguish between permeation, penetration, and degradation of chemical protective clothing (CPC).

2. Use information about chemical resistance properties of certain CPC to select chemical protective clothing that is appropriate for various jobs.

3. Distinguish between coveralls that protect against particulates and those that protect against gases, vapors, and liquids.

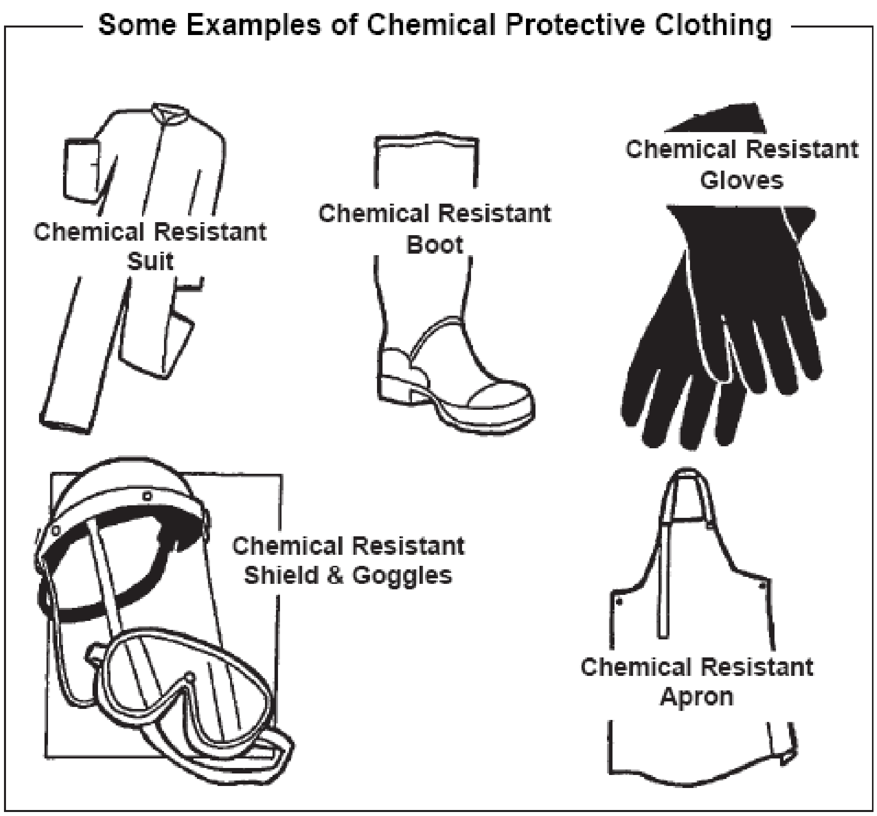
I. SELECTING CHEMICAL PROTECTIVE CLOTHING (CPC)

CPC is specifically designed to prevent exposure from chemicals. It may include goggles, a face shield, an apron, gloves, boots, and chemical suits.

CPC acts as a barrier between the skin and chemicals that may damage the skin, tissue, and organs.

Selecting the appropriate CPC does not insure adequate protection. CPC must be inspected before each use to insure that it will function as designed. These inspections should include: defective or damaged seams and zippers.

Different manufacturers may produce the same types of materials, such as butyl rubber, neoprene and latex. Don't assume that these materials will perform the same. Look at the performance data for the specific product you intend to use.



II. CHEMICAL FORM AND EXPOSURE

The form chemicals take is an important role in determining clothing to be worn. Suits are designed to protect the wearer from certain types of chemicals.

- Vapor and gases
- Liquid
- Solid

Users must establish the hazard of the chemical to help determine the type of clothing to select. Is it Toxic, Reactive, Ignitable, or Corrosive?

Most chemical protective clothing will not protect the worker/wearer from a flash or fire hazard.

Vapor

If the chemical is presented in the form of a vapor, and is toxic by inhalation and/or contact, a **vapor tight suit** should be worn. This type of suit provides the highest level of chemical protection with the supplied air respirator worn on the inside providing positive pressure of the suit allowing no vapors inside.

Liquid

Liquid **splash suits** give the wearer skin protection from liquid splash. These types of suits can range from garments made of durable chemical resistant materials to thin coated paper suits.

Solid

Chemicals in solid form can present unseen hazards. **Suits made of paper type** or coated paper type materials can normally be used for solid particulates protecting the user from dermal (skin) contact.

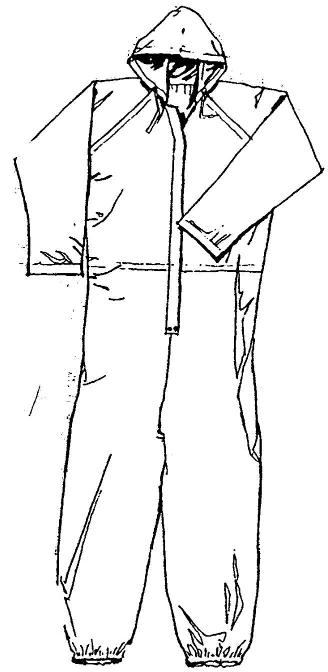
Chemical Exposure

- Evaluate the extent of hazard by looking at the IDLH, TLV, or PEL.
- Evaluate the route of chemicals exposure.
- Evaluate the extent or level of your potential exposure for the job.

  What type of contamination will you receive, direct or indirect?

  How long will you be exposed to the chemical?

III. CHEMICAL RESISTANCES OF CPC



Chemical resistance is the ability of the clothing or material to prevent or reduce exposure to chemicals.

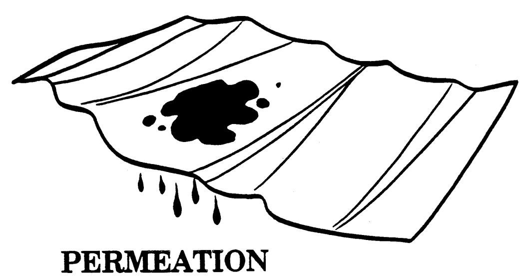
All materials are subject to some degree of degradation or permeation and penetration. The time it takes a chemical to permeate a material is called the **breakthrough time**. Breakthrough may be immediate or take more than 24 hours.

The actual **breakthrough time depends on the suit material and the chemicals involved.** You want material which has a breakthrough time greater than your exposure time. Permeation data should be provided by the manufacturer.

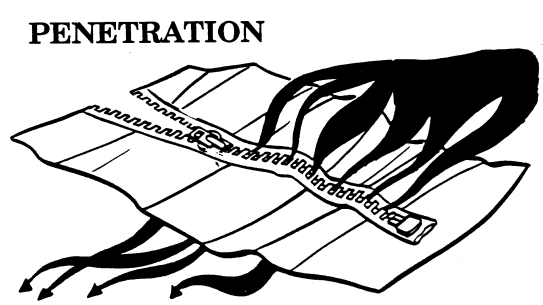
There is no such thing as a completely impermeable suit. One means of increasing protection is by layering suits. Many suits today are made of several thin layers of different materials. This strategy allows for lightweight suits with good permeation characteristics for a wide range of chemicals.

How does the chemical move through the clothing? Chemicals can get through materials in three ways:

Permeation is the process by which a chemical passes through protective materials at a molecular level.



Degradation is the loss of, or change in, the fabric's chemical resistance.



Penetration is the movement of chemicals through zippers, stitched seams, or imperfections in a protective material.

Five major factors affect permeation, degradation, and penetration:

- Contact time
- Concentration
- Temperature
- Size of contaminant molecules
- Physical state of the chemical

Check **ALL** clothing for chemical compatibility, chemical suits, chemical gloves, face protection, and chemical boots. Caution, if you use tape to close opening in the clothing to protect the wearer from the chemical hazard maybe you are in the wrong clothing.

Other Considerations in CPC Selection

Heat Transfer Characteristics – how much heat does the fabric retain? How much does it interfere with the body's cooling mechanisms?

Durability – does the material have sufficient strength to withstand the physical stress of the task(s) at hand?

Flexibility – will the CPC interfere with the worker's ability to perform assigned tasks, such as putting on gloves?

Duration of use – can the required task be accomplished before chemical breakthrough occurs, or degradation of CPC becomes significant?

Special conditions – fire, explosion, heat, and radiation require special protective equipment. This equipment may be used in conjunction with the CPC, or may provide adequate chemical protection in itself.

Temperature Effects – will the material maintain its protective and flexible characteristics in extreme heat or cold?

Ease of Decontamination – are decontamination procedures available on site? Will the material pose any decontamination problems? Should disposable clothing be used? Can splash and over-covering suits be used?

Compatibility with other equipment – does the clothing restrict the use of another necessary piece of protective equipment, such as suits that restrict hardhat use in a hardhat area?

In general, workers should report any perceived problems or difficulties to their supervisors while wearing the clothing, including:

- Degradation of the protective ensemble
- Perception of odors
- Skin irritation
- Unusual residues
- Discomfort, rapid pulse, nausea, or chest pain
- Resistance to breathing, fatigue due to respirator use
- Interference with vision or communication, restriction of movement

Chemical Protective Guide

The following is a list of the more common materials used in CPC. The classes of chemicals rated as "good for" or "poor for" represent test data for both permeation breakthrough and permeation rate.

Material	Good for	Poor for
Butyl Rubber	bases & many organics; heat & resistance	halogenated & aromatic hydrocarbons; gasoline
Chlorinated Polyethylene (Chloropel, CPE)	acids & bases; hydrocarbons; alcohols; phenols	amines; esters; ketones; halogenated hydrocarbons
Natural Rubber	alcohol; flexibility; dilute acids & bases	organic chemicals
Neoprene	bases & dilute acids; peroxides; fuels & oils; alcohols; glycols; phenols	Halogenated & aromatic hydrocarbons; ketones
Nitrile	petroleum products; PCBs; phenols alcohols; amines; bases; peroxides	aromatic & halogenated hydrocarbons; amides; ketones
Polyurethane	bases; alcohols	halogenated hydrocarbons
Polyvinyl Alcohol (PVA)	acids & caustics; almost all organics	water; water solutions; esters; ethers
Polyvinyl Chloride (PVC)	acids & bases; peroxides; some organic amines	most organics;
Saranex	acids & bases; amines; some organics; PCBs	Aromatics & halogenated hydrocarbons
Viton (Plastic Fluoroelastomer similar to Teflon)	Aliphatic, halogenated & aromatic hydrocarbons; oxidizers; acids	ketones; esters; aldehydes; amines

IV. PHYSICAL CHARACTERISTICS OF WORK

- What type of work will be needed?
- Will work gloves over chemical gloves be needed?
- Will an over suit be required to protect the chemical suit?

CPC is of little value if it easily rips or tears. It is also of limited value if things like folding the material or leaving it in hot environments reduces its chemical resistance. To prevent these problems, the following important performance tests have been developed to evaluate physical characteristics.

• abrasion resistance	heat resistance	ozone resistance
• cut resistance	puncture resistance	burst strength
• flexibility	tear resistance	

The National Fire Protection Association (NFPA) standards define the conditions required for vapor (NFPA 1991) and splash (NFPA 1992) protective clothing. They also list minimum performance tests and test methods for each category of CPC. Most of these tests were developed by the American Society for Testing and Materials (ASTM).

You should not assume that manufacturers are performing the correct tests. Some manufacturers may be performing limited testing or using faulty methods. When selecting CPC, you want to know the test results and how the tests were performed.

There are other **stress factors** when wearing CPC. These include:

- Restricted communication;
- Restricted visibility;
- Limited agility and dexterity;
- Psychological effects (claustrophobia and isolation).

These factors combine to increase the likelihood of accidents due to slips, trips, falls, and other basic safety hazards. Consider these limitations when developing job descriptions for people working in CPC.

These problems are accentuated when CPC does not fit. Oversized or undersized CPC creates a very serious safety hazard. A selection of different sizes should be available for all types of CPC.

A garment should not be worn if it has any rips or tears, discoloration, cracking or blistering of protective layers. Imperfections in gloves and outer boots can be detected by trapping air inside to determine if there are leaks.

Vapor-protective suits should be pressure tested according to the manufacturer's recommendations. If the CPC has a shelf life, make sure it has not gone beyond it.

Physical Characteristics of Some CPC Materials*

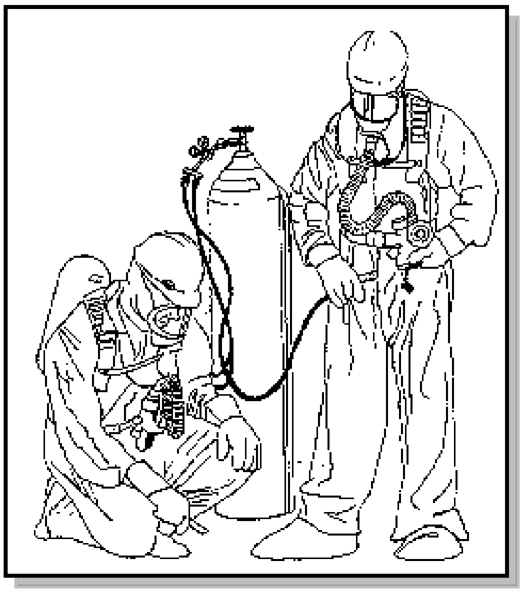
Material	Abrasion Resistance	Cut Resistance	Flexibility	Heat Resistance	Ozone Resistance	Puncture Resistance	Tear Resistance
Butyl Rubber (Butyl)	F	G	G	E	E	G	G
Natural Rubber (Nat. Rub.)	E	E	E	F	P	E	E
Neoprene (Neop.)	E	E	G	G	E	G	G
Neoprene/Styrene-Butadiene Rubber (Neop./SBR)	G	G	G	G	G	G	G
Neoprene/Natural Rubber (Neop./Nat. Rub.)	E	E	E	G	G	G	G
Nitrile Rubber (Nitrile)	E	E	E	G	F	E	G
Nitrile Rubber/Polyvinyl Chloride (Nitrile/PVC)	G	G	G	F	E	G	G
Polyethylene (PE)	F	F	G	F	F	P	F
Chlorinated Polyethylene (CPE)	E	G	G	G	E	G	G
Polyurethane (PU)	E	G	E	G	G	G	G
Polyvinyl Alcohol (PVA)	F	F	P	G	E	F	G
Polyvinyl Chloride (PVC)	G	P	G	P	E	G	G
S tyrene-butadiene Rubber (SBR)	E	G	G	G	F	F	F
Viton	G	G	F	G	E	G	G

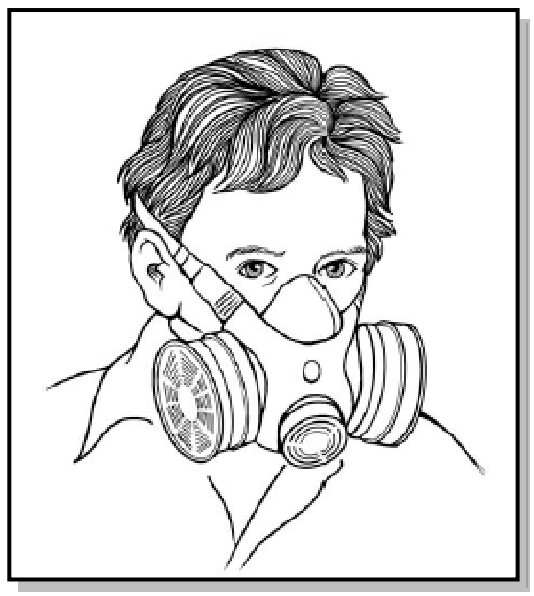
* Ratings are subject to variation depending on formulation, thickness, and whether the material is supported by fabric. **E = Excellent; G = Good; F = Fair; P = Poor**

Source: Martin, W. F., Lippitt, J. M., Prothero, T. G. (1987). *Hazardous Waste Handbook for Safety and Health,* Butterworths, Boston.

MODULE 11C

Respiratory Protection





Module 11C
Respiratory Protection

GISO 5192 (g)

OUTLINE

I. Respirators: The last Resort

II. Cal-OSHA Requirement for a Respiratory Protection Program

III. Types of Respirators

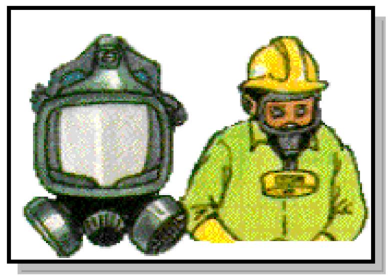
IV. Air Purifying Respirators (APR)

V. Warning Properties and Protection Factors

VI. Atmosphere Supplying Respirators (ASR)

VII. Fit-Testing

VIII. Maintenance of Respirators



OBJECTIVES

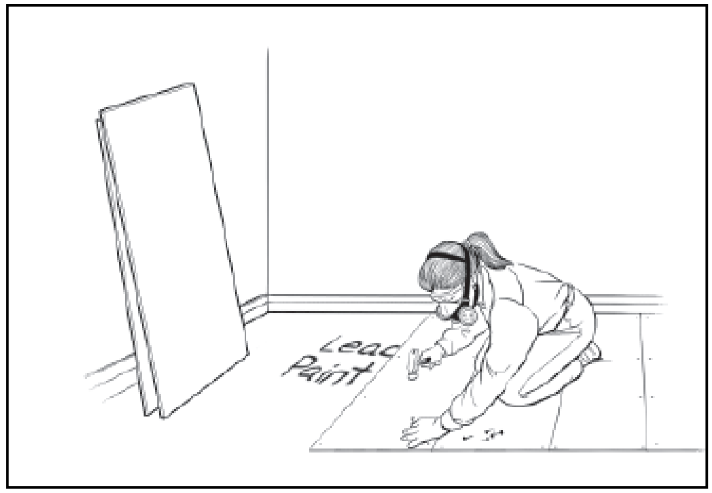
Trainees will be able to:

1. Explain why respirators are considered to be the last resort for workers protection.
2. Recognize the difference between the two classes of respirators: APR and ASR.
3. Describe the importance of Protective Factors.
4. Demonstrate a negative and positive seal check.
5. Understand how and how often to inspect a respirator.

I. RESPIRATORS – THE LAST RESORT

Respirators are very limited as control devices and their use must be carefully monitored. Respirators:

- are hot and uncomfortable
- often fit poorly, allowing you to breathe in the toxic substance
- put extra stress on the heart and lungs
- do not prevent skin exposure
- limit conversation and therefore safety
- do not stop the toxic material from getting into the environment



Since respiratory protection is the control of last resort, Cal/OSHA requires that harmful exposures to chemicals be controlled by engineering means whenever feasible.

These include: ventilation; isolation of the process; and substitution of a less toxic agent. If engineering controls are not feasible or adequate, exposures may be controlled by administrative means such as limiting the amount of time that a worker is exposed. Control of chemical exposures which are above the PEL through the use of respirators is only permitted when:

- engineering controls are being implemented
- engineering and/or administrative controls don't achieve full compliance
- emergency protection against occasional and/or relatively brief exposure is needed

RESPIRATORY TERMS

Before you use a respirator, you should have answers to the following questions:

- What is the hazard?
- What's the maximum anticipated concentration?
- Can the contaminant be engineered out?
- What are the health effects?
- Is it an eye irritant?
- Can it be absorbed through the skin?

If you need to wear a respirator, some key terms to help you understand your options are explained below.

Respirator Hazards - What are you protecting yourself from when you wear a respirator?

- PARTICULATES - such as small solid particles (e.g. wood dust); very small solid particles (e.g. welding fumes); or small liquid droplets (e.g. acid mist).
- VAPORS - evaporated liquids (e.g. solvent vapor)
- GASES - e.g. hydrogen sulfide, carbon monoxide

Immediately Dangerous to Life or Health (IDLH) – an atmosphere in which exposure to a contaminant can cause serious injury or death within a short time, irreversible or delayed health effects, such as cancer, and/or would impair individual's ability to escape from a dangerous atmosphere.

Oxygen Deficiency - an atmosphere which contains less than 19.5 % oxygen at sea level. Air normally contains 21% oxygen at sea level.

II. Cal/OSHA REQUIREMENTS FOR A RESPIRATORY PROTECTION PROGRAM (GISO 5144)

When other methods of control (engineering, administrative) are not possible adequate, respirators should be used. According to Cal/OSHA, companies that use respirators must have the following:

1. A written Respiratory Protection Program covering the use of respirators during normal and emergency operations.

2. Selection of respirators based on the hazard.

3. Procedures for training workers on respirator use and respiratory hazard. This training must be annually.

4. Annual fit-testing of every worker who wears a tight-fitting respirator.

5. Procedures and schedules for cleaning, disinfecting, storing, inspecting, and discarding respirators.

6. Inspection of respirators used for emergencies at least once a month and after each use. Self-contained breathing apparatus (SCBA) must be inspected every month whether they are used for emergencies or not.

7. Periodic surveillance of the work area including exposure monitoring.

8. Use of NIOSH approved respirators.

9. Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.

10. Prior to use of a respirator, approval of a physician licensed health care professional (PLHCP). Medical evaluation of respirator wearers

11. Procedures for respirator program evaluation.

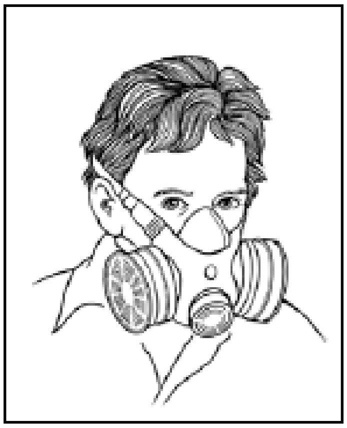
12. A qualified program administrator must be appointed to manage the program.

13. Voluntary use program.

III. TYPES OF RESPIRATORS

There are two main classes of respirators that may be a part of your personal protective equipment: air purifying respirators (APRs) and air supplying respirators (ASRs).

1. Air Purifying Respirator (APRs):



APRs do not supply air. The air enters the respirator when the wearer inhales, thereby creating a negative pressure in the facepiece. The contaminated air passes through the air-purifying elements of the respirator (filter, cartridge, or canisters), theoretically delivering purified air inside the facepiece.

This type of respirator is limited in its use to those environments where there is sufficient oxygen to support life, and the contaminant's airborne concentration level does not exceed the capacity of the air purifying elements.

2. Atmosphere Supplying Respirators (ASRs):

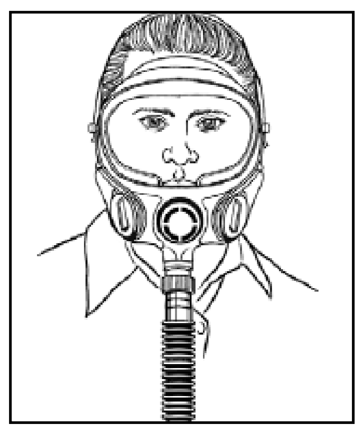
Excludes the contaminated or oxygen deficient air altogether by providing clean air from an independent source.

ASRs are used under the following conditions:

a. Concentrations of contaminants above PEL

b. Unknown contaminants or unknown concentrations of contaminants

c. Not enough oxygen – less than 19.5%



IV. AIR PURIFYING RESPIRATORS (APRs)

APRs can be grouped according to type of facepiece and according to type of air purifying element:

1. Facepiece

a. Half-mask Facepiece

These respirators offer respiratory protection from certain chemicals, but they do not provide eye protection. The facepiece covers the nose and mouth, and the lower sealing surface is under the chin. The two basic types are:

- replaceable filters/chemical cartridges
- disposable/single-use respirators – referred to as dust mask

Disposable/single-use respirators are designed to protect only against certain particulates (dusts, mists, fumes), and will not protect against gases, vapors or asbestos fibers.

b. Full Facepiece

These respirators offer respiratory protection from certain chemicals. They have a more reliable seal in addition to providing eye and greater skin protection.

They are used with replaceable filters, chemical cartridges, or canisters.

2. Powered Air Purifying Respirator (PAPR)

- PAPR facepiece can be full face-mask, half-mask, hood, or helmet.
- A blower is used to pass contaminated air through a filter, chemical cartridge, or canister.
- Advantages are: less breathing resistance and leakage is more likely to be outward because air is supplied at a positive pressure.
- Disadvantage: air purifying elements may get used up faster due to increased air flow.
- Battery pack should be maintained and adds extra weight to wearer.

TYPES OF AIR PURIFYING ELEMENTS

1. Aerosol Filters are used to protect against particulates such as dust, mist, fibers and fumes. They work by trapping the contaminant particles in a fibrous material. They do not provide protection against gases and vapors. Filters remove aerosols from the air.

Some single-use respirators are referred to as dust masks. They are less protective and should not be used if the original contour or shape has been altered due to damage from crushing, bending, etc.

NIOSH certifies nine classes of filters. These filters may be either replaceable or an integral part of the respirator. The replaceable filters may be used on either a half-facepiece or a full-facepiece respirator. The filters are divided into three filters series. These are designated as N, R, and P. Each filter series has three levels of filter efficiency – 95, 99, and 99.97%.

Filter Series	Minimum Filter Efficiency	Designation
N – Use when only solid and water-based particulates are present in the work environment. Examples include metal dusts and water-based paint surveys.	95% 99% 99.7%	N95 N99 N100*
R – Use when oil particulates are present and filter will be used for only one shift. Examples include lubricants and cutting fluids.	95% 99% 99.7%	R95 R99 R100*
P – Use when oil particles are present and filter will be used for more than one shift. Examples include lubricants and cutting fluids.	95% 99% 99.7%	P95 P99 P100*

* The N100, R100, P100 are equivalent to the HEPA filter (49CFR84)

It is difficult to perceive the difference between aerosol filters visually. Therefore, it is important to read the NIOSH approval label or filter designation to identify against which aerosol (oil or non-oil) the filter should be used. Oil has never been defined by a regulatory agency.

Filters should be changed when it becomes more difficult to breath.

2. Chemical Cartridges and Canisters are used with air purifying respirators to remove gases and vapors from contaminated air. A variety of sorbents, such as activated carbon, are employed to remove harmful contaminants from the air.

Chemical cartridges and canisters are designed to provide protection against specific gases and vapors (ammonia gas, formaldehyde, etc.) and classes of gases and vapors (acid gases, organic vapors). The ability of cartridges to remove air contaminants varies greatly with:

a. the specific gas or vapor
b. the concentration
c. the breathing rate of the wearer
d. humid or dry air and shelf life

Canisters generally have a larger capacity than cartridges and may provide more protection in more highly contaminated environments. They are usually used with a full facepiece respirator, in which the canister is mounted at the chin of the respirator or on the wearer's chest or back via a harness. This combination is referred to as a "gas mask."

The service life of chemical cartridges and canisters depends on many factors such as: exposure conditions including breathing rate of the wearer, relative humidity, temperature, contaminant concentration, the affinity of the gas or vapor for the sorbent, and presence of other gases and vapors.

Chemical cartridges and canisters shall be changed under any one or more of the following conditions:

- If the end of service life indicator on the cartridge shows the specified color change
- As indicated by the change out schedule
- If the shelf life is exceeded
- If an OSHA regulation specifies a disposal frequency
- Before breakthrough occurs

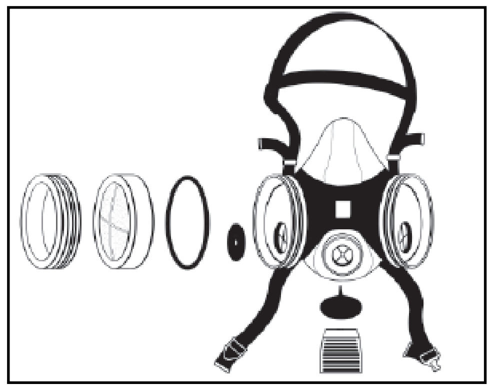
3. Combination Aerosol Filter/Gas or Vapor-Removing Respirators – these respirators use aerosol-removing filters with a chemical cartridge or canister for exposure to multiple contaminants or more than one physical form (i.e., mist and vapor).

The filter is generally a permanent part of the canister, but can be either permanent or replaceable on the chemical cartridge. Replaceable filters are sometimes used because the filter and chemical cartridge are not exhausted at the same time. This allows for disposing only of the part that is in need of changing.

All chemical cartridges are specifically labeled and color-coded to indicate the type and nature of protection they provide. Using the wrong cartridge can result in long-term health problems or a fatality.

Read always the label on all air purifying elements to determine the specific contaminants that they will protect against.

ADVANTAGES AND DISADVANTAGES OF APRs



Advantages of APRs

- Relatively small and lightweight.
- Does not affect mobility.
- Easily maintained: disassemble and clean.
- They can protect the respiratory system from toxic exposures if used properly.

Disadvantages of APRs

- Cannot be used in oxygen-deficient atmospheres.
- Chemical cartridges are not available for all air contaminants.
- Certain cartridges, canisters, or filters inhibit air flow and can make it difficult to breathe. Also, large physiological burden placed upon the user when utilizing combo cartridges.
- Limited capacity of the air-purifying elements.
- Hot and uncomfortable.
- Often fit poorly, allowing you to breathe in toxic substances.
- Some types do not provide eye protection or prevent skin exposure.
- Proper use requires training, regular maintenance, proper storage, and air monitoring.

V. WARNING PROPERTIES AND PROTECTION FACTORS

Warning properties are not the primary way to determine when to change a chemical cartridge. Some gases and vapors have noticeable smell or taste below the PEL, but others, such as carbon monoxide, give you no warning. Given the variability among people with respect to detection of odors and differences in measuring odor threshold, it is a must to establish a change-out-schedule in place.

PROTECTION FACTORS

Does Your Respirator Offer You Enough Protection?

The assigned protection factor is the expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users.

In short, APFs are a measure of the overall effectiveness of a respirator used in conjunction with a good respirator program.

An assigned protection factor (APF) of 10 means that the respirator is supposed to protect you up to concentrations of 10 times the PEL. Likewise, an APF of 50 is supposed to protect you up to concentrations of 50 times the PEL. The higher the APF of a respirator type, the more protection the respirator provides.

The following table shows the APF for several different types of respirators enforced by Federal OSHA.

Respirator	OSHA
Air Purifying Respirator	
Quarter Mask	5
Half-Mask	10
Full-Facepiece	50
Powered Air Purifying Respirator	
Half Mask	50
Full-Facepiece	1,000
Loose-fitting facepiece	25
Supplied-Air Respirator (SAR)	
Half-Mask Demand mode	10
Half-Mask Pressure-demand mode	50
Full-Facepiece Demand mode	50
Full-Facepiece Pressure-demand mode	1,000
Self-Contained Breathing Apparatus (SCBA)	
Half-Mask Demand mode	10
Full-Facepiece Demand mode	50
Full-Facepiece Pressure-demand mode	10,000

2006 OSHA Revised Respiratory Protection Standards www.osha.gov

The above APFs do not apply to respirators used solely for escape, which are covered by 29 CFR 1910 (z). To decide whether you can use a certain respirator, you want to assess if the concentration of the chemical in the air that you breathe (air inside the respirator) will be lower than the PEL.

You can use two methods to determine if a respirator will provide adequate respiratory protection in a contaminated environment:

METHOD #1:

Figure out what the **maximum use concentration limit (MUC)** can be in order to use a specific respirator. To do this, simply multiply the PEL (or TLV) for the specific contaminant by the APF of that respirator.

If the measured airborne concentration of the contaminant (determined by monitoring) is less than the calculated maximum allowable concentration, then the respirator should provide adequate respiratory protection. If it is greater, it will not provide adequate respiratory protection and the employer must choose a respirator with a higher APF.

Maximum Use Concentration Limit = PEL x APF

For example: Use the following information to determine whether or not a half-mask respirator will provide adequate respiratory protection in the following situation:

- Ambient air concentration of toluene is 400 ppm (determined by monitoring)
- Cal/OSHA- PEL for toluene is 50 ppm
- APF for a half-mask respirator 10
- IDLH for Toluene is 500 ppm. If the airborne concentration of the contaminant is greater than the IDLH, then an Air Purifying Respirator cannot be used. An Air Supplying Respirator must be used

MUC = PEL x APF

MUC = 50ppm x 10

MUC = 500ppm

So, in order to use a half-mask respirator, the concentration of toluene cannot exceed 500 ppm. The measured airborne concentration was 400 ppm, which is less than 500 ppm. Therefore, a half-mask respirator should provide adequate respiratory protection.

REMEMBER: The oxygen content of the air must be at least 19.5% to use an Air Purifying Respirator; and the contaminant concentration should not be greater than the IDLH.

METHOD #2:

Figure out the **Hazard Ratio** in order to receive adequate respiratory protection in a specific contaminated environment. To do this, divide the airborne contaminant concentration by the PEL (or TLV). The respirator you will require has to have an APF rating equal or greater to the result of this calculation.

$$\textbf{Hazard Ratio} = \frac{\textbf{Air Contaminant Concentration}}{\textbf{PEL (or TLV)}}$$

For example: Use the following information to determine whether or not a half-mask respirator will provide adequate respiratory protection in this situation:

- Ambient air concentration for toluene 400ppm (determined by monitoring)
- Cal/OSHA - PEL for toluene is 50ppm
- IDLH for toluene is 500ppm. If the airborne concentration of the contaminant is greater than the IDLH, then an Air Purifying Respirator cannot be used. An Air Supplying Respirator must be used.

$$\textbf{Hazard Ratio} = \frac{400 \text{ ppm}}{50 \text{ ppm}} = \textbf{8}$$

So, if the measured airborne concentration of toluene were 400ppm, you would have to use a respirator that has an APF rating of at least 8 in order to receive adequate respiratory protection.

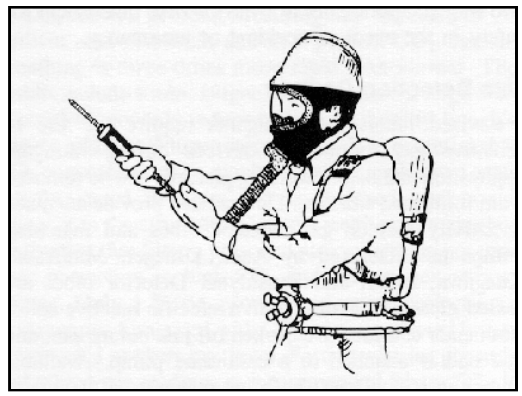
REMEMBER: The oxygen content of the air must be at least 19.5% to use an Air Purifying Respirator; and the contaminant concentration should not be greater than the IDLH.

VI. TYPES OF ATMOSPHERE SUPPLYING RESPIRATORS (ASRs)

When the concentration of a chemical is either too high or unknown, or when there is less than 19.5% oxygen in the environment, you need to bring in your own fresh air.

Atmosphere Supplying Respirators provide fresh air to breathe. There are two types of air supplying respirators: the Self-Contained Breathing Apparatus (SCBA) and the airline respirator.

1. Self-Contained Breathing Apparatus (SCBA)



With an SCBA, you carry a breathing supply of air with you that last from 3 minutes to 4 hours, depending on the type of SCBA.

Unlike the airline respirator, the SCBA does not require an escape bottle and can be used **by itself** in IDLH environments. There are two main types of SCBAs:

a. Open Circuit SCBA:

- A tank of compressed air is carried on the back which supplies air via a regulator to the facepiece.
- Exhaled air is returned (or exhausted) to the atmosphere (this is why it is called “open circuit” because it is open to the atmosphere).
- According to OSHA regulation 1910.134, only full-facepiece, pressure demand (positive-pressure) SCBAs are approved for IDLH atmospheres. Typically they are designed to provide 30-60 min of service.

The SCBA is the only respirator that can be used if either the air contaminants or their concentrations are unknown.

Open Circuit SCBA’s are available with two types of facepieces: Negative Pressure and Positive Pressure.

Negative Pressure

These are also called “demand” respirators, since fresh air enters the facepiece only when you breathe in (on demand). During inhalation, there is a negative pressure in the mask, so that if leakage occurs, contaminated air will be drawn into the mask.

Positive Pressure

These are called “pressure demand” respirators because they have a continuous flow of air into the respirator at all times regardless of your “demand.” Pressure in the mask is usually positive, so that if leakage occurs, contaminated air will generally not be drawn into the mask.

b. Closed Circuit SCBAs

- Air is “re-breathed” after the exhaled carbon dioxide is removed and the oxygen content restored.
- Units designed from 15 min to 4 hour use.
- This respirator is available as both negative and positive pressure devices.

Escape SCBA

Some SCBAs are designed for escape only. They are similar to the types described above, except that the use duration tends to be shorter, typically 5, 7, or 10 min. Units approved for escape only may not be used to enter into hazardous atmosphere. The fact that they are certified for escape only means that assigned protection factors have not been established for this category of respirator.

2. Airline Respirators

- Deliver compressed air from a stationary source through a high pressure hose; you do not carry the air with you. It is important that your employer receive a guarantee from the airline supplier to make sure that the equipment has been properly maintained and decontaminated. There have been situations in the field that the airline is contaminated from previous jobs resulting in respiratory tract problems of current users. The maximum hose length is 300’.
- Can be equipped with half- or full-face masks, helmets, or hoods, or can come as a complete suit. Have facepieces that operate on “pressure demand” or “positive pressure”, so contaminated air cannot be drawn into the mask.
- **Cannot** be used **by themselves** in IDLH atmospheres because if something happened to the hose or air supply, you could die. If you have a small self-contained supply of air for escape (an “escape bottle”), an airline respirator may be used in IDLH environments. Unlike SCBAs, the airline respirator can be continuously used for a long period of time, depending on the amount of air in the supply tanks.

ADVANTAGES AND DISADVANTAGES OF ASRs

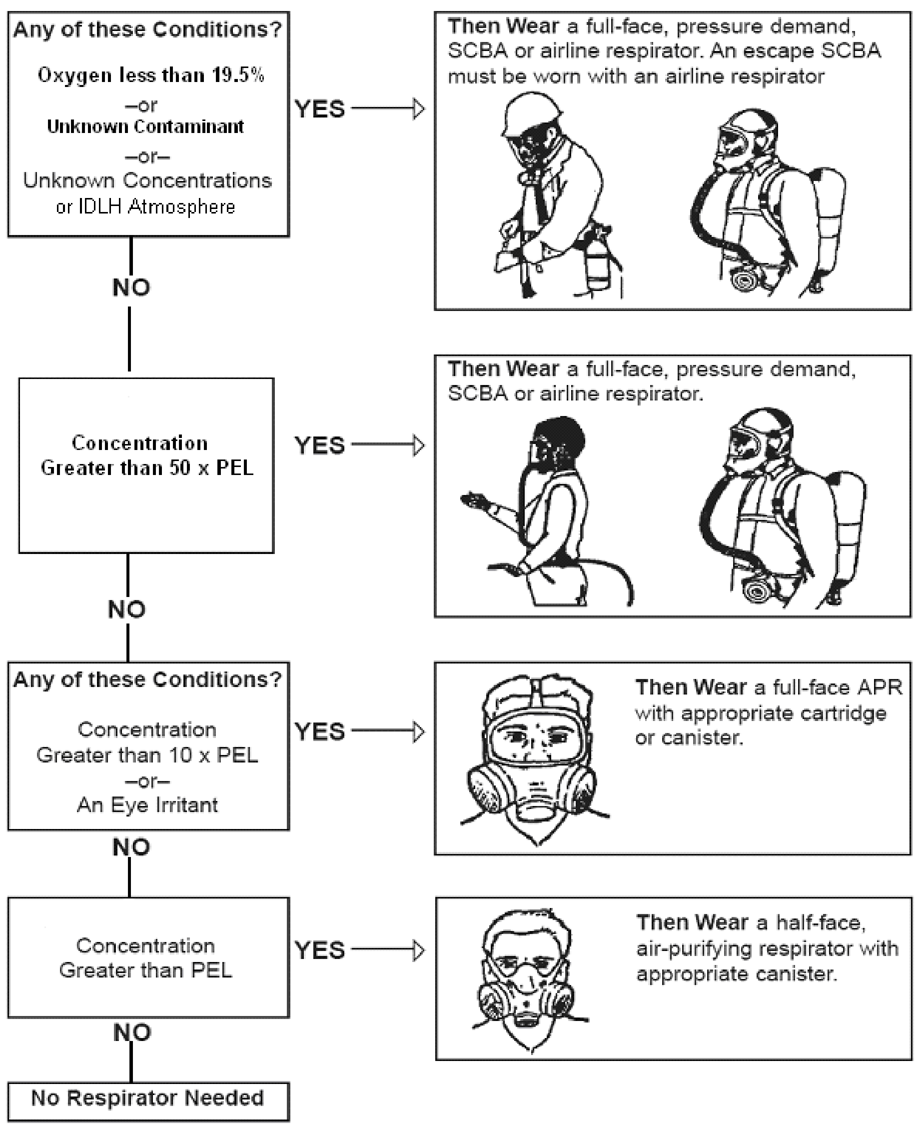
Advantages of Atmosphere Supplying Respirators:

- They have high protection factors. This allows workers to enter areas with unknown contaminants or with high concentrations of contaminants.
- They provide an independent source of oxygen.

Disadvantages of Atmosphere Supplying Respirators:

- The equipment can limit your mobility.
- The equipment is costly and must be regularly and carefully maintained.

CHOOSING A RESPIRATOR



VII. FIT-TESTING

What is fit-testing?

A respirator is only as good as its ability to create a seal with your face. Fit-testing tests how well your respirator forms a seal with your face to prevent leaks.

Why do fit-testing?

Most respirators are made to fit the average male face. But half of us are not males and very few of us have average faces. Scars, dentures, high cheekbones, etc., can make it very difficult to get a proper fit with a respirator. Your respirator must fit you properly in order to protect you against dangerous chemicals.

Cal-OSHA requires that your employer fit-test you when you first receive your respirator to make sure it fit you properly. Fit testing is required annually.

Which respirators should be fit-tested?

All respirators, both negative and positive pressure tight fitting facepiece, must be fit-tested.

A **qualitative fit test** uses a substance that typically can be detected by the wearer. The agent can be isoamyl acetate (banana oil), saccharin, Bitrex or irritant smoke.

For example, using isoamyl acetate while being fit-tested, if the wearer smells it, the respirator does not fit well and it should be adjusted or replaced. Because this test is based on the respirator wearer's subjective response to a test chemical, it is important that the purpose and importance of this test be thoroughly explained to the worker.

Four qualitative tests are commonly used. Detailed protocols are available in the OSHA Respiratory Protection Standard that must be followed when conducting fit testing.

Advantages of Qualitative Test

- Fast
- No complicated or expensive equipment required

Disadvantages of Qualitative Test

- Relies only on worker's response (greater margin of error)

A **quantitative fit test** uses a mechanical device to detect a leak in the facepiece.

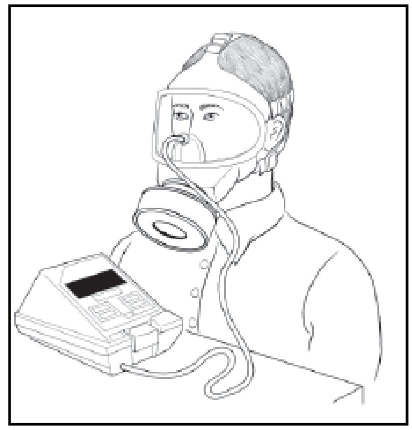
This is done by:

1. Using a probe to continuously measure the concentration of the chemical inside the worker's respirator

2. Using a probe that measures leakage of air into the mask, and after each exercise, the worker holds his/her breathe while the measurement is taken

   For qualitative and quantitative fit testing a prescribed set of movements must be performed, which include:

   - breathe normally and deeply
   - move the head side-to-side
   - move the head up and down
   - read out loud either the Rainbow passage or count backwards from 100
   - do toe touches and breathe normally again



Advantages of Quantitative Test

- More accurate
- Does not rely only on a worker's response (less margin of error)

Disadvantages of Quantitative Test

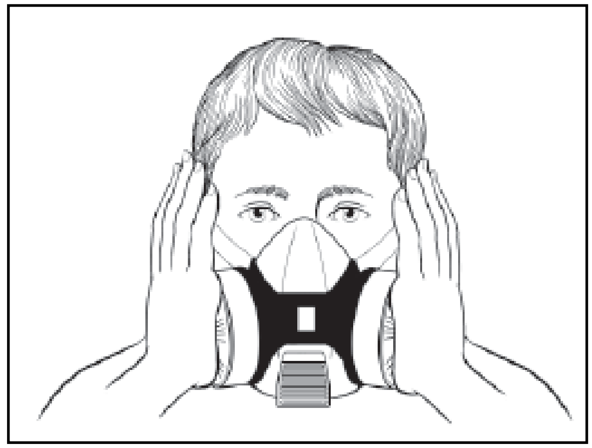
- It can be more time-consuming
- Requires expensive equipment, operated by trained personnel only

Facepiece Seal-Checks (User Seal Checks)

These tests can be performed alone by a worker with his/her respirator and no other equipment. While your employer must do either qualitative or quantitative fit-testing when providing you with a respirator, you must do "field" seal-checks just before you enter a hazardous environment and periodically during the work day. This is the **only** way that you can be sure that the facepiece seal is good.

There are two user seal-checks you should do before wearing your respirator:

Negative Pressure Seal-Check:



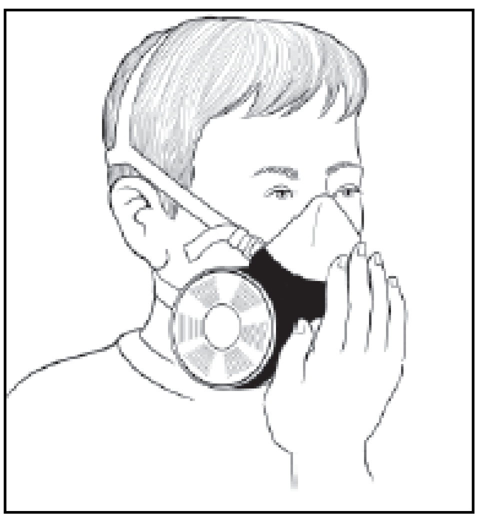
1. Cover the opening of the canister, cartridge(s), and filter(s) with the palms of the hand so that air cannot get through.

2. Inhale gently so that the facepiece collapses slightly.

3. Hold your breath for about 10 seconds.

4. If the facepiece remains slightly collapsed and no leakage is felt, the fit is probably acceptable.

Positive Pressure Seal-Check:



1. Cover up the exhalation valve so that no air can get through.

2. Exhale gently into the facepiece.

3. The fit is considered acceptable if slight positive pressure can be built up inside the facepiece without outward leakage.

VIII. MAINTENANCE OF RESPIRATORY PROTECTION EQUIPMENT

The respirator maintenance program includes inspection of the equipment for defects, cleaning and disinfecting of respirators where necessary, maintenance, and repairs of defects found, and proper storage of the respirator. The manufacturer's instructions should be followed.

INSPECTION

a. Inspection Schedules

All respiratory protective equipment must be inspected:

- **Before** and **after** each use
- During cleaning

Equipment designated for emergency use must be inspected:

- After each use
- At least monthly
- During cleaning

b. Inspection of Air Purifying Respirators

Before putting on your respirator, examine the facepiece for:

- Excessive dirt, dust
- Cracks, tears, holes or distortion from improper storage
- Cracked or badly scratched lenses in full facepiece
- Incorrectly mounted full facepiece lens or missing mounting clips
- Cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s), if required
- Missing inhalation and exhalation flaps (p.11C-25)

Examine the head straps or head harness for:

- Breaks
- Loss of elasticity
- Broken or malfunctioning buckles and attachments
- Excessively worn straps which might permit slippage

Examine the exhalation and inhalation valve for:

- Foreign material, such as detergent residue, dust particles, or human hair under the valve seat
- Cracks, tears, or distortion in the valve material
- Improper insertion of the valve body in the facepiece
- Cracks, breaks, or chips in the valve body, especially in the sealing surface
- Missing or defective valve cover (exhalation valve)
- Improper installation of the valve in the valve body

Remove and examine the o-rings, checking for cracks and tears, detergent residue, and deformities.

Examine the air-purifying elements for:

- Correct cartridge, canister, or filter for the specific hazard
- Correct installation, loose connections, missing or worn gaskets, or cross threading in the holder
- Expired shelf-life date on the cartridge
- Cracks or dents in the outside case of the filter cartridge
- Evidence of prior use of the absorbent cartridge or canister, indicated by the absence of sealing material, foil, tape over inlet. Check manufacturer’s instructions for further information.

c. Inspection of SCBA

Compressed gas cylinders on self-contained breathing apparatus must be checked to ensure that they are fully charged. The cylinders must be recharged when the pressure falls to 90 percent of the manufacturer's recommended pressure level.

The inspection of emergency use respirators must be certified by documenting the date inspection was performed, the name (or signature) of person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator. The information should be provided on a tag or label that is attached to the respirator storage compartment.

CLEANING AND SANITIZING

The manufacturer's instructions should be followed for cleaning and sanitizing respirators, especially in regard to maximum temperatures.

Any good detergent may be used, but cleaner and sanitizer solutions that clean effectively and contain a bactericide are available. There is a possibility of dermatitis (a skin condition) if the sanitizing solutions are not completely rinsed from the respirator.

An alternative is to wash the respirators in detergent, followed by a disinfecting rinse.

Disinfection is not absolutely necessary if the respirator is reused by the same worker. However, where individual issue is not practiced, disinfection must be done.

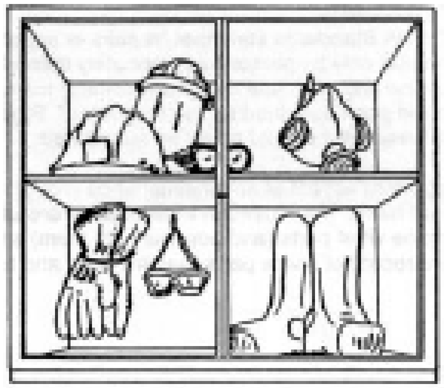
Commonly recommended disinfecting solutions are an aqueous hypochlorite (bleach) solution and aqueous iodine solution; 50 ppm of chlorine and iodine, respectively. Add approximately 2 ml of hypochlorite (bleach) or iodine to 1 liter of water. A 2-minute immersion disinfects the respirators.

To avoid damaging the rubber and plastic in the respirator facepiece, the cleaner and disinfectant temperatures should not exceed 110ºF.

RINSING

To remove all traces of detergent, cleaner, sanitizer and disinfectant, the cleaned and disinfected respirators should be rinsed thoroughly in clean water (110ºF maximum). This is very important to prevent dermatitis.

DRYING



The respirators may be allowed to dry by themselves on a clean surface. They also may be hung from a horizontal wire, like drying clothes, but care must be taken not to damage the facepiece.

A better method is to use a commercially available electrically heated steel storage cabinet with a built-in circulating fan, and replacing the solid shelves with steel mesh, if necessary.

REASSEMBLY AND INSPECTION

The clean, dry respirator facepiece should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. Inspect for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve, and can cause valve leakage or sticking.

At this time, the respirators should be thoroughly inspected and all defects corrected.

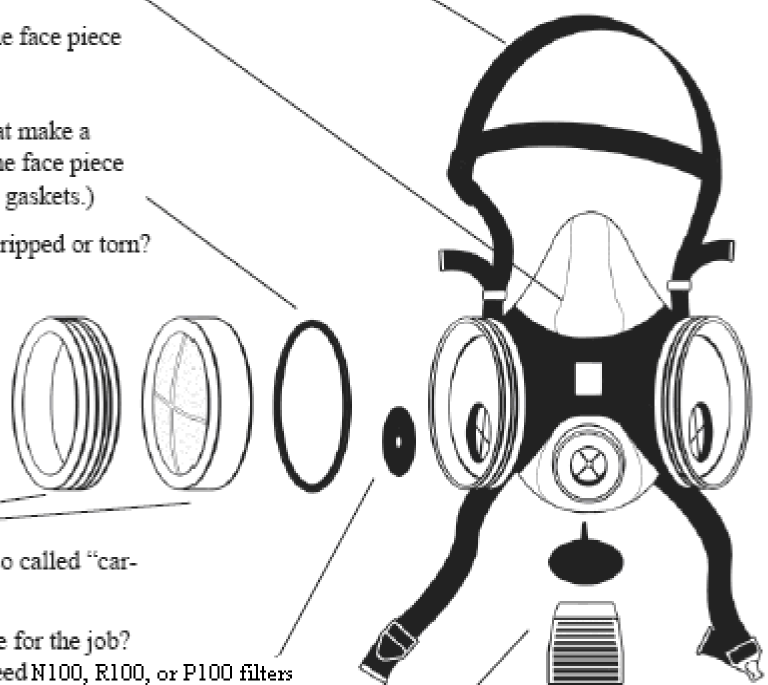
New or retested filters, or new cartridges and canisters should be installed, and the completely reassembled respirator should be tested for leaks. Finally, you should store respirator in a sealed bag out of heat exposure.

ADJUSTMENT AND REPAIR

The OSHA Standards state that “repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer’s NIOSH-approved parts designed for the respirator.”

An important aspect of any maintenance program is having enough spare parts on hand. Pay attention to what parts are used up quickly in order to determine what parts (and how many of them) should be kept in stock. Keep a record of spare parts that are used and how many are on hand.

How to Inspect Your Respirator



STRAPS—hold the respirator on your head. One goes over the crown of your head. Another headband has two plastic straps, which go straight up and straight back on your head.

Check: Are they elastic? Are they torn? Do the buckles and snaps work?

FACE PIECE—is made of rubber, silicon, or other materials.

Check: Is it ripped or worn? Is the face piece bent? Is it clean?

GASKETS—are rubber rings that make a tight seal between the filter and the face piece present. (Not every respirator has gaskets.)

Check: Are they there? Are they ripped or torn?

Filters-filter the air. They are also called "cartridges."

Check: Do you have the right one for the job? When you work with lead, you need N100, R100, or P100 filters When you use solvents or caustic pa: need other filters, too. Change filters especially when it becomes harder to breathe.

INHALATION VALVES—are where you breathe in. There are two small rubber flaps behind the filters.

Check: Are both there? Are they ripped or bent? Are they dirty?

EXHALATION VALVE-Is where you breathe out. It Is a small rubber flap about the size of a quarter. It is underneath a cover.

Check: Take off the cover. Is the valve there? Is It ripped or bent? Is it dirty?

Activity 1. Respiratory Protection

- Select the best answer for each question

1) It is necessary to wear a respirator because:

□ Wearing a respirator is required by law
□ A respirator protects against harmful or toxic airborne contamination
□ A respirator may protect your eyes
□ All of the above

2) Which of the following are considered when selecting a respirator?

□ Protection factor
□ Other PPE that may be needed when wearing a respirator
□ Comfort for the user
□ Contaminant the respirator will be used for
□ All of these are used when selecting a respirator

3) How does a respirator work?

□ It cleans all of the air around you
□ It creates a seal on your face forcing inhaled air to be filtered
□ It makes the chemicals non-hazardous
□ None of the above

4) What is the purpose of a fit test?

□ To assure that the respirator creates a good seal around your face
□ To assure that all contaminants are being filtered
□ To assess if a chemical being used is hazardous
□ To make sure you are wearing the right chemical gloves

5) How can you test the fit and function of a respirator before you use it?

□ It is not possible to check the fit
□ Expose yourself to a chemical and see if you smell it
□ Perform a positive and negative pressure check
□ There is no need to check the fit of your respirator

6) What are some proper ways to store a respirator?

□ **A.** Throw it in box when you are done
□ **B.** Hang it on a hook
□ **C.** Put it in a bag, and keep it away from chemicals
□ **D.** Make sure the respirator is not bent out of shape
□ Both C and D

7) What should you do when the respirator malfunctions?

- □ **A.** Go to an area with clean air immediately
- □ **B.** Fix the respirator before it is used again
- □ **C.** Just keep working
- □ Both A and B

8) Which medical conditions can be aggravated by wearing a respirator?

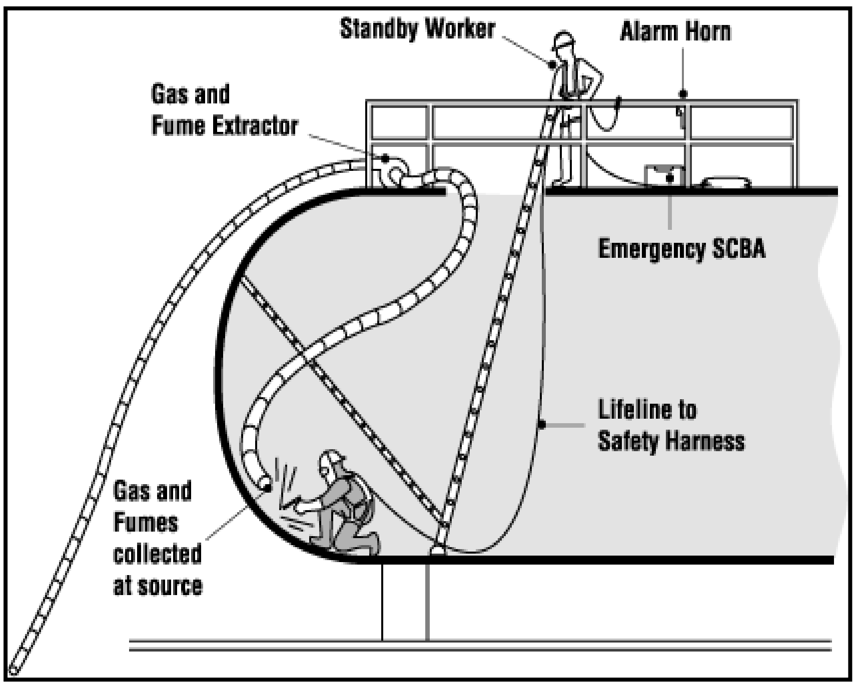
- □ Bad knee joints and arthritis
- □ Hair loss
- □ Asthma and high blood pressure
- □ Wearing a respirator will not aggravate any medical condition

9) What are the general requirements of the Respiratory Protection Standard GISO 5144?

- □ Fit testing
- □ Written Plan
- □ Annual refit testing
- □ All of the above

MODULE 12

Confined Space



Module 12
Confined Space

GISO 5192 (b) & (j)

OUTLINE

I. Overview of Confined Space

II. The Hazards in Confined Space

- Oxygen deficient atmospheres
- Flammable atmospheres
- Toxic atmospheres
- General physical hazards

III. Methods for a Safe Confined Space Entry

IV. Entry Permit System

V. Cal/OSHA Confined Space Standard

OBJECTIVES

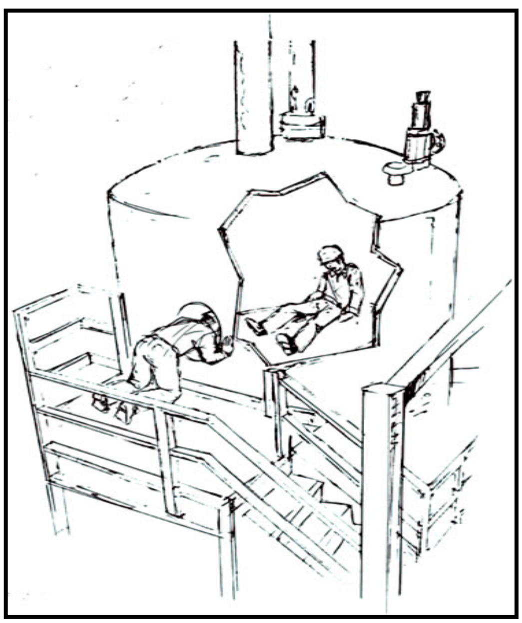
At the end of this session, trainees will be able to:

1. Define "confined space" according to Cal-OSHA.
2. Describe the difference between non-permit and permit-required confined space.
3. Describe the steps to be used for safe entry into a confined space.
4. Describe at least three hazards involved in entering and working in confined spaces.

I. OVERVIEW OF CONFINED SPACE

As many as 1.6 million U.S. workers are required to enter confined spaces, such as tanks or trenches, each year to do construction, maintenance, or repair work. More than 50 of these workers die and 5,000 of them are injured each year. 60% of these deaths are rescuers.

These deaths and injuries can be prevented simply by recognizing the hazards and implementing proper controls before entry. Federal OSHA has promulgated a standard (29 CFR 1910.146) for confined spaces. This standard requires the development of entry permit systems whenever workers will be entering a confined space. Cal/OSHA in turn has promulgated a Confined Space Standard (CCR, Title 8, General Industrial Safety Orders Sections: 5156, Scope, Application, Definitions. 5157, Permit Required Confined Spaces, Appendix A – Decision Flow Chart and 5158, Other Confined Space Operations) which will be referenced in this Module.



What Constitutes a Confined Space? [Ref: CCR, Title 8, Section 5157 (b) of the General Industrial Safety Orders.]

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means of entry and exit (for example, Tanks, vessels, vaults, silos, storage bins, hoppers, and pits which are spaces that may have limited means of entry; and
- Is not designed for continuous employee occupancy.

What Constitutes a Permit-Required Confined Space? [Ref: CCR Title 8, Section 5157 (b) (5) of the General Industrial Safety Orders].

A permit-required confined space has one or more of the following characteristics:

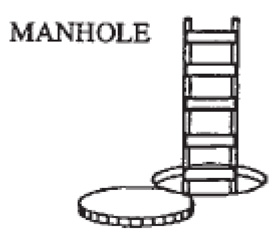
- Contains or has the potential of containing a hazardous atmosphere;

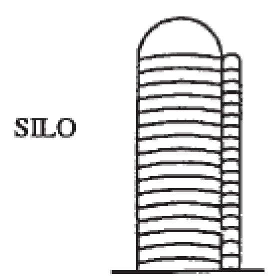
- Contains a material that has the potential for engulfing the entrant;

- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

- Contains any other recognized serious safety or health hazard.

Some examples:





II. THE HAZARDS IN CONFINED SPACE

Oxygen-Deficient Atmospheres

An oxygen-deficient atmosphere has less than 19.5% available oxygen (O_2). You should not enter any atmosphere having less than 19.5% oxygen without wearing an approved self-contained breathing apparatus (SCBA) or an approved Air Supplied Respirator System.

The oxygen level in a confined space can decrease because of work being done, such as welding, cutting, or brazing; or it can be decreased by certain chemical reactions (for example, rusting) or through fermentation. The oxygen level also decreases if another gas, such as carbon dioxide or nitrogen, displaces it. Total displacement of oxygen by another gas will result in unconsciousness, followed by death.

The Health Effects of Different Levels of Oxygen

Level of Oxygen	Result
21%	Plenty of oxygen
19.5%	Enough oxygen to enter a confined space
16%	Tire rapidly; cannot think clearly
14%	Not enough oxygen; difficult to breathe
6%	Cannot breathe; death

Flammable Atmospheres

Two things make an atmosphere flammable:

- The amount of oxygen in the air
- A specific mixture of flammable gas, vapor or dust.

If a source of ignition (for example, a sparking or electrical tool) is used in a space containing a flammable atmosphere, an explosion will result.
If the air in a confined space is rich in oxygen (above 21 %), flammable materials, such as clothing and hair, will burn quickly when ignited. Therefore, never use pure oxygen to ventilate a confined space. Ventilate with normal air. If the LEL of the CHEM is 10% or greater, workers shall evaluate the tank until these conditions can be lowered.

Toxic Atmospheres

Most liquids, vapors, gases, mists, solids, and dusts that you work with should be considered hazardous in a confined space. Toxic materials can come from:

- Products stored in a confined space - Products stored in a confined space can be absorbed into the walls and give off toxic gases. When cleaning the walls, toxic gases can give off gas. For example in the removal of sludge from a tank, decomposed material can give off deadly hydrogen sulfide gas.

- Work in and around confined spaces - Toxic atmospheres are created in many processes. Examples include welding, cutting, brazing, painting, scraping, sanding and degreasing. Many of the industrial cleaning solvents are very toxic in a confined space. Toxic materials produced by work near a confined space can also enter and build up in a confined space.

- You can measure for toxic atmospheres with a toxic gas meter, dräeger pump, Photo-Ionization Detector (PID) or Flame Ionization Detector (FID).

Exemptions to the Rules for Confined Space Entry

A confined space may be considered a permit-required confine space only because of an actual or potential hazardous atmosphere. If continuous ventilation of such a space is sufficient to control the hazard, then the employer is not subject to all of the requirements in the standard. Instead, the employer may use the alternative procedures specified in CCR, Title 8, General Industrial Safety Orders, Section 5157, subsection (c)(5)(b) for entering a Permit Space under the conditions set forth in subsection (c)(5)(A).

Limited and Challenging Openings for Entry and Exit

Confined space openings are usually **small in size**. For example, they may be as small as 18 inches in diameter, therefore making it difficult to move through. Small openings make it very difficult to get work equipment in or out of the spaces.

It is also difficult to get protective equipment, such as respirators, and life-saving equipment into these spaces. In some cases, confined space openings may be very large and **challenging** – for example, open-topped containers such as tanks or degreasers. You may have to use ladders, hoists, or other equipment to enter or exit these spaces. Escape from such areas may be very difficult in an emergency.

Not Designed for Continuous Worker Occupancy

Most confined spaces are not designed for workers to enter and work in on a routine basis. They are designed to store a product, enclose materials and processes, or transport products.

Therefore, occasional worker entry for inspection, maintenance, repair, cleanup, or similar tasks is often difficult and dangerous due to chemical or physical hazards within the space.

General Physical Hazards

In addition to hazardous atmospheres, confined spaces may also contain potential hazards such as electrical shock, radiation machinery and other hazards such as:

Extreme Temperatures: Extremely hot or cold temperatures can be a problem for workers in a confined space. For example, if the space has been steam cleaned, it should be allowed to cool before any entry is made.

Noise: Noise within a confined space can be amplified because of the design and acoustic properties of the space. This can damage hearing and interfere with communication, causing a shouted warning to go unheard.

Slippery/Wet Surfaces: Slips and falls can occur on a wet surface, causing injury or death to workers. Also, a wet surface will increase the chance of injury from electric shock in areas where electrical circuits, equipment, and tools are used.

Falling Objects: Workers in confined spaces should be careful of the possibility of falling objects, especially in spaces that have top-side openings for entry, and where work is being done above the worker.

Engulfment Hazards: Loose, granular material (such as grain, sand, coal, or similar material), stored in bins and hoppers, can engulf and suffocate a worker by crusting or bridging over in a bin appearing to be a firm surface, it can break loose under the weight of a worker. Also, consider liquids such as slurries, water and other chemicals as possible engulfment hazards.

<u>Special Note</u>**:** A worker should be concerned when encountering any of the above mentioned criteria. Immediately consult with a health and safety representative when you feel you may be entering a permit-required confined space which has not been identified.

III. METHODS FOR A SAFE CONFINED SPACE ENTRY

Employers should make available to employees a list of all permit-required confined spaces. Workers should be trained to identify confined spaces and the hazards that may be found in them. This training should stress that death is the likely outcome if the following precautions are not taken before entry is made:

Required Positions

The following positions are required in order to make entry into a Permit-Required Confined Space (Ref: CCR, Title 8, Section 5157 of General Industrial Safety Orders).

- Supervisor: Knows hazards, verifies safety and is responsible for entry signature. [Ref: GISO 5157 (j)]

- Authorized Entrant: Enters the permit space and is trained in the hazards and duties of entry. [Ref: GISO 5157 (h)]

- Attendants: Located outside one or more Permit Spaces, Monitors the Entrant, Performs other Attendant duties. [Ref: GISO 5157 (i)]

- Rescue and Emergency Services: At least on person at the site, available and trained: In the hazards of entry / In rescue / In basic First-Aid and CPR and has practiced with rescue at least once in the last 12 months. [Ref: GISO 5157 (k)]

Written Entry Permit (Safe Work Permit)

A set of established written work procedures that explains how jobs in each confined space shall be done and then is posted at the entry to the job-site.

Air Monitoring

Remember that some gases or vapors are "heavier" than air and will settle to the bottom of a confined space. Also, some gases are "lighter" than air and will be found around the top of the confined space. Therefore, it is very important that a qualified person monitor all areas (top, middle, and bottom) of a confined space for toxic gases and vapors before anyone enters it. Monitoring for oxygen level, flammability, and known or suspected toxic materials should all be conducted.

If testing reveals oxygen deficiency, toxic gases and vapors, or flammable gases and vapors, the space must be ventilated and re-tested before workers enter.

If ventilation is not possible and entry is necessary (for emergency rescue, for example), workers must don appropriate level of protection before entry.

Never trust your senses to determine if the air in a confined space is safe! You can not see or smell many toxic or flammable gases and vapors, nor can you determine the level of oxygen present. A confined space should be monitored continually to determine whether the atmosphere has changed due to the work being done.

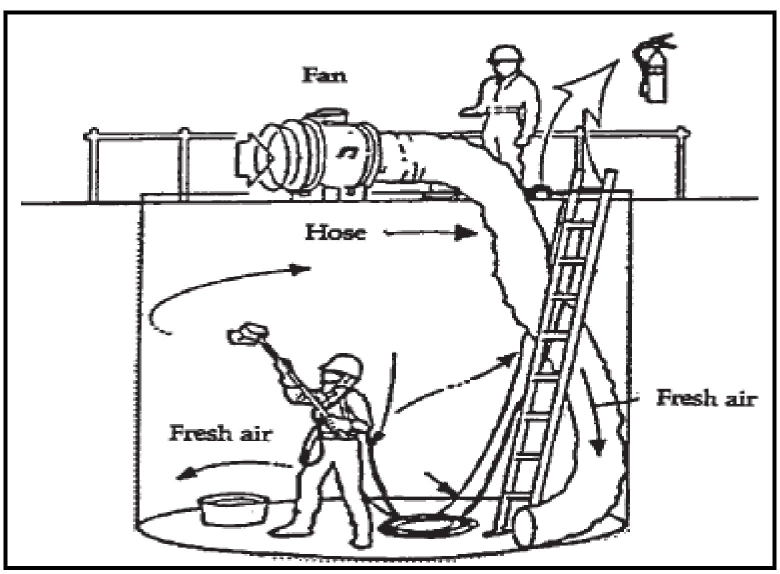
Ventilation

Ventilation by a blower or fan may be necessary to remove harmful gases and vapors from a confined space. The method and equipment to use depend on:

- Size of the confined space openings
- Gases to be ventilated out (e.g., are they flammable?)
- Source of the fresh air (air that is blown into the confined space).

A common method of ventilation requires a large hose with one end attached to a fan and the other lowered into a manhole or opening. For example, in a manhole the ventilating hose would run to the bottom to blow out all harmful gases and vapors.

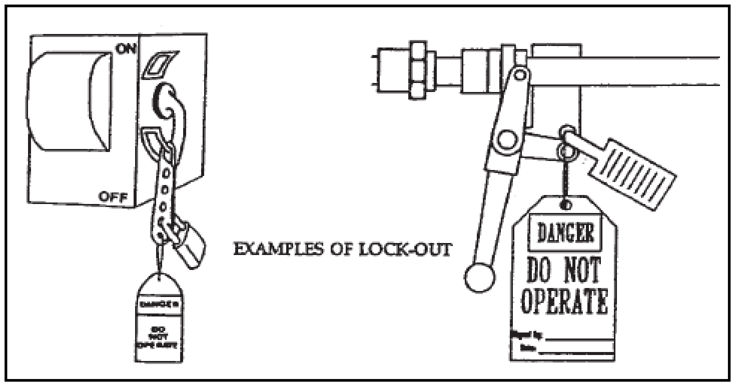
The fan should be placed in an area that will draw in fresh air only. Ventilation should be continuous where possible because in many confined spaces the hazardous atmosphere will form again when the flow of air is stopped.



Isolation

Isolation is the process of putting an area out of service. Whenever the safety of a confined space entry cannot be ensured, the space should be isolated. There are several methods to remove a confined space from service:

- **Lock-out** of electrical sources, preferably with the use of disconnect switches far from the equipment.



- **Blanking and bleeding** of pneumatic and hydraulic lines.
- **Disconnecting** belt and chain drives and mechanical linkages on shaft driven equipment where possible.
- **Securing** mechanical moving parts within confined spaces with latches, chains, chocks, blocks, or other devices.

What about Tags?

Tags are sometimes used in place of locks to prevent accidental start up of machinery.

This is a risky approach and should not be relied upon except for very brief periods, or when a locking mechanism is absolutely impossible.

OSHA says a “Do Not Start” tag on power equipment shall be used for a few moments or a very short time until the switch in the system can be locked out. For the rare instances where tags are used, they must be highly visible and placed in a conspicuous location that effectively stops people from operating the starting mechanism.

All personnel must be trained in the meanings of any tags used and the serious hazards resulting from not heeding the warnings.

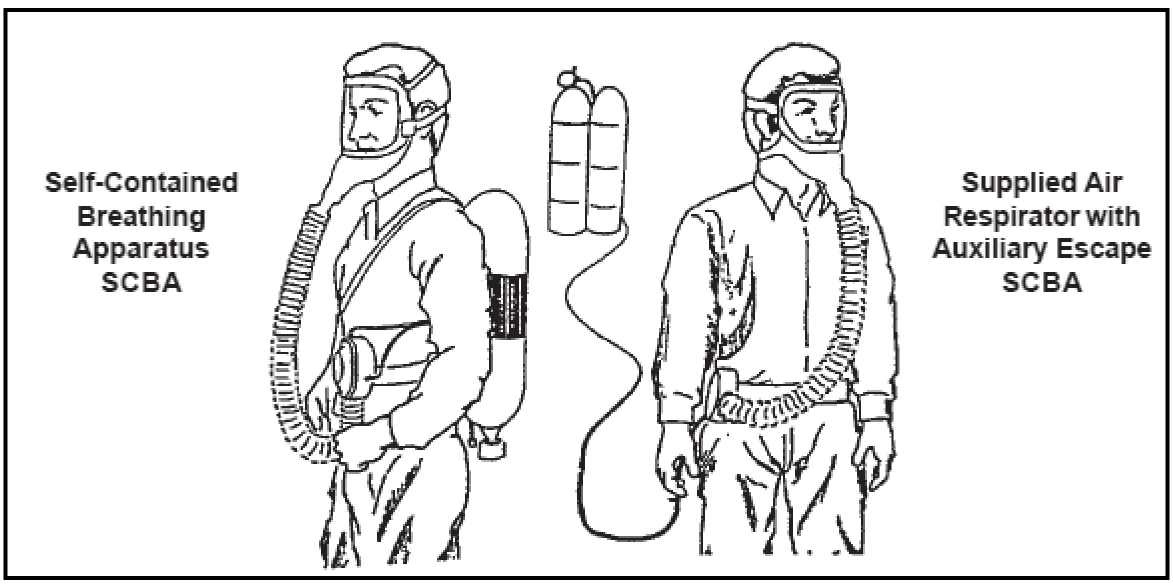
Remember--- Effective lockout/tagout should occur in three phases:

- Applying lockout/tagout
- Servicing and repairing equipment
- Returning equipment to proper operation

Respiratory Protection

Respirators allow you to breathe safely without inhaling toxic gases or particles. Use only air-supplying respirators in confined spaces where there is not enough oxygen.

- **Air-Supplying Respirators**



- **Air-Purifying Respirators** Do not use the types of respirators shown below in oxygen-deficient atmosphere.

Communication

Due to limited space and other work conditions, workers may not be able to communicate. Alternative communications such as horns, ropes or intrinsically safe electronic communication should be available for all possible types of emergencies.

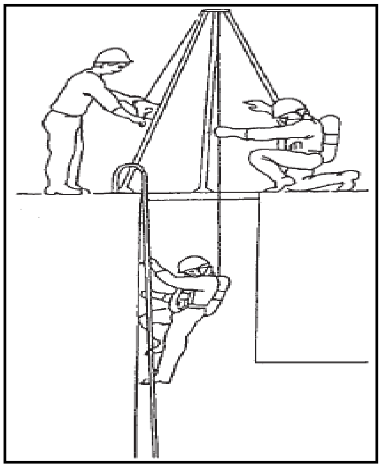
Rescue Plan

Over 60% of the workers who die in confined spaces are attempting to rescue other workers. Rescuers must be trained in and follow established emergency procedures and use appropriate equipment and techniques (lifelines, respiratory protection, standby persons, etc.).

Steps for a safe rescue should be:

- Included in all confined space entry procedures.
- Established before entry.
- Specific for each type of confined space.
- Well planned and practiced often enough to ensure an efficient and calm response to any emergency. Unplanned rescue such as when someone rushes in without thinking can easily result in another death.

Standby Person



A standby person is someone assigned to remain on the outside of the confined space. The standby should be in constant contact (through sight or speech) with the workers inside. The standby person should:

- Not have any other duties but to serve as standby.
- Be equipped with rescue equipment, for example: a safety line attached to the worker in the confined space, SCBA, protective clothing, boots.
- Know who to notify in case of emergency.
- Not enter a confined space in case of emergency until he/she has alerted at least one additional employee outside of the confined space of the emergency and of his/her intent to enter the confined space.

IV. ENTRY PERMIT SYSTEM [Title 8, GISO, Section 5157 (b)]

Entry permits provide documentation that the appropriate procedures for safe entry have been followed. Whenever a worker is required to enter a confined space, an entry supervisor must sign an entry permit to authorize entry.

The permit must be made available to all entry personnel. It is valid only for the amount of time it takes to complete the task specified on the permit, but for no longer than one shift. It must be cancelled on completion of the job. Permits must be kept on record for at least one year.

What Is on an Entry Permit?
[Title 8, GISO, Section 5157 (f)]

Entry permits must include the following information:

- The permit space to be entered;
- The purpose of the entry;

- The date and the authorized duration of the entry permit;

- The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

  Note: This requirement may be met by inserting a reference on the entry permit as to the means used, such as roster or tracking systems, to keep track of the authorized entrants within the permit space;

- The personnel, by name, currently serving as attendants;

- The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry;

- The hazards of the permit space to be entered;

- The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;
  Note: Those measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

- The acceptable entry conditions;

- The results of initial and periodic test performed under subsection (d)(5) accompanied by the names or initials of the testers and by an indication of when the tests were performed;

- The rescue and emergency services that can be provided on-site and additional service that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

- The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

- Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment to be provided for compliance with this section;

- Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure employee safety, and

- Any additional permits, such as for **hot work**, that have been issued to authorize work in the permit space.

Note: **Hot Work Permit** means the employer's written authorization to perform operations such as: Riveting, Welding, Cutting, Burning, and Heating.

Caution: Some materials –Hydrogen Fluoride gas and Cadmium vapor, for example---may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possible fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life and health.

V. OVERVIEW OF Cal/OSHA CONFINED SPACE STANDARD

Both private and public sector workers in California are covered by a set of Confined Spaces standards: CCR, Title 8, GISO 5156, 5157 and 5158.

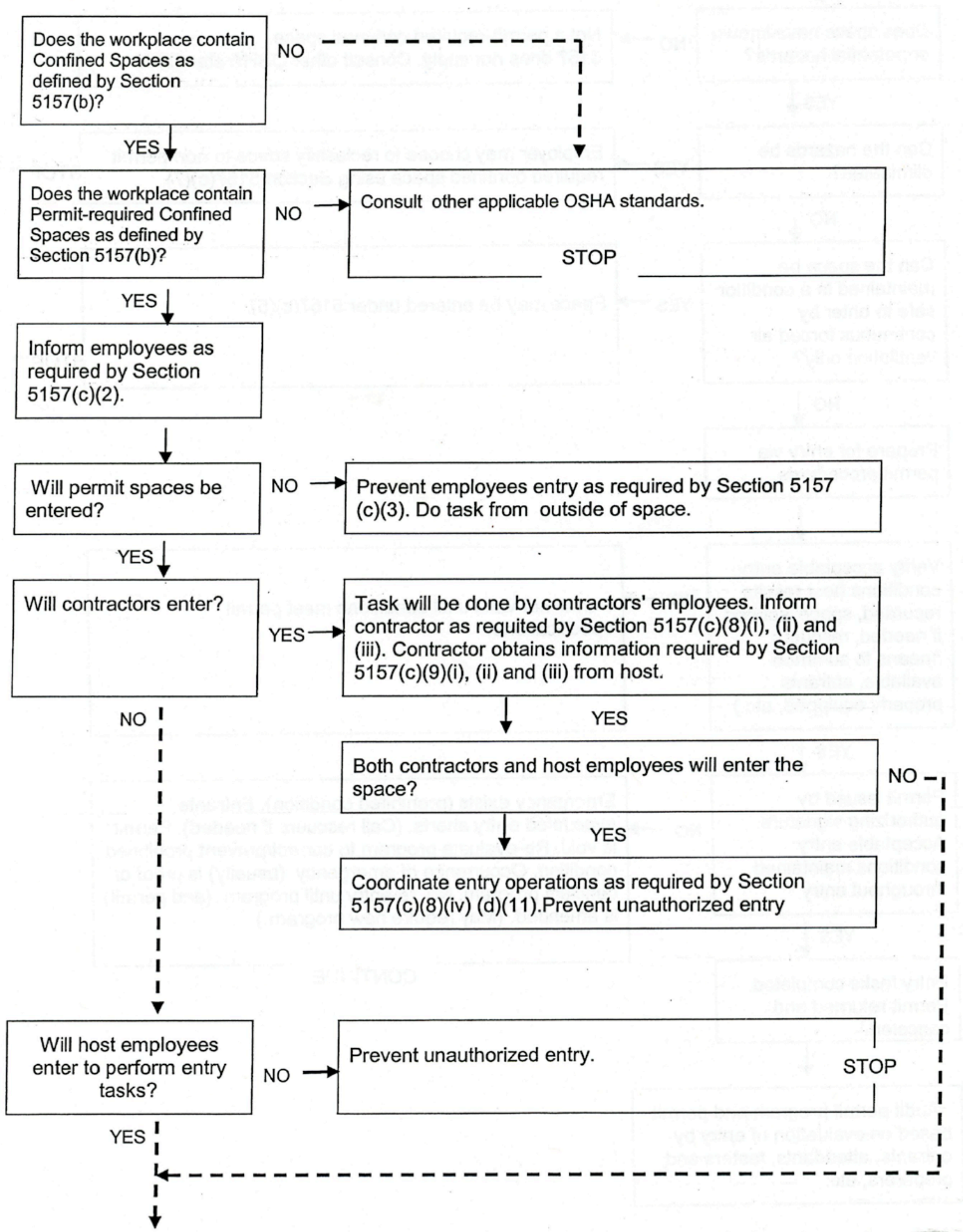
Cal-OSHA requires employers to:

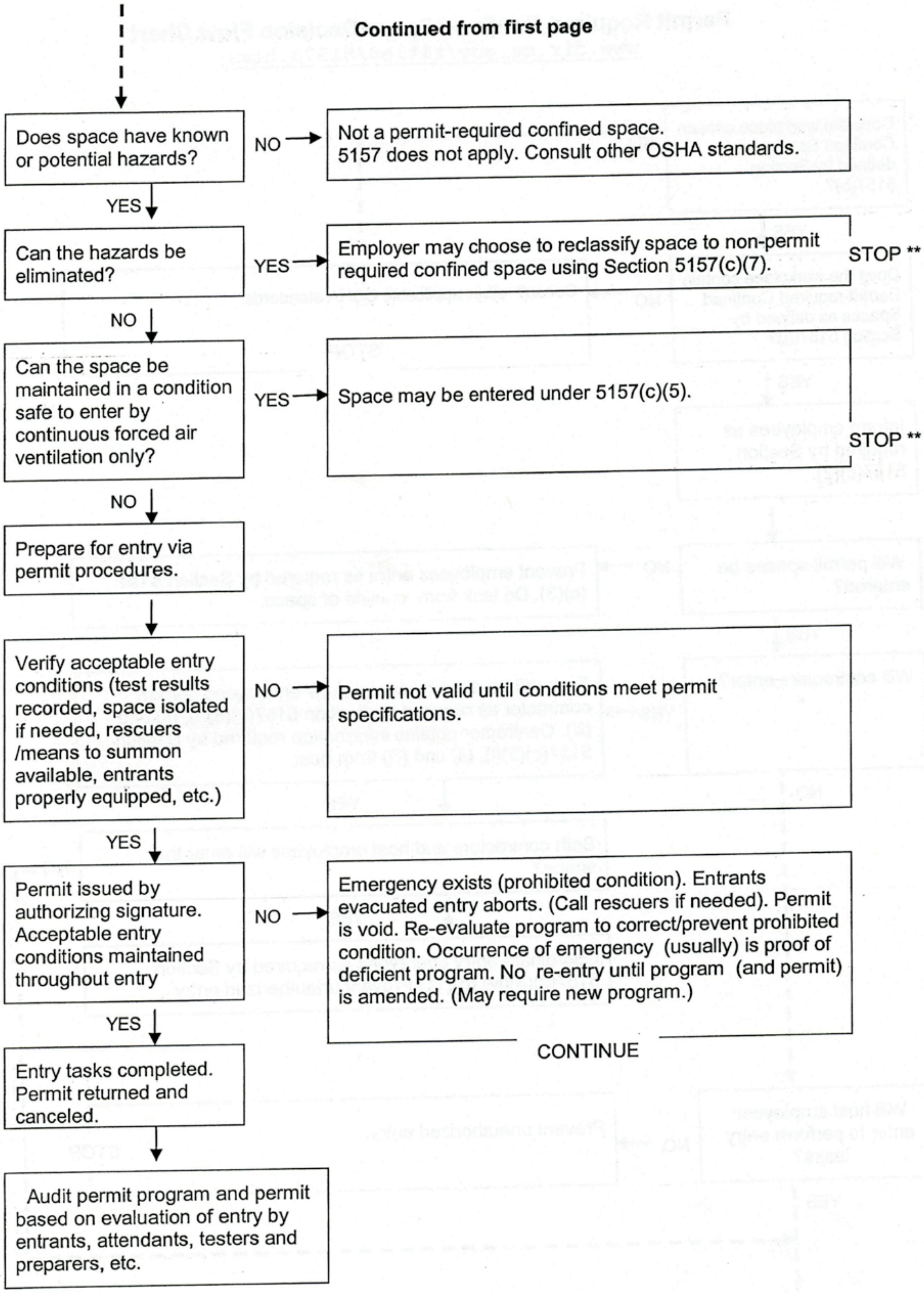
- Evaluate the workplace to identify any confined spaces requiring a permit
- Conduct air monitoring
- Provide proper respirators and safety equipment (e.g. harnesses, belts)
- Follow specified operating procedures
- Provide employee training
- Develop written procedures for confined spaces entry—with clearly designated duties for entrants, attendants and supervisors
- Designate outside attendants & rescuers, with PPE
- Develop and follow emergency and rescue procedures
- Develop and use a written permit system

Special Note: Section V above is only an overview of the Cal/OSHA Standard. Always refer to the complete standard you are attempting to comply with in order to ensure that all requirements of the Standard are met.

Permit Required Confined Space Decision Flow Chart

www.dir.ca.gov/title8/5157a.html





**** Spaces may have to be evacuated and re-evaluated if hazards arise during entry.**

Activity 1. Confined Space

Confined space accidents are rare but they can be deadly both to the worker who initially enters the space and to rescuers. Over 60 per cent of confined space fatalities are would-be rescuers.

Case Study 1: A contract employee was cleaning paint chips out of 8,000 gallon steel above ground storage tank. He was overcome by the cyclohexanone vapors from the solvent. Two workers attempted to rescue him, but also collapsed. No monitoring of the tank atmosphere was performed prior to entry or subsequent to entry. All three men died.

1. What are the three criteria which define a confined space?

2. What constitutes a permit-required confined space?

3. Was the tank which the worker enter a confined space?

4. Was this a permit-required confined space?

5. What should have been checked for prior to entering the tank?

6. What type of training should these employees have had?

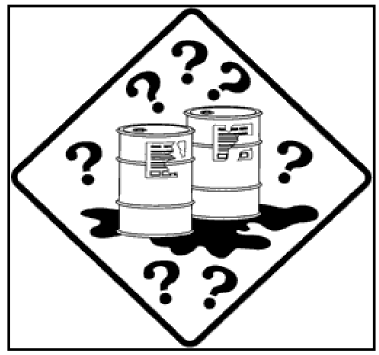
7. What information should an entry permit have?

8. What kind of PPE could have been of use to the worker?

9. Explain how this tragedy could have been avoided?

MODULE 13

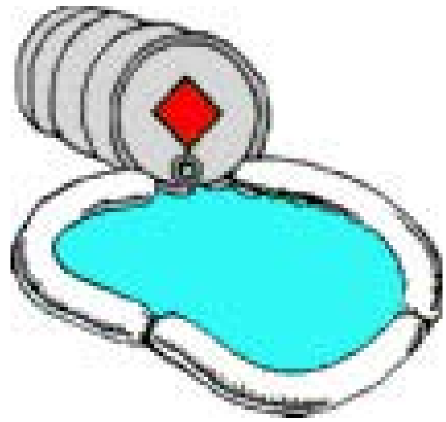
Drum Handling and Sampling



Module 13
Drum Handling, Sampling, and Shipping Hazardous Waste

GISO 5192 (j)

OUTLINE



I. Introduction
II. Types of Drums
III. Identifying Drum Contents
IV. Drum Inspection, Handling and Staging
V. Hazards Associated with Handling Drums
VI. Preventing Accidents and Emergencies
VII. Samples and Sampling Methods
VIII. Sampling Method Selection Criteria
IX. Sampling Plan
X. Documentation (Field Logbook, Photographs, and Sample Labels)
XI. Chain-of-Custody Procedures
XII. Packaging and Shipping

OBJECTIVES

Trainees will be able to:

1. Recognize different types of drums and their use.
2. Describe types of hazardous waste samples and methods of "containerizing."
3. Describe hazards associated with handling drums and other containers and identify procedures to minimize these risks.
4. Identify safe work procedures and control methods for hazardous waste samples.
5. List types of equipment used to move drums.
6. Identify the regulations for the packaging, shipping and handling of hazardous waste samples.

I. INTRODUCTION

Containers are handled during characterization and removal of their contents and during operations. Accidents may occur during handling of drums and other hazardous waste containers. Hazards include detonations, fires, explosions, vapor generation, and physical injury resulting from moving heavy containers by hand and working around stacked drums, heavy equipment, and deteriorated drums. While these hazards are always present, proper work practices – such as minimizing handling and using equipment and procedures, if feasible, that isolate workers from hazardous substances – can minimize the risks to site personnel.

Considering the high cost of legally disposing of hazardous wastes and their contaminated containers, it's very common to find drums dumped in empty lots or open fields or at abandon facilities. Workers must approach these seemingly benign drums cautiously, looking for signs of drum failure.

II. TYPES OF DRUMS

There are basically three types of drums: metal, plastic or cardboard. Naturally, their construction and use is mandated by compatibility with the product they will contain.

Closed-top drums are sealed and have small openings called bungs in the top through which liquids can be poured.
Open-top drums have removable lids, and some have the small openings characteristics of the closed-top drum.

Type of Drum	Construction	Contents
Closed-top (bung)	Metal	Non corrosive products in liquid form
Closed-top (bung)	Plastic or composite (plastic inside metal or cardboard)	Liquid, acid, or bases
Open-top	Metal	Corrosive solids or sludge
Open-top	Polyethylene	Corrosive solids or sludge
Special	Stainless steel, nickel, and Aluminum	Extremely hazardous chemicals
Over-pack	Metal or plastic	Any drums listed above
Closed-top drums with fittings	Fittings for pressurizing with inert gas	Reactive, flammable, or explosive liquids
Open-top	Plastic or metal	Lab packs of a variety of potentially dangerous and incompatible material.

Determine drum type:

a. **Polyethylene or PVC-Lined Drums:** These often contain strong acids or bases. If the lining is punctured, the contents may quickly corrode the metal, resulting in a significant leak or spill.

b. **Metal Drum:** If a drum is made of a very expensive metal such as aluminum, nickel, or stainless steel, it may contain an extremely dangerous material.

c. **Laboratory Packs:** These are used to dispose of used chemicals and wastes from laboratories and hospitals. They may contain incompatible materials, radioiostopes, shock sensitive, volatile, corrosive, or toxic chemicals. Special requirements for handling lab packs are also covered by 49 CFR 173.25.

III. IDENTIFYING DRUM CONTENTS

Drum contents may be difficult to identify (characterize). Unknown contents are dangerous because they may be toxic, reactive, ignitable, shock sensitive, corrosive, radioactive, or a combination of these. Before handling a drum, always be sure to take the following step:

- Look for symbols, words, or colors on the drum indicating that its contents are hazardous. Look for special markings such as NFPA 704 Hazard Diamond, DOT hazard identification, EPA Hazardous Waste Label, Department of Energy radiation label, or pesticide label.

IV. DRUM INSPECTION, HANDLING AND STAGING

Inspection - The appropriate procedures for handling drums depend on the drum contents. Thus, prior to any handling, drums should be visually inspected to gain as much information as possible about their contents. The inspection crew should look for:

- Symbols, words, or other marks on the drum indicating that its contents are hazardous.
- Symbols, words, or other marks on a drum indicating that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers.
- Signs of deterioration such as corrosion, rust, and leaks.
- Signs that the drum is under pressure such as swelling and bulging.
- Drum type.
- Configuration of the drumhead.

Conditions in the immediate vicinity of the drums may provide information about drum contents and their associated hazards. Monitoring should be conducted around the drums using instruments such as a gamma radiation survey instrument, organic vapor monitors, and a combustible gas meter.

As a precautionary measure, personnel should assume that unlabelled drums contain hazardous materials until their contents are characterized. Also, they should be aware of mislabeled drums that are reused.

Planning - Since drum handling is fraught with danger, every step of the operation should be carefully planned, based on all the information available at the time. The results of the preliminary inspection can be used to determine:

1. if any hazards are present and the appropriate response
2. which drums need to be moved in order to be opened and samples.

A preliminary plan should be developed which specifies the extent of handling necessary, the personnel selected for the job, and the most appropriate procedures based on hazards associated with the probable drum contents as determined by visual inspection.

Sample Drum Characterization Sheet.

SITE: ________

DRUM SIZE:
0 unknown ___
1 55 gal. ___
2 30 gal. ___
3 other ___
specify ___

DRUM NO. ________

DRUM OPENING:
0 unknown ___
1 ring top ___
2 closed top ___
3 open top ___
4 other ___
specify ___

SAMPLE NO. ___

DRUM TYPE:
0 unknown ___
1 metal ___
2 plastic ___
3 fiber ___
4 glass ___
5 other ___
specify ___

SCREENING RESULTS (AREA):
0 unknown ___
1 radioactive ___
2 acid/oxidizer ___
3 caustic/reducer/cyanide ___
4 flammable organic ___
5 nonflammable organic ___
6 peroxide ___
7 air or water reactive ___
8 inert ___

DRUM COLOR: PRI SEC
0 unknown ___ ___
1 cream ___ ___
2 clear ___ ___
3 black ___ ___
4 white ___ ___
5 red ___ ___
6 green ___ ___
7 blue ___ ___
8 brown ___ ___
9 pink ___ ___
10 orange ___ ___
11 yellow ___ ___
12 gray ___ ___
13 purple ___ ___
14 amber ___ ___
15 green-blue ___ ___

DRUM CONTENTS COLOR:
0 unknown ___ ___
1 cream ___ ___
2 clear ___ ___
3 black ___ ___
4 white ___ ___
5 red ___ ___
6 green ___ ___
7 blue ___ ___
8 brown ___ ___
9 pink ___ ___
10 orange ___ ___
11 yellow ___ ___
12 gray ___ ___
13 purple ___ ___
14 amber ___ ___
15 green-blue ___ ___

DRUM CONDITION:
0 unknown ___
1 good ___
2 fair ___
3 poor ___

DRUM MARKING KEYWORD 1
____

DRUM MARKING KEYWORD 2
____

DRUM MARKING KEYWORD 3
____

DRUM CONTENTS STATE: PRI SEC
0 unknown ___ ___
1 solid ___ ___
2 liquid ___ ___
3 sludge ___ ___
4 gas ___ ___
5 trash ___ ___
6 dirt ___ ___
7 gel ___ ___

DRUM CONTENT AMOUNT:
0 unknown ___
1 full ___
2 part ___
3 empty ___

CHEMICAL ANALYSIS: YES NO
radiation ___ ___
ignitable ___ ___
water reactive ___ ___
cyanide ___ ___
oxidizer ___ ___
organic vapor _____ ppm
pH _____

SCREENING DATA:

	YES	NO	
RADIOACTIVE	___	___	$\geq$ 1 mR over background
ACIDIC	___	___	pH $\leq$ 3
CAUSTIC	___	___	pH $\geq$ 12
AIR REACTIVE	___	___	Reaction of $\geq 10°F$ temp. change
WATER REACTIVE	___	___	Reaction of $\geq 10°F$ temp. change
WATER SOLUBLE	___	___	Dissolves in water
WATER BATH OVA	___	___	Reading = ____ $\geq$ 10 ppm = Yes
COMBUSTIBLE	___	___	Catches fire when torched in water bath
HALIDE	___	___	Green flame when heated with copper
INORGANIC	___	___	WATER BATH OVA and COMBUSTIBLE = No
ORGANIC	___	___	INORGANIC = No
ALCOHOL/ALDEHYDE	___	___	WATER BATH OVA, WATER SOLUBLE and COMBUSTIBLE = Yes
CYANIDE	___	___	Draeger tube over water bath $\geq$ 2 ppm
FLAMMABLE	___	___	COMBUSTIBLE = Yes, and SETA flashpoint $\leq 140°F$
OXIDIZER	___	___	Starch iodine paper shows positive reaction
INERT OR OTHER	___	___	Everything "No" except INORGANIC or ORGANIC

Source: EPA Region VII Emergency Planning and Response Branch.
(This figure is provided only as an example. Values were selected by EPA Region VII and should be modified as appropriate.)

Handling - The purpose of handling is:

1. To respond to any obvious problems that might impair worker safety, such as radioactivity, leakage, or the presence of explosive substances.

2. To unstack and orient drums for sampling.

3. To organize, if necessary, drums into different areas on site to facilitate characterization and remedial action.

Prior to handling, all personnel should be warned about the hazards of handling, and be instructed to minimize handling as much as possible. In all phases of handling, personnel should be alert for new information about potential hazards.

The major causes of leaks and spills at hazardous waste sites are:

- Swollen containers due to pressure of contents.

- Damage from rough handling during transport.

- Drum bungs that are not completely tightened.

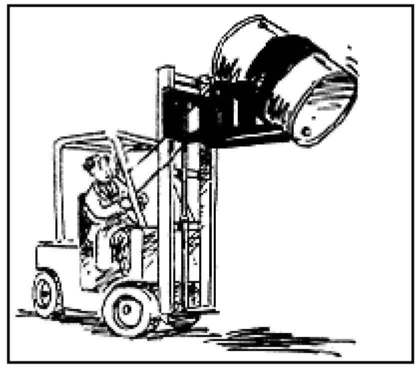
- Corrosion from contact with the soil or from acids or chlorinated hydrocarbons in the drums.

Over pack drums (larger drums in which leaking or damage drums are placed for storage or shipment and an adequate volume of absorbent should be kept near areas where minor spills may occur.

Where major spills may occur, a containment berm adequate to contain the entire volume of liquid in the drums should be constructed before handling takes place.

Keep absorbent spill control materials (brooms, bulk solid absorbent such as vermiculite) available on site.

There is some equipment which can be used to move drums:



- A drum grappler attached to hydraulic excavator
- A small front-end loader, which can be either loaded manually or equipped with a bucket sling.
- A rough terrain forklift.
- A roller conveyor equipped with solid rollers.
- Drum carts designed specifically for drum handling.

Drums are also sometimes moved manually. The drum grappler is the preferred piece of equipment for drum handling because it keeps the operator removed from the drums so that there is less likelihood of injury if the drums detonate or rupture.

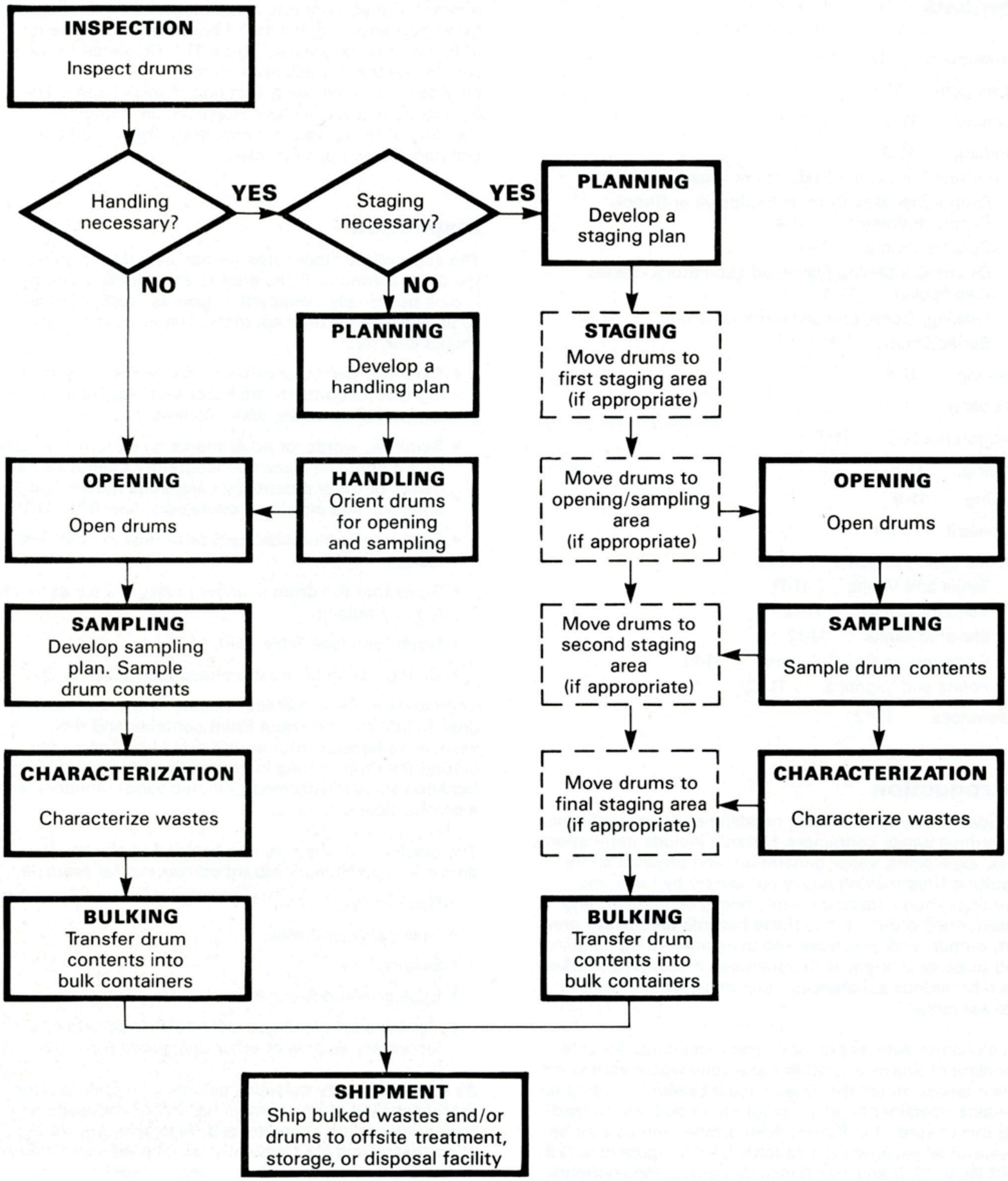
If a drum is leaking, the operator can stop the leak by rotating the drum and immediately placing it into an over-pack.

Drums that May Contain Explosive or Shock-Sensitive Waste

- If a drum is suspected to contain explosive or shock-sensitive waste as determined by visual inspection, seek specialized assistance before any handling.
- Prior to handling these drums, make sure all non-essential personnel have moved a safe distance away.
- Use a grappler unit constructed for explosives containment for initial handling of such a drum.
- Palletize the drums prior to transport. Secure drums to pallets.

- Bulging drums are extremely hazardous. Wherever possible, do not move drums that may be under internal pressure, as evidenced by bulging or swelling.
- If a pressurized drum has to be moved, whenever possible handle the drum with a grappler unit constructed for explosive containment. Either move the bulged drum only as far as necessary to allow seating on firm ground, or carefully over-pack the drum.

Flow Chart for Drum Handling.

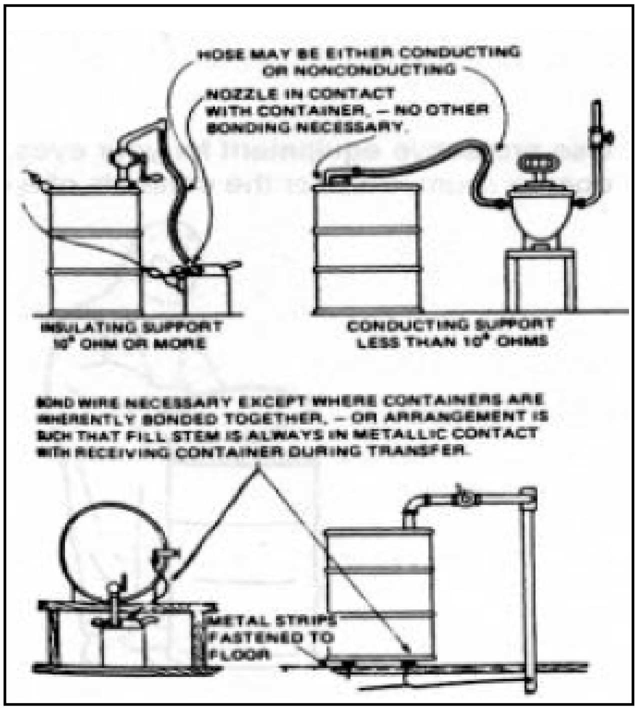


Dashed boxes indicate optional steps.

Leaking, Open, and Deteriorated Containers

Deteriorated Containers

If a drum containing a liquid cannot be moved without rupture, immediately transfer its contents to another drum using a pump designed for transferring that liquid.



When transferring combustible liquids from one drum to another, be sure that the two containers are bonded and grounded.

Two containers are **bonded** when a heavy copper wire is soldered between both containers. A container is **grounded** when a copper wire from the container to the ground prevents sparks or shocks by dissipating the static charge to the ground.
Use protective equipment for your eyes, skin, and lungs when you open a drum, transfer the contents of a drum, or clean a spill.

Leaking Containers

Stopping the leak by plugging or patching helps reduce contaminatioon. Most important, there is less of a hazard to both personnel and the environment once the leak is stopped.

Plugging and patching are not always options, however. Plugging devices may not fit the opening. Valves may be stuck or damaged beyond use. Patching substances may not stick to the container. The chemical may be incompatible with plugging and patching devices, or may eat through the container. Or, there may be too much pressure inside the container causing plugging/patching devices to continually “blow off.” These last two situations are most critical because they can occur after workers have applied the device, relying on the device to maintain safe working conditions.

Repositioning a Leaking Drum.

There are a number of different methods for dealing with a leaking drum. The position and condition of the drum will often dictate the appropriate action to take:

- The most common cause of a leak when a drum is lying on its side is a loose cap. The bung cap should be tightened slowly and carefully. If the bung cap shows signs of corrosion, stripped threads or other damage, this may not work to control the leak.

- The drum may be rolled to place the leak at the highest point. A piece of plastic sheeting should be placed on the ground next to the drum before it is rolled in order to protect the ground from any further damage once the drum is rolled onto it. The drum should then be secured so that it cannot roll back once the leak is controlled.

- The drum may be lifted to the upright position so that the end that is leaking will be furthest away from the ground. A “drum lifter” should be used if available to avoid back injuries. It may also be necessary to first roll the drum out of and away from any pooling liquid in order to minimize the risk to personnel. In rare cases, it may be necessary to upright a drum or barrel “upside down” in order to stop the leak. However, this does not allow personnel to readily empty the drum or take samples from it.

- A drum, which is standing upright and leaking from the midsection or bottom, may have to be laid down. The exact location of the leak should be identified before the drum is moved. Bung caps should be tightened securely. A piece of plastic sheeting should be placed on the ground to “receive” the drum once it is repositioned. The drum should be repositioned in such a way that the leaking portion is at the highest point. The drum should then be secured so that it cannot roll out of position.

Plugging involves using a mechanical device to stop the leak. Plugging devices work in one of two ways:

- Friction. These are devices that are wedged into the hole to create a seal. Examples include wood or neoprene plugs and wedges, threaded and tapered boiler plugs, sheet metal screws with rubber grommets, and small lag bolts.
- Expansion. There are devices that are inserted into the hole, then expanded to seal the hole. They consist of rubber balls, tapered rubber test plugs or rubber caps. They also usually have a threaded rod down the middle with a “butterfly” nut on one end that is inserted into the tank through the puncture or hole.

Patching involves placing something that will stick or adhere to the outer surface of the container. The patching material is usually a chemical substance. Use of “adhesion” type patching materials is not advisable on pressurized cylinders or liquid containers if the “head pressure” of the liquid is eight (8) pounds or more. There are many categories of patching materials:

- Epoxies. These may be mixable on site or pre-mixed. They may also be filled with lead or steel.

- Rubber compounds such as swelled neoprene rubber, butyl rubber sealer or polysulfide rubber.

- Foams or plastics such as polystyrene, polyacetate or polyurethane.

- Fiberglass mastics.

- Commercial substances such as Plug “N” Dike, Aqua Seal or silica gel.

- Compression. These devices are applied around the container or pipe, then cinched down. They can consist of very simple muffler clamps with a rubber seal. Or, they can be very expensive and intricately made pipe clamps.

Lab Packing

Lab packing is the term used to describe the process of

1. categorizing small containers of chemicals, solvents, industrial supplies, etc.,
2. repackaging and packing them into 55-gallon drums with compatible absorbent,
3. labeling and preparing the drums to be shipped for disposal and
4. providing the complete paperwork (manifests, shipping inventories, MSDS, etc.) for shipment.

Over-packing.

"Over-packing" involves placing the damaged drum inside a larger container. Over-packing is a method commonly used to handle leaking containers, particularly when drums are very heavy and require a forklift or special drum lifting apparatus to maneuver. Personnel should never try to move heavy drums without assistance.
USE THE BUDDY SYSTEM

There are three methods of placing the target drum into the overpack drum:

- A forklift or special drum-lifting device may be used to lift the target drum mechanically and place it into the over-pack drum.

- The over-pack drum may be turned upside down and placed over the target drum. The over-pack drum may then be turned upright with the target drum inside. The target drum will now be upside down.

- Both drums may be turned on their sides. The target drum may then be slid into the over-pack drum. The target drum should be positioned so that the top end is accessible when both drums are up-righted.

Bulging Containers.

Are the drums bulging? This could be due to a previous exposure to heat or fire. If the drum is bulging, but open, then we need not fear an explosion. If the drum is closed, the bulging indicates tremendous pressure inside. The drum is now a ticking time bomb. Tampering with the bung cap could be very dangerous as the products inside are under tremendous pressure. If this drum must be opened a remote opening device should be used, keeping personnel at a safe distance while the pressure is relieved.

Bulging may be caused by two incompatible chemicals combining, causing heat and pressure during this chemical reaction. Drums may be deformed due to impacts and collision from an accident. Drums, which are thickly, coated with rust are indicators of possible container failure and must be handled as if imminent failure is a possibility.

Drum Opening

There are three basic techniques available for opening drums at hazardous waste sites:

- Manual opening with non-sparking bung wrenches
- Drum de-heading
- Remote drum puncturing or bung removal

The choice of drum opening techniques and accessories depends on the number of drums to be opened, their waste contents, and physical condition.

Remote drum opening equipment should always be considered in order to protect worker safety. Under OSHA 1910.120, manual drum opening with bung wrenches or de-headers should be performed ONLY with structurally sound drums and waste contents that are known to be non-shock sensitive, non-reactive, non-explosive, and non-flammable.

Bung Wrench

A common method for opening drums manually is using a universal bung wrench.

These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of a non-sparking metal alloy (i.e. brass, bronze/manganese, aluminum) formulated to reduce the likelihood of sparks. The use of a "NON-SPARKING Wrench" does not completely eliminate the possibility of a spark being produced.

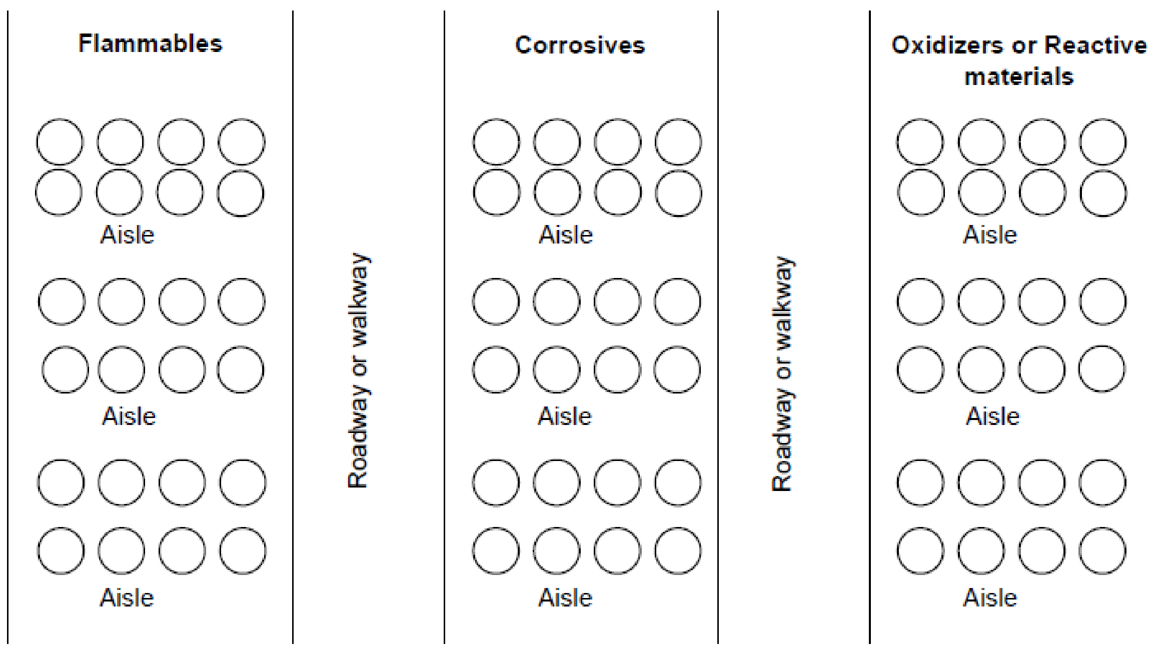
Staging - Although every attempt should be made to minimize drum handling, drums must sometimes be staged to facilitate characterization, remedial action, and to protect drums from potentially hazardous site conditions.

The number of staging areas necessary depends on site specific circumstances such as the scope of the operation, the accessibility of drums in their original positions, and perceived hazards.

During staging, the drums should be physically separated into the following categories: those containing liquids, those containing solids, those containing lab packs, and those which are empty. This is done because the strategy for sampling and handling drums/containers in each of these categories will be different. This may be achieved by visual inspection of the drum and its labels, codes, etc. Solids and sludge are typically disposed of in open top drums. Closed head drums with a bung opening generally contain liquid.

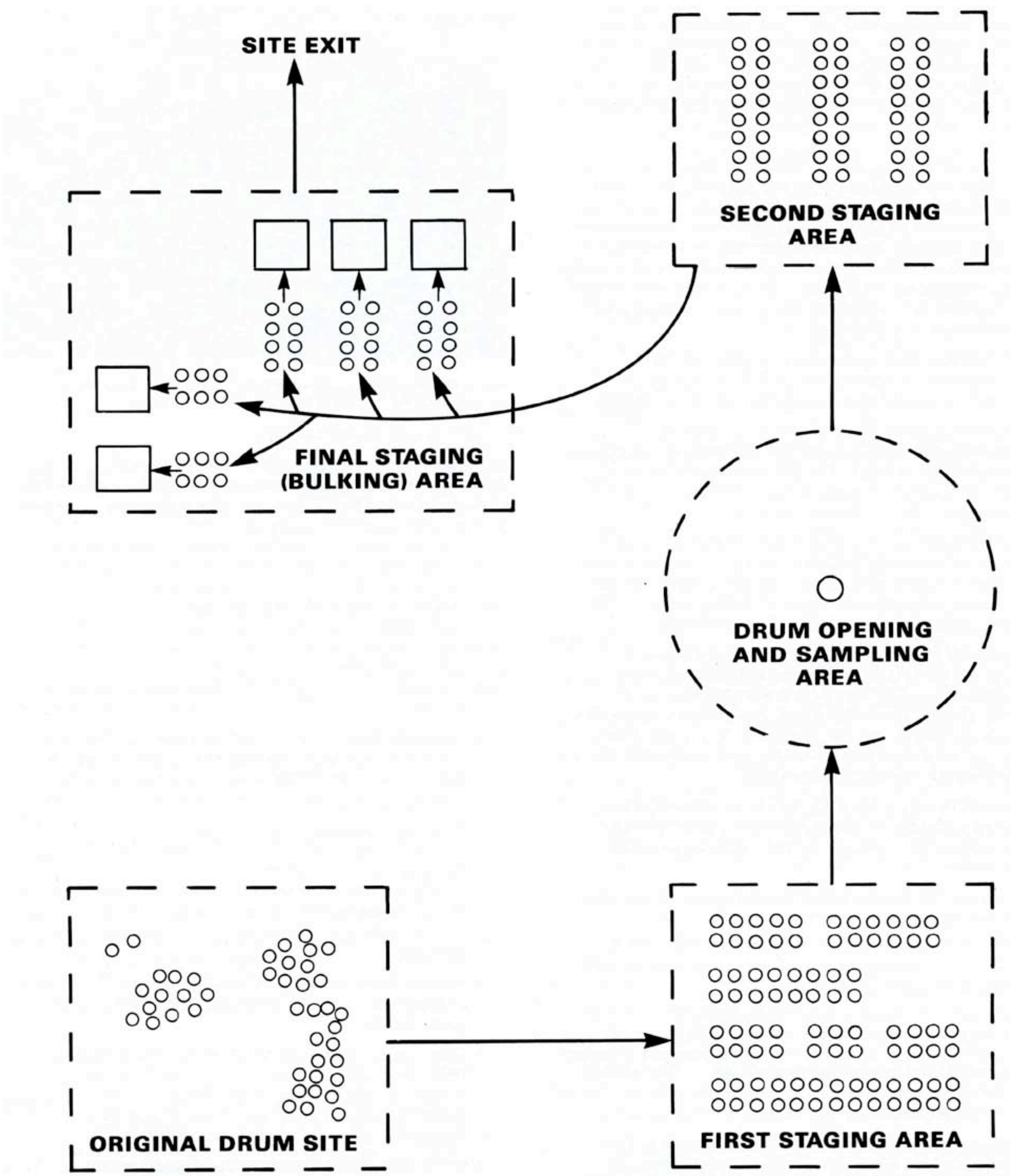
Where there is good reason to suspect that drums contain radioactive, explosive, or shock-sensitive materials, these drums should be staged in a separate isolated area. Placement of explosives and shock-sensitive materials in bermed and fenced areas will minimize the hazard and the adverse effects of any premature detonation of explosives.

Sample Drum Staging Layout



- Aisles need to allow enough room to work with and around containers.
- Roadway would allow an area large enough to accommodate forklifts or drum carriers.
- Walkways could be smaller if foot traffic is the only concern.

Possible Staging Areas at a Hazardous Waste Site.



- Staging areas are site specific.
- Amount and size of containers and materials envolved will dictate area.

V. HAZARDS ASSOCIATED WITH HANDLING DRUMS

Working with drums and other containers can present the following six hazards:

1. Unknown materials

2. Spills, leaks and ruptures

3. Physical exposure (through lungs, skin or mouth) to toxic chemicals

4. Fires and explosions

5. Unforeseen emergencies

6. Back injuries

Preventing Physical Exposure to Toxic Chemicals

When you work with drums it is important to protect your lungs, skin and eyes from harmful contacts with chemicals. OSHA requires your employer to have a respiratory protection program. This program should state exactly what type of protection is necessary for each job where you work. If you do not know the contents of a drum, **use at least level B protection**.

Always open bulging, corroded, dented, and otherwise damaged drums by remote handling tools. If the contents of a drum are known to be non-explosive and the drums are not damaged, use the following safety procedures for manual opening.

- complete, appropriate protective equipment (respirators, splash aprons, eye protection, gloves);

- drum should be positioned upright, bung up or, if a side bung is used, drum on its side, bung up;

- wrench bung plug open slowly and steadily; keep fire extinguishers available;

- if there is evidence of reactive, incompatible chemicals, pressurized contents or sudden release of toxic gases/vapors in high concentration,

  STOP, evacuate and finish the job using remote handling tools.

VI. PREVENTING ACCIDENTS AND EMERGENCIES

Your workplace should have an **emergency action plan** for any emergency that may occur. The plan must be in written form. It must explain **who** does **what** and **when** during an emergency.

Be sure that you and your co-workers practice the steps in the emergency action plan frequently. These practices should include the fire department and all affected workers.

Preventing Back Injuries

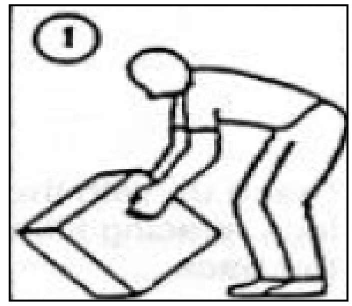
Fires, explosions, and toxic gases are important and immediate dangers. **However, the most common hazard for workers working with drums is back injury.**

When handling drums, manual handling means lifting, lowering, pushing, pulling, carrying, moving, or holding drums of all sizes. If possible, use the following suggestions to avoid strain injuries:

- Introduce bulk handling to eliminate the use of drums
- Provide and use mechanical handling equipment
- Palletize the drums and use mechanical lifting
- Allocate sufficient space for handling the drums
- Use a drum lifter
- Ask your supplier to provide smaller sized drums
- Clean up floor spills immediately
- Provide unloading ramps
- Provide and maintain even and non slip floors

The following are lifting guidelines to take into account when working with drums:

1. Place what you will lift as high above the ground as possible. (Stand it up if it is a sack. Stand it on a corner if it is a box)



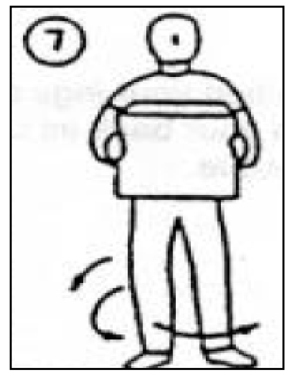
2. Get the object as close to your body as possible.

3. Position your legs and feet firmly, with your back as straight as possible.

4. Lift smoothly with the arms first, and roll the object over your knee. Do not jerk.

5. Pull the object as close to you as possible.

6. Stand up with the load, using the legs, placing little or no strain on the back.



7. If you need to turn, do so with your feet. **Do not twist your back, hips, or shoulders.**

8. When lifting a load overhead, make the load lighter, because you cannot use your legs to help you lift.

VII. SAMPLES AND SAMPLING METHODS

Sometimes it is required to get a sample of a hazardous waste substance in order to determine what it is (if unknown), concentration and what precautions should be taken when handling the substance. To start, let us define what a sample is.

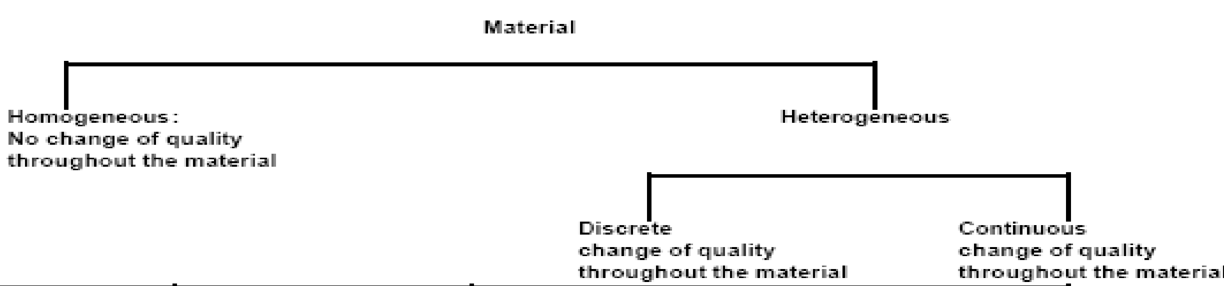
What is a sample?

A sample is a representative part of the material to be analyzed.

- To be representative, the sample needs to be chosen so that it has and maintains the same qualities as the material being investigated.
- Degradation or alteration of the sample through exposure to air, excess heat or cold, or contaminants from the container must be avoided during collection, transport, and delivery to the analyst (usually a laboratory).
- The number and frequency of sub-samples (samples making up a composite sample) should reflect the nature of the material being sampled. Materials can be divided into three basic groups as outlined in the figure below.

  For example, if the material is thought to be homogeneous (the same throughout), a single sample may be enough. If the sample is thought to be heterogeneous (of varying composition throughout), several samples should be collected at specific time intervals or distances.

Types of Materials



Homogeneous	Discrete Changes	Continuous Changes
Well-mixed liquid Well-mixed gases Pure metals	Ore pellets Tablets Crystallized rocks Suspensions	Fluids or gases with gradients Mixture of reacting compounds Granulated materials with granules much smaller than sample size

Purpose of any sampling program:

To produce a set of samples representative of the materials under investigation that are suitable for analysis.

Purpose of hazardous waste sampling:

- To gain information to help investigators identify unknown materials.
- To assess the extent to which these materials have become integrated into the surrounding environment.
- To help plan remedial actions.

Types of samples:

When discussing types of samples, it is important to distinguish between the type of media to be sampled and the sampling method that gives a specific type of sample. There are two basic types of media samples: the environmental sample and the hazardous sample.

- Environmental samples are generally dilute (in terms of pollutant concentration) samples taken from an area surrounding a spill or dump site (e.g., off-site samples from soils, rivers, lakes, etc.). They usually do not require special handling procedures. However, in certain instances, environmental samples can contain high concentrations of pollutants, and in such cases would have to be handled as hazardous samples.

- Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, etc. They require special handling procedures because of their potential toxicity or hazard.

There are two important criteria for making the distinction between environmental and hazardous samples:

Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner that is safe for both field and laboratory personnel.

Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to United States Department of Transportation (USDOT) regulations and Environmental Protection Agency (EPA) guidelines. These regulations (49 CFR parts 171 through 180) describe proper marking, labeling, packaging, and shipment of hazardous wastes. In particular, part 172.402 (h) of 49 CFR is intended to cover shipment of samples of unknown materials destined for laboratory analysis. If there is any doubt about the hazardous nature of a material, the sample should be considered hazardous and shipped accordingly.

Important: If you are packing, preparing, shipping papers (including hazardous waste manifest), marking, labeling or placarding shipments involving hazardous materials (waste), you must be trained and certified by your employer as required in 49CFR, Subpart H, commencing with Section 172.700.

Sampling methods:

For sampling situations involving hazardous wastes, **grab sampling** techniques are generally preferred because they:

- minimize the amount of time sampling personnel must be in contact with the wastes;
- reduce the risks associated with compositing unknowns; and
- eliminate chemical changes that might occur due to compositing.

Integrated sampling (compositing) is still often used for environmental samples and may be used for hazardous samples under certain conditions (after compatibility tests have been completed).

VIII. SAMPLING METHOD SELECTION CRITERIA

Investigations at hazardous waste sites place more demands on personnel, materials, and methods than those usually found in routine environmental surveys. Thus, the collection of hazardous waste samples will frequently require special equipment and methods. Certain criteria should be considered when selecting a sampling method. Some important considerations are:

- **Safety** - The risk to sampling personnel, intrinsic safety of instrumentation, and safety equipment required for conducting sampling all need to be considered in relation to the selection of proper methods and procedures.
- **Representativeness** - The point of sampling is to collect samples that represent the material of interest. The selected methods, although strongly considering economics, simplicity, versatility, and practicality, must also give a true representation of the situation under investigation.
- **Versatility** - Methods and materials must be useful in a wide range of situations and applications because of the unknown nature of many hazardous waste investigations and environmental spill responses. Versatility, however, should not jeopardize the representativeness of the sample.

- **Ability to Minimize Exposure** - Hazardous waste sampling has the ability to produce both acute and chronic exposure to dangerous, toxic chemicals. Sample methods must be used that minimize personnel exposure.

- **Practicality** - The selected methods should stress the use of simple, practical, proven procedures that can be easily adapted to a variety of situations.

- **Simplicity and Ease of Operation** - Because of the nature of the material to be sampled, the hazards of sampling, and the heavy and uncomfortable safety equipment often required, the sampling procedures selected must be relatively easy to follow. Equipment should be easy to operate, portable, lightweight, rugged, and, if possible, direct-reading.

- **Economics** - The costs of equipment, manpower, and operational maintenance need to be considered in relation to overall benefit. Instrument durability, disposable equipment, cost of decontamination, and degree of precision and accuracy required should also be considered.

IX. SAMPLING PLAN

Before beginning any sampling activities, it is important to identify the purpose of the sampling program, equipment, methods, and logistics to be used by developing a sampling plan. This plan should be developed along with or immediately following the preliminary site assessment.
The plan should be clear and concise and should detail the following basic components:

- background information collected during the preliminary assessment;
- objectives and goals of the investigation;
- sampling methods to be used, including equipment, procedures, sample containment, and preservation;
- justification for selected methods and procedures;
- sample locations, including number and types of samples to be collected at each location;
- organization of the investigative team;
- safety plan (includes safety equipment and decontamination equipment,
- transportation and shipping information;
- training information;
- additional site-specific information or requirements.

Note that this list of sampling plan elements may be incomplete and that additional component may be added or altered depending on the specific requirements of the field investigation. It should also be noted that although a detailed sampling plan is important, it may be impractical in some situations. For example, emergency responses to accidental spills usually prohibit the development of site-specific sampling plans. In such cases, investigators will have to rely on general guidelines and personal judgment. The sampling plans may then be finalized on site.

In any case, a plan of action needs to be developed, no matter how informal, to help investigators consistently perform their tasks.

X. DOCUMENTATION

Field Logbook

All information regarding the investigation must be written in a bound book with consecutively numbered pages. Entries in the logbook must include at least the following:

- Date and time of entry.
- Purpose of sampling.
- Name and address.
- Producer of the waste, and address (if known).
- Type of process producing the waste (if known).
- Type of waste (sludge, wastewater)
- Description of sample.
- Waste components and concentration (if known).
- Number and size of sample taken.
- Description of sampling point.
- Date and time of sample collection.
- Collector's sample identification number(s) and/or name.
- References, such as maps or photographs of the sampling site.
- Field observations.
- Field measurements, such as pH, flammability, or explosiveness.

Notes should be as descriptive as possible. Someone reading the entries should be able to reconstruct the sampling situation from the written information. If anyone other than the person to whom the logbook was assigned makes an entry, he/she must date and sign it.

Photographs

Photographs are the most accurate record of the investigator's observations. They should be taken with a camera-lens system with a perspective similar to that of the naked eye. Photographs can be important during future inspections, informal meetings, and hearings. A photograph must be documented if it is to be for any of these situations. Therefore, for each photograph taken, the following items should be recorded in the field logbook:

- Date and time.
- Signature of photographer.
- Name and identification number of site.
- General direction faced and description of the subject.
- Location on site.
- Sequential number of the photograph and the roll number.

Sample Labels

Each sample must be sealed immediately after it is collected. Labels should be written using waterproof ink. Label tags may be filled out before sample collection to minimize handling of the sample containers.

Labels must be firmly attached to the sample containers. Tags may be attached by string when gummed labels are not available or applicable. Be sure that the container is dry enough for a gummed label to be securely attached. The label tag must include at least the following information:

- Name of the collector
- Date and time of collection
- Place of collection and Sample number

Occasionally, sample containers are marked in the field using an etching tool rather than immediately applying a sample label or tag. This avoids possible label contamination problems and decontamination difficulties. In this case, the sample label data are written into a sampling logbook and written onto the label after the sample containers have been decontaminated.

XI. CHAIN-OF-CUSTODY PROCEDURES

Written procedures must be available and followed whenever samples are collected, transferred, stored, analyzed, or destroyed. The main objective of these procedures is to create an accurate written record that can be used to trace the possession and handling of the sample from its collection through its analysis.

A sample is in someone's custody if any of the following conditions are met:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It is in one's physical possession and then locked up so that no one can tamper with it.
- It is kept in a secured area, restricted to authorized personnel only.

Sample Collection, Handling, and Identification:

The number of persons involved in collecting and handling samples should be kept to a minimum. Final records should be completed at the time the sample is collected and should be signed or initialed, including the date and time, by the sample collector(s). One member of the sampling team should be appointed field custodian. Team members who collect the samples turn the samples over to the field custodian, who then documents each transaction. The sample remains in his/her custody until it is shipped to the laboratory.

Prior to shipping, the sample container should be placed in a transportation case, along with the chain-of-custody record, pertinent field records, and analysis request forms as needed. The transportation case should be sealed or locked to reduce the need for close control of individual samples. In situations when the use of a chest is inconvenient, the collector should seal the cap of the individual sample container in a way that any tampering would be easy to detect.

Transfer of Custody and Shipment:

When transferring the samples, the person receiving the sample must sign and record the date and time on the chain-of-custody record. Every person who takes custody must fill in the appropriate section of the chain-of-custody record. To minimize custody records, the number of custodians in the chain-of-possession should be minimized.

All packages sent to the laboratory should be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be kept in the originating office (either carbon or photocopy). Mailed packages can be registered with return receipt requested. For packages sent by common carrier, receipts should be kept as part of the permanent chain-of-custody documentation. Samples to be shipped must be packed so as not to break. The package should be sealed or locked so that any tampering can be easily detected.

XII. PACKAGING AND SHIPPING

Environmental samples may be packaged following the procedures outlined for samples classified as "flammable liquids" or "flammable solids". Requirements for marking, labeling, and shipping papers do not apply.

Environmental samples may also be packaged without being placed inside metal cans, as required for flammable liquids or solids. Instead:

- Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag.
- Place sample in a fiberboard container or metal picnic cooler that has been lined with a large polyethylene bag.
- Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
- Seal large bag.
- Seal or close outside container.

Hazardous Material Samples:

Samples not determined to be environmental samples or samples known or expected to contain hazardous materials must be considered hazardous material samples and transported according to the following requirements:

If the material in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101.

For samples of hazardous materials of unknown content, 49 CFR allows the designation of hazard class based on the shipper's knowledge of the material and selection of the appropriate hazard class from part 173.2

The correct shipping classification for an unknown sample is selected through the process of elimination, using the DOT classification system. Unless known or demonstrated otherwise (through the use of radiation survey instruments), the sample is considered radioactive and appropriate shipping regulations for "radioactive material" must be followed.

Basic rules:

49CFR 172.101(c) (9) Hazardous wastes - If the word " waste" is not included in the hazardous material description in Column 2 of the Table, the proper shipping name for a hazardous waste (as defined in § 171.8 of this subchapter), shall include the word "Waste" preceding the proper shipping name of the material. For example: Waste acetone

49CFR 172.101(c)(11) Except for a material subject to or prohibited by § 173.21 , 173.54 , 173.56(d) , 173.56(e) , 173.224(c) or 173.225(b) of this subchapter, a material that is considered to be a hazardous waste or a sample of a material for which the hazard class is uncertain and must be determined by testing may be assigned a tentative proper shipping name, hazard class, identification number and packing group, if applicable, based on the shipper's tentative determination according to:

(i) Defining criteria in this subchapter;

(ii) The hazard precedence prescribed in § 173.2a of this subchapter;

(iii) The shipper's knowledge of the material;

(iv) In addition to paragraphs (c)(11)(i) through (iii) of this section, for a sample of a material other than a waste, the following must be met:

(A) Except when the word " Sample" already appears in the proper shipping name, the word " Sample" must appear as part of the proper shipping name or in association with the basic description on the shipping paper.

(B) When the proper shipping description for a sample is assigned a " G" in Column (1) of the § 172.101 Table, and the primary constituent(s) for which the tentative classification is based are not known, the provisions requiring a technical name for the constituent(s) do not apply; and

(C) A sample must be transported in a combination packaging that conforms to the requirements of this subchapter that are applicable to the tentative packing group assigned, and may not exceed a net mass of 2.5 kg (5.5 pounds) per package. Note to Paragraph (c)(11): For the transportation of self-reactive, organic peroxide and explosive samples, see §§ 173.224(c)(3) , 173.225(b)(2) and 173.56(d) of this subchapter, respectively.

Example: Samples Classified as Flammable Liquids or Flammable Solids:

The following procedure is designed to meet the requirements for "limited quantity" exclusion for shipment of flammable liquids and solids, as described in parts 173.150 of 49 CFR. By meeting these requirements, the DOT constraints on packaging are greatly reduced. Packaging according to the limited quantity exclusion requires notification on the shipping papers.

A. Packaging

1. Collect sample in a glass container (16 ounces or less), with nonmetallic, Teflon-lined screw cap. To prevent leakage, fill the container no more than 90 percent full at 130 degrees F. If an air space in the sample container would affect sample integrity, place that container within a second container to meet 90 percent requirement.

2. Complete sample identification label tag and attach securely to sample container.

3. Seal container and place in 2-millimeter-thick (or thicker) polyethylene bag, one sample per bag. Place identification tag so that it can be read through the bag. Seal the bag.

4. Place sealed bag inside a metal can and cushion it with enough noncombustible, absorbent material (e.g., vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other means to hold can lid securely, tightly, and permanently.

5. Place one or more metal cans into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans with noncombustible, absorbent, cushioning material for stability during transport.

6. Limited quantities of flammable liquids, for the purpose of this exclusion, are defined as one pint or less.

B. Marking/Labeling

1. Use abbreviations only where specified.

2. Place the following information, either hand-printed or in label form, on the metal can:
    - Laboratory name and address.
    - "Flammable Liquid, n.o.s. ID 1993"

   If the flammable liquid or flammable solid is identified, then "not otherwise specified" (n.o.s.) is not used. Instead, the name of the specific material should be listed before the hazard class (e.g., Acetone, 3) followed by its appropriate UN number found in the DOT hazardous materials table (172.101).

3. Place the following DOT labels (if applicable) on outside of can (or bottle):

    - Class 3 USDOT label
    - "Cargo Aircraft Only." Must be used if net quantity of sample in each outer container is greater than one quart (for "Flammable Liquid, n.o.s.") or more than 25 pounds (for "Flammable Solid, n.o.s.").

4. Place all information on outside shipping container as on drum, pail or other container, specifically:

- Proper shipping name.
- ID number.
- Proper label(s).
- Addressee and addressor.

Print "Laboratory Samples" clearly on top of shipping container. Put orientation arrows (49CFR 172.312) on two opposing sides of container.

C. Shipping Papers

1. Use abbreviations only where specified.

2. Complete carrier-provided bill of lading and sign certification statement (If carrier does not provide, use standard industry form.) Provide the following information in the order listed. (One form may be used for more than one exterior container.)

   - "Flammable Liquid, n.o.s. UN1993"
   - "Limited Quantity"
   - Net weight or net volume just before or just after "Flammable Liquid, n.o.s. ID 1993", PG* *Insert correct packing group I, II or III
   - Further descriptions such as "Laboratory Samples" or "Cargo Aircraft Only" (if applicable) are allowed if they do not contradict required information.

3. Include chain-of-custody record in the outside container.

D. Transportation

1. Transportation unknown hazardous material samples classified as flammable liquids by rented or common carrier truck, railroad, or express overnight package service.

2. Do not transport by any passenger-carrying air transport system, even if it has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airlines that carry only cargo.

E. Other Considerations

1. Check with laboratory for size of sample to be collected and if sample should be preserved or packed in ice.

2. For overnight package services, determine weight restrictions.

MODULE 14

Health and Safety Program

Module 14
Health and Safety Program

GISO 5192 (b) & (q)

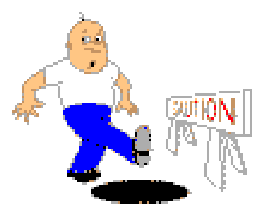
OUTLINE

I. General

II. Components of the Health and Safety Plan (HASP)

III. Site-specific HASP

IV. Incident Command System



OBJECTIVES

At the end of this session, trainees will be able to:

1. Provide a safe and healthful work environment by identifying and controlling hazards.

2. Present a mechanism for organizing thoughts and approaches and documenting activities.

3. Develop a structure for action, especially in an emergency.

I. GENERAL

A Health and Safety Plan (HASP) is a written procedure, which is required to identify, evaluate, and control health and safety hazards at the site, and to facilitate emergency response.

The plan must be maintained by the employer and made available to:

- Any worker or worker representative
- Any contractor, subcontractor, or other representative working for the employer who may be exposed to hazards
- Compliance officers of federal, state, and local agencies with regulatory authority over the site

As required by HAZWOPER, the HASP must include:

- Organizational structure
- Work plan
- Safety and health programs
- Medical monitoring program
- Emergency response plan
- Standard operating procedures (SOPs) for health and safety
- Site communication program

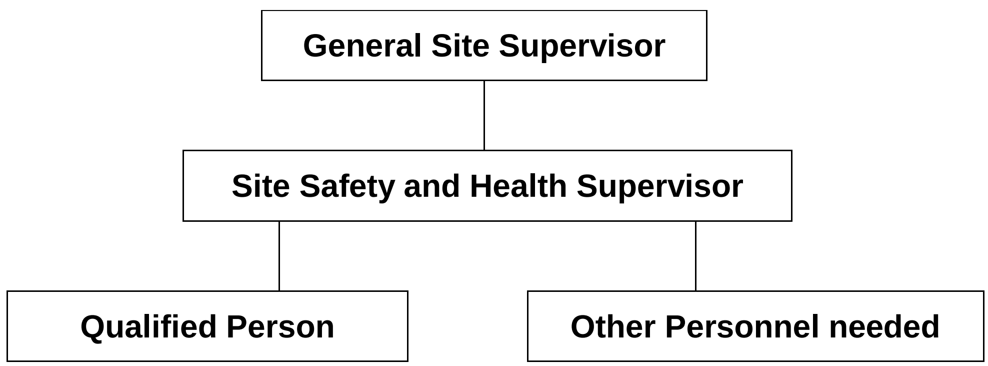
Employers should allow the worker time to review the Health and Safety Plan and understand all phases of it.

If the worker is asked to sign the HASP, the worker should read and understand what they are signing or ask questions prior to signing.

II. COMPONENTS OF THE HASP

A site specific written HASP must include certain general sections. Each is described briefly as follows:

Organizational Structure – this section identifies the chain of command in the employer's organization; states the responsibilities of supervisor and workers; identifies the general supervisor for all hazardous waste operations; describes the responsibilities of other workers involved; and identifies the lines of authority, communication, and coordination.



It is necessary to review and update the structure periodically to show changes in workers and operations.

Work Plan – comprehensive plan developed for each site to determine the method and resources needed to carry out the HASP. The work plan identifies clean-up activities and normal SOPs; defines tasks, objectives, and methods of accomplishment; establishes personnel requirements; implements training programs, informational programs, and medical surveillance.

Some of the activities that should take place, although not required by the standard, are:

- Review the available information such as site records, waste inventories manifests, sampling data, site photos, etc

- Determine workers' physical requirements and equipment requirements

Safety and Health Training Programs – the HAZWOPER standard requires that the safety and health training programs include training for **all site workers and supervisors** that must address:

- Hazards on site
- Work practices to reduce risk
- Medical surveillance requirements
- Safe use of PPE and equipment
- Safe use of engineering controls
- Decontamination and spill containment

Medical Monitoring Program – required to include details for ensuring and monitoring the general health of workers. The HASP must address the medical surveillance requirements and site-specific surveillance concerns. Refer to the Medical Surveillance Module for more details.

Emergency Response Plan – site-specific plan to provide initial responders information to determine what happened, what equipment is needed, whether there are casualties, injured, or missing workers, what could happen next, and what can be done.

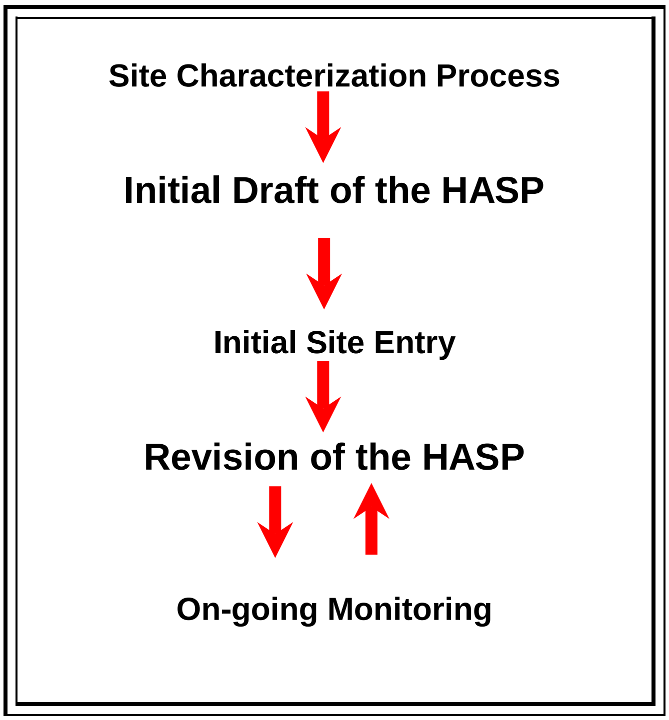
Standards Operating Procedures – the HAZWOPER standard requires employers to have SOPs for safe work practices. The SOP explains step by step how to do a task.

Site Communication Program – must be established and followed at all operations. It is important that all personnel be aware of how to receive and transmit information in a clear manner since communications vary from site to site. Information can be transmitted through:

- Bulletin boards, tool-box talks, public address loud speakers
- Evacuation alarms, hand signals, portable two-way radios

III. SITE-SPECIFIC HEALTH AND SAFETY PLAN

The site health and safety plan must be kept on site, shall address the health and safety hazards of each phase of site operation, and includes the requirements and procedures for workers protection. At each phase in the site characterization process, information should be gathered and evaluated to determine possible hazards. This assessment can then be used to amend the HASP.



Once the initial entry is done, the site manager is responsible for updating the HASP to reflect changes. Any deficiencies in the effectiveness of the site HASP shall be corrected by the employer. At most sites, any sampling done during the initial site entry will provide accurate information about the level of PPE and the proper designation of work zones.

On-going monitoring provides an indicator for any changes that may need to be made to the HASP. Periodic monitoring should be done when:

- Exposures have risen above the PELs
- Other dangerous conditions exist
- New tasks are initiated or site conditions changes, especially weather

When a new technology, a new task, or a hazard is introduced to a site, the HAZWOPER standard requires that the site HASP be updated. If a subcontractor is working at a site, the subcontractor should carefully evaluate and identify all work and prepare an addition to the HASP for any hazards. This plan should be submitted to the site manager who will approve or disapprove it. An approved plan must be developed for each site-specific area before work can start.

To Follow during and Emergency

Any worker at your worksite could be the first to recognize an emergency. Therefore, it is very important that all workers know the steps to take in the event of an emergency.

Accident-related emergencies

- Fire
- Explosion
- Leak
- Release of toxic vapors
- Collapse of containers
- Reaction of incompatible chemicals

Work-related emergencies

- Minor accidents (slips, trips, falls)
- Excessive contact with chemicals or radiation
- Medical problems (e.g., heat stress and heart attacks)
- Physical injury (injury from hot or flying objects, loose clothing entangled in machinery, serious falls, accidents)

Equipment-related emergencies

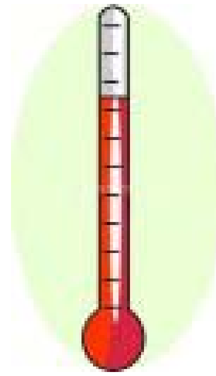
- Personal protective equipment failure (air source failure, tearing or permeation of protective clothing, facepiece fogging)
- Electrical problems (burns, shock electrocution)
- Machinery defects

Environment-related causes

- Weather change (rain, lightning, etc).
- Natural disasters (earthquakes, floods, hurricanes, tornadoes)

Pre-Entry and Post-Entry Assessments.

Medical support and assessment is an important element of an effective entry. Medical monitoring should be initiated both before entry into the Exclusion Zone, and after exiting.



More important than the legal requirements for medical monitoring is the personal impact of monitoring on the individual. Heat related illness (heat stress, heat exhaustion and heat stroke) is the number one health risk to workers in chemical protective clothing. Heat related illnesses are most prevalent during warm or hot weather. Monitoring vital signs provides the best method to prevent or identify these conditions. Obviously, the backbone of this program rests with assigning critical values that identify these symptoms before they become serious.

Baseline medical evaluations are conducted under the guidance of a physician and are done biennially, annually, or prior to work. Pre-entry physicals are routinely conducted by workers trained in the medical field or first aid and assigned exclusively to this duty at the work site and answer directly to Site Safety only. Post-entry screening applies the monitoring guidelines, as suggested in this chapter.

Personnel should establish a medical monitoring station at each site. The medical monitoring site should be located near the “dress out” area for the Entry and Decon Team personnel. If possible, this should be in a cool, shaded location away from noise and other distractions.

All pre-entry and post-entry vitals that are taken must be documented. Therefore, companies/agencies should establish some sort of record keeping system to document these vitals.

Elements of an Effective Medical Monitoring Program.

Advances in medical science have altered our understanding of what constitutes heat illnesses and what their more accurate indicators are assessing the patient’s body core temperature, heart rate and water weight loss. Therefore, an effective medical monitoring program should include assessments of these essential factors.

Body temperature:

Tympanic temperature readings (taken through the ear drum) are a good indicator of body core temperatures and are relatively easy to acquire.

The best method of accurately determining an individual's temperature rise is by establishing a baseline prior to the event. This is accomplished by measuring the temperature every day over a two week period. However, this is not always an easy task to accomplish. Again, some guidelines can be utilized:

- A maximum rise in temperature should not exceed 1.5 degrees Fahrenheit upon post-entry examination.
- No personnel should be permitted to continue working until their temperatures return to within 0.5 degrees of normal.
- To be valid, the temperature must be acquired as quickly as possible after the individual has exited the work zones.

Pulse or heart rate:

The pulse is the best indicator of the overall stress being applied to the body. It is a direct measurement of how fast the body is attempting to cool itself, and it indicates the aerobic exercise recently generated by the individual. The most widely accepted pulse measurement is known as the *"Age Adjusted Maximum Heart Rate."* This figure represents the limit to which an individual can maintain aerobic exercise for extended periods without damaging the heart muscles. However, this number should never be exceeded by personnel. To figure the Age Adjusted Heart Rate, subtract the individual's age from the number 220.

220 - age = Adjusted Heart Rate

Blood pressure: This is a health component that is not believed to be affected by heat stress, and does not require constant monitoring. However, it is a measurement of the "quality" of rest by the heart muscle between each stroke and is worth tracking.

General health: Is an overall indicator of the workers fitness for stressful working environments. This includes general physical appearance and identification of personnel who haven't been feeling well lately.

Neurological status: Can be an early indicator of stress and/or exposure.

Electrocardiograph strip: These devices are rarely available in the field, but they are a good, qualitative baseline when they are.

Water Loss:

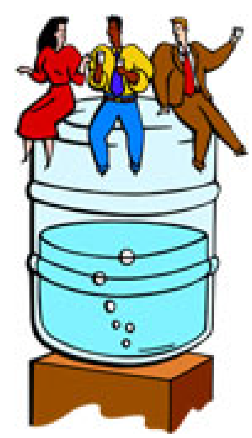
Suggested water weight loss parameters are:

Fluid loss is an element of heat stress management that cannot be made up quickly. Fluid metabolism is a slow process that must occur throughout the day to be truly effective. When considering the administration of fluids, do not rely on the patient's thirst level alone.

- Body weight loss should not be allowed to exceed 1.5% of total body weight.
- A 3% loss of body weight should require that the individual be immediately removed from all duties pending a thorough assessment by a qualified medical authority.
- A 5% loss of body weight should require that the individual be immediately transported to the nearest medical facility for a thorough assessment.

Be cautious when taking the post-entry body weights. Post-entry assessment is intended to weigh the amount of fluid remaining in the body tissues. Weighing individuals who have rehydrated or are still in sweat soaked garments defeats the purpose of the measurement. Pools of liquid in the stomach or hanging on the body serve no immediate value and may mask a serious condition. Make sure the post-entry weight is a "dry" one.

Fluid Replacement, Rest and Recuperation Guidelines.



The Medical Monitoring plan must address every factor pertinent to the full recovery and return-to-work of all personnel. These factors include: fluid replacement, rest, and heart recovery.

Water is the best fluid replacement. Sweetened drinks tend to inhibit the metabolic process that restores water to the cells, as does carbonation. However, personnel should be allowed to drink something that they like. Fruit juices and electrolyte solutions should be diluted with water prior to consumption. This will improve the body's ability to assimilate these liquids. Alcohol and caffeinated drinks should never be permitted because they actually promote dehydration, as do salt tablets. Additionally, drinks that are cooled to between 50˚F - 60˚F better facilitate the absorption of water by the body.

Rest Periods:

The medical monitoring plan may use a variety of methods to determine rest and recuperation periods. As an example, aerobically fit personnel, working under normal conditions for twenty minutes should rest as shown below.

Ambient Air Temperature	Rest Period
< 70˚F	30 minutes
70-85˚F	45 minutes
> 85˚F	60 minutes

Recommended work durations, between rest periods, for personnel wearing CPC is covered by the Occupational Safety and Health Guidance manual for Hazardous Waste Site. However, minimum recovery guidelines must to be utilized to determine when personnel have returned to a condition where they may wear CPC and return to a work zone again. The minimum suggested health guidelines are shown below.

Vital Sign	Minimum Guideline
Temperature	A return to within .5 degrees of normal
Body Weight	A return to within 1.5% of normal
Pulse	A return to within 5%, and
	< 90 beats per minute
Blood Pressure	< 150/90

These are guidelines, and should be based upon the guidance of your physician.

Guidelines for Removing Workers.

A worker manifesting any one of the following signs should be removed from work. Workers removed from work due to these medical signs are not allowed to return to work until cleared by a qualified medical authority:

Vital Sign	Point at Which Responders Should Be Removed from Work
Body Temperature	> 38˚C (100.4˚F) – ACGIH action level
Pulse	> 85% of the maximum heart rate (Maximum 220-age)
	> 110 beats per minute while the individual is at rest
Heart rate recovery	< 10 beats per minute *
Body weight loss	> 3%
Other	Other signs and symptoms of heat related illness such as skin temperature and cardiac rhythms

* Heart rate recovery is measured by taking the first and third minute pulse rates immediately upon exiting the work zone and then determining the difference. It is stated as:
(Heart rate recovery = 1 minute rate - 3 minute rate)

Work Mission Duration
Worksheet Instructions

Each part of the Work Mission Duration Form which needs to be completed is explained below: These are guidelines to assist with stress in chemical clothing.

1. Air Supply: Across the top of the form are standard air supplies (30/45/60 minute air bottles and umbilical air). When completing the form, enter information into the column that corresponds to the air supply being used by the worker.

2. Safety Factor: A standard rule of thumb is that personnel should be able to perform the task, exit the zone, complete decontamination, and begin doffing before the low-air alarm bell sounds. On most SCBAs the bell will alarm with approximately 20% air reserve. Therefore, 5 minutes is an acceptable standard entry in this portion of the form for a thirty minute bottle for the average user.

3. Travel Time: This should be a close estimation of the travel time to and from the site.

4. Environmental Conditions: Environmental conditions impact emergency response personnel before they don PPE, while they are working, and after they doff the garments. Temperature and humidity are the primary factors to be concerned about. The recommended entries are as follows:

Entry	Environmental Condition
0	Cool and Dry
5	Warm and Moist
10	Hot and Wet

5. Work Load: The type of work is another measurable factor. The greater the work load, the greater the impact. The recommended entries are as follows:

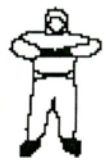
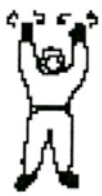
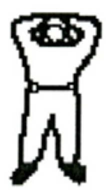
Entry	Work Load
0	Light
5	Moderate
10	Heavy

6. Decontamination: De-con takes time to accomplish. The more people who need decontamination, the more time will be required. The number entered into this row should account for the time that it takes to decontaminate *all* team members.

7. Other: This row provides a place to account for other factors which impact air supply such as age, obesity or personal habits.

8. Operating Work Time: The estimated operating work time is entered at the bottom of the form. To determine the operating work time, add the entries from all the previous rows, then subtract that number from the total air supply available.

Work Mission Duration Worksheet

Hand Signals	Air Supply	30 Minutes	45 Minutes	60 Minutes	Umbilical Air
	Safety Factor				
Out of Air	Travel Time In				
	Travel Time Out				
Need Help	Environmental Conditions (L=0, M=5, H=10)				
	Work Load (L=0, M=5, H=10)				
Evacuate	Decontamination				
	Other				
O.K.	Operating Work Time				

Recommended Work Time Between Rest Periods			
Air Temperature	Sunshine (Radiant Heat Exposure)		
	Full Sun	Partly Sunny	Full Shade
70^{o}F	60 min. of work	90 min. of work	120 min. of work
75^{o}F	30 min. of work	60 min. of work	90 min. of work
80^{o}F	20 min. of work	30 min. of work	60 min. of work
85^{o}F	15 min. of work	20 min. of work	30 min. of work
90^{o}F	15 min. of light work	15 min. of work	20 min. of work
95^{o}F	Extreme Danger	Danger	15 min. of work

Critical Values for the Medical Monitoring Worksheet

Weight	3% Loss	5% Loss
130	126	124
135	131	128
140	136	133
145	141	138
150	146	143
155	150	147
160	155	152
165	160	157
170	165	162
175	170	166
180	175	171
185	179	176
190	184	181
195	189	185
200	194	190
205	199	195
210	204	200
215	209	204
220	213	209
225	218	214
230	223	219
235	228	223
240	233	228
245	238	233
250	243	238
255	247	242
260	252	247
265	257	252
270	262	257
275	267	261
280	272	266
285	276	271
290	281	276
295	286	280
300	291	285

Age	MHR	85% MHR	60% MHR
20	200	170	120
21	199	169	119
22	198	168	119
23	197	167	118
24	196	167	118
25	195	166	117
26	194	165	116
27	193	164	116
28	192	163	115
29	191	162	115
30	190	162	114
31	189	161	113
32	188	160	113
33	187	159	112
34	186	158	112
35	185	157	111
36	184	156	110
37	183	156	110
38	182	155	109
39	181	154	109
40	180	153	108
41	179	152	107
42	178	151	107
43	177	150	106
44	176	150	106
45	175	149	105
46	174	148	104
47	173	147	104
48	172	146	103
49	171	145	103
50	170	145	102
51	169	144	101
52	168	143	101
53	167	142	100
54	166	141	100

IV. INCIDENT COMMAND SYSTEM

Incident Command

A. An Incident Commander has overall responsibility for all actions that occur during response to hazardous materials emergencies.

B. An Incident Commander ***must*** be established for each incident subject to the HAZWOPER rule:

   1. 29 CFR 1910.120 (q) – Federal OSHA regulation.

   2. 8 CCR Section 5192 (q) – Cal-OSHA regulation.

C. Certain environmental regulations also stipulate that an Incident Command be established to oversee incident management.

   1. Example: CGC 8670 (Department of Fish and Game Code) for Oil Spill Prevention and Response (OSPR).

D. Option for "Single or Unified" command:

   1. When a single agency or entity will be responsible for all aspects of incident management, one individual with command authority will assume "Single Command". This is a rare situation in hazardous materials response due to many governmental and private jurisdictional concerns.

   2. When multiple agencies or entities all share responsibilities for a given spill response, lead individuals from each response entity will co-locate and operate one "Unified Command", producing common objectives, pooling resources, and specking with one voice. It is not uncommon to have Law Enforcement, Fire, Health, Environmental, and Responsible Party representatives all participating in Unified Command for a given incident.

E. Duration of Command:

   1. OSHA rules stipulate that Incident Command shall be operational as long as emergency response operations subject to the HAZWOPER rules are in effect.

NIMS and SEMS:

Background:

Recent catastrophic events emphasized the need for a nationwide system of emergency management with common terminology and a standard structure that would allow all levels of government to interact and respond and recover effectively.

In 2003, the President issued Homeland Security Presidential Directive-5 (HSPD-5) directing the Secretary of Homeland Security to develop and administer a National Incident Management System (NIMS). For the purpose of providing a consistent nationwide approach for federal, state, local and tribal governments to work together more effectively and efficiently to prevent, prepare for, respond to, and recover from emergencies and disasters.

- Federal agencies required to use NIMS by law.
- States must be compliant with NIMS in order to apply for Federal preparedness grant funding. Grants from:
  - ✓ USDA
  - ✓ Centers for Disease Control
  - ✓ Dept. of Energy
  - ✓ FEMA

- SEMS is now incorporating those areas in NIMS that were not automatic
  - ✓ Private sector
  - ✓ Tribal governments

Some coordination with these groups in SEMS, but not consistently. That is now changing.

NIMS:
The National Incident Management System (NIMS) is an incident management framework created by United States Presidential Directive in 2004. Under NIMS local, state and federal first responder agencies and departments tasked with incident management responsibilities must utilize the Incident Command System (ICS) and other NIMS principles when responding to a variety of incidents that may occur within their jurisdictions.

SEMS:
NIMS compliance for California consists of integrating Standardized Emergency Management System (SEMS) and NIMS to the extent possible as directed by the Governor’s Executive Order S-02-05. Specific NIMS/SEMS/ICS (Incident Command System) training is required for all public employees who may be called upon during an emergency. Failure to be NIMS compliant may result in loss of Federal assistance and grant funding.

EMA:
California Emergency Management Agency (EMA) previously Office of Emergency Services (OES) recently traveled to Washington D.C. and was able to meet directly with Al Fluman, the Director of the NIMS Integration Center to clarify new training requirements and expectations.

Federal Fiscal Year 2007 training requirements include:

- Completion of ICS-300 by:
  Middle management, Command, and general staff
- Completion of ICS 400 by:
  Command and general staff

To date, California has made significant progress in the integration of SEMS/NIMS. This effort reinvigorated the SEMS Maintenance System, as directed by Governor Schwarzenegger in Executive Order S-02-05. The SEMS Advisory Board established several Specialist Committees to develop materials to assist in meeting the FY 06 NIMS requirements. These materials were compiled in the *California Implementation Guidelines for the National Incident Management System – NIMS.* These guidelines are available on the OES website.

The most significant difference for Federal Fiscal Year 07 is the elimination of the statewide self-certification. FFY 07 and future NIMS requirements will use performance metrics that capture details on how a jurisdiction has met the FY 05 and FY 06 requirements. Compliance assessment with these metrics will provide the basis for all future federal preparedness funding beginning with FFY 2008. Compliance metrics are organized in tiers; Tier One requirements are those that must be completed this fiscal year, and Tier Two are future requirements.

Designated Responsibilities of Incident Command.

A. While Incident Commanders may delegate the accomplishment of necessary actions, they retain overall responsibilities.

B. OSHA regulations stipulate that IC's are responsible for:

1. Identification, to the extent possible, of hazardous conditions present at the incident site.

2. Ensuring that appropriate technical site analysis occurs.

3. Ensuring that appropriate protection equipment is used to minimize worker exposure.

4. Ensuring that appropriate site control and decontamination practices are established.

5. Ensuring coordination of ***all*** emergency responders and their incident actions.

6. Ensuring that a "Buddy-system" is utilized for entry into hazardous areas and that an appropriate back-up/rescue team is established.

7. Ensuring that on-scene medical surveillance of responders is implemented, and that first aid and medical transportation is available at the incident.

8. Ensuring that appropriate "Incident Objectives" are developed and communicated to responders.

9. Remaining cognizant of various responder's training levels under their command and ensuring that only properly trained individuals work in hazardous areas.

10. Establishing a "Safety Official" (Safety Officer) with responsibility to identify hazards and provide direction regarding operational safety.

NOTE: IC may be dual tasked to accomplish command and safety functions if worker health and safety will not be affected.

C. Other duties are established in State and Federal Response Plans, Business Plans, Area Plans, and other documents. These duties commonly include:

1. Responsibility for management of affected populations.

2. Ordering of appropriate response resources.

3. Establishing an “Incident Command System” for incident management.

4. Facilitating appropriate operational control, planning, logistical, and financial management to match the size and sophistication of the incident.

5. Ensuring appropriate liaison with affected entities.

6. Ensuring safety management and informational/public relations concerns are adequately addressed.

7. Providing appropriate information, through notification, to concerned governmental agencies, executive management, and others.

Tools for the Incident Commander.

A. Two basic written tools are used by an Incident Commander to organize incidents. These tools allow the IC to assign and track resources, identify objectives, and assist as briefing guides. They are:

1. A”strategic” document that outlines broad incident management goals or objectives. This document identifies the incident’s organization, resources, and assignments. It is common to stipulate communications, medical, coordination, and specialty resource management issues in this plan.

2. Site Safety Plans.
   a. A “tactical” document that details specifics and methods for accomplishment of incident objectives. This is a technical document that requires the input of trained individuals to prepare.

A thorough working knowledge of the Incident Command System is necessary for efficient operation at a hazardous materials incident.
The Incident Command System (ICS) is used for Hazardous Materials Incidents to provide an organization for multi-agency response, to ensure coordinated use of resources and to effectively mitigate the incident. ICS is a tool customized to fit the emergency.

Principles on which the Incident Command System is based include:

Hazardous materials incidents usually involves several different organizations, companies, fire, law enforcement and public health agencies, a *unified command* structure will generally be established. As incidents escalate, an Emergency Operations Center (EOC) may be needed to coordinate all of the agencies and functions involved. Very large incidents may require a State Operations Center to coordinate statewide mutual aid and outside resources.

- Common Terminology.
- Modular Organization.
- Integrated Communications.
- Unified Command Structure.
- Consolidated Incident Action Plans.
- Manageable Span-of-Control.

Incident Command Organization.

Organization of the Incident Command System is based on a structure which is identified by common terminology. There is a position title for each position with in the ICS. The position title not only identifies the position, but also identifies the level of the position. The criteria for position identification is as follows:

- Incident Commander — Commander.
- Command Staff — Officers.
- Sections — Chiefs.
- Branches — Directors.
- Groups — Supervisors.
- Teams/Units — Leaders.
- Areas — Managers.

There are also identifiers for each level within the command structure. Criteria for organizational identification is as follows:

- Section — Management Element.
- Group — Functional Areas.
- Division — Geographical Areas.
- Branch — Span of Control Limitations.

At a hazardous materials incident, a “Hazardous Materials Group” is established specifically to manage the activities within the Control Zones and to develop product information, while all other functions are carried out by other elements with in the command structure. This class focuses on the positions within this hazardous materials group. However, it is important that hazardous materials response personnel be familiar with the other positions that they may need to coordinate with within the command structure.

Both the *Command Staff* and *General Staff* report to the Incident Commander (or Unified Command). The Command staff includes the Information Officer, Safety Officer and Liaison Officer. Members of the Command Staff have the following responsibilities:

- The Information Officer is responsible for the formulation and release of information about the incident to the news media and other appropriate agencies.

- The Safety Officer is responsible for monitoring and assessing hazardous and unsafe situations and developing measures for ensuring personnel safety.

- The Liaison Officer is the point of contact for assisting and cooperating Agency Representatives. An Agency Representative is an individual from an assisting or cooperating agency who has been delegated full authority to make decisions on all matters affecting that agency’s participation at the incident.

The General Staff includes the Operations Section Chief, Planning/Intelligence Section Chief, Logistics Section Chief and Finance/Administration Section Chief. The responsibilities of the General staff are as follows:

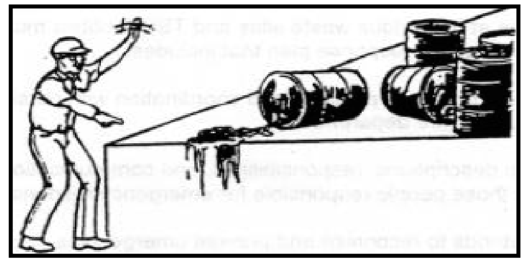
- The Operations Chief is responsible for management of tactical operations for the primary mission. The Operations Chief supervises the tactical elements in accordance with the Incident Action Plan; directing the preparation of the unit operational plans, requesting and releasing resources, making expedient changes to the Incident Action Plan as necessary, and reporting such changes to the Incident Commander.

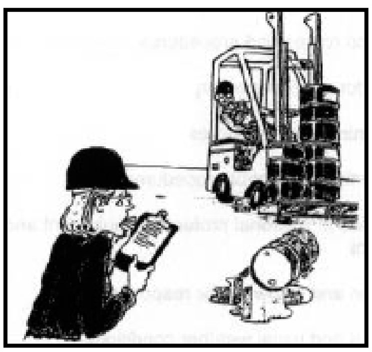
- The Logistics Chief is responsible for providing facilities, services and materials in support of the incident. The Logistics Chief also provides direction for units such as Medical and Supply for a Hazardous Materials Incident.

- The Finance/Administration Chief is responsible for the financial and cost analysis aspects of the incident including personnel, equipment and contractor accounting. This function is particularly important at hazardous materials incidents as the responsible party must pay for any costs involved in the incident.

What should you do in case of an emergency? Be aware that the exact order of the steps may vary from emergency to emergency.

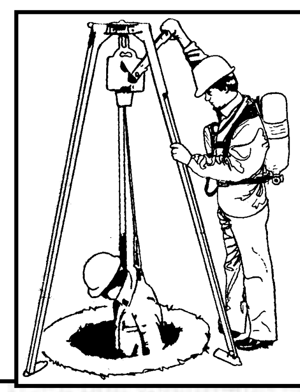
ALERT others nearby: Warn co-workers or anyone else nearby that there is a problem.

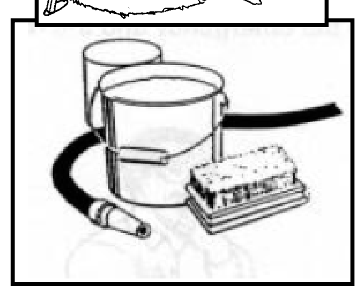




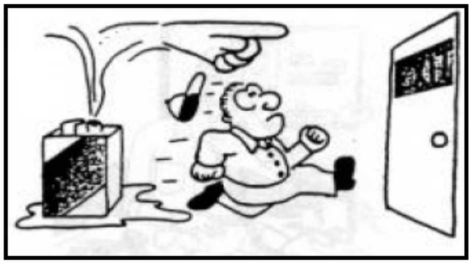
SIZE UP the situation: From a safe area consider the situation as you see it and what to report to the trained responders.

RESCUE the injured: Only if your health and safety is not endangered or assist the injured person on your way out.



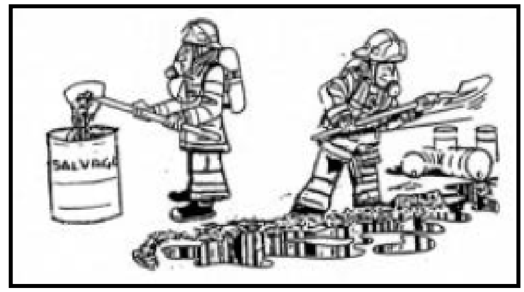


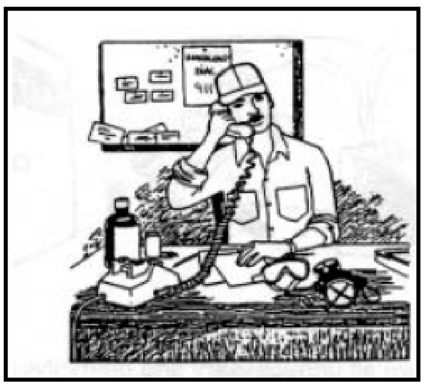
DECONTAMINATE: With proper protection, decontaminate you, other workers, or injured persons.



EVACUATE: Make sure all unnecessary and uninvolved personnel are cleared from the problem area.

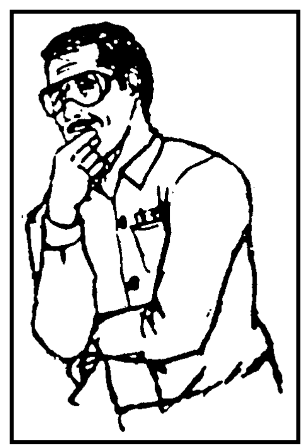
CONTROL the hazard: From a safe distance protect areas that the hazard may reach by blocking or diverting the flow.





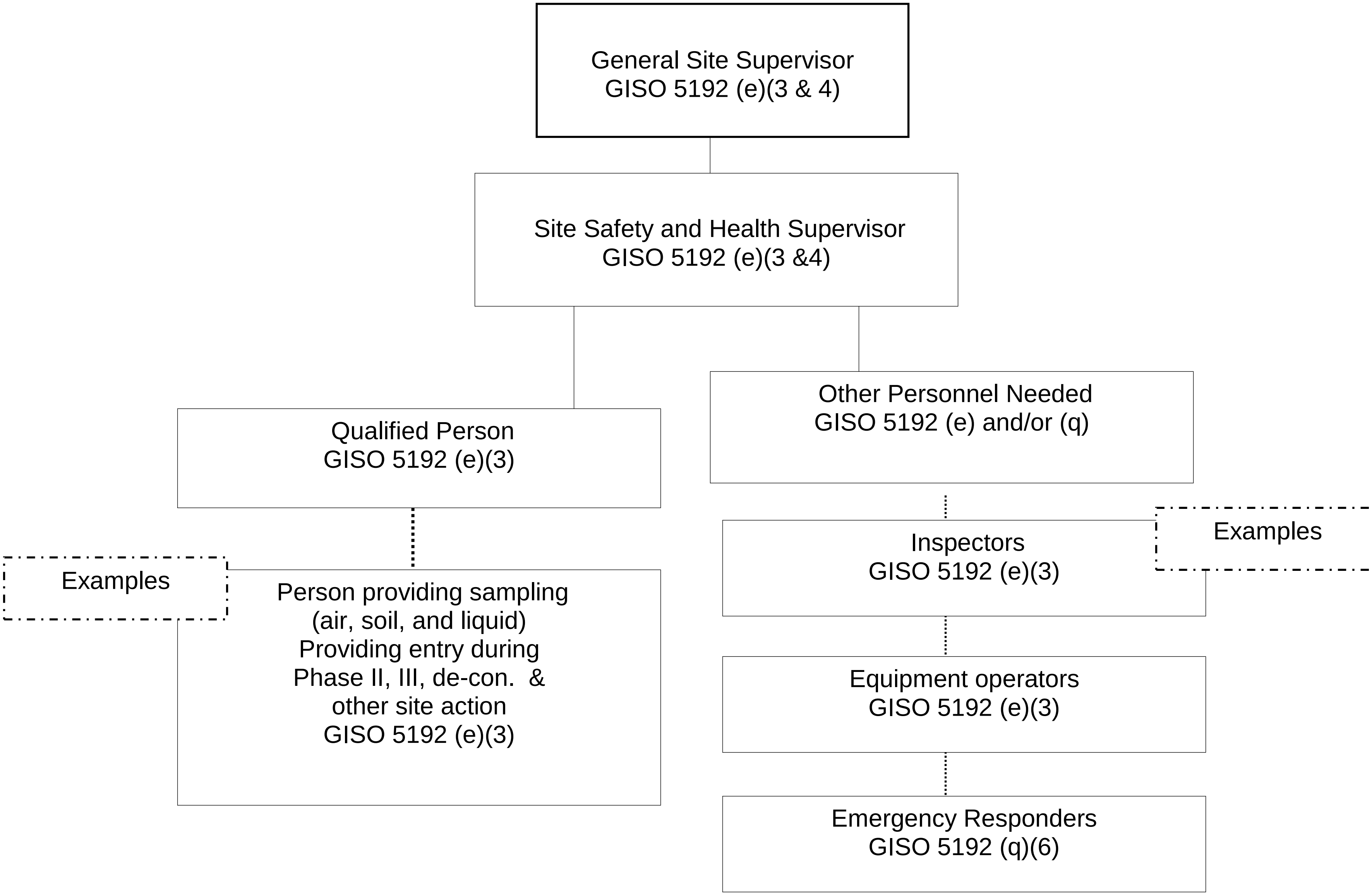
NOTIFY: Communicate to in-house or appropriate government agency to let them know an accident has occurred.

EVALUATE: the emergency and the responses made to it.



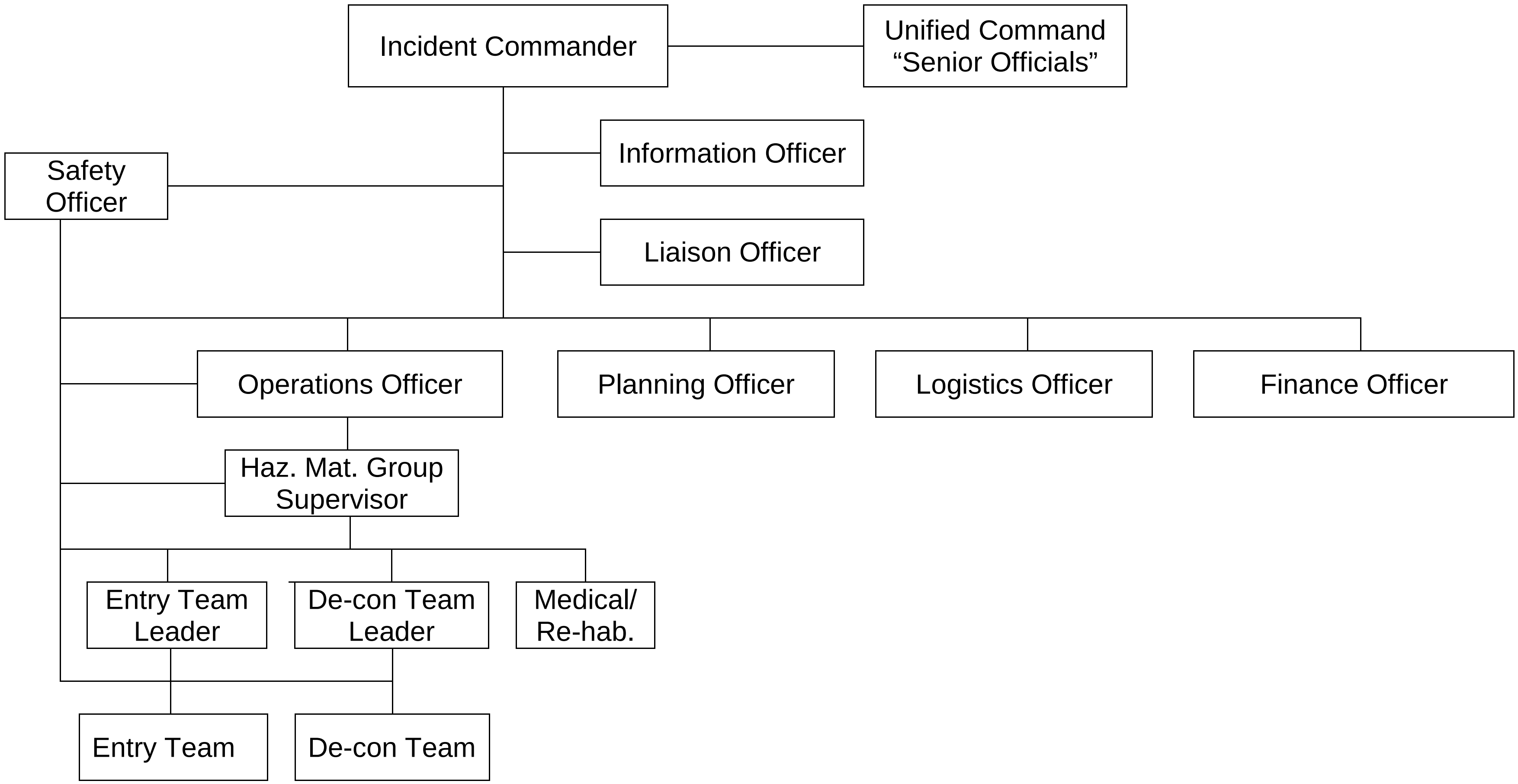
Remember: Preparing a pre-emergency plan where personnel roles, lines of authority, training, and means of communication are described. Also, mention safe distances, places of refuge, site security and control, and evacuation routes and procedures.

Organizational Structure for Site Worker or for Clean-up Operations



Incident Command System Organizational Chart

Organizational charts are designed for workers to report to their direct supervisor or the Safety Officer. At any time workers feel a hazard or safety concerns exist, they can report directly to the Safety Officer.



Worksheet # 1 Site Control Measures (use map) 5192 (b & d)

North

Description of Site Activities:

Phase II – On Site

1. ______________________________

2. ______________________________

3. ______________________________

Phase III – Site Mitigation

1. ______________________________

2. ______________________________

3. ______________________________

Worksheet # 2 Site Safety and Health Hazards 5192 (b)(4)

Safety Hazards: Source

1. ______________________________ ______________________________
2. ______________________________ ______________________________
3. ______________________________ ______________________________
4. ______________________________ ______________________________

Environmental Hazards: Source

1. ______________________________ ______________________________
2. ______________________________ ______________________________
3. ______________________________ ______________________________
4. ______________________________ ______________________________

Instrumentation:

Organic Vapor Analyzer	☐	Sampling Pumps	☐
Photo-ionization Detector	☐	Colorimetric Detector Tubes	☐
Combustible Gas Indicator	☐	Area Sampling	☐
Oxygen Meter	☐	Personal Monitors	☐
Specific Toxic Meter	☐	RAD Meter	☐
Other ______________	☐	Other ______________	☐
Other ______________	☐	Other ______________	☐

Worksheet # 3 Description of Site Activities 5192 (b)(3 & 4)

Sampling Methods: Air, Liquid, and Soil

1. ______________________________

2. ______________________________

3. ______________________________

Chemical Incompatibility and Storage Concerns: Container Management

1. ______________________________

2. ______________________________

3. ______________________________

Engineering Controls and Work Practices: (PPE)

Phase II ______________________________

Phase III ______________________________

Rescue ______________________________

Decontamination Procedures:

Phase II ______________________________

Phase III ______________________________

Equipment ______________________________

Rescue ______________________________

Worksheet # 4 **Emergency Response Plan** **5192 (b)(4) & (l)**

Procedures to be used in case of:

A. Accident / injury
B. Environmental spill or release of hazardous substance
C. Natural catastrophe (extreme weather, earthquake, flood, etc)

Risk Analysis (Hazard vs. Specified conditions = Risk)

Most probable event	Preventive Measures

Means of Notification (911 or Response Team)

Alerting system

Emergency Decontamination

Emergency Evacuation

Medical Facilities

Sample Site Health and Safety Plan

Site information

Location: ______________________________

Supervisor/Commander Area: ______________________________

Control Zones Established: Support/Cold Zone ☐ Decontamination/Warm ☐ Exclusion/Hot Zone ☐

Weather Conditions: Wind Direction __________ Wind Speed __________ Temperature __________

Forecast: ______________________________

Organizational Structure

Site Supervisor/Incident Commander: ______________________________

Site Safety Officer: ______________________________

Qualified Person/Haz Mat Group Supervisor: ______________________________

Entry Leader: ______________ Decon. Leader: ______________ Support Leader: ______________

Entry/Mitigation Team		Decontamination Team		Medical Team	Other

Level of Protection (PPE)

Entry/Mitigation Team				Decontamination Team			
CPC	Respirator	CPC	Respirator	CPC	Respirator	CPC	Respirator

Hazard Evaluation

Chemical Information:

Chemical Name	PEL	REL	IDLH	Ca	TRIC Hazard
1					
2					
3					
4					
5					

Environmental Monitoring

	Equipment	Times/Location Taken					
Air	____________						
Liquid	____________						
Soil	____________						

Exposure

	Time Taken	Amount	Time Taken	Amount	Time Taken	Amount
Worker Exposure						
Area Exposure						

Communication

Entry Team	Back-up Team	Decontamination Team

Site Map

N

N

W E

S

MODULE 15

Site Characterization

Module 15
Site Characterization
GISO 5192 (c), (l) & (m)

OUTLINE

I. Site Characterization

II. Requirements for Site Characterization
   - Off-Site Survey
   - Initial On-Site Survey
   - Continuous On-Site Assessment

III. Emergency Response Site Characterization

IV. Off-Site Hazard and Risk Assessment

V. Illumination

OBJECTIVES

At the end of this session, trainees will be able to:

1. Identify the purposes of site characterization to provide information for the development of the site health and safety plan and to select appropriate levels of protection.

2. Describe a site characterization procedure.

I. SITE CHARACTERIZATION

Federal and Cal/OSHA definition

According to 29 CFR 1910.120 (C) and GISO 5192 (C):
"...to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards."

EPA definition

Site characterization is the collection and evaluation of information in order to determine the:

- necessity for remedial action
- extent of necessary remedial action
- feasibility of potential remedial action

Purposes of Site Characterization

1. To identify site hazards:
   a. physical
   b. toxic/chemical
   c. explosion/fire
2. To determine the necessary personal protective equipment, work practices and engineering controls.
3. To provide information for use in developing a site safety and health plan.

II. REQUIREMENTS FOR SITE CHARACTERIZATION

Off-Site Survey

Before workers enter a site for the first time, employers must always collect available information from interviews, records, and examination of the site from a distance. All these methods of gathering information before entering a site are called off-site assessment.

According to 29 CFR 1910.120 (c) (3) - site characterization, paragraph (c) (4), the following information, to the extent available, must be obtained by the employer before workers can enter a site:

i. Location and approximate size of site.

ii. Description of the job to be performed.

iii. Duration of the planned job.

iv. Site topography and characteristics (hills, valley, rivers, buildings, etc.) and accessibility.

v. Safety and health hazards expected at the site.

vi. Pathways of dispersion (air, water, etc.) of hazardous substances.

vii. Present status and capabilities of emergency response teams that would provide assistance to the hazardous waste cleanup site employees at the time of emergency.

viii. Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.

Initial On-Site Survey

In order to select the best cleanup strategy for each site, a more detailed investigation is often conducted. This detailed investigation includes sampling and laboratory analyses to identify types and amounts of hazardous waste on the site. These procedures are all part of the initial on-site survey.
During this initial on-site survey, the hazardous waste standard requires that:

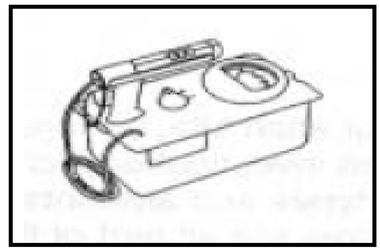
1. Minimum Level B personal protective equipment is worn until the hazards on site are identified.

2. Direct reading instruments be used to monitor the following conditions:

   - IDLH (immediately dangerous to life or health) conditions (see NIOSH Guide to Chemical Hazards for IDLH levels of specific chemicals)

   - Presence of ionizing radiation

   - Combustible or explosive atmospheres, oxygen deficiency, and/or toxic substances.



Indicators of Dangerous Conditions

- Confined spaces that must be entered: containers, tanks, buildings, or trenches

- Bulging drums, foaming, or gas generation

- Extremely hazardous materials (examples: cyanide, phosgene)

- Visible vapor clouds

- Biological indicators – dead animals or vegetation

- Strange odors

Continuous On-Site Assessment

During the cleanup phase, continuous monitoring of air, soil, water, and cleanup workers should be done to reassess the safety actions being taken.

III. EMERGENCY RESPONSE SITE CHARACTERIZATION

Performing site characterization during the emergency takes the same actions as site characterization for a clean-up operation. During a clean-up operations you can take time to secure proper information to continue working in a safe environment. When responding to an emergency site characterization is still performed but requires less time to mitigate the emergency and stop or lessen the spread of the contamination.

Emergency Response		**Site Clean-up Operation**	
Mission	**Time**	**Mission**	**Time**
Off-site / Size-up	15 min. to 1 hr.	Off-site / Off-Site Survey	Days to years
On-site / Re-con (*Reconnaissance)*	15 min. to 1 hr *One air bottle*	Initial On-Site Survey	Days to months
Site Mitigation	Mins. to days	Continuous On-Site Assessment	Month to years

Size-up

Before workers enter a site for the first time, responders must collect available information from interviews with responsible parties, witnesses, and examination of the site from a distance for hazard identification and threat hazards. All these methods of gathering information before entering a site are called size-up.

Site Specific Safety Plans shall be developed prior to entry describing information obtained during size-up, task re-con personnel will perform, including additional information needed from with-in the contaminated area, and consideration given to evacuation procedures to prevent future contamination or injuries.

When size-up has been completed and the team has researched information to make a safe entry, Entry Teams and Back-up personnel begin a cautious and safe entry.

Re-con

During this initial on-site survey, HAZWOPER requires that Level B personal protective equipment at minimum be worn until the hazards on site are identified.

Direct reading instruments be used to monitor flammable atmospheres, oxygen concentrations, and for ionizing radiation if unknown contamination or concentration exist.

Re-con teams monitor the area for atmospheric and unknown safety hazards and retrieve additional information to mitigate the emergency in a safe manor.

Time will be dictated by area, size and type of release, and environmental conditions. Normally the duration of one breathing air bottle will be the time spent for this task.

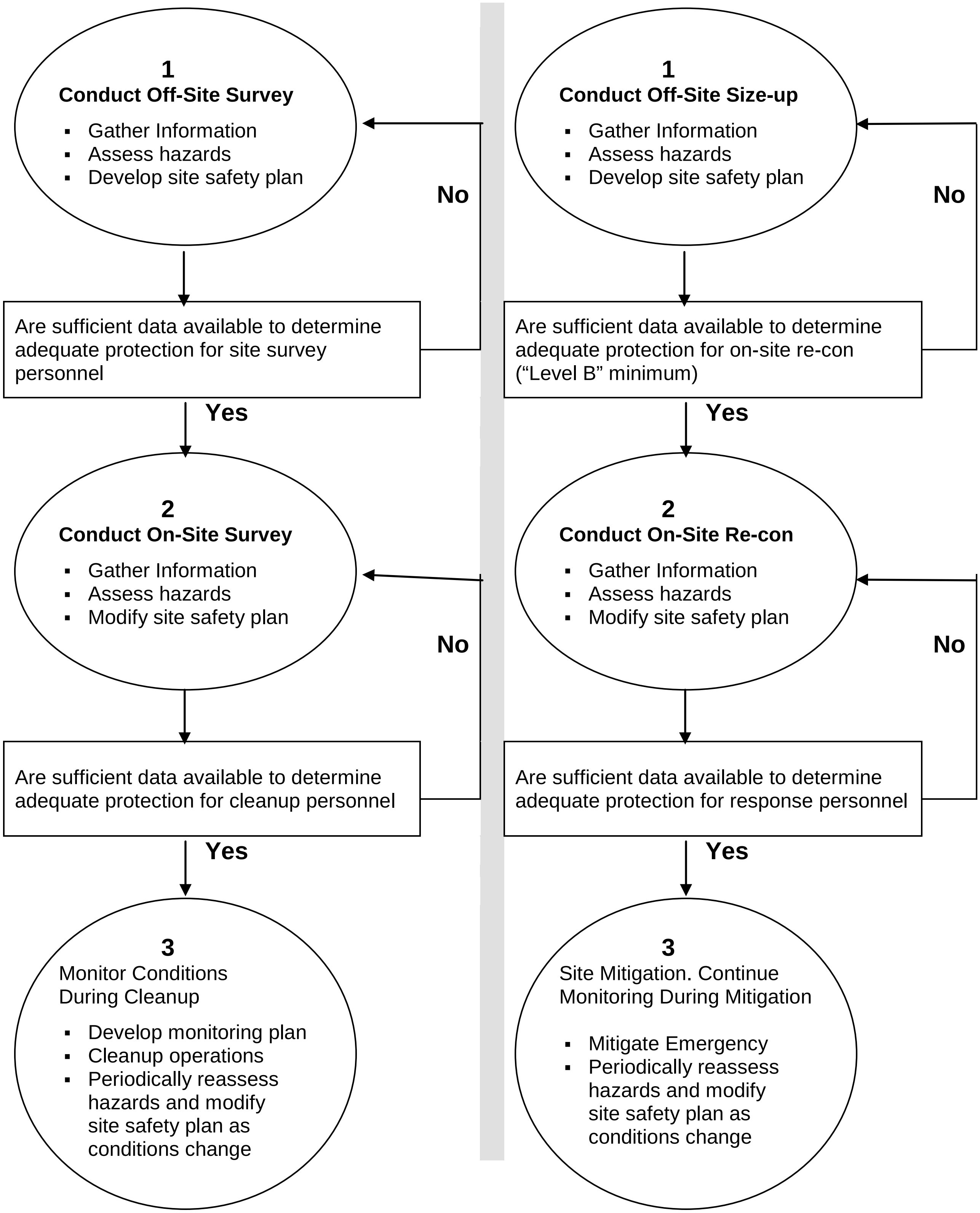
Site Mitigation

During this phase, continuous monitoring of air should be done to assess any changes in atmospheric hazards while work is being performed.

The mission of emergency responders will be to mitigate the emergency to a static situation and release the area over to clean-up operation.

The major difference between site cleanup and emergency response is time spent during each phase. Site cleanup may take months to years, as emergency response will take minutes to perform.

MAJOR PHASES OF SITE CHARACTERIZTION **MAJOR PHASES OF EMERGENCY**



IV. Off-Site Hazard and Risk Assessment

During the process of characterizing the site for a safe entry evaluation for hazards and the risk associated with the hazards need to be evaluated.

The evaluation of information and the assessment of relative risk is one of the most critical points in the decision making process. Before a decision regarding what actions to take can be made, facts concerning hazards and risks must be gathered and analyzed. Workers and responders must be able to perform a hazard and risk assessment in order to develop a successful plan of action.

Hazard and risk assessment simply means "size-up." It is a process of taking all the factors involved, weighing them and arriving at a sound decision for a safe operation.

Hazard.

First of all, let us define "hazard. A hazard is any situation which has a potential for causing damage to life, the environment and/or property and refers to the hazardous chemical and physical properties of a material. It would include:

A. Toxicity.

B. Flammability.

    1. Flash point.

    2. Ignition temperature.

    3. Flammable limits.

C. Reactivity.

D. Radioactivity.

E. Corrosivity.

F. Specific gravity.

G. Vapor Pressure.

H. Vapor Density.

Risk.

The definition of risk is the probability that damage to life, property, and/or the environment will occur. Risks include those intangibles that cannot be looked up in any reference source or data base. Risk assessment considerations include the following:

A. Size and type of container and quantity of material involved.

1. Risks will often be greater when dealing with bulk quantities of hazardous materials as compared to limited-quantity, individual containers.
2. The type of material will also be a significant factor. For example, metal, plastic, fiberboard etc.
3. Another obvious and critical factor would be whether it is a pressure or non-pressure vessel.

B. The nature of the container stress must also be considered.

1. Is the container rusted or corroded?
2. Has the container been punctured or torn?
3. Is the container leaking?
4. Is the container bulging or dented?
5. Has the container been exposed to flame or heat?
6. Has any valving or piping been damaged.

C. The potential behavior of the container and its contents must be determined. The behavior of the container will depend on its:

1. Type and size.
2. The physical and chemical characteristics of the material it contains.
3. The condition to which the contents are subjected.

D. The levels of resources available must be considered:

1. What Personal Protective Equipment is available?
2. What is the level of training of the personnel?
3. What containment equipment is readily available?
4. Is equipment available to effectively handle the incident? Is heavy equipment needed?

E. What is the exposure potential to people, property and the environment?

1. Where will the material go?

F. The weather conditions and the terrain must be taken into account.

1. Wind direction and speed.
2. Ambient temperature.
3. Is it raining or is it a hot, dry day?
4. What is the topography? Is it flat, are there hills?
5. Will the topography affect the approach considerations or evacuation considerations?

Although the risks associated with hazardous materials will never be completely eliminated, they can be successfully managed.

V. ILLUMINATION

Areas accessible to employees shall be lighted to not less than the minimum illumination intensities listed in the table below (GISO 5192 Table H-1) while any work is in progress. The lighting level is referred to Foot-Candles.

"A foot-candle is an English unit of measure. It shows how bright the light is one foot away from the source."

Minimum Illumination Intensity in Foot-Candles follows:

Foot Candles	*Area or operations*
5	General site areas.
3	Excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: Warehouses, corridors, hallways, and exit ways.
5	Tunnels, shafts, and general under-ground work areas. (EXCEPTION: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.)
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

Activity 1. Cleaning up at the Cisnero's Hazardous Materials Transportation, Inc.

You are a representative of the Grit & Grimes Company, which has been hired by the State Toxic Substance Control Division (STSCD) to investigate and characterize the hazards at the Cisneros Hazardous Materials Incident in Perris, California. The month is late August. Your Preliminary Site Evaluation includes gathering information about the site from 5 of the following 15 sources:

1. Visual inspection of the site
2. Interview with the owner
3. Interview with residents in the neighborhood
4. Chamber of Commerce
5. U.S. Geological Survey
6. U.S. Weather Service
7. Company records, receipts, logbooks, ledgers
8. State OSHA Office/State Attorney's Office
9. Regional Water Quality Management Board
10. South Coast Air Quality Management District
11. State Fire Marshall's Office and local Fire Department
12. Water department and sewage district records
13. Utility company records
14. Media reports
15. Employee interviews

After you have chosen your sources and read what information those sources provided, answer the following questions to the best of your ability:

1. What are the apparent hazards on site?

- Chemical

- Physical

2. What additional information do you want?

3. What is your next step?

4. Based upon what you know about the site, what Level of Protection should workers doing the initial physical site investigation be wearing? What other protective measures can you take?

5. What information will you incorporate into the initial site safety plan?

MODULE 16

Site Control

Module 16
Site Control

GISO 5192 (d) & (c)

OUTLINE:

I. Site Control Program
II. Defensive Control Options
III. Rescue

OBJECTIVES

At the end of this session, trainees will be able to:

1. Identify the elements of a site control program.
2. Establish site control zones– exclusion zone, contamination reduction zone, and support zone.

I. Site Control Program

A site control program will help prevent the spread of hazardous materials to other parts of your workplace. When there is a hazardous material release, it is very important to control the movement of the material quickly and safely.

Appropriate site control procedures shall be implemented to control employee exposure to hazardous substances before work begins.

A. Site control program:
A site control program for protecting employees which is part of the employer's site safety and health program shall be developed during the planning stages of a hazardous waste clean-up operation or emergency response and modified as necessary as new information becomes available.

Why is a site control program needed?

A site control program is needed to:

- control access to the site and to contaminated work areas
- prevent the spread of contamination from sources on site
- document the type and amount of exposure

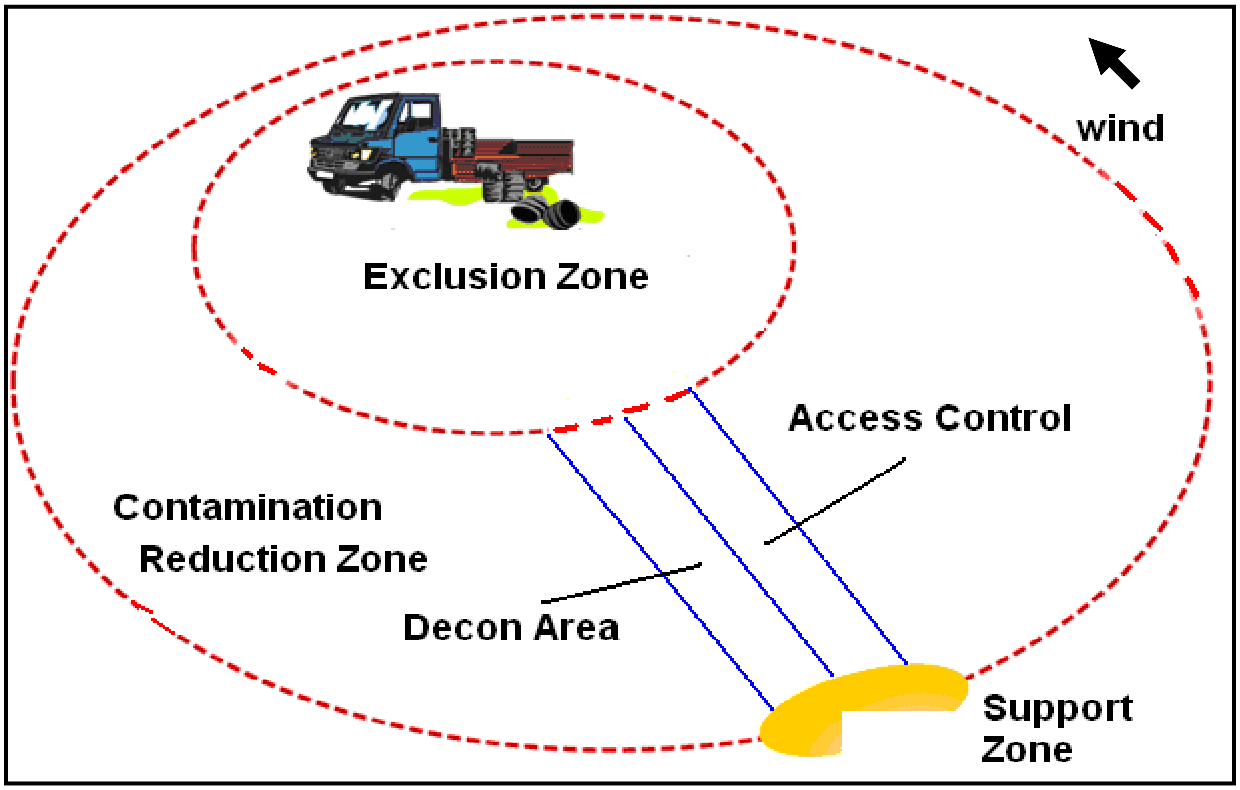
Who might become contaminated?

- Workers on site, in "hot" (contaminated) work areas.
- Workers in "clean" work areas next to the contaminated areas.
- Residents in surrounding communities.
- Workers' families or other immediate contacts (e.g., laundry service).
- Other persons who might enter the site.

B. Elements of the site control program:
The site control program shall, as a minimum, include: A site map; site work zones, the use of a "buddy system;" site communications including alerting means for emergencies; the standard operating procedures or safe work practices; and, identification of nearest medical assistance. Where these requirements are covered elsewhere they need not be repeated.

According to 29 CFR 1910.120 (d) (3) and GISO 5192, a site control program should include:

1. Establishment of site work zones: When you deal with a major spill or emergency, or clean-up operation set up "work zones" so workers do not accidentally carry chemicals away from the spill to other areas. There usually should be three zones, which must be clearly marked:



The boundaries should be placed:

- **Uphill**: Always approach the contamination from the highest point in order to avoid the flow of contamination into the clean area.

- **Upwind**: Always attempt to keep the wind at your back. (If you cannot place the boundary both uphill and upwind, always consider the form of the hazard. If the hazard is in gas form, an upwind approach will help to keep the gas away. However, a liquid can be avoided by an uphill approach.

- **Away**: Stay at a distance that would be safe in the event of a problem. The Department of Transportation (DOT) Emergency Response Guide suggests 330 feet as a minimum distance for an unknown hazard.

a. Exclusion Zone: the contaminated area “Hot Zone”.

This is where the contamination is. It is also known as Hot Zone. Everyone entering the hot zone must wear the proper protection for the chemical involved. Keep the number of people allowed in the hot zone to a minimum. People should always enter the zone in pairs “Buddy System”.

The dividing line between the hot zone and the warm zone is called the hotline. It’s not always easy to decide where the hotline should be. Measuring chemical levels is very important in deciding where to locate the hotline. Other factors to consider include the layout of the area and wind direction. The goal is to set up the hotline at a “safe distance” from the spill so people outside the line will not get exposed.

Sub-zone may be needed in the ot Zone. When contaminated workers or victims can move on their own and need to be decontaminated a predetermined area known as “Area of Safe Refuge” in the Hot Zone near the decontamination area.

b. Contamination Reduction Zone: “Warm Zone”.

The contamination reduction zone should be set up between the exclusion and support zones. It should be uphill, upwind, and away from the exclusion zone. Access should be provided for equipment and personnel.

It is also known as warm zone, which puts distance between the spill and the clean area, and provides a safe place for decontamination.

At first, the warm zone is considered uncontaminated. But as workers leave the hot zone and go through the decontamination, the warm zone becomes contaminated. Contaminated clothing, equipment, and people must not leave the warm zone until they have been decontaminated.

Decontamination stations should be set up within the warm zone. At these stations, workers leaving the hot zone remove their protective clothing and equipment. All items are cleaned and/or disposed of properly. The number of decontamination stations you need depends on the number of workers, the kind of protection they are using, and the space available.

c. Support Zone: This area is considered clean “Cold Zone”

No contaminated clothing, equipment, or people may enter the cold zone. People wear normal work clothes in the cold zone. It is a staging area for the cleanup job.

The location of the cold zone is based on: the amount of space available, physical layout, wind direction, distance from the hot zone, and resources available such as telephones, water, reference materials, parking, and ease of access for people coming from outside to work on the spill.

2. Site communications which may include:

- Audible fire or chemical release alarms (required by OSHA).
- Hand signals among workers in areas where hearing may be difficult, such as the signals used by equipment operators.
- Two-way radios for communication over distances up to about one mile and internal communication.

3. The buddy system: Each worker should work with a buddy when entering the exclusion zone. A buddy should be able to:

- Provide quick assistance in the event of an emergency.
- Notify the site safety officer or person designated in the site safety and health plan of any emergency involving his/her buddy.
- Assist in rescue, if necessary.

4. Standard operating procedures and safe work practices include:

- Use of appropriate equipment (e.g., non-sparking tools, spark arresters on engines, etc).
- Use of a signal person/spotter when backing up heavy equipment.
- Keeping non-essential personnel in the support zone and at a safe distance from the work area.

5. Site Map: When information has been gathered, a site map should be produced showing features that affect placement of:

- Zones
- Access control points
- Prevailing winds
- Other information assisting with offensive actions

6. Identification of the nearest medical assistance: When developing the plan, prior to site entry, identification of the nearest medical facilities along with transportation and direction to the facility. Advanced planning on proper method of communicating information to medical facility of injury or chemical exposure and proper decontamination has been preformed.

II. Defensive Control Options

Introduction

When a product "gets out" of its container, it is identified by many names: a leak, a spill, a breach, etc. What the product does once it is out of its container is also of great importance.

Considerations for **Defensive Control:**

- How much product could potentially spill?
- How much secondary contamination can occur?
- What equipment is on hand?

This module will use the word <u>spill</u> to indicate that the product has left its container or area of use. Spill usually carries an accidental connotation, however, for the purposes of this module, the word spill can include all types of releases.

National Fire Protection Association (NFPA) Definitions:

Control: The defensive or offensive procedures, techniques and methods used in the mitigation of a hazardous materials by enclosing, containment, extinguishment and confinement.

Containment:: Offensive actions taken to keep an material in its container (e.g.: stop a release of the material or reduce the amount being released).

This subject was covered in Module 10, Drum Handling, Sampling, and Shipping of Hazardous Waste.

Relases can occur in many forms and many ways. Examples:

- Spills from over-turned containers
- Spills from leaking (worn-out, punctured or breached) containers
- Intentional spills or illegal dumping
- Spills from uncontrolled - or runaway - reactions
- Spills while taking samples

With this in mind, we must also consider the nature of the spill and the ten (10) factors which affect how we deal with it.

1. Risk assessment
2. Hazards associated with the materials
3. State of the materials (Solid-Liquid-Gas)
4. Quantity of materials (Company and regulatory definitions)
5. Company policies (What constitutes a small or large spill?)
6. Equipment needs (Do you have what you need?)
7. Route of dispersion
8. Secondary contamination potential (For Entry and Decontamination Team)
9. Weather
10. Topography

In business or industry where the chemicals on site are known and identified, the process of containment and control can be very simple. Pre-planning is the key. Pre-planning can include:

- Knowing which containment or control method is compatible with each chemical capable of spilling.
- Having adequate supplies available to manage all emergencies.
- Establishing policies and procedures for dealing with each chemical, based on a variety of specific spill sizes.
- Training all personnel in emergency procedures

When you know what you have on site, what you are facing and how to control it before a spill occurs -- the job of mitigation and remediation is simple, fast and effective.

Confinement: Defensive actions taken to keep a material in a defined or local area once released. Confinement includes:

Secondary Containment	Absorb/Adsorb
Retaining	Damming
Isolating	Diluting
Berms	Diverting
Dispersing	Containerize

Berming as a Method of Containment.

Berming is often an effective method to contain a leak and prevent needless environmental damage. A berm is used to direct the flow of a material to some holding area for further action. However, several factors should be considered before making a final decision:

- **Amount of fluid.** Berms is the most appropriate method for releases approximately 6000 gallons or less.
- **Rate of fluid leak.** Personnel must consider whether they can construct an adequate berm given the rate at which the liquid is flowing.
- **Chemical hazard.** Can a berm be constructed safely given the hazard? Is there more than one chemical releasing from multiple containers.
- **Suitability of diking material.** It's essential to use berming material that is compatible with the leaking substance. Dry dirt and sand are excellent under most conditions.
- **Availability of berming material.** Small leaks can generally be managed with the supplies either found at the site. It can take time to locate supplies, transport vehicles and drivers, especially after hours or on weekends and holidays.
- **Personnel required for berming operations.** A small leak from a 55 gallon drum can be bermed easily by a handful of people in just a few minutes. Larger leaks require additional personnel.

Utilizing Surrounding Areas in Berm Construction.

When spills are large or bermng materials not available in sufficient quantities, it may be necessary to improvise. For example, curbs and gutters can be used to help berm a liquid flowing along surface streets. The liquid will have a tendency to flow towards the side of a street or parking lot on its own anyhow. The curb can be used to form one wall of the berm, while additional berming materials are placed at both ends of the gutter a reasonable distance apart.

There may be times when it's necessary to contain a spill in open fields, vacant lots or creek beds. The advantage is that it may take less time to build a berm using the dirt already available. However, ground and water contamination is a major concern.

Diverting.

The flow of the product is moving in a direction that may increase the hazard, such as, flowing towards water or a flammable product flowing towards an ignition source.

Workers need to consider ways to divert the flow in a direction that they have control on the situation. Digging trenches to direct the flow is the quickest way to manage the flow.

Divert product to area large enough to accommodate total release of product. Digging a large hole and lining it with plastic then divert the product to the hole will allow large containment.

Retention.

This method used to retain large amounts of product. Using berms.

Other Containment Measures.

A number of other measures may be used for containment. They include:

- **Weirs**. Construction of a dam to prevent a floating insoluble substance from going downstream, while allowing a large flow of water to continue underneath.
- **Oil control booms**. Construction of floating barriers to contain or divert an insoluble floating substance.
- **Skimmers**. Collection of an insoluble floating substance by suction devices from a vacuum truck.
- **Dredging**. Removal of sediment and heavier-than-water contaminants from the bottom.
- **Encapsulation**. Covering the contaminant either with a plastic sheet, or a chemical substance to initiate jelling and solidification of the liquid.
- **Burning**. Intentionally burning a flammable liquid floating on the surface.
- **Nets**. Encircling a floating contaminant with nets to contain and collect it.
- **Biodegradation**. Application of microbes to take up and digest the contaminant in place.

Creating Dams for Containment.

A dam is a man-made barrier constructed to hold back flowing water, or in this case to contain contaminants. It may be used to contain the product and allow water to continue to flow.

Dams are good for controlling water runoff at large fires and hazardous materials incidents, and controlling contaminants that enter slow moving, but active creeks and drainage ditches. They can be used to prevent further spread of contaminant to other water ways. However, dams are often time-consuming to build properly.

If they're not constructed:

- high enough,
- wide enough,
- fast enough,
- or using appropriate materials,

they may fail to contain the contaminant. Heavy rain or fast moving creeks can reduce the effectiveness of a dam.

Types of Dams.

There are two types of dams, simple and complex.

Simple dams constructed of earth, sand or filled sandbags. It can be constructed rapidly if sufficient materials are available on scene. Despite being called "simple dams," they can be made quite sturdy. Plastic sheets or bags can also be used in the construction of these dams to add strength and integrity while reducing erosion and seepage.

Complex dams, sometimes called *"separation dams,"* are designed to separate the contaminant from the water. They are best utilized for recovery of the product, as well as to prevent overflow and further spread of contamination.

If a separation dam is required, a confinement or isolation area should be built first to slow the product down.

There are two types of separation dams:

- ✓ **overflow dam**
- ✓ **underflow dam**

Overflow dams are used when the contaminant is *heavier* than water. An earthen berm is constructed to contain insoluble sinking materials, while the uncontaminated water flows over the top or through a pipe close to the top. This type of dam is relatively quick to construct. *(Figure 13B.1)*

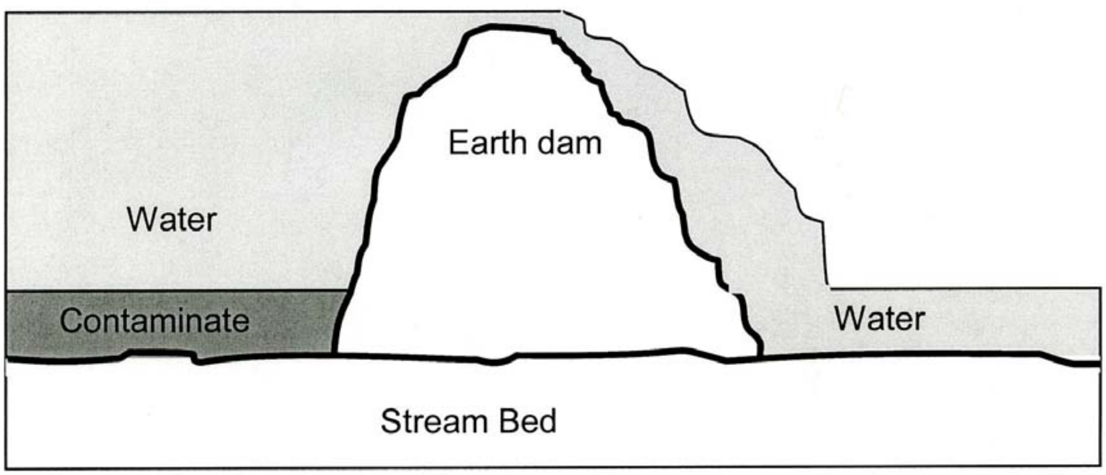


Figure 13B.1: An Overflow Dam for Contaminants That Are Heavier the Water

Underflow separation dams are used when the contaminant is *lighter* than water and will float on top. An earthen berm is built on a stream bed to contain insoluble floating substances. A pipe is installed through the earthen berm, allowing uncontaminated water to pass through the dam, under the contaminant. This is more complex to construct than an overflow dam. *(Figure 13B.2)*

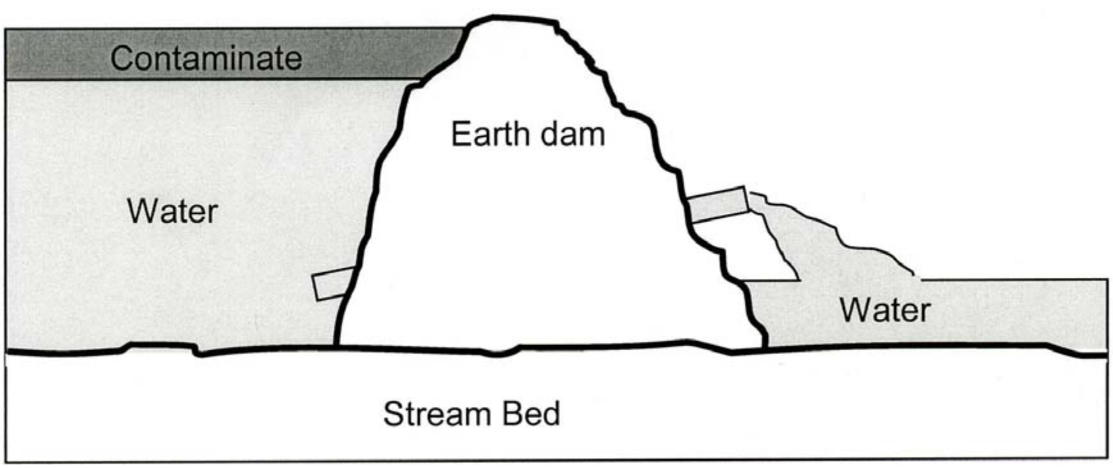


Figure 13B.2: An Underflow Dam for Contaminants That Are Lighter Than Water

III. Rescue

Workers may be called upon to rescue persons from various hazardous situations. These situations may be compounded by the existence of physical injury and/or chemical contamination. Such situations require extreme caution and a very careful hazard and risk assessment on the part of the rescuer. Additionally, the above mentioned considerations are essential in order to ensure the rescuers health and safety.

Introduction.

A fine line may exist between a worker being a rescuer or becoming a victim. Statistical examination of data available from O.S.H.A. reflects the following;

- One occupational related fatality occurs every 5 minutes.
- 170 occupational related injuries occur every 10 minutes.

The potential for the occurrence of an event requiring a rescue effort in the workplace is significant. Consider also that over 50% of all confined space fatalities started out as rescuers and what emerges is a very sobering picture of risk and potential for disaster.

Rescue efforts must be initiated and executed safely and competently within the rescuer’s level of training, resources and capabilities.

Hazard and Risk Assessment.

Entrapment and entanglement issues aside, rescue and rescuer safety requires special emphasis on two critical points;

1. The need to get as much information as possible about the situation; and
2. The need to take action when little or no information is available.

When very little is known about the condition of victims and/or the status of the situation, rescuers should always base their response efforts upon a worst case scenario and consider very conservative actions until such time as more information is acquired or the situation becomes more stable. It must be remembered that no action is always an option.

Potentials hazards to be addressed by rescuers include but not limited to the following:

- Chemical exposure.
- Fire and explosion.
- Oxygen levels.
- Ionizing radiation.
- Biologic hazards.
- Physical safety hazards.
- Electrical hazards.
- Heat stress.
- Cold exposure.
- Noise.

In addition, the following tactical issues need to be addressed as well:

- Safety of personnel.
- Isolation of hazards.
- Requests for assistance.
- Identification of the product(s)
- Action planning requirements.
- Protective equipment.
- Notification
- Mitigate hazards and risks.
- Protective action options.
- Decontamination needs.
- Documentation needs.
- Emergency escape routes.

The rescue decision process can be complex and time consuming. Couple this with a degree of urgency and personal safety envelopes can be easily compromised. It is essential that rescuers secure detailed information prior to initiating action. The process by which information is acquired can be referred to as " size - up ".

Securing Size - up Information.

Prior to taking action, rescuers need to ask specific questions and obtain specific information. Many information sources may be available and each should be explored to the fullest.

- What is known from pre-event planning and training?
- What is known about the industrial processes involved?
- What is known from similar situations and conditions experienced in the past?
- What information is available through various internal communications systems?
- What information is available through employees, security staff, witnesses, supervisors, etc.?
- What information can be gained through observation of such things as physical conditions, marking systems and signage?
- What information can be gained though external sources and outside technical expertise?

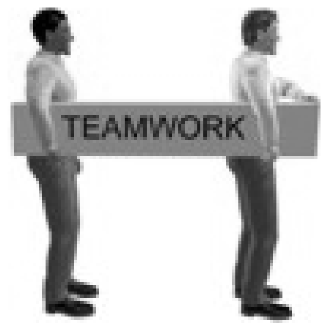
Risk versus Gain.

Once all the hazards have been identified and individual risks assessed, then, and only then, should entry be attempted providing there is something to be gained in the attempt.

Personnel Resources.

Even a simple " snatch and drag " rescue effort may prove labor intensive. Entry for rescue will require at least two people for entry and at a minimum, require two additional people in a stand-by role should the need arise to extract the initial rescue team. The size of individual team members is also an issue. Teamwork is also essential. Rescue is not the time for independent actions or individual heroics.

ACT AS A TEAM.
GO IN AS A TEAM,
COME OUT AS A TEAM.



Emphasis on Prevention.

Given the complexities of the rescue task, emphasis must be placed upon injury and illness prevention in the workplace.

Self rescue or self evacuation as an alternative in some cases where bona fide rescue actions are impractical.

Rescue Techniques.

Expertise in specific rescue techniques are not included as part of this course, such skills development requires specialized training which may address specific situations and conditions found in individual workplaces. Confined space rescue, utilizing rope techniques, would be an example.

Considerations for Victim Care

Treatment.

Moving the Victim.

Ambulatory victims should be directed to an area of safe refuge or emergency decontamination facilities depending upon the given situation. Should the victim's vision be impaired, it may be necessary to lead such individuals as appropriate.

Semi-ambulatory and non-ambulatory victims will require greater assistance of personal protection in such a way as to match the threat posed by the substance or substances involved.

Activity 2. Site Control Scenario

Problem:

A hazardous waste reclamation and recycling center (now a potential hazardous waste site) has just been discovered by the Department of Health Services/Toxic Substances Control Division after a recent thunderstorm (see map). There are a variety of serious problems at this site which need to be addressed via long term projects (e.g., groundwater); however, at present your group has been called in to investigate the immediate hazards.

Information: Hazardous Waste:

Located at the north eastern section of the site within the southern flood plain is a series of about 250 55 gallon drums filled with various unknown chlorinated organic solvents. Some of the drums are thought to contain unused pesticides, and other acids and bases. These drums were first noticed after the thunderstorm when the river flooded and moved many of them from their outdoor storage yard some 50 yards east down river but still within the flood plain.

Weather:

It's winter in Southern California. The average temperature is a low of 45° F at 7 a.m. in the morning and again at 7 p.m. in the evening to a high of 75° F at 1 p.m. Last week, there was a severe thunderstorm lasting 3 days, which caused the river to overflow into the flood plain, dragging a few barrels of waste along with it. The humidity this week has been averaging around 80% with one in five change of rainfall.

Wind:

The wind tends to blow toward the lake in a northwest direction, averaging approximately 10 mph.

Topography:

Being so close to the lake and river, the soil is, understandably, very moist. The further south one moves from the river, the less moisture the soil contains. Groundwater depth ranges from 15 feet in the flood plain to 50 feet in the Eucalyptus Grove.

1. What additional information would you like to have before you begin work?

2. How would you prepare the site before you begin work?

3. What physical/safety hazards might you be concerned about and how might you prevent these problems from occurring?

4. What do you do if an emergency occur requiring immediate evacuation of an injured worker?

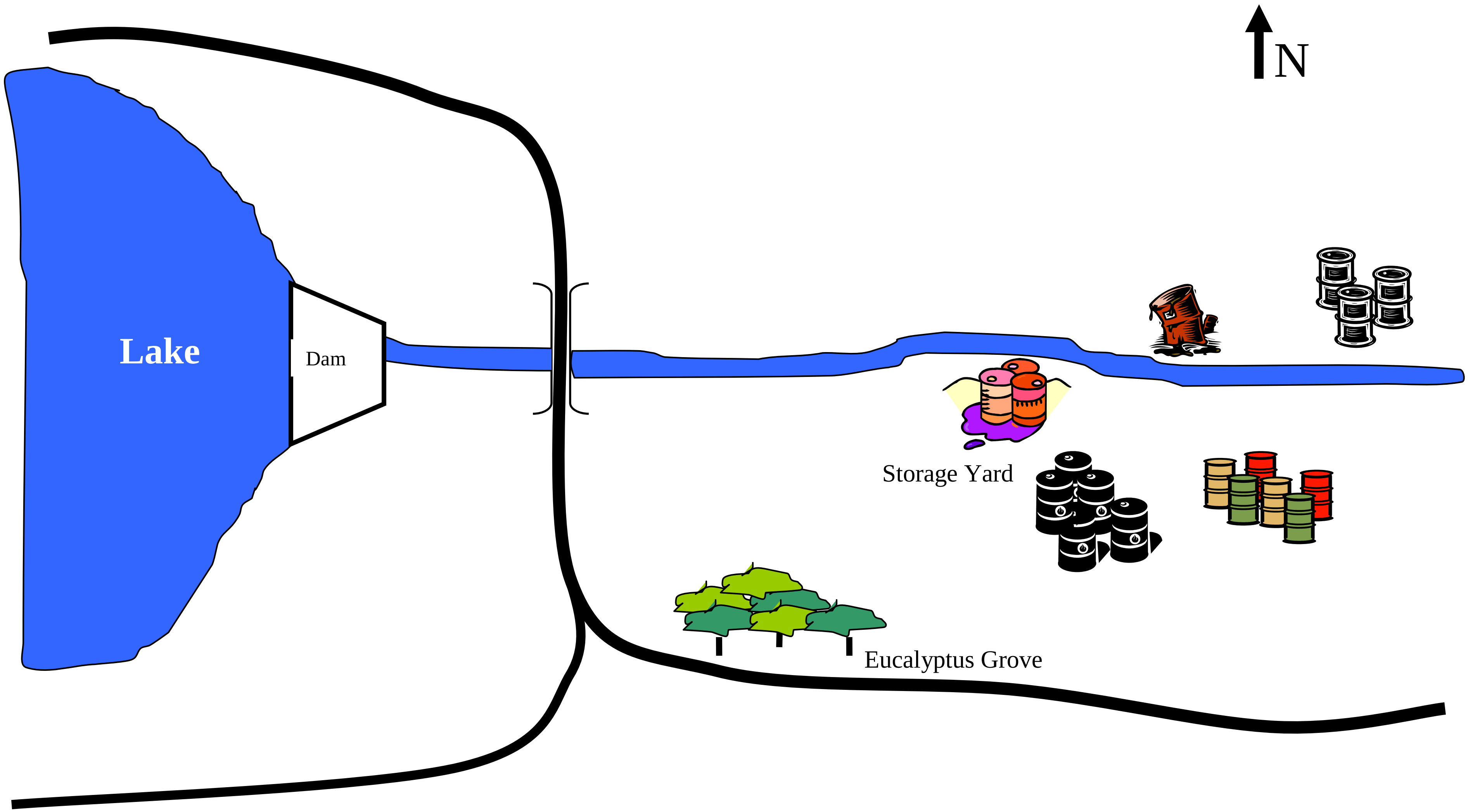
5. Where would you place the exclusion, contamination reduction, and support zones? Specifically, where would you place the decontamination station? {Draw your answer on the map.}

6. How will you protect the site against vandalism and other intruders?

7. What methods will you use for communication on site?

8. What methods will you use to enforce safe work practices?

Site Control, Drum Handling, and Product Sampling Activity



MODULE 17

Decontamination

Module 17
Decontamination

GISO 5192 (k) & (n)

OUTLINE

I. Introduction

II. Methods of Decontamination

III. Sanitation

OBJECTIVES

At the end of this session, trainees will be able to:

1. Describe the purpose for decontaminating people and equipment.

2. List the stations and clean up procedures required along a decontamination line.

I. INTRODUCTION

Hazardous waste clean-up sites and emergency response incidents often involve employees that have been exposed to potentially deadly chemicals. Prompt, safe and effective decontamination procedures are essential to protect both the victims and workers.

Decontamination means removing hazardous chemicals from your body, clothing, and equipment (like your respirator or tools).

There are four basic methods of decontamination:

- Discarding - The process of removing and disposing of the contaminated clothing and equipment.
- Dilution - The use of copious amounts of soap and water, or a specific decon solution to flush off or dilute the contaminants.
- Absorption - The use of an absorbing material to trap and hold contaminants.
- Neutralization - Chemically altering the contaminant to an innocuous or less harmful state.

Generally speaking, discarding is the preferred methods of removing contaminants. This method is easy to implement, effective and relatively inexpensive.

Decontaminate or Discard?

Until recently, most chemical protective clothing (CPC) was rinsed, washed, and then used again. This old practice is starting to change because of two problems:

1. Rinsing and washing create contaminated waste water.
2. There is no way to know if washed clothing is really decontaminated and safe.

In the last few years, disposable chemical protective clothing has become available. It might eventually do away with the need for washing and rinsing.

Disposable CPC (sometimes called "single use" CPC) is worn only once. After use, it is carefully removed and put directly into a labeled drum. The drum can then be disposed of as hazardous waste, following EPA rules.

Using disposable CPC means that contaminated waste water can be kept to a minimum. This saves money and helps the environment.

Generally Recognized Types of Decontamination.

Primary or Gross Decontamination refers to that form of decon which is provided to personnel working in the Exclusion Zone or the Contamination Reduction Zone. This generally includes an organized decontamination process with workers providing the decontamination. Workers that remove the contaminated clothing with no assistance, also known as a form of dry de-con or self decontamination is a common form of decontamination.

Secondary Decontamination refers to after contaminated clothing has been removed they proceed to an area to wash with soap and water in the form of a shower or wash face and hands.

Dry Decontamination refers to using **no** water in the decontamination process. Workers using the self-decontamination process normally use no water until they have removed their contaminated clothing.
Another form of dry decontamination will be used for chemicals that react with water. Prior to gross decontamination process, workers remove as much chemical or clothing as possible keeping the reactive materials away from water. This process can be accomplish by clothing removal, brushing the chemical from the clothing, or using a decontamination vacuum to remove the contaminate.

Emergency Decontamination refers to decon that is urgent, field and/or site expedient. Most often it is performed on employees/workers, or response personnel who have had a direct exposure to hazardous solids, liquids, mist, smoke and certain gases, and who are displaying related symptoms. First clothing removal and a gross two-to-five minute water rinse. Exposures to the eyes might involve flushing for 15 minutes or longer.

Emergency Decon may be followed by Secondary Decon if deemed necessary by company protocol or the Poison Control Center.

Most hospitals will not accept contaminated victims in their emergency rooms. If possible after decontaminating the victim at the scene, transport them with information about the chemical, such as an MSDS, and written information they have been properly decontaminated

Respiratory Decon is provided to employees who have had an exposure to a gas which is toxic, but poses little or no risk of secondary contamination to rescue and EMS personnel. It may be required on an emergency basis for victims displaying related symptoms. It involves removing the victims from the hazardous environment and relocating them to a clean and safe location. Remove contaminated clothing to remove the threat of trapped vapors. It may include the administration of oxygen. Seek immediate medical attention.

Equipment Decon refers to the form of decon which is utilized to clean equipment so that it can be returned to service. Cleaning of equipment contaminated during mitigation of the incident which can include hand tools, monitoring equipment, and larger equipment such as backhoes and trucks.

Before placing equipment back into service for future use, secondary decontamination should be done using the proper solution and containment. It is difficult to determine if proper decontamination has been successful. One method would be, after containing equipment in a bag for a given amount of time, use a colorimetric tube for the given contaminate, and pull an air sample from the bag.

Preventing Contamination

When you work around chemicals:

- Avoid contact with toxic chemicals. Don't taste, touch, or sniff chemicals. Don't walk through areas that you know are contaminated.
- Use disposable protective clothing and equipment.
- Avoid sharp objects that could tear your protective clothing.
- Use remote equipment such as drum grapplers to move and open drums. Don't handle things unless you have to.
- Protect instruments and tools from contamination. Tools can be painted with a coating that peels off later. Keep your equipment bagged. (Measuring instruments in bags may have to be vented to work properly).
- Watch for signs that your personal protective equipment (PPE) isn't working.
    - ➢ The material can weaken (break down) and allow chemicals to get through. If your skin begins to itch or burn, your PPE isn't working.
- Always work with a buddy. Check your buddy's PPE for rips, tears, swelling, and other problems.
- Act fast. If you get contaminated or think your PPE has failed, leave the area quickly, and get decontaminated.
- Remember, PPE can help prevent contamination for a while, but that doesn't mean you can take unnecessary risks.

What to Decontaminate?

To decide what to decontaminate, and how, you need to ask these questions:

- Which chemical is involved?

Different chemicals call for different methods of decontamination. You neutralize an acid in a different way than you neutralize a base.

- How much of the chemical is present?

The more chemical there is, the more likely it is that the chemical has gone into or through your chemical protective clothing (CPC) or your personal protective equipment (PPE). There's an increased chance that your CPC, your PPE, or your body could be contaminated.

Chemicals are often invisible, so you may not be able to tell how much there is by sight. And even very small amounts of certain chemicals can be harmful. For example, small amounts of some corrosives can severely burn the skin.

When you decontaminate, you don't want to leave even tiny amounts behind.

- What type of protection are you using?

The level of protection will dictate type of de-con required. For example, if you use Level "B" with exposed Self-Contained Breathing Apparatus (SCBA), its straps and backpack need to be decontaminated.

Disposable protective gear should be used whenever possible.

II. METHODS OF DECONTAMINATION

Decontamination workers are people trained to remove chemicals from other workers' bodies, clothing, and equipment.

Personal protective equipment (PPE) and chemical protective clothing (CPC) are often decontaminated by scrubbing with a decontamination solution and water mixture. Then they are rinsed with copious amounts of water. (There is also disposable CPC which doesn't need decontamination, but must be disposed of in a safe manor.

To choose the right decontamination procedure you must know which specific chemical is involved. The right procedure also will depend upon how much chemical contamination there is, and what protective gear you are using when the contamination occurs.

Decontamination Solution

Dry decontamination and disposal of contaminated equipment is the best method, reduced waste and no cross contamination from re-use.

Other than water-reactive materials, **water is the best solution**. Water dilutes with little to no reaction from the chemical, however increases waste.

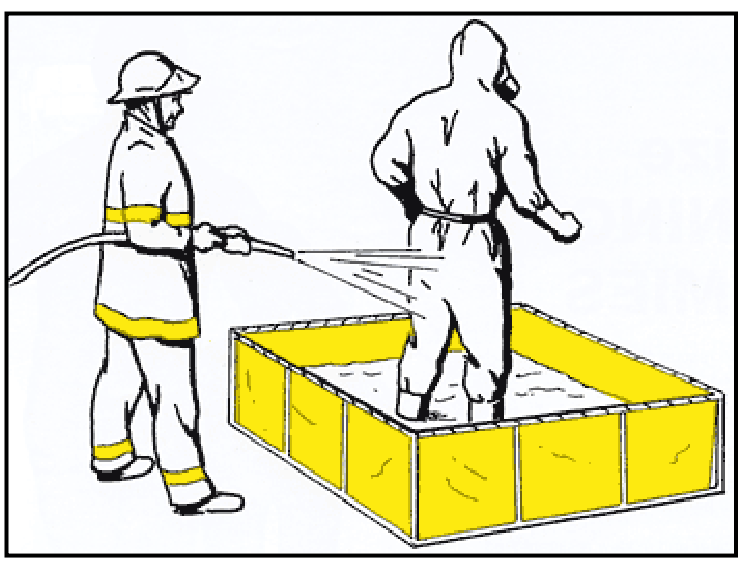
Historically, de-con solutions have been more harmful than the chemical being removed, such as caustic soda or soda ash and water solution for an acid. Caution should be taken in decisions for de-con solutions.

Below is a chart for suggestions on lower hazard solutions. If you use a de-con solution it needs to be followed by at least one water rinse.

Chemical	De-con solution	Suggested use and cautions
Hydrocarbons	Mild dish soap and water	Mix soap in container of water using soft bristled brush, sponge, or towel.
Acids	Baking soda	Small amount mixed in water.
Bases	Vinegar and water	Small amount mixed in water. *pH waste water for neutral results with both acids and bases.*
Bio Hazards	Bleach	Bleach should not be used on skin.
Water-reactive	Dry (use no water)	Wet de-con, using copious amount of water may follow after removing most of the contaminate.

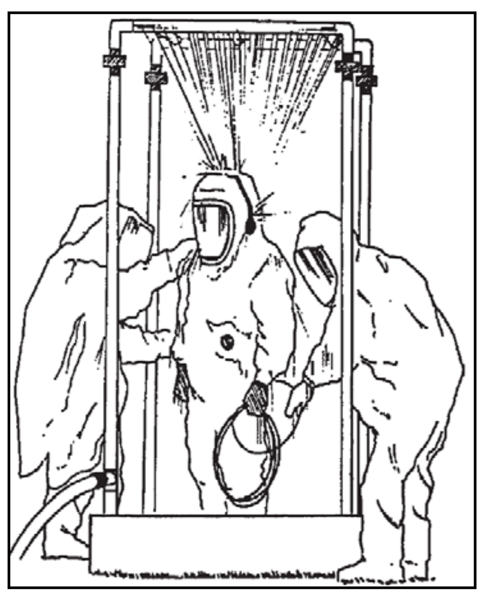
Decontamination Procedures

Decontamination procedures must provide an organized process by which levels of contamination are reduced. The objective of these procedures is to minimize the risk of exposure to hazardous substances and reduce or stop the spread out side the contaminated area.



In order to control and contain hazards in the de-con area a few general rules should be followed during any decontamination process:

- Establish clear procedures for each station on the decontamination line.
- Limit access to those who are supposed to be in the warm zone.
- Control runoff from decontamination showers.
- Regulate entry to and exit from work zones.
- Wear the appropriate PPE while in the decontamination area.
- Discard everything that cannot be thoroughly cleaned. (Stains, discoloration, and visible changes such as blistering are signs that a suit has been compromised). Porous materials, such as wood, are difficult to thoroughly clean.
- Avoid touching the inside or clean section of the suit with outer contaminated gloves.
- Do not touch contaminated surfaces with inner gloves or bare hands.
- Always leave breathing apparatus face mask on until clothing has been removed.
- Use comfortably tepid water to wash skin.
- Flush de-con water hose before using on worker. Hoses sitting in the sun will create very hot water.
- Double-bag or containerize contaminated items and keep them in the Contamination Reduction Zone until properly decontaminated.
- Decontamination takes priority over modesty or short-term exposure to extreme weather.
- Wash hair and body thoroughly as soon as possible after leaving the hot zone and before going home.



The lists that follow will give you a rough idea of the decontamination process. Steps applied for levels “A”, “B”, and “C” are different and range from self-decontamination to multi-pool de-con procedure.

The following suggestions are normally be used during Phase II of Site Characterization or Emergency Response. Long-range site clean-up operations normally utilize an area for self de-con.

In the Exclusion Zone (Hot Zone)

- Leave tools and equipment you used behind in the hot zone before you enter the Decontamination Reduction Zone (CRZ). Put tools, monitoring equipment, radios, clipboards, and other items in the predetermined area.

In the Contamination Reduction Zone (Warm Zone)

- De-con process:
  - ➢ De-con personnel should be suited no lower than one level below entry personnel with one person at each station.
    - ❖ One person at each pool
    - ❖ Two people at the Doffing area to assist with the removal of equipment.
  - ➢ An area can be set-up to wash and rinse outer boot covers and outer gloves.
  - ➢ For highly toxic or contaminated clothing, combination pools are used to reduce the contamination. This may take several washes and rinses. One suggested practice is to utilize several pools to contain waste water.
    - ❖ First pool, de-con solution is applied to the worker and rinsed with water.
    - ❖ Next pools would be for solution application or rinsing with water.
  - ➢ Suggested equipment used for de-con process;
    - ❖ Long-handled soft-bristled brushes, sponges, and towels.
    - ❖ When available garden hoses provide good water application.
    - ❖ Low-pressure spray units can be used to apply de-con solutions or containers (buckets) for solution.

- Doffing process:
  - Level “A”
    - Remove boots and deposit them in the proper container.
    - Remove outer gloves
    - Remove your chemical protective suit.
    - With a Vapor Tight Suit, the SCBA and face piece should be clean and the worker can leave the area with this equipment still on.
  - Level “B”
    - Remove boots and deposit them in the proper container.
    - Remove outer gloves
    - Remove SCBA harness leaving mask on worker (this normally will take an additional worker or something to place the back-pack on).
    - Remove your chemical protective suit.
    - Remove your face piece.
    - Deposit the face piece into protective container.
    - Remove your inner gloves.
    - Leave the area immediately.
  - Level “C”
    - Remove boots and deposit them in the proper container.
    - Remove outer gloves
    - Remove your chemical protective suit.
    - Remove your face piece.
    - Deposit the face piece into protective container.
    - Remove your inner gloves.
    - Leave area immediately.

- During the pre-planning stage;
  - Rehabilitation Area (Rehab) should be established close to the doffing area for medical assistance and liquids.
  - An area should be established for the workers to place their shoes close to the doffing area.

III. SANITATION

Sanitation is important at any worksite that deals with hazardous materials or waste in order to avoid contamination. Washing your hands after handling chemicals, after using the restroom and before handling food; showering regularly and wearing clean clothes are some basic elements of personal hygiene. But although personal hygiene is extremely important, workplace sanitation involves more than just personal hygiene. GISO 5192 states the ways in which employers are required to provide a sanitary workplace which contributes directly to the overall safety of the worksite.

(l) Potable water:

- (A) An adequate supply of potable water shall be provided on the site.
- (B) Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap, and shall be otherwise designed, constructed, and serviced so that sanitary conditions are maintained. Water shall not be dipped from containers.
- (C) Any container used to store, dispense, or distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.
- (D) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(2) Non potable water:

- (A) Outlets for non potable water, such as water for industrial or fire fighting purposes shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.
- (B) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing non potable water.

(3) Toilet facilities:

- (A) A minimum of one separate toilet facility shall be provided for each 20 employees or fraction thereof of each sex. Such facilities may include both toilets and urinals provided that the number of toilets shall not be less than one half of the minimum required number of facilities.

EXCEPTION: Where there are less than 5 employees, separate toilet facilities for each sex are not required provided the toilet facilities can be locked from the inside and contain at least one toilet.

(B) Under temporary field conditions, provisions shall be made to assure that at least one toilet facility is available.

(C) Hazardous waste sites, not provided with a sanitary sewer, shall be provided with the following toilet facilities unless prohibited by local codes:

1. Chemical toilets;
2. Re-circulating toilets;
3. Combustion toilets, or
4. Flush toilets.

(D) The requirements of this subsection for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

(E) Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.

(F) Toilet facilities shall be kept clean, maintained in good working order, and provided with an adequate supply of toilet paper.

(4) Food handling:
All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

(5) Temporary sleeping quarters:
When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

(6) Washing facilities:

The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below PELs and published exposure levels and which are under the control of the employer, and shall be so equipped as to enable employees to remove hazardous substances from themselves.

(7) Showers and change rooms:

When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.

(A) Showers shall be provided and shall meet the requirements of 8 CCR 3366(f).

(B) Change rooms shall be provided and shall meet the requirements of 8 CCR 3367. Change rooms shall consist of two separate change areas separated by the shower area required in subsection (n)(7)(A) of this section. One change area, with an exit leading off the worksite, shall provide employees with a clean area where they can remove, store, and put on street clothing. The second area, with an exit to the worksite, shall provide employees with an area where they can put on, remove, and store work clothing and personal protective equipment.

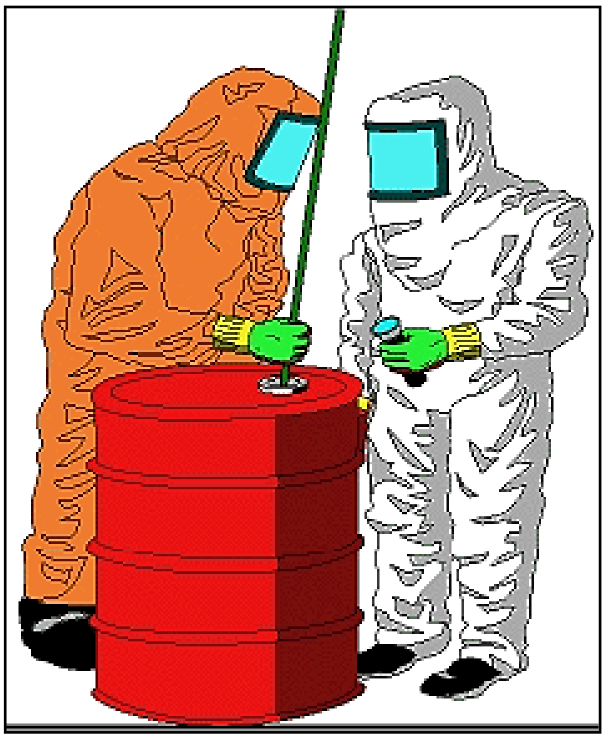
(C) Showers and change rooms shall be located in areas where exposures are below the PELs and published exposure levels. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the PELs and published exposure levels.

(D) Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.

Shower with soap and water. Personal decontamination assists in reducing secondary exposure to the hazard. Put on clean, uncontaminated clothing.

MODULE 18

Field Investigation and Lab Activity



Module 18
Field Investigation
And Lab Activity

OUTLINE

I. Lab Activity - Five Stations:
   - CGI,
   - Toxic Meter,
   - Colorimetric Tubes,
   - pH,
   - References

II. Field Activity Scenario

OBJECTIVES

At the end of this session, trainees will be able to:

1. Use different monitoring equipment to determine flammability and toxicity levels during a lab activity.

1. Develop an emergency response plan to perform a mock site investigation and spill mitigation.

2. Demonstrate their ability to use the following types of equipment:

   - Levels B or C personal protective equipment, including chemical protective gear and SCBAs or APRs using the “Buddy System”.
   - Air monitoring instruments, including the PID, CGI, multigas monitor, and colorimetric detector tubes.
   - Liquid sampling tubes and jars.

3. Demonstrate proper PPE donning and doffing

4. Demonstrate decontamination procedures.

I. LAB ACTIVITY

Using the monitoring equipment, identify flammable, corrosive, and toxic levels of each chemical at the sample stations.

All chemicals are household chemicals. Improper use may still cause injury. Use all chemicals carefully and use safety equipment.

Safety Procedures

All participants will use:

- *Safety glasses*
- *Lab gloves*

Respect other participants work area

Properly dispose of all waste

Keep lids on containers

Use caution when breaking glass tubes

Report any injury immediately

Directions for tests

Do not immerse tube or monitoring probe into liquid.

Direct reading stations: PPM and %LEL (measured by CGI):

Using the combustible gas indicator, PID, FID, combination monitor, ammonia and chlorine meters:

Remove the cap from the sample jar and take a reading at the rim of the jar. Record the reading on the work sheet.

Colorimetric tube station:

Follow the directions for the appropriate detector tubes. Each will be different.

(a) Using the Dräger or MSA bellows pump, draw a sample of vapors from the sample jar.

(b) Using the Dräger chip measurement system, determine the chemical concentration in each sample jar.

pH station: Place two drops of the chemical on the test paper. Use the chart on the test paper container to determine the pH level.

Reference station:
Using the NIOSH Pocket guide and NFPA Handbook, fill in the information for each chemical on the worksheet for station #5.

II. FIELD ACTIVITY SCENARIO

Your team will be given a scenario. Using information from the 40 hour manual, your team will be expected to mitigate the hazard facing the team to a safe conclusion.

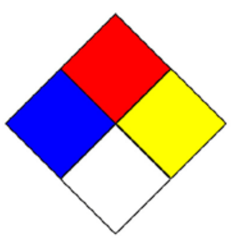
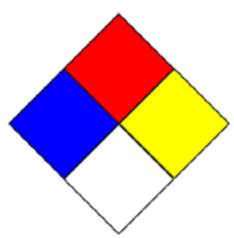
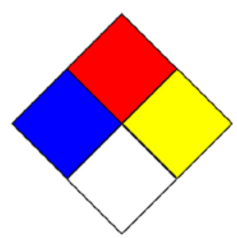
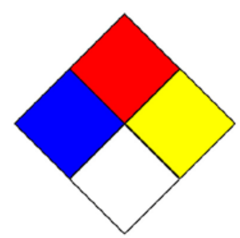
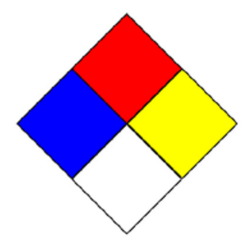
Your team should:

1. Evaluate the hazards.
    - What are the chemicals?
    - What will the chemicals do - alone with others?
    - What hazards, other than chemical, are present heat, noise, trenches, etc.)?
2. Establish a site safety plan.
3. Establish an emergency response plan.
4. Assign positions:
    - team leader, safety officer (two important positions)
    - buddy system with backup
    - decontamination
5. Task to be accomplished:
    - securing the area
    - handle emergencies
    - sampling, air and product samples
    - product containment
    - removal of the contaminant
6. Cleanup:
    - Restore the scene back to a classroom environment.
7. Critique:
    - With your team, evaluate your scenario. Did you accomplish your goals, and was everything done with safety in mind?

Monitoring Activity

	Station #1		**Station #2**		**Station #3**								**Station #4**	
	Litmus	Water Test	FID	PID	MSA/VOC		GasTech/CGI		Ammonia		Chlorine		Color-i-metric	
Sample	pH	Pos./Neg.	PPM	PPM	PPM	LEL	PPM	LEL	PPM	LEL	PPM	LEL	Tube Type	PPM
#1														
#2														
#3														
#4														
#5														

Chemical Name Using References - **Station #5**

	Sample #1 - Product Name	Sample #2 - Product Name	Sample #3 - Product Name	Sample #4 - Product Name	Sample #5 - Product Name
PEL					
IDLH					
VP					
RgasD					
LEL/UEL					
NFPA-704 Ratings 0 – 4					
Other hazards					

Module 19

Appendix
General Information
And Hand-outs

Appendix

Table of Content

GLOSSARY

A

Absorption – materials may be taken into the body (absorbed) through the skin or lungs.

Acid – any chemical with a low pH that can cause skin or tissue damage. (See also pH.)

Acute effect – a health effect which develops rapidly. Exposure to carbon monoxide may cause a person to pass out, an acute effect.

Additive effect – one in which the combined effect of two chemicals is equal to the sum of the agents acting alone.

Administrative controls – policies and practices written before work begins to minimize exposure to chemical and physical hazards.

Adsorption – when a chemical becomes attached to another material, for example, soil.

Aerosol – liquid droplets or solid particles dispersed in a gas. Particle size ranges from 0.002 to more than 100 µm.

AIHA – American Industrial Hygiene Association

Air-purifying respirator – protective mask which filters air and toxic materials through filters.

Alkali – any chemical with a high pH that in water solution is bitter and more or less irritating or caustic to the skin. Strong alkalis in solution are corrosive to the skin and mucous membranes. (See also pH.)

Alpha – positively charged radiation particle capable of traveling only a few inches in air.

Alveoli – the small air spaces deep in the lung where oxygen goes into the blood.

American Conference of Governmental Industrial Hygienists (ACGIH) – An organization of professional personnel in governmental agencies or educational institutions engaged in occupational safety and health programs. ACGIH develops and publishes recommended occupational exposure programs. ACGIH develops and publishes recommended occupational exposure limits (see TLV) for hundreds of chemical substances and physical agents.

Anhydrous – free from water.

Antagonism – the situation in which two chemicals, when introduced, interfere with each other's actions, or when one chemical interferes with the action of the other.

Asbestos – strong and incombustible fiber widely used in the past for fireproofing and insulation.

Asbestosis – a disease of the lungs caused by the inhalation of fine airborne fibers of asbestos.

Asphyxiant – a vapor or gas which can cause unconsciousness or death by suffocation (lack of oxygen). Asphyxiation is one of the principal potential hazards of working in confined spaces.

ASTM – American Society for Testing and Materials

Atrophy – the progressive loss of muscle mass, or wasting, caused by reduction in the size or number of muscle cells

B

Base – a liquid or solid which has a pH higher than 7. Beta-a negatively charged radiation particle. Boiling point-temperature at which a liquid changes to a vapor. Flammable materials with low boiling points generally present special fire hazards. Buddy system-a work practice in which workers team up in pairs during work activities. Bung-the cap or plug that fits into the holes in a drum.

Biohazards area – any area in which work has been, or is being performed with biohazardous agents or materials.

Biological (half-life) – the time required for a given species, organ, or tissue to eliminate half of a substance which it takes in.

Biological Hazardous Waste – Any substances of human or animal origin, other than food wastes, which are to be disposed of and could harbor or transmit pathogenic organisms including, but not limited to, pathological specimens such as tissues, blood elements, excreta, secretions, and related substances. This category includes wastes from health care facilities and laboratories, and biological and chemical warfare agents. Wastes from hospitals would include malignant or benign tissues taken during autopsies, biopsies, or surgery; hypodermic needles; and bandaging materials. Although the production of biological warfare agents has been restricted and production of chemical agents discontinued, some quantities still remain and must be disposed of. See Title 9 CFR Part 102 (licensed veterinary biological products), Title 21 CFR Part 601 (Licensing) or Title 42 CFR Part 72. Any substances of human or animal origin, other than food wastes, which are to be disposed of and could harbor or transmit pathogenic organisms including, but not limited to, pathological specimens such as tissues, blood elements, excreta, secretions, and related substances. This category includes wastes from health care facilities and laboratories, and biological and chemical warfare agents.

Breathing Zone Sample – an air sample, collected in the breathing area (around the nose) of a worker to assess his exposure to airborne contaminants.

C

Carcinogen – a substance which can cause cancer.

CAS Number – a unique number assigned to a chemical by the Chemical Abstract Service.

Catalyst – a substance that speeds up a chemical reaction.

cc – cubic centimeter, a metric measurement about the size of a sugar cube.

CCR – Code of California Regulations

Ceiling (C) – the maximum allowable exposure limit for an airborne substance, not to be exceeded during the shift.

Centigrade (ºC Celsius) – the internationally used scale for measuring temperature, in which 100° is the boiling point of water at sea level (1 atmosphere), and 0° is the freezing point.

Central Nervous System (CNS) – the part of the nervous system protected by the skull and the spinal column.

CFR – Code of Federal Regulations

Chlorofluorocarbons – a class of halochemical compounds containing both chlorine and fluorine used as refrigerants or cleaning solvents and commonly referred to as Freon.

Chemical cartridge – a filtering device which is attached to an air-purifying respirator.

Chemical Resistant Materials – materials that inhibit or protect against penetration of certain chemicals.

Chronic effect – a health effect which develops slowly over a long period of time.

Combustible Liquid (DOT usage) – liquid which have a flash point greater than 141ºF and below 200ºF.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) – authorized government money for clean-up of abandoned hazardous waste sites, clean-up and emergency response to transportation incidents involving chemical releases, payment to injured or diseased citizens, etc. It was amended in 1986.

Compressed Gas – Material packaged in a cylinder, tank, or aerosol under pressure exceeding 40 psi at 70° F or other pressure parameters identified by DOT.

Concentration – the amount of one material in another.

Confined space – any area which limits natural ventilation, making it easier for gases or vapors to accumulate.

Container – any portable device, in which a material is stored, transported, disposed of, or otherwise handled. (Title 40 CFR 260.10 (a) (9))

Corrosive – a liquid or solid that destroys another material or substance with which it comes in contact.

cu m (or m3) – cubic meter.

Cyanosis – Blue appearance of the skin, especially on the face and extremities, indicating a lack of sufficient oxygen in the arterial blood.

D

Dangerous when wet – a label required for certain materials being shipped under US DOT, ICAO, and IMO regulations. Any of this labeled material that is in contact with water or moisture may produce flammable gases. In some cases, these gases are liable to spontaneous combustion.

Decibels – a unit of measurement to detect noise levels.

Decomposition – the breakdown of a material (by heat, chemical reaction, decay, or other processes).

Decontamination – the chemical or physical process of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

Decontamination line – a line set up with stations for decontamination procedures between the Exclusion Zone and the Support Zone.

Degradation – method by which the protective properties of CPC are diminished.

Demand regulator – reduces tank pressure to provide air when the wearer inhales.

Department of Transportation (DOT) – Regulates shipments and transfer of hazardous materials.

Dermal toxicity – adverse effects resulting from skin exposure to a substance.

Dermatitis – redness or irritation of the skin.

Dilution – method of reducing the concentration of a contaminant to a safe level.

Desiccant – a substance such as silica gel that removes moisture (water vapor) from the air and is used to maintain a dry atmosphere in containers of food or chemical packaging.

Disposal drum – A nonprofessional reference to a drum used to over pack damaged or leading containers of hazardous materials for shipment; the proper shipping name is Salvage Drum as cited in Title 49 CFR 173.3.

Dose – the quantity of a chemical taken into the body.

Dose response – the relationship between the amount of the chemical and the amount of response in humans or animals.

Dose response curve – a graph that shows how much of the chemical dose causes an observed effect.

Drum grappler – a device designed to be attached to mechanical equipment for drum handling.

Dust – Solid particles generated by handling, crushing, grinding, rapid impact, of organic or inorganic materials, such as rock, ore, metal, coal wood, and grain. Dusts do not tend to flocculate except under electrostatic forces; they do not diffuse in air but settle under the influence of gravity.

Dyspnea – shortness of breath, difficult or labored breathing.

E

Emergency – an unexpected or unplanned event requiring remedial action.

Emergency response plan – written descriptions of planned actions and personnel responsibilities for emergency response actions.

Engineering control – substitution, isolation, and ventilation methods used to reduce the level of the contaminant at the source.

Environmental Protection Agency (EPA) – federal agency concerned with environmental air, water, and land quality.

Evaporation rate – how fast a liquid enters the air when compared with a known material. The evaporation rate can be useful in evaluating the health and fire hazards of a material. The known material is usually normal butyl acetate (NBUAC), with a vaporization rate designated as 1.0. Vaporization rates of other solvents or materials have three classifications: FAST evaporating if greater than 3.0. MEDIUM evaporating if 0.8 to 3.0. SLOW evaporating if less than 0.8.

Exclusion zone (Hot Zone) – the area where the hazard is present-contaminated area.

Explosion-proof Equipment – Apparatus enclosed in a case capable of withstanding an explosion of a specified gas or vapor that may occur and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and that operates at an external temperature such that a surrounding flammable atmosphere will not be ignited.

Explosive Limits – Some items have a minimum and maximum concentration in air which can be detonated by spark, shock, or fire.

Exposure – the concentration of a material in the air to which a worker can come into contact. Usually, exposure is measured near the nose of the worker (breathing zone)

F

Fahrenheit – The scale of temperature in which 212° is boiling water at 760 mm Hg and 32° is the freezing point.

Flammable (DOT usage) – a liquid with a flash point of 141ºF (60.5 ºC) or below.

Flash Point – the temperature at which a liquid will give off enough flammable vapor to burn. There are several flash point test methods, and flash points may vary for the same material, depending on the method used; so the test method is indicated when the flash point is given.

Full protective clothing – such units are typically recommended where high chemical gas, vapor, or fume concentrations in air may have a corrosive effect on exposed skin, and/or where the chemical in air may be readily absorbed through the skin to produce toxic effects. These suits are impervious to chemicals, offer full body protection, and include self-contained breathing apparatus (SCBA).

Fully Encapsulating Suits – full chemical protective suits that are impervious to chemicals. They offer full body protection from chemicals and their vapors/fumes, and are to be used with self-contained breathing apparatus (SCBA).

G

Gas – a state of matter in which the material has very low density and viscosity; can expand and contract greatly in response to changes in temperature and pressure.

Gram (gm) – a metric unit of weight. One U.S. ounce is about 28.4 grams.

H

Hazardous Chemicals – chemicals or materials used in the workplace that are regulated under the OSHA Hazard Communication Standard or the "right-to-know" regulations in Title 29 CFR 1910.120.

Hazardous material – to be considered hazardous, a waste must be on the list of specific hazardous waste streams or chemicals, or else it must exhibit one or more of certain specific characteristics including flammability, corrosivity, reactivity, and toxicity. The definition excludes household waste, agricultural waste returned to the soil, and mining overburden returned to the mine site. It also excludes all wastewater returned directly or indirectly to surface waters. However, hazardous waste may physically be in the liquid state.

Hazardous Waste Landfill – an excavated or engineered area on which hazardous waste is deposited and covered; proper protection of the environment from the materials to be deposited in such a landfill requires careful site selection, good design, proper operation, leachate collection and treatment, and thorough final closure

Hazardous Waste Leachate – the liquid that has percolated through or drained from hazardous waste emplaced in or on the ground.

Hazardous Waste Management – systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of hazardous wastes.

Hazardous Waste Operations and Emergency Response (HAZWOPER) – OSHA standard which was developed to protect hazardous waste personnel and emergency response personnel.

Hazards – the inherent characteristics of a material that may cause incapacitation, injury or mortality by contact, inhalation, or ingestion.

HAZCOM (1910.1200) – OSHA Hazard Communication Standard. Heat exhaustion-prolonged exposure to intense heat exceeds the body's ability to cool down, causing excessive sweating and sodium deficiency.

Heat stroke – a life-threatening condition during prolonged exposure to intense heat when the body is unable to sweat; extremely high body temperature and collapse may result.

Heavy metals – the major toxic metals.

Hematotoxin – toxic to the blood or organs where blood is made.

Hepatotoxin - toxic to the liver.

Hypothermia – condition of reduced body temperature.

I

Immediately Dangerous to Life or Health (IDLH) – any condition which may result in damage to health which cannot be repaired. IDLH situations include explosive and oxygen-deficient environments and the presence of Class A poisons or substances which can be absorbed through the skin.

Inactive Facility – the EPA designation for a treatment, storage, or disposal facility that has not accepted hazardous waste since November 19, 1980.

Inactive Portion – a portion of a hazardous waste management facility that has not operated since November 19, 1980, but is not yet a closed portion (no longer accepts waste to that area).

Incident Command System (ICS) – an organized system of personnel and delegation of responsibilities which controls the response to an emergency.

Incident Commander – person in charge of on-site management of all activities at a hazardous materials emergency.

Incompatible chemicals – chemicals which produce a negative reaction when mixed. Ingestion-taking a substance in through the mouth.

Inhalation – Breathing in through the mouth or nose a substance in the form of a gas, vapor, fume, mist, or dust.

Irritant – a substance which causes an inflammatory response when brought into contact with the eyes, skin, or respiratory system.

Isolation – method of decontamination in which contaminated equipment and materials are bagged or covered and set aside, usually for subsequent shipment to an approved landfill for disposal.

L

Lab Pack – For use with smaller non-damaged bottles, cans, carboys and 5 gallon pails of non-leaking hazardous materials - if leaking, must pack with sufficient sorbents for (No Free Liquids)

Latency – the time interval between exposure to a substance and the development of a disease.

Leachate – liquid released into soil from a land disposal facility. Leachate is generated when water enters a landfill, migrates through it, picking up soluble materials, and seeps into the soil.

Lethal Concentration (LC_{50}) – the concentration of a material which on the basis of laboratory tests is expected to kill 50 percent of a group of test animals when administered as a single exposure (usually 1 or 4 hours). Also, other LC values can be expressed (e.g., LC_{10} and LC_{20}).

Lock-out – a procedure to prevent use of any equipment which should not be used, generally tagged and locked closed or off.

Low Lethal Concentration (LLC) – is the lowest concentration of a substance in air, which has been reported to have caused death in humans or animals. The reported concentrations may be entered for periods of exposure that are less than 24 hours (acute) or greater than 24 hours (sub-acute and chronic).

Lower explosive limit (LEL) – the lowest concentration (lowest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc, flame) is present.

Lower Flammable Limit (LFL) – the lowest concentration of the material in air that will support combustion from a spark or flame.

M

M (m) – meter; a metric unit of length equal to about 39 inches. Main-line valve-controls air flow to the regulator on supplied-air respirators.

Manifest form – required by the EPA to track hazardous wastes.

Material Safety Data Sheet (MSDS) – informational sheet which is sent with hazardous materials. MSDS lists chemical properties, emergency response procedures, reactivity data, control measures, safe handling procedures, and manufacturer.

Melting point – the temperature at which a solid substance changes to a liquid state. For mixtures, a melting range may be given.

Metabolism – the chemical reactions that go on in the body to maintain life.

Millirad (mrad) – a unit of radiation dose equal to 0.001 rad or 10 micrograys.

Milligrams per cubic meter (mg/m3) – unit of measurement generally used to weigh fibers. One U.S. gram is about 1,000 milligrams.

Miscibility – The ability of a liquid or gas to dissolve uniformly in another liquid or gas.

Monitoring – measuring concentrations of substances in the workplace.

Morbidity – non-fatal disease from an exposure.

Mortality – death from an exposure.

Mutagen – a substance which can change the genetic material (DNA) in a living cell.

N

National Fire Protection Association (NFPA) – produces many standards, including the four-color diamond used on labels to indicate hazard. Health, fire, and reactivity hazards are rated from 0 (none) to 4 (extreme). The Health rating is in the blue section, Fire in red, and Reactivity in yellow. The white section is reserved for Other Specific Hazards (for example, "radiation: do not use water" or "fire.")

National Institute for Environmental Health Sciences (NIEHS) – a federal agency responsible for issues related to the environment.

National Institute for Occupational Safety and Health (NIOSH) – a federal research agency responsible for issues related to occupational safety and health.

Neurotoxin – a substance which is toxic to the brain and nerves.

Neutralization – The process by which acid or alkaline properties of a solution are altered by addition of certain reagents to bring the hydrogen and hydroxide concentrations to an equal value; sometimes referred to as pH7 the value of pure water.

Nuclear Regulatory Commission – responsible for community and worker protection from radiation hazards.

O

Occupational Safety and Health Administration (OSHA) – a federal unit responsible for creating and enforcing laws related to occupational safety and health.

Olfactory – relating to the nose or sense of smell. Oral-taken into the body through the mouth.

Oral toxicity – adverse effects resulting from taking a substance into the body through the mouth.

Overpack – Except when referenced to a packaging specified in Title 49 CFR Part 178,.For use with larger non-damaged containers, cans and drums of non-leaking hazardous materials - if leaking, must pack with sufficient sorbents for (No Free Liquids)

Oxidation – a reaction in which a substance combines with oxygen, the oxygen being provided by an oxidizer or oxidizing agent.

Oxidizer – a substance that gives up oxygen readily to stimulate the combustion of organic matter.

Oxygen deficient – air which contains less than 19.5% oxygen.

Oxygen enriched – an atmosphere containing more than 23.5% oxygen.

P

Parts per million (ppm) – a unit used to measure particulates.

Penetration – the flow of a chemical through zippers, stitched seams, pores, or imperfections in the material.

Percutaneous absorption – absorption into the skin.

Permeation – process by which a chemical dissolves in or moves through a protective clothing material on a molecular level.

Permissible Exposure Limit (PEL) – the highest level of a substance to which a person can be exposed, set by OSHA.

pH – power of hydrogen, applies to liquids. A pH less than 7 is acid. A pH of 7 is neutral, and a pH greater than 7 is alkaline.

Physical agent – heat, noise, radiation, vibration.

Pretreatment Standards (CWA Usage) – specific industrial operation or pollutant removal requirements in order to discharge to a municipal sewer.

Poison Control Centers – a nationwide network of poison control centers has been set up with the aid of the United States Food and Drug Administration and Department of Health and Human Services. The centers, usually established in local hospitals, are now widely distributed and available by phone from most parts of the country. Staff members are specially trained in the treatment of poisoning cases.

Polymerization – a chemical reaction usually carried out with a catalyst, heat, or light, and often under high pressure. In this reaction a large number of relatively simple molecules combine to form a chain-like macromolecule.

Pulmonary toxin – toxic to the lungs.

Pyrophoric – a chemical that will ignite spontaneously in air at a temperature of 130° F (54.4° C) or below.

Q

Qualitative fit-test – measures effectiveness of a respirator by exposing wearer to a test atmosphere containing an irritating or smelly substance. Wearer should not be able to detect the substance.

Quantitative fit-test – measures effectiveness of a respirator in preventing substance from entering the facepiece while wearer is in a test chamber. Actual amount of concentration of substance is measured inside the facepiece of the respirator.

R

Rad – a measure of radiation energy absorbed by the body.

Reactivity – a description of the tendency of a substance to undergo chemical reaction with the release of energy. Undesirable effects such as pressure build-up, temperature increase, or formation of noxious, toxic, or corrosive by-products may occur because of the reactivity of a substance to heating, burning, direct contact with other material, or other conditions found in use or in storage.

REM – Roentgen Equivalent Man, a measure of radiation dose. Renal-pertaining to the kidney. About 500 R in 5 hours is lethal for humans a typical dose of normal background radiation for a human is 200 mR per year.

Residual volume (RV) – the amount of air remaining in the lung after maximum expiratory effort.

Resource Conservation and Recovery Act (RCRA) – a federal law which regulates management and disposal of hazardous materials and wastes.

Risk – exposure to the chance of injury or loss.

Route of Entry – how material gets into the body: inhaled, ingested, via the skin (dermal), or eye(s).

S

Salvage Drum – A drum with a removable metal head that is compatible with the lading used to transport damaged or leaking hazardous materials or used absorbent materials for repackaging or disposal. (see Title 49 CFR 173.3). Require "Salvage Drum" labeling and must pass a 3-PSI pressure test.

Self-contained breathing apparatus (SCBA) – a supplied-air respirator consisting of an oxygen tank, carrying assembly, gauge, safety valve, and full facepiece for use when exposures are unknown or particularly toxic.

Sensitizer – a substance which on first exposure causes little or no reaction but which on repeated exposure may cause a marked response not necessarily limited to the contact site.

Short-Term Exposure Limit (STEL) – an exposure limit set by ACGIH that sets the maximum concentration that a worker can be exposed to during a 15-minute period.

Solubility in water – a measure of how much of a material will dissolve in water. Specific gravity is the weight of a material compared to the weight of an equal volume of water; an expression of the density (or heaviness) of the material. Insoluble materials with specific gravity less than 1.0 will float in water; insoluble materials with specific gravity greater than 1.0 will sink in water.

Stability – an expression of the ability of a material to remain unchanged. For MSDS purposes, a material is stable if it remains in the same form under expected and reasonable conditions of storage or use. Conditions which may cause instability (dangerous change) are stated. Examples are temperatures above 150ºF or shock from dropping.

Standard Operating Procedures (SOP) – written descriptions of tasks and activities to be followed during work.

Support Zone (Cold Zone) – area where administrative and support functions not requiring respiratory protective equipment are performed.

Synergistic effect – a combined effect of two or more substances which is greater than the sum of the effect of each. Systemic-relating to the whole body rather than its individual parts.

T

Teratogen –a substance or agent to which exposure of a pregnant female can result in changes in the fetus.

Threshold – the lowest dose or exposure to a chemical at which a specific effect is observed.

Threshold Limit Value (TLV) – a term used by ACGIH to express the airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects. ACGIH express TLVs in three ways:

TLV-TWA – the allowable time weighted average concentration for a normal 8-hour workday.

TLV-STEL – the short-term exposure limit or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods a day, with at least 60 minutes between exposure periods and provided that the daily TLV-TWA is not exceeded).

TLV-C – the ceiling exposure limit or "the concentration that should not be exceeded during any part of the working exposure . . . a 15-minute period except for those substances which may cause immediate irritation . . ."

Time-Weighted Average (TWA) – measurement to determine the worker's average exposure to a substance over a typical 8-hour work shift. The actual exposure is then compared to OSHA standards or other professional guidelines.

Toxic Substances Control Act (TSCA – a list of reviewed harmful substances that require precautions and safe work practices by the community and industry.

Toxicity – the adverse effects from exposure.

U

United Nations' Identification Number (UN Number) – a number used internationally to identify a hazardous material. United States Coast Guard (USCG) - concerned with the transportation of hazardous materials across navigable waterways and other bodies of water.

Upper Explosive Limit or Upper Flammable Limit (UEL/UFL) – pertaining to a vapor or gas. It is the highest concentration (highest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc, or flame) is present. At higher concentrations, the mixture is too "rich" to burn. Also see "LEL."

V

Vapor – gaseous form of a substance normally in the liquid or solid state at room temperature. Vapor density is the weight of a vapor or gas compared to the weight of an equal volume of air; an expression of the density of the vapor or gas. Materials lighter than air have vapor densities less than 1.0. Materials heavier than air have vapor densities greater than 1.0.

Vapor pressure – indicates the tendency of a liquid to evaporate into the air.

Ventilation – a form of engineering control that removes airborne contaminants.

Viscosity – the property of liquid; resistance to flow.

Volatility – The tendency of a solid or liquid material to pass into the vapor state at a given temperature.

W

Waste profile sheet – a document which is provided by the laboratory that conducted the analysis of the hazardous waste. It describes the physical and chemical properties of the waste sample.

Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
AOR	Area of Responsibility
APF	Air Protection Factor
APR	Air Purifying Respirator
ATSDR	Agency for Toxic Substances and Disease Registry
AQMD	Air Quality Management District
BLEVE	Boiling Liquid Expanding Vapor Explosion
CAC	California Administrative Code
CAER	Community Awareness/Emergency Response Program
CAL-OSHA	California Occupational Safety and Health Administration
CAS	Chemical Abstracts Service
CCR	California Code of Regulations
Ca	Carcinogen
CEEL	Community Emergency Exposure Level
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CGC	California Government Code
CHEMTREC	Chemical Transportation Emergency Center
CHLOREP	Chlorine Emergency Program
CHRIS	Chemical Hazards Response Information System
C	Ceiling
CGI	Combustible Gas Indicator
CIH	Certified Industrial Hygienist
CMA	Chemical Manufacturer’s Association
CPC	Chemical Protective Clothing
CRWQCB	California Regional Water Quality Control Board
CUPA	Certified Unified Program Agency
CWA	Clean Water Act (1972)
DOE	Department of Energy
DOT	Department of Transportation
DOFF	take off (defensive off)
DON	put on (defensive on)
DTSC	Department of Toxic Substances Control
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERD	Emergency Response Division (EPA)
ERG	Emergency Response Guidebook

EHS	Extremely Hazardous Substance
EMS	Emergency Medical Service
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	Emergency Response Plan
FHSA	Federal Hazardous Substance Act (1960)
FID	Flame Ionization Detector
FOSC	Federal On-Scene Coordinator
FRA	First Responder Awareness
FRO	First Responder Operations
FWPCA	Federal Water Pollution Control Act (1972) = CWA
GISO	General Industrial Safety Orders
HazCom	Hazard Communication
HAZ MAT	Hazardous Material
HAZWOPER	Hazardous Waste Operation and Emergency Response
HEPA	High Efficiency Particulate Air filter
HHS	U. S. Department of Health and Human Services
HMTA	Hazardous Materials Transportation Act
ICS	Incident Command System
IDHA	Identification and Hazard Assessment
IDLH	Immediately Dangerous to Life or Health
IIPP	Injury and Illness Prevention Program
LC LO	Lethal Concentration, low
LC 50	Lethal Concentrations, 50%
LD 50	Lethal Doses, 50%
LEL	Lower Explosive Limit
LEPC	Local Emergency Planning Committee
LOP	Level of Protection
LOSH	Labor Occupational Health and Safety Program
mg/m^3	Milligrams per cubic meter
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NCP	National Contingency Plan
NCRIC	National Chemical Response and Information Center
NEPA	National Environmental Policy Act (1970)
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NOS	Not Otherwise Specified
NRC	National Response Center
NSC	National Safety Council
NSF	National Strike Force
OES	Office of Emergency Services (State or County)

OFT	Oxygen Flammability Toxicity
OPA '90	Oil Pollution Act of 1990
ORM	Other Regulated Material
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
OSPR	Office of Oil Spill Prevention and Response
PEL	Permissible Exposure Limit
PID	Photo Ionization Detector
PPB	Parts per Billion
PPE	Personal Protective Equipment
PPM	Parts Per Million
PAPR	Powered Air Purifying Respirator
pH	power of Hydrogen
RCRA	Resource Conservation and Recovery Act (1976)
REL	Recommended Exposure Limits (NIOSH)
RgasD	Relative Gas Density (VD=vapor density)
RQ	Reportable Quantity
RTECS	Registry of Toxic Effects of Chemical Substances
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCBA	Self-Contained Breathing Apparatus
SDWA	Safe Drinking Water Act (1974)
SEMS	Standardized Emergency Management System
SpG	Specific Gravity
STCC	Standard Transportation Commodity Code
SERC	State Emergency Response Commission
STEL	Short Term Exposure Limit
SWRCB	State Water Resources Control Board
TLV	Threshold Limit Value
TLV-STLV	Short Term Limit Value
TRIC	Toxic Reactive Ignitable Corrosive
TSCA	Toxic Substances Control Act (1976)
TSCD	Toxic Substances Control Division
TSDF	Treatment, Storage and Disposal Facility
TWA	Time Weighted Average
UL	Underwriter's Laboratories
USCG	U. S. Coast Guard
USDOT	U. S. Department of Transportation
USEPA	U. S. Environmental Protection Agency (EPA)
USFWS	U. S. Fish and Wildlife Service
USNRC	U. S. Nuclear Regulatory Commission
VOC	Volatile Organic Compound
VP	Vapor Pressure

Module 2. Compliance and Enforcement

Web Sites Relating to Hazardous Materials

Laws and Regulations

California	Federal
www.dir.ca.gov/samples/search/query.htm	www.osha.gov
www.calregs.com	www.hazmat.dot.gov
	www.epa.gov

General

Centers for Disease Control and Prevention www.cdc.gov

Database and Internet Searching www.chemfinder.com

Emergency Response and Research Institute www.emergency.com

Database of Hazardous Chemicals and Occupational Disease www.haz-map.com

Department of Toxic Substances Control www.DTSC.CA.Gov

Office of Environmental Health Hazard Assessment www.OEHHA.CA.Gov
www.terraserver.com

Module 3. Workers' Rights

Cal/OSHA Consultation Programs

Toll-free number: 1-800-963-9424 **Internet: www.dir.ca.gov**

•On-site Assistance Program

Area Offices

Northern California
2424 Arden Way, Suite 410
Sacramento, CA 95825
(916) 263-0704

San Francisco Bay Area
1515 Clay Street, Suite 1103
Oakland, CA 94612
(510) 622-2891

Central Valley
1901 North Gateway Blvd., Suite 102
Fresno, CA 93727
(559) 454-1295

San Bernardino
464 West 4th Street., Suite 339
San Bernardino CA 92401
(909) 383-4567

San Fernando Valley
6150 Van Nuys Blvd., Suite 307
Van Nuys, CA 91401
(818) 901-5754

San Diego/Imperial
7575 Metropolitan Drive,
Suite 204
San Diego, CA 92108
(619) 767-2060

Los Angeles/Orange
10350 Heritage Park Drive., Suite 201
Santa Fe Springs, CA 90670
(562) 944-9366

Your call will in no way trigger an inspection by Cal/OSHA Enforcement

- **Voluntary Protection Program**
  San Francisco, CA 94142
  (415) 703-5272

- **Research and Education Unit**
  Sacramento, CA 95825
  (916) 574-2528

DIR CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS

16 REU JUNE 2005

Module 11C. Respiratory Protection

Safety & Health Fact Sheet

CAL OSHA CONSULTATION SERVICE

February 2005

Cal/OSHA Consultation Service
California Department of Industrial Relations
P.O. Box 420603 • San Francisco, CA 94142-0603

Respirator Regulation

Cal/OSHA's regulation for worker use of respirators is Section 5144 in Title 8, California Code of Regulations. Section 5144 details steps employers must take to assure safe and effective use of respirators in the workplace.

The regulation contains many provisions. However, it is important to start with the requirements related to the most serious hazards in your workplace first.

The regulation applies to all workplace respirator use. Also, substance-specific standards (e.g. lead, asbestos, carcinogens) now reference parts of Section 5144. (Firefighters: see also Section 3409.)

Before resorting to use of respirators, hazardous airborne exposures must be controlled whenever feasible by engineering and work practice controls.

The Cal/OSHA respirator regulation can be accessed at the Division of Occupational Safety and Health section of the California Department of Industrial Relations website: **http://www.dir.ca.gov**

Elements of the comprehensive respirator program required of employers:

- All procedures in written form
- Selecting appropriate respirators
- Medical evaluation of respirator users
- Annual face seal fit testing
- Procedures for routine and emergency use
- Respirator cleaning and disinfection, storage, inspection, maintenance and repair
- Air quality for supplied air devices
- Annual employee training
- Periodic program evaluation

Getting Help

Improper use of respirators can result in worker injury and illness, fines and job shutdowns. For help in complying with Section 5144, contact:

Cal/OSHA Consultation Service

Employers can request at no cost an industrial hygienist to come to their worksite to determine if respirators are needed and which ones to use. The Consultation Service is independent of Cal/OSHA's enforcement unit and can be reached at:

San Bernardino 909-383-4567
San Diego 619-767-2060
Santa Fe Springs 562-944-9366
Sacramento 916-263-0704
Fresno 559-454-1295
Oakland 510-622-2891
Van Nuys 818-901-5754
Or toll-free 1-800-963-9424

Important requirements in the regulation:

- Voluntary use: provisions where employees use respirators and dust masks as a voluntary precaution.......5144(c)(2)
- Qualified program administrator required 5144(c)(3)
- Atmospheres immediately dangerous to life or health: detailed specification of acceptable respirators. ....5144(d)(2)
- End-of-service-life indicators: required for chemical cartridges, or the employer must have data showing acceptable change-out times. ....5144(d)(3)(C)2
- Employee medical evaluations: required prior to first use of a respirator, as well as follow-up medical examinations and allowing employees to discuss their medical questionnaire results with the administering health care provider.......5144(e)
- Powered air-purifying respirators: to be provided to employees unable to wear a negative pressure respirator for medical reasons..........5144(e)(6)(B)
- Annual face seal fit testing with test atmosphere: acceptable methods of fit testing are detailed in Appendix A. Fit testing is now also required for tight fitting air-supplied respirators............5144(f)
- Facepiece seal checks: each time a tight fitting respirator is put on, its user must perform a seal check as specified in Appendix B-1...5144(g)(1)(C)
- Atmospheres that may be immediately dangerous to life or health: detailed precautions to be taken. ....5144(g)(3)
- Annual employee training: employees must be able to demonstrate knowledge and skills specific to the hazards and uses of respirators in their particular workplace, including emergency use. ....5144(k)
- Ongoing respirator program evaluation: including periodic consultation with employees.........5144(l)

Internet Resources

- Cal/OSHA http://www.dir.ca.gov
- Federal OSHA http://www.osha.gov
- NIOSH publications http://www.cdc.gov/niosh or phone 1-800-356-4674

Module 11C. Respiratory Protection

Checklist to determine when you can wear an APR

Yes No

☐ ☐ Does the air contain at least 19.5% oxygen?

☐ ☐ Are the identities and concentrations of **all** the contaminants known so you can select the proper respirator and cartridges/canisters?

☐ ☐ Are the concentrations of all air contaminants less than IDLH levels?

☐ ☐ Is the protection factor of the respirator adequate to keep the exposures below the PEL?

☐ ☐ Is the respirator (facepiece and cartridges) NIOSH/MSHA approved for the contaminants at the measured concentrations?

☐ ☐ Have you been fit-tested for the respirator in use?

☐ ☐ Have you been trained in the proper use of your respirator, including how often to change the cartridge/canister?

In general, if the answer to all of these questions is YES, you may wear an air purifying respirator. If the answer to any of these questions is NO, you **must** use a supplied air respirator with a self-contained air supply.

Module 11C. Respiratory Protection

ANSI Z88.7-2001 COLOR CODES

CONTAMINANT	COLOR
Acid gases	White
Organic vapors	Black
Ammonia gas	Green
Ammonia/methyl amine gas	Green
Carbon monoxide gas	Blue
Acid gases and organic vapors	Yellow
Acid gases, ammonia and organic vapors	Brown
Organic vapors, chlorine, chlorine dioxide, hydrogen chloride, hydrogen fluoride, sulfur dioxide, formaldehyde, hydrogen sulfide, ammonia, and methyl amine	Tan (Pale Brown)
Acid gases, ammonia, organic vapors carbon monoxide	Red
Other vapors and gases or combinations not mentioned above	Olive
High-efficiency (PAPRs only)	Purple
Any particulates (P100)	Purple
Any particulates (P95, P99, R95, R99, R100)	Orange
Any particulates free of oil (N95, N99, or N100)	Teal

ANSI Standard, ANSI Z88.7-2001, Color Coding of Air-Purifying Respirator Canisters, Cartridges, and Filters, establishes a system for identifying NIOSH-approved respirator air-purifying elements by means of color-coding.

Module 11C. Respiratory Protection

How To Inspect Your Respirator

STRAPS—hold the respirator on your head. One goes over the crown of your head. Another headband has two plastic straps, which go straight up and straight back on your head.

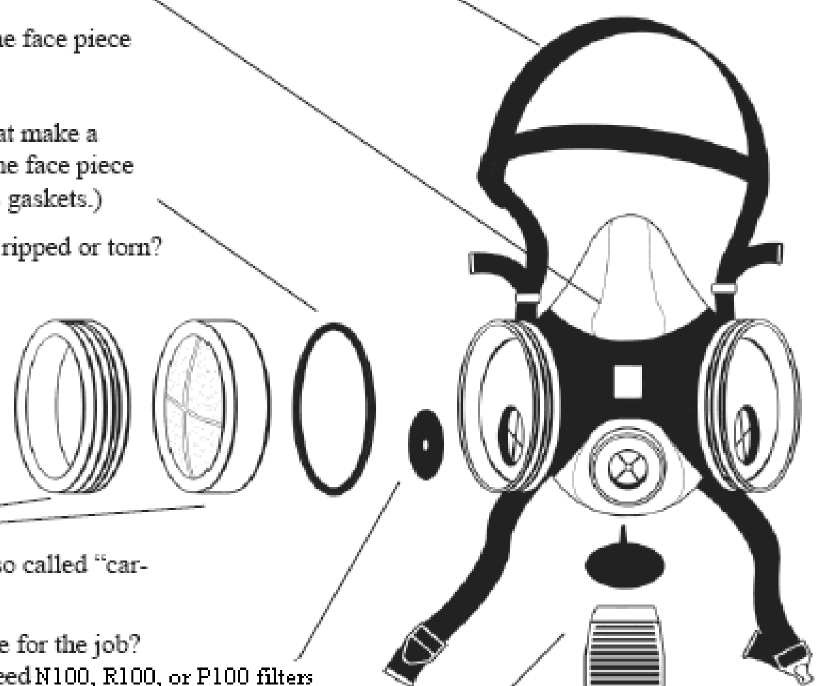
Check: Are they elastic? Are they torn? Do the buckles and snaps work?

FACE PIECE—is made of rubber, silicon, or other materials.

Check: Is it ripped or worn? Is the face piece bent? Is it clean?

GASKETS—are rubber rings that make a tight seal between the filter and the face piece present. (Not every respirator has gaskets.)

Check: Are they there? Are they ripped or torn?



Filters-filter the air. They are also called "car-tridges."

Check: Do you have the right one for the job? When you work with lead, you need N100, R100, or P100 filters When you use solvents or caustic pa: need other filters, too. Change filters especially when it becomes harder to breathe.

INHALATION VALVES—are where you breathe in. There are two small rubber flaps behind the filters.

Check: Are both there? Are they ripped or bent? Are they dirty?

EXHALATION VALVE-Is where you breathe out. It Is a small rubber flap about the size of a quarter. It is underneath a cover.

Check: Take off the cover. Is the valve there? Is It ripped or bent? Is it dirty?

Module 14.
Checklist for Hazardous Waste Activity and Safety Program

☐ **Project name, location, facility name, and number**

____
____
____

□ **Project objectives** (include duration of project)

	Site Prep		Soil Sampling		UST Removal
	Site Characterization		GW sample		Spill Response
	Drum Sampling		Remediation		Construction
	Soil Gas Sampling		Soil Removal	Other (specify):	

□ **Site description, history, and disposal practices** (include also: size, topography, and site map)

____
____
____

□ **Key personnel, job title, and training requirements**

Name and Job Title	Training	Medical Exam	PPE	Other Information

□ **Hazardous Materials Summary**

	Acids		Cyanides		Laboratory Waste		Oily waste		Sludge
	Aluminum		Dyes/Inks		Metals		Paints pigments		Solids
	Asbestos		Fly Ash		Non-halogenated solvents		Pesticides		Solvents
	Caustics		Halogenated Solvents		Oils		Phenols		Radiological

□ **Fire and Explosion Potential**

	High		Medium		Low		Unknown		Other

Include Rationale and Justification (i.e., LEL measurements, flash point, etc)

□ **Waste types, waste characteristics, hazards of concern, and known contaminants** (describe each and provide monitoring results and controls)

Waste Types:

	Liquid		Solid		Sludge		Gas	Other		Unknown

Waste Characteristics (Physical/Chemical Properties – include references):

	Chemical		Toxic		Corrosive		Volatile		Shock Sensitive
	Biological		Radiological		Reactive		Flammable		Unknown

Hazards of Concern:

	Biological		Cutting/Welding		Explosive/Flammable		Noise
	Cold Stress		Electrical		Heat Stress		Overhead Hazards
	Confined Space Entry		Excavation		Heavy Equipment		Sanitation

Known Contaminants (list all, include references – i.e., MSDS):

Contaminants	PEL/TLV	IDLH	Warning	Symptoms or Effects	Immediate First aid

□ **Personal Protective Equipment**

Job Task	Work Zone/location	PPE level

□ Access and Hazard Controls

o **Toxic Materials:** Protective clothing, respirators, gloves, decontamination, direct monitoring, personal monitoring, continuous monitoring.	o **Heat Stress:** Periodic work monitoring. Adjust work/rest breaks according regulation. Minimize clothing when possible. Drink water regularly. Discuss signs and symptoms. Work during cooler part of the day.
o **Heavy Equipment:** Safety features and devices in place and functioning. Warning signs in place as required. Flagger assigned where necessary. Guards in place. Swing radius roped off and marked.	o **Subsidence:** Underground anomalies located by ground penetrating radar. Areas located and posted. Load test where appropriate. Personnel notified of hazard areas.
o **Cold Stress:** Wear layered, insulated clothing. Monitor temperature periodically. Take breaks in warm areas where possible. Discuss symptoms and signs of cold stress.	o **Walking Working Surfaces:** Carry out daily house keeping efforts. Keep walkways areas clear. Designate walkways and emergency routes where necessary. Flag or post problem areas.
o **Excavation:** Shoring and sloping per OSHA requirements. Access in and out of excavation. Spoils 2 ft back from edge. Monitoring if confined space. Rope excavation if unattended.	o **Explosive and Flammable**: Proper container used. Non-sparking tools. Grounding/bounding used. HAZMAT team notified of location of materials. Fire extinguisher.
o **Emergency Equipment:** Two forms of communication. Emergency numbers posted. Emergency Plan covered. Emergency first-aid kits.	o **Pinch Points:** Ensure guards are in place. Brief site personnel on location of potential pinch points. Identify and post areas where guarding is not appropriate or feasible.
o **Electrical:** Lock and tag where required. Insulating materials and clothing when required.	o **Confined-Space Entry:** Ventilation, access controls, illumination, monitoring. Permits monitoring.
o **Overhead Hazards:** Work not permitted under a suspended load. Use tag lines to handle loads. Secure loose overhead objects. Discuss dangerous parts of the work. Wear head protection when required. Post head protection areas.	o **Noise:** Hearing protection provided and worn. Signs posted. Hearing conservation training. Monitoring.

□ **Site Work Zones and Decontamination**

Site control will be established by initiating the following work zones:

1. Support Zone
2. Contamination Reduction Zone
3. Exclusion Zone
4. Other

Also include entry points and location of emergency equipment as well as a map showing the route to the nearest medical facility.

List all personnel, sampling equipment, and heavy equipment decontamination

____

____

____

Develop and include a waste disposal plan for hazardous waste generated during decontamination.

□ **Monitoring Equipment and Action Levels**

Job or task to be monitored	Type of Instrument	Monitoring Frequency	Action Level

□ **Communication** (list communication system to be used for each task and zone)

Task	Work Zone	Communication Method	Special Instructions

1. hand signals
2. 2-way radios
3. horns
4. emergency alarms
5. others________________

□ **Emergency Response Plan and Procedures**

Emergency Contacts
Facility Manager: ____________________
Project Manager: ____________________
Site Safety and Health Officer: ____________________
Personal Injury: ____________________
Fire Department: ____________________
Security/Police: ____________________
Chemical Exposure: ____________________
Industrial Hygiene: ____________________
Safety: ____________________
Health Physics: ____________________

Spill Control Plan
Contacts: ____________________
Containment Kit: ____________________
Other Equipment: ____________________
Actions to be taken: ____________________

Medical Facilities

Location: ____________________
Phone: ____________________

□ **Emergency Equipment** (include location of equipment)

	First aid kit		PPE		Decon equipment
	Fire extinguisher		Radio/phone		Wind indicator
	Breathing air		Eye wash		Signal device
	Signs (specify):				
	Other (specify):				

□ **Develop and include and Emergency Action Plan if employees will NOT assist in handling emergency:**

1. Emergency escape procedures
2. Procedures for critical employees who must temporarily remain
3. Procedures to account for all employees
4. Rescue medical procedures
5. Means of reporting all emergencies
6. Contact for further help

□ **Develop as a separate section of the HASP and Emergency Response Plan and Emergency Incident Procedures if employers WILL assist in emergencies:**

Emergency Response Plan Elements

1. Pre-emergency planning
2. Personnel roles, lines of authority and communication
3. Emergency recognition and prevention
4. Safe distances and refuge
5. Site security and control
6. Evacuation routes and procedures
7. Decontamination procedures
8. Emergency medical treatment and first aid
9. Emergency alerting and response procedures
10. Critique of response
11. PPE and emergency equipment

Emergency Incident Procedures

1. Site topography, layout, weather
2. Procedures for reporting to governmental agencies integrated with fire, disaster plans.
3. Rehearsed as part of training program
4. Periodic review
5. Alarm System

□ **Confined Space**

□ **Spill Containment** (describe how hazardous spills will be contained and isolated)

□ **Require Pre-entry Briefings Prior to Initiating Any Site Activities**

□ **Use Site Characterization and Monitoring Data to Update HASP**

□ **Review HASP periodically for effectiveness**

Module 14.
Emergency Response Checklist

<u>BEFORE AN EMERGENCY</u>

☐ Establish an evacuation “assembly area” for your group. This area is where, during an emergency when evacuation occurs, <u>ALL your employees will meet</u>

☐ Review this procedure with all employees.

☐ Ensure all employees have a copy of the “Emergency Procedures”.

☐ Ensure all employees know where their “assembly area” is.

☐ Make arrangements for any disabled employees.

<u>DURING AN EMERGENCY:</u>

☐ Ensure all employees evacuate the area quickly by the most direct route and meet at the prearranged assembly area.

☐ Conduct a headcount to ensure accountability of all assigned employees. If someone is missing or unaccounted for, take the necessary steps to locate those without reentering any evacuated building or dangerous areas.

☐ Report any “un-accounted individuals” to the communications center.

☐ Do not release or send home any individuals without proper instructions from upper management.

☐ Any employees who are injured or suffered ill effects from the emergency or evacuation must be immediately reported to medical, protective service officer, or the communications center.

Module 14. Emergency Sample Site Health and Safety Plan

Site information

Location: ______________________________

Supervisor/Commander Area: ______________________________

Control Zones Established: Support/Cold Zone ☐ Decontamination/Warm ☐ Exclusion/Hot Zone ☐

Weather Conditions: Wind Direction __________ Wind Speed __________ Temperature __________

Forecast: ______________________________

Organizational Structure

Site Supervisor/Incident Commander: ______________________________

Site Safety Officer: ______________________________

Qualified Person/Haz Mat Group Supervisor: ______________________________

Entry Leader: __________ Decon. Leader: __________ Support Leader: __________

Entry/Mitigation Team		Decontamination Team		Medical Team	Other

Level of Protection (PPE)

Entry/Mitigation Team				Decontamination Team			
CPC	Respirator	CPC	Respirator	CPC	Respirator	CPC	Respirator

Hazard Evaluation

Chemical Information:

Chemical Name	PEL	REL	IDLH	Ca	TRIC Hazard
1					
2					
3					
4					
5					

Environmental Monitoring

	Equipment	Times/Location Taken					
Air							
Liquid							
Soil							

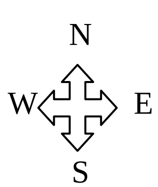
Exposure

	Time Taken	Amount	Time Taken	Amount	Time Taken	Amount
Worker Exposure						
Area Exposure						

Communication

Entry Team	Back-up Team	Decontamination Team

Site Map



CCR'S

California Code of Regulations
CCR

General Industry Safety Orders
GISO

HAZWOPER
5192

Confined Space
5156, 5157, & 5158

Respiratory Protection
5144

Heat Illness Prevention
3395

GISO 3395

Heat Illness Prevention

CALIFORNIA CODE OF REGULATIONS

TITLE 8 SECTION 3395

OF THE

GENERAL INDUSTRY SAFETY ORDERS

Heat Illness Prevention - GISO 3395

Subchapter 7. General Industry Safety Orders Group 2. Safe Practices and Personal Protection Article 10. Personal Safety Devices and Safeguards

(a) Scope and Application.

This section applies to the control of risk of occurrence of heat illness. This is not intended to exclude the application of other sections of Title 8, including, but not necessarily limited to, sections 1230(a), 1512, 1524, 3203, 3363, 3400, 3439, 3457, 6251, 6512, 6969, 6975, 8420 and 8602(e). This section applies to all outdoor places of employment.

Note No. 1: The measures required here may be integrated into the employer's Injury and Illness Program required by section 3203.

Note No. 2: This standard is enforceable by the Division of Occupational Safety and Health pursuant to Labor Code sections 6308 and 6317 and any other statutes conferring enforcement powers upon the Division. It is a violation of Labor Code sections 6310, 6311, and 6312 to discharge or discriminate in any other manner against employees for exercising their rights under this or any other provision offering occupational safety and health protection to employees.

(b) Definitions.

"Acclimatization" means temporary adaptation of the body to work in the heat that occurs gradually when a person is exposed to it. Acclimatization peaks in most people within four to fourteen days of regular work for at least two hours per day in the heat.

"Heat Illness" means a serious medical condition resulting from the body's inability to cope with a particular heat load, and includes heat cramps, heat exhaustion, heat syncope and heat stroke.

"Environmental risk factors for heat illness" means working conditions that create the possibility that heat illness could occur, including air temperature, relative humidity, radiant heat from the sun and other sources, conductive heat sources such as the ground, air movement, workload severity and duration, protective clothing and personal protective equipment worn by employees.

"Personal risk factors for heat illness" means factors such as an individual's age, degree of acclimatization, health, water consumption, alcohol consumption, caffeine consumption, and use of prescription medications that affect the body's water retention or other physiological responses to heat.

"Preventative recovery period" means a period of time to recover from the heat in order to prevent heat illness.

"Shade" means blockage of direct sunlight. Canopies, umbrellas and other temporary structures or devices may be used to provide shade. One indicator that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight. Shade is not adequate when heat in the area of shade defeats the purpose of shade, which is to allow the body to cool. For example, a car sitting in the sun does not provide acceptable shade to a person inside it, unless the car is running with air conditioning.

(c) Provision of water.

Employees shall have access to potable drinking water meeting the requirements of Sections 1524, 3363, and 3457, as applicable. Where it is not plumbed or otherwise continuously supplied, it shall be provided in sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Employers may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour. The frequent drinking of water, as described in (e), shall be encouraged.

(d) Access to shade.

Employees suffering from heat illness or believing a preventative recovery period is needed, shall be provided access to an area with shade that is either open to the air or provided with ventilation or cooling for a period of no less than five minutes. Such access to shade shall be permitted at all times. Except for employers in the agricultural industry, cooling measures other than shade (e.g., use of misting machines) may be provided in lieu of shade if the employer can demonstrate that these measures are at least as effective as shade in allowing employees to cool.

(e) Training.

(1) Employee training. Training in the following topics shall be provided to all supervisory and non-supervisory employees.

(A) The environmental and personal risk factors for heat illness;

(B) The employer's procedures for complying with the requirements of this standard;

(C) The importance of frequent consumption of small quantities of water, up to 4 cups per hour, when the work environment is hot and employees are likely to be sweating more than usual in the performance of their duties;

(D) The importance of acclimatization;

(E) The different types of heat illness and the common signs and symptoms of heat illness;

(F) The importance to employees of immediately reporting to the employer, directly or through the employee's supervisor, symptoms or signs of heat illness in themselves, or in co-workers;

(G) The employer's procedures for responding to symptoms of possible heat illness, including how emergency medical services will be provided should they become necessary;

(H) The employer's procedures for contacting emergency medical services, and if necessary, for transporting employees to a point where they can be reached by an emergency medical service provider;

(I) The employer's procedures for ensuring that, in the event of an emergency, clear and precise directions to the work site can and will be provided as needed to emergency responders.

(2) Supervisor training. Prior to assignment to supervision of employees working in the heat, training on the following topics shall be provided:

(A) The information required to be provided by section (e)(1) above.

(B) The procedures the supervisor is to follow to implement the applicable provisions in this section.

(C) The procedures the supervisor is to follow when an employee exhibits symptoms consistent with possible heat illness, including emergency response procedures.

(3) The employer's procedures required by subsections (e)(1)(B), (G), (H), and (I) shall be in writing and shall be made available to employees and to representatives of the Division upon request.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

HISTORY

1. New section filed 8-22-2005 as an emergency; operative 8-22-2005 (Register 2005, No. 34). A Certificate of Compliance must be transmitted to OAL by 12-20-2005 or emergency language will be repealed by operation of law on the following day.

2. New section refiled 12-20-2005 as an emergency; operative 12-20-2005 (Register 2005, No. 51). A Certificate of Compliance must be transmitted to OAL by 4-19-2006 or emergency language will be repealed by operation of law on the following day.

3. New section refiled 4-19-2006 as an emergency; operative 4-19-2006 (Register 2006, No. 16). A Certificate of Compliance must be transmitted to OAL by 8-17-2006 or emergency language will be repealed by operation of law on the following day.

4. Certificate of Compliance as to 4-19-2006 order, including amendment of section heading and section, transmitted to OAL 6-16-2006 and filed 7-27-2006 (Register 2006, No. 30).

GISO 5144

Respiratory Protection

CALIFORNIA CODE OF REGULATIONS

TITLE 8 SECTION 5144

OF THE

GENERAL INDUSTRY SAFETY ORDERS

TITLE 8. INDUSTRIAL RELATIONS
DIVISION 1. DEPARTMENT OF INDUSTRIAL RELATIONS
CHAPTER 4. DIVISION OF INDUSTRIAL SAFETY
SUBCHAPTER 7. GENERAL INDUSTRY SAFETY ORDERS
GROUP 16. CONTROL OF HAZARDOUS SUBSTANCES
ARTICLE 107. DUSTS, FUMES, MISTS, VAPORS AND GASES
This database is current through 9/19/08, Register 2008, No. 38

§ 5144. Respiratory Protection.

(a) Permissible practice.

(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall include the requirements outlined in subsection (c).

(b) Definitions. The following definitions are important terms used in the respiratory protection standard in this section.

Air-purifying respirator means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned protection factor (APF) means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator (ESLI) means a system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator means a respirator intended to be used only for emergency exit.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.
Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Helmet means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

High efficiency particulate air (HEPA) filter means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. (See Article 10.1)

Loose-fitting facepiece means a respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) means the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the assigned protection factor specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with an oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope or practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by subsection (e).

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering means that portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life means the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Tight-fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

(c) Respiratory protection program. This subsection requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator. In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator. The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a sample program that meets the requirements of this subsection. Copies of the Small Entity Compliance Guide will be available from the Occupational Safety and Health Administration's Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).

(1) In any workplace where respirators are necessary to protect the health of the employee or whenever respirators are required by the employer, the employer shall establish and implement a written respiratory protection program with worksite-specific procedures. The program shall be updated as necessary to reflect those changes in workplace conditions that affect respirator use. The employer shall include in the program the following provisions, as applicable:

(A) Procedures for selecting respirators for use in the workplace;

(B) Medical evaluations of employees required to use respirators;

(C) Fit testing procedures for tight-fitting respirators;

(D) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;

(E) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;

(F) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;

(G) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;

(H) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and

(I) Procedures for regularly evaluating the effectiveness of the program.

(2) Where respirator use is not required:

(A) An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard. If the employer determines that any voluntary respirator use is permissible, the employer shall provide the respirator users with the information contained in Appendix D to this section ("Information for Employees Using Respirators When Not Required Under the Standard"); and

(B) In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Exception: Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering facepieces (dust masks).

(3) The employer shall designate a program administrator who is qualified by appropriate training or experience that is commensurate with the complexity of the program to administer or oversee the respiratory protection program and conduct the required evaluations of program effectiveness.

(4) The employer shall provide respirators, training, and medical evaluations at no cost to the employee.

(d) Selection of respirators. This subsection requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors, and base respirator selection on these factors. The subsection also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

(1) General requirements.

(A) The employer shall select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability.

(B) The employer shall select a NIOSH-certified respirator. The respirator shall be used in compliance with the conditions of its certification.

(C) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

(D) The employer shall select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

(2) Respirators for IDLH atmospheres.

(A) The employer shall provide the following respirators for employee use in IDLH atmospheres:

1. A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or

2. A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

(B) Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

(C) All oxygen-deficient atmospheres shall be considered IDLH.

Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

(3) Respirators for atmospheres that are not IDLH.

(A) The employer shall provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

1. Assigned Protection Factors (APFs) Employers must use the assigned protection factors listed in Table 1 to select a respirator that meets or exceeds the required level of employee protection. When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers must ensure that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.

Table 1. -Assigned Protection Factors [5]

Type of respirator [1,2]	Quarter mask	Half mask	Full facepiece	Helmet/hood	Loose–fitting facepiece
1. Air–Purifying Respirator	5	[3] 10	50	......	......
2. Powered Air–Purifying Respirator (PAPR).		50	1,000	[4] 25/1,000	25
3. Supplied–Air Respirator (SAR) or Airline Respirator					
Demand mode	......	10	50	......	......
Continuous flow mode	......	50	1,000	[4] 25/1,000	25
Pressure–demand or other positive–pressure mode	......	50	1,000	......	......
4. Self–Contained Breathing Apparatus (SCBA)					
Demand mode	......	10	50	50	......
Pressure–demand or other positive–pressure mode (e.g., open/closed circuit).	......	......	10,000	10,000	......

Notes:

1. Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

2. The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respirator program as required by this section, including training, fit testing, maintenance, and use requirements.

3. This APF category includes filtering facepieces, and half masks with elastomeric facepieces.

4. The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a Workplace Protection Factor (WPF) or simulated WPF study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose–fitting facepiece respirators, and receive an APF of 25.

5. These APFs do not apply to respirators used solely for escape. For escape respirators used in association with substances covered by substance–specific standards in Title 8, Division 1, Chapter 4, Subchapters 4, 7, and 18, employers must refer to the appropriate substance–specific standards. Escape respirators for other IDLH atmospheres are specified by subsection (d)(2)(B).

2. Maximum Use Concentration (MUC)

a. The employer must select a respirator for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the MUC.

b. Employers must not apply MUCs to conditions that are immediately dangerous to life or health (IDLH); instead, they must use respirators listed for IDLH conditions in subsection (d)(2) of this section.

c. When the calculated MUC exceeds the IDLH level for a hazardous substance, or the performance limits of the cartridge or canister, then employers must set the maximum MUC at that lower limit.

(B) The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

(C) For protection against gases and vapors, the employer shall provide:

1. An atmosphere-supplying respirator, or

2. An air-purifying respirator, provided that:

a. The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

b. If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer shall describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

(D) For protection against particulates, the employer shall provide:

1. An atmosphere-supplying respirator; or

2. An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for

particulates by NIOSH under 42 CFR part 84; or

3. For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

Table II

Altitude (ft.)	Oxygen deficient Atmospheres ($\% O_2$) for which the employer may rely on atmosphere-supplying respirators
Less than 3,001	16.0-19.5
3.001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6,000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000[1]	19.3-19.5

[1]Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

(e) Medical evaluation. Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this subsection specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

(1) General. The employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

(2) Medical evaluation procedures.

(A) The employer shall identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

(B) The medical evaluation shall obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C.

Exception to subsection (e)(2)(B): For the use of filtering facepiece respirators for protection against M. Tuberculosis only, the employer may rely upon a medical evaluation completed prior to October 18, 2004, in meeting the requirement for initial medical evaluation, if that evaluation meets the following conditions:

1. The evaluation consisted of a questionnaire, medical examination, or both, evaluated or conducted by a PLHCP; and

2. The employer obtained a written statement from the evaluating PLHCP that the employee is medically able to use a respirator.

(3) Follow-up medical examination.

(A) The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C or whose initial medical examination demonstrates the need for a follow-up medical examination.

(B) The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

(4) Administration of the medical questionnaire and examinations.

(A) The medical questionnaire and examinations shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire shall be administered in a manner that ensures that the employee understands its content.

(B) The employer shall provide the employee with an opportunity to discuss the questionnaire and examination results with the PLHCP.

(5) Supplemental information for the PLHCP.

(A) The following information must be provided to the PLHCP before the PLHCP makes a recommendation concerning an employee's ability to use a respirator:

1. The type and weight of the respirator to be used by the employee;

2. The duration and frequency of respirator use (including use for rescue and escape);

3. The expected physical work effort;

4. Additional protective clothing and equipment to be worn; and

5. Temperature and humidity extremes that may be encountered.

(B) Any supplemental information provided previously to the PLHCP regarding an employee need not be provided for a subsequent medical evaluation if the information and the PLHCP remain the same.

(C) The employer shall provide the PLHCP with a copy of the written respiratory protection program and a copy of this section.

Note to Subsection (e)(5)(C): When the employer replaces a PLHCP, the employer must ensure that the new PLHCP obtains this information, either by providing the documents directly to the PLHCP or having the documents transferred from the former PLHCP to the new PLHCP. However, OSHA does not expect employers to have employees medically reevaluated solely because a new PLHCP has been selected.

(6) Medical determination. In determining the employee's ability to use a respirator, the employer shall:

(A) Obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation shall provide only the following information:

1. Any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;

2. The need, if any, for follow-up medical evaluations; and

3. A statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

(B) If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer shall provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

(7) Additional medical evaluations. At a minimum, the employer shall provide additional medical evaluations that comply with the requirements of this section if:

(A) An employee reports medical signs or symptoms that are related to ability to use a respirator;

(B) A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;

(C) Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or

(D) A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

(f) Fit testing. This subsection requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This subsection specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

(1) The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this subsection.

(2) The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

(4) If after passing a QLFT or QNFT, the employee subsequently notifies the employer, program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator facepiece and to be retested.

(5) The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol. The OSHA-accepted QLFT and QNFT protocols and procedures are contained in Appendix A.

(6) QLFT may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less.

(7) If the fit factor, as determined through an OSHA-accepted QNFT protocol, is equal to or greater than 100 for tight-fitting half facepieces, or equal to or greater than 500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

(8) Fit testing of tight-fitting atmosphere-supplying respirators and tight- fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.

(A) Qualitative fit testing of these respirators shall be accomplished by temporarily converting the respirator user's actual facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure air-purifying respirator facepiece with the same sealing surfaces as a surrogate for the atmosphere-supplying or powered air-purifying respirator facepiece.

(B) Quantitative fit testing of these respirators shall be accomplished by modifying the facepiece to allow sampling inside the facepiece in the breathing zone of the user, midway between the nose and mouth. This requirement shall be accomplished by installing a permanent sampling probe onto a surrogate facepiece, or by using a sampling adapter designed to temporarily provide a means of sampling air from inside the facepiece.

(C) Any modifications to the respirator facepiece for fit testing shall be completely removed, and the facepiece restored to NIOSH-approved configuration, before that facepiece can be used in the workplace.

(g) Use of respirators. This subsection requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

(1) Facepiece seal protection.

(A) The employer shall not permit respirators with tight-fitting facepieces to be worn by employees who have:

1. Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or

2. Any condition that interferes with the face-to-facepiece seal or valve function.

(B) If an employee wears corrective glasses or goggles or other personal protective equipment, the employer shall ensure that such equipment is worn in a manner that does not interfere with the seal of the facepiece to the face of the user.

(C) For all tight-fitting respirators, the employer shall ensure that employees perform a user seal check each time they put on the respirator using the procedures in Appendix B-1 or procedures recommended by the respirator manufacturer that the employer demonstrates are as effective as those in Appendix B-1.

(2) Continuing respirator effectiveness.

(A) Appropriate surveillance shall be maintained of work area conditions and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, the employer shall reevaluate the continued effectiveness of the respirator.

(B) The employer shall ensure that employees leave the respirator use area:

1. To wash their faces and respirator facepieces as necessary to prevent eye or skin irritation associated with respirator use; or

2. If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece; or

3. To replace the respirator or the filter, cartridge, or canister elements.

(C) If the employee detects vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece, the employer must replace or repair the respirator before allowing the employee to return to the work area.

(3) Procedures for IDLH atmospheres. For all IDLH atmospheres, the employer shall ensure that:

(A) One employee or, when needed, more than one employee is located outside the IDLH atmosphere;

(B) Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;

(C) The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;

(D) The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;

(E) The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation;

(F) Employee(s) located outside the IDLH atmospheres are equipped with:

1. Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SBA; and either

2. Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or

3. Equivalent means for rescue where retrieval equipment is not required under subsection (g)(3)(F)2.

(4) Procedures for interior structural firefighting. In addition to the requirements set forth under subsection (g)(3), in interior structural fires, the employer shall ensure that:

(A) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

(B) At least two employees are located outside the IDLH atmosphere; and

(C) All employees engaged in interior structural firefighting use SCBAs.

Note 1 to subsection (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to subsection (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

(h) Maintenance and care of respirators. This subsection requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

(1) Cleaning and disinfecting. The employer shall provide each respirator user with a respirator that is clean, sanitary, and in good working order. The employer shall ensure that respirators are cleaned and disinfected using the procedures in Appendix B-2, or procedures recommended by the respirator manufacturer, provided that such procedures are of equivalent effectiveness. The respirators shall be cleaned and disinfected at the following intervals:

(A) Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;

(B) Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals;

(C) Respirators maintained for emergency use shall be cleaned and disinfected after each use; and

(D) Respirators used in fit testing and training shall be cleaned and disinfected after each use.

(2) Storage. The employer shall ensure that respirators are stored as follows:

(A) All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.

(B) In addition to the requirements of subsection (h)(2)(A), emergency respirators shall be:

1. Kept accessible to the work area;

2. Stored in compartments or in covers that are clearly marked as containing emergency respirators; and

3. Stored in accordance with any applicable manufacturer instructions.

(3) Inspection.

(A) The employer shall ensure that respirators are inspected as follows:

1. All respirators used in routine situations shall be inspected before each use and during cleaning;

2. All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturer's recommendations, and shall be checked for proper function before and after each use; and

3. Emergency escape-only respirators shall be inspected before being carried into the workplace for use.

(B) The employer shall ensure that respirator inspections include the following:

1. A check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters; and

2. A check of elastomeric parts for pliability and signs of deterioration.

(C) In addition to the requirements of subsections (h)(3)(A) and (B), self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level. The employer shall determine that the regulator and warning devices function properly.

(D) For respirators maintained for emergency use, the employer shall:

1. Certify the respirator by documenting the date the inspection was performed, the name (or signature) of the person who made the inspection, the findings, required remedial action, and a serial number or other means of identifying the inspected respirator; and

2. Provide this information on a tag or label that is attached to the storage compartment for the respirator, is kept with the respirator, or is included in inspection reports stored as paper or electronic files. This information shall be maintained until replaced following a subsequent certification.

(4) Repairs. The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

(A) Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator;

(B) Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed; and

(C) Reducing and admission valves, regulators, and alarms shall be adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

(i) Breathing air quality and use. This subsection requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

(1) The employer shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(A) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and

(B) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

1. Oxygen content (v/v) of 19.5-23.5%;

2. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

3. Carbon monoxide (CO) content of 10 ppm or less;

4. Carbon dioxide content of 1,000 ppm or less; and

5. Lack of noticeable odor.

(2) The employer shall ensure that compressed oxygen is not used in atmosphere- supplying respirators that have previously used compressed air.

(3) The employer shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

(4) The employer shall ensure that cylinders used to supply breathing air to respirators meet the following requirements:

(A) Cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR 173 and part 178);

(B) Cylinders of purchased breathing air have a certificate of analysis from the supplier that the breathing air meets the requirements for Grade D breathing air; and

(C) The moisture content in the cylinder does not exceed a dew point of -50 deg. F (-45.6 deg. C) at 1 atmosphere pressure.

(5) The employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

(A) Prevent entry of contaminated air into the air-supply system;

(B) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (-5.56 deg. C) below the ambient temperature;

(C) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(D) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

(6) For compressors that are not oil-lubricated, the employer shall ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

(7) For oil lubricated compressors, the employer shall use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used, the air supply shall be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

(8) The employer shall ensure that breathing air couplings are incompatible with outlets for nonrespirable worksite air or other gas systems. No asphyxiating substance shall be introduced into breathing air lines.

(9) The employer shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84.

(j) Identification of filters, cartridges, and canisters. The employer shall ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

(k) Training and information. This subsection requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This subsection also requires the employer to provide the basic information on respirators in Appendix D to employees who wear respirators when not required by this section or by the employer to do so.

(1) The employer shall ensure that each employee can demonstrate knowledge of at least the following:

(A) Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;

(B) What the limitations and capabilities of the respirator are;

(C) How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;

(D) How to inspect, put on and remove, use, and check the seals of the respirator;

(E) What the procedures are for maintenance and storage of the respirator;

(F) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and

(G) The general requirements of this section.

(2) The training shall be conducted in a manner that is understandable to the employee.

(3) The employer shall provide the training prior to requiring the employee to use a respirator in the workplace.

(4) An employer who is able to demonstrate that a new employee has received training withing the last 12 months that addresses the elements specified in subsection (k)(1)(A) through (G) is not required to repeat such training provided that, as required by subsection (k)(1), the employee can demonstrate knowledge of those element(s). Previous training not repeated initially by the employer must be provided no later than 12 months from the date of the previous training.

(5) Retraining shall be administered annually, and when the following situations occur:

(A) Changes in the workplace or the type of respirator render previous training obsolete;

(B) Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or

(C) Any other situation arises in which retraining appears necessary to ensure safe respirator use.

(6) The basic advisory information on respirators, as presented in Appendix D, shall be provided by the employer in any written or oral format, to employees who wear respirators when such use is not required by this section or by the employer.

(l) Program evaluation. This section requires the employer to conduct evaluations of the workplace to ensure that the written respiratory protection program is being properly implemented, and to consult employees to ensure that they are using the respirators properly.

(1) The employer shall conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

(2) The employer shall regularly consult employees required to use respirators to assess the employees' views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

(A) Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);

(B) Appropriate respirator selection for the hazards to which the employee is exposed;

(C) Proper respirator use under the workplace conditions the employee encounters; and

(D) Proper respirator maintenance.

(m) Recordkeeping. This section requires the employer to establish and retain written information regarding medical evaluations, fit testing, and the respirator program. This information will facilitate employee involvement in the respirator program, assist the employer in auditing the adequacy of the program, and provide a record for compliance determinations by OSHA.

(1) Medical evaluation. Records of medical evaluations required by this section must be retained and made available in accordance with section 3204.

(2) Fit testing.

(A) The employer shall establish a record of the qualitative and quantitative fit tests administered to an employee including:

1. The name or identification of the employee tested;

2. Type of fit test performed;

3. Specific make, model, style, and size of respirator tested;

4. Date of test; and

5. The pass/fail results for QLFTs or the fit factor and strip chart recording or other recording of the test results for QNFTs.

(B) Fit test records shall be retained for respirator users until the next fit test is administered.

(3) A written copy of the current respirator program shall be retained by the employer.

(4) Written materials required to be retained under this subsection shall be made available upon request to affected employees and to the Chief or designee for examination and copying.

(n) Effective date. Subsections (d)(3)(A)1 and (d)(3)(A)2 of this section become effective March 6, 2007.

(o) Appendices. Compliance with Appendix A, Appendix B-1, Appendix B-2, Appendix C, and Appendix D is mandatory.

Note: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

HISTORY

1. Repealer and new section filed 7-12-74; effective thirtieth day thereafter (Register 74, No. 28).

2. Amendment filed 7-27-77; effective thirtieth day thereafter (Register 77, No. 31).

3. Amendment of subsection (g) filed 9-14-78; effective thirtieth day thereafter (Register 78, No. 37).

4. Amendment of subsection (e)(1) filed 5-25-79; effective thirtieth day thereafter (Register 79, No. 21).

5. Amendment of subsection (e)(1) filed 10-18-79; effective thirtieth day thereafter (Register 79, No. 42).

6. Amendment of subsection (d) filed 9-11-80; effective thirtieth day thereafter (Register 80, No. 37).

7. Amendment of subsection (f)(2) filed 7-8-85; effective thirtieth day thereafter (Register 85, No. 28).

8. HISTORY NOTE No. 7 omitted from Register 85, No. 28 due to printing plant error (Register 85, No. 38).

9. Amendment of subsection (h) filed 3-20-95; operative 4-19-95 (Register 95, No. 12).

10. Amendment of subsection (e)(3) filed 6-29-95; operative 7-29-95 (Register 95, No. 26).

11. Renumbering of former section 5144 to section 5147 and new section filed 8-25-98; operative 11-23-98 (Register 98, No. 35).

12. Change without regulatory effect amending designator for subsection (e)(7) filed 3-15-99 pursuant to section 100, title 1, California Code ofRegulations (Register 2000, No. 4).

13. Editorial correction of subsection (h)(4)(A) (Register 2002, No. 46).

14. New exceptions to subsections (e)(2)(B) and (f)(2) filed 10-7-2004 as an emergency; operative 10-7-2004 (Register 2004, No. 41). A Certificate of Compliance must be transmitted to OAL by 2-4-2005 or emergency language will be repealed by operation of law on the following day.

15. Certificate of Compliance as to 3-7-2005 order, including further amendment of exception to subsection (e)(2)(B) and repealer of exception to subsection (f)(2), transmitted to OAL 1-21-2005 and filed 3-7-2005 (Register 2005, No.10).

16. Amendment of subsections (b), (d)(3)(A)1.-2. and (n) and repealer of subsections (n)(1)-(3) filed 3-6-2007; operative 3-6-2007. Submitted to OAL for printing only pursuant to Labor Code section 142.3(a)(3) (Register 2007, No. 10).

GISO 5156
GISO 5157
GISO 5158

Confined Space Regulations

CALIFORNIA CODE OF REGULATIONS

TITLE 8 SECTION 5156, 57, & 58

OF THE

GENERAL INDUSTRY SAFETY ORDERS

Subchapter 7. General Industry Safety Orders
Group 16. Control of Hazardous Substances
Article 108. Confined Spaces

§5156. Scope, Application and Definitions.

(a) Scope. This Article prescribes minimum standards for preventing employee exposure to confined space hazards, as defined by Section 5156(b), within such spaces as silos, tanks, vats, vessels, boilers, compartments, ducts, sewers, pipelines, vaults, bins, tubs, and pits.

NOTE: This Article does not apply to underwater operations conducted in diving bells or other underwater devices or to supervised hyperbaric facilities.

(b) Application and definitions.

(1) For operations and industries not identified in subsection (b)(2), the confined space definition along with other definitions and requirements of section 5157, Permit-Required Confined Spaces shall apply.

(2) The confined space definition along with other definitions and requirements of section 5158, Other Confined Space Operations shall apply to:

(A) Construction operations regulated by section 1502;

(B) Agriculture operations (including cotton gins) defined by section 3437;

(C) Marine terminal operations defined in section 3460;

(D) Telecommunication manholes and unvented vaults regulated by section 8616;

(E) Grain handling facilities regulated by section 5178.

(F) Natural gas utility operation within distribution and transmission facility vaults defined in Title 49 Code of Federal Regulations Parts 191, 192 and 193; or

(G) Electric utility operations within underground vaults. See section 2700 for a definition of vault.

NOTE: Shipyard operations are regulated by section 8355.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§5157. Permit-Required Confined Spaces.

(a) Scope and application. This section contains requirements for practices and procedures to protect employees from the hazards of entry into permit-required confined spaces. This section applies to employers, as specified in section 5156(b)(1).

(b) Definitions.

Acceptable entry conditions means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Attendant means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

Authorized entrant means an employee who is authorized by the employer to enter a permit space.

Blanking or blinding means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit (permit) means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in subsection (f).

Entry supervisor means the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 M) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose is published in Group 14 for Radiation and Radioactivity or a permissible exposure limit is published in section 5155 for Airborne contaminants and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which a dose is not published in Group 14 for Radiation and Radioactivity or a permissible exposure limit is not published in section 5155 for Airborne contaminants, other sources of information such as: Material Safety Data Sheets that comply with section 5194, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Hot work permit means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials -- hydrogen fluoride gas and cadmium vapor, for example -- may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim “feels normal” from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be “immediately” dangerous to life or health.

Inerting means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Note: This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: Blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Line breaking means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure or temperature capable of causing injury.

Non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Oxygen deficient atmosphere means an atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program (permit space program) means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue service means the personnel designated to rescue employees from permit spaces.

Retrieval system means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Testing means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space. If electronic or thermal equipment is used to perform such tests, and the possibility exists of an explosive substance or a hazardous atmosphere due to flammable gases and vapors, then the testing equipment must be approved for use in such explosive or flammable conditions as required by section 2540.2.

Note: Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

(c) General requirements.

(1) The employer shall evaluate the workplace to determine if any spaces are permit-required confined spaces.

Note: Proper application of the decision flow chart in Appendix A would facilitate compliance with this requirement.

(2) If the workplace contains permit spaces, the employer shall inform exposed employees and other employees performing work in the area, by posting danger signs or by any other equally effective means, of the existence, location of and the danger posed by the permit spaces.

Note: A sign reading “DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER” or using other similar language would satisfy the requirement for a sign.

(3) If the employer decides that its employees and other employees performing work in the area will not enter permit spaces, the employer shall take effective measures to prevent all such employees from entering the permit spaces and shall comply with subsections (c)(1), (c)(2), (c)(6), and (c)(8).

(4) If the employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this section. The written program shall be available for inspection by employees and their authorized representatives.

(5) An employer may use the alternate procedures specified in subsection (c)(5)(B) for entering a permit space under the conditions set forth in subsection (c)(5)(A).

(A) An employer whose employees enter a permit space need not comply with subsections (d) through (f) and (h) through (k), provided that:

1. The employer can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;

2. The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry;

3. The employer develops monitoring and inspection data that supports the demonstrations required by subsections (c)(5)(A)1. and 2.;

4. If an initial entry of the permit space is necessary to obtain the data required by subsection (c)(5)(A)3., the entry is performed in compliance with subsections (d) through (k);

5. The determinations and supporting data required by subsections (c)(5)(A)1., 2. and 3. are documented by the employer and are made available to each employee who enters the permit space under the terms of subsection (c)(5) or to that employee's authorized representative; and

6. Entry into the permit space under the terms of subsection (c)(5)(A) is performed in accordance with the requirements of subsection (c)(5)(B).

Note: See subsection (c)(7) for reclassification of a permit space after all hazards within the space have been eliminated.

(B) The following requirements apply to entry into permit spaces that meet the conditions set forth in subsection (c)(5)(A).

1. Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed.

2. When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

3. Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for the following conditions in the order given:

a. Oxygen content,

b. Flammable gases and vapors, and

c. Potential toxic air contaminants.

4. There may be no hazardous atmosphere within the space whenever any employee is inside the space.

5. Continuous forced air ventilation shall be used, as follows:

a. An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;

b. The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;

c. The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

6. The atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.

7. If a hazardous atmosphere is detected during entry:

a. Each employee shall leave the space immediately;

b. The space shall be evaluated to determine how the hazardous atmosphere developed; and

c. Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

8. The employer shall verify that the space is safe for entry and that the pre-entry measures required by subsection (c)(5)(B) have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification shall be made before entry and shall be made available to each employee entering the space or to that employee's authorized representative.

9. Any employee who enters the space, or that employee's authorized representative, shall be provided an opportunity to observe the pre-entry testing required by subsections (c)(5)(B)3. and 6.

(6) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the employer shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

(7) A space classified by the employer as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

(A) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

(B) If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed under subsections (d) through (k). If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards. Subsection (c)(5) covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

(C) The employer shall document the basis for determining that all hazards in a permit space have been eliminated through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space or to that employee's authorized representative.

(D) If hazards arise within a permit space that has been declassified to a non-permit space under subsection (c)(7), each employee in the space shall exit the space. The employer shall then reevaluate the space and determine whether it must be reclassified as a permit space, in accordance with other applicable provisions of this section.

(8) When an employer (host employer) arranges to have employees of another employer (contractor) perform work that involves permit space entry or confined space entries covered by sections 5158 or 8355, the host employer shall:

(A) Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this section, section 5158 or section 8355, depending on which section applies to the contractor;

(B) Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the space, that make the space in question a permit space;

(C) Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;

(D) Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by subsection (d)(11); and

(E) Debrief the contractor at the conclusion of the entry operations regarding the permit spaced program followed and regarding any hazards confronted or created in permit spaces during entry operations.

(9) In addition to complying with the permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

(A) Obtain any available information regarding permit space hazards and entry operations from the host employer;

(B) Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by subsection (d)(11); and

(C) Inform the host employer of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

(d) Permit-required confined space program (permit space program). Under the permit required confined space program required by subsection (c)(4), the employer shall:

(1) Implement the measures necessary to prevent unauthorized entry;

(2) Identify and evaluate the hazards of permit spaces before employees enter them;

(3) Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

(A) Specifying acceptable entry conditions;

(B) Isolating the permit space;

(C) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

(D) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards; and

(E) Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

(4) Provide the following equipment (specified in subsections (A) through (I), below) at no cost to employees, maintain that equipment properly, and ensure that employees use that equipment properly:

(A) Testing and monitoring equipment needed to comply with subsection (d)(5);

(B) Ventilating equipment needed to obtain acceptable entry conditions;

(C) Communications equipment necessary for compliance with subsections (h)(3) and (i)(5);

(D) Personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees;

(E) Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency;

(F) Barriers and shields as required by subsection (d)(3)(D);

(G) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(H) Rescue and emergency equipment needed to comply with subsection (d)(9), except to the extent that the equipment is provided by rescue services; and

(I) Any other equipment necessary for safe entry into and rescue from permit spaces.

(5) Evaluate permit space conditions as follows when entry operations are conducted:

(A) Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin, except that, if isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer), pre-entry testing shall be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions shall be continuously monitored in the areas where authorized entrants are working;

(B) Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of entry operations, and

(C) When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

(D) Provide each authorized entrant or that employee's authorized representative an opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces;

(E) Reevaluate the permit space in the presence of any authorized entrant or that employee's authorized representative who requests that the employer conduct such reevaluation because the entrant or representative has reason to believe that the evaluation of that space may not have been adequate;

(F) Immediately provide each authorized entrant or that employee's authorized representative with the results of any testing conducted in accord with subsection (d).

Note: Atmospheric testing conducted in accordance with Appendix B would be considered as satisfying the requirements of this subsection. For permit space operations in sewers, atmospheric testing conducted in accordance with Appendix B, as supplemented by Appendix E, would be considered as satisfying the requirements of this subsection,

(6) Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations;

Note: Attendants may be assigned to monitor more than one permit space provided the duties described in subsection (i) can be effectively performed for each permit space that is monitored. Likewise, attendants may be stationed at any location outside the permit space to be monitored as long as the duties described in subsection (i) can be effectively performed for each permit space that is monitored.

(7) If multiple spaces are to be monitored by a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of the permit spaces being monitored without distraction from the attendants responsibilities under subsection (i);

(8) Designate the persons who are to have active roles (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by subsection (g);

(9) Develop and implement procedures for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, for summoning additional rescue and emergency services, and for preventing unauthorized personnel from attempting a rescue;

(10) Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this section;

(11) Develop and implement procedures to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants in a permit space, so that employees of one employer do not endanger the employees of any other employer. If the requirements of sections 5158 or 8355 apply to one or more of the other employers, then the procedures shall also ensure coordination with those employers, so as not to endanger any exposed employees;

(12) Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;

(13) Review entry operations when the employer has reason to believe that the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

Note: Examples of circumstances requiring the review of the permit space program are: any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.

(14) Review the permit space program, using the canceled permits retained under subsection (e)(6) within 1 year after each entry and revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

Note: Employers may perform a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review is necessary.

Appendix C presents examples of permit space programs that are considered to comply with the requirements of subsection (d).

(e) Permit system.

(1) Before entry is authorized, the employer shall document the completion of measures required by subsection (d)(3) by preparing an entry permit.

Note: Appendix D presents examples of permits whose elements are considered to comply with the requirements of this section.

(2) Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize entry.

(3) The completed permit shall be made available at the time of entry to all authorized entrants or their authorized representatives, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

(4) The duration of the permit may not exceed the time required to complete the assigned task of job identified on the permit in accordance with subsection (f)(2).

(5) The entry supervisor shall terminate entry and cancel the entry permit when:

(A) The entry operations covered by the entry permit have been completed; or

(B) A condition that is not allowed under the entry permit arises in or near the permit space.

(6) The employer shall retain each canceled entry permit for at least 1 year to facilitate the review of the permit space program required by subsection (d)(14). Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

(f) Entry permit. The entry permit that documents compliance with this section and authorizes entry to a permit space shall identify:

(1) The permit space to be entered;

(2) The purpose of the entry;

(3) The date and the authorized duration of the entry permit;

(4) The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

Note: This requirement may be met by inserting a reference on the entry permit as to the means used, such as roster or tracking systems, to keep track of the authorized entrants within the permit space.

(5) The personnel, by name, currently serving as attendants;

(6) The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry;

(7) The hazards of the permit space to be entered;

(8) The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

Note: Those measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

(9) The acceptable entry conditions;

(10) The results of initial and periodic tests performed under subsection (d)(5) accompanied by the names or initials of the testers and by an indication of when the tests were performed;

(11) The rescue and emergency services that can be provided on-site and additional service that can be summoned and the means such as the equipment to use and the numbers to call) for summoning those services;

(12) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

(13) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this section;

(14) Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure employee safety, and

(15) Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.

(g) Training.

(1) The employer shall provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this section.

(2) Training shall be provided to each affected employee:

(A) Before the employee is first assigned duties under this section;

(B) Before there is a change in assigned duties;

(C) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(D) Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required by subsection (d)(3) or that there are inadequacies in the employee's knowledge or use of these procedures.

(3) The training shall establish employee proficiency in the duties required by this section and shall introduce new or revised procedures, as necessary, for compliance with this section.

(4) The employer shall certify that the training required by subsections (g)(1) through (g)(3) has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees and their authorized representatives.

(h) Duties of authorized entrants. The employer shall ensure that all authorized entrants:

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Properly use equipment as required by subsection (d)(4);

(3) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by subsection (i)(6);

(4) Alert the attendant whenever:

(A) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or

(B) The entrant detects a prohibited condition; and

(5) Exit from the permit space as quickly as possible whenever:

(A) An order to evacuate is given by the attendant or the entry supervisor,

(B) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation,

(C) The entrant detects a prohibited condition, or

(D) An evacuation alarm is activated.

(i) Duties of attendants. The employer shall ensure that each attendant:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(3) Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants under subsection (f)(4) accurately identifies who is in the permit space;

(4) Remains outside the permit space during entry operations until relieved by another attendant;

Note: When the employer's permit entry program allows attendant entry for rescue, attendants may enter a permit space to attempt a rescue if they have been trained and equipped for rescue operations as required by subsection (k)(1) and if they have been relieved as required by subsection (i)(4).

(5) Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space under subsection (i)(6);

(6) Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions;

(A) If the attendant detects a prohibited condition;

(B) If the attendant detects the behavioral effects of hazards exposure in an authorized entrant;

(C) If the attendant detects a situation outside the space that could endanger the authorized entrants; or

(D) If the attendant cannot effectively and safely perform all the duties required under subsection (i);

(7) Initiate on-site rescue procedures and, if necessary, summon additional rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(8) Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(A) Warn the unauthorized persons that they must stay away from the permit space;

(B) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and

(C) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(9) Performs non-entry rescues or other rescue services as part of the employer's on-site rescue procedure; and

(10) Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

(j) Duties of entry supervisors. The employer shall ensure that each entry supervisor:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminates the entry and cancels the permit as required by subsection (e)(5);

(4) Verifies that rescue services are available and that the means for summoning additional services are operable;

(5) Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(6) Determines, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

(k) Rescue and emergency services. The employer shall ensure that at least one standby person at the site is trained and immediately available to perform rescue and emergency services.

(1) The following requirements apply to employers who have employees enter permit spaces to perform rescue services.

(A) The employer shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from permit spaces.

(B) Each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorized entrants under subsections (g) and (h).

(C) Each member of the rescue service shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

(D) Each member of the rescue service shall be trained in basic first-aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue service holding current certification in first aid and in CPR shall be available.

(2) When an employer (host employer) arranges to have persons other than the host employer's employees perform permit space rescue, the host employer shall:

(A) Inform the rescue service of the hazards they may confront when called on to perform rescue at the host employer's facility, and

(B) Provide the rescue service with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

(3) To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements.

(A) Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at a suitable point so that when rescued, the entrant presents the smallest possible profile (for example at the center of the entrant's back near shoulder level, or above the entrant's head). Wristlets may be used in lieu of the chest of full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

(B) The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

(4) If an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

(l) Employee participation.

(1) Employers shall consult with affected employees and their authorized representatives on the development and implementation of all aspects of the permit space program required by subsection (c).

(2) Employers shall make available to affected employees and their authorized representatives all information required to be developed by this section.

(m) Appendices. Appendices A through E serve to provide information and non-mandatory guidelines to assist employers and employees in complying with the appropriate requirements of this section.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

§5158. Other Confined Space Operations.

(a) Scope. For industries and operations specified in section 5156(b)(2) this section prescribes minimum standards for preventing employee exposure to dangerous air contamination, oxygen enrichment and/or oxygen deficiency in confined spaces, as defined in subsection (b).

Note: Implementing a permit-required confined space program in accordance with section 5157 shall meet the requirements of this section.

(b) Definitions.

(1) Confined Space. A space defined by the concurrent existence of the following conditions:

(A) Existing ventilation is insufficient to remove dangerous air contamination, oxygen enrichment and/or oxygen deficiency which may exist or develop.

(B) Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).

(2) Dangerous Air Contamination. An atmosphere presenting a threat of causing death, injury, acute illness, or disablement due to the presence of flammable and/or explosive, toxic, or otherwise injurious or incapacitating substances.

(A) Dangerous air contamination due to the flammability of a gas or vapor is defined as an atmosphere containing the gas or vapor at a concentration greater than 20 percent of its lower explosive (lower flammable) limit.

(B) Dangerous air contamination due to a combustible particulate is defined as a concentration greater than 20 percent of the minimum explosive concentration of the particulate.

(C) Dangerous air contamination due to the toxicity of a substance is defined as the atmospheric concentration immediately hazardous to life or health.

Note: This definition of dangerous air contamination due to the toxicity of a substance does not preclude the requirement to control harmful exposures, under the provisions of Article 107, to toxic substances at concentrations less than those immediately hazardous to life or health.

(3) Oxygen Deficiency. An atmosphere containing oxygen at a concentration of less than 19.5 percent by volume.

(4) Oxygen Enrichment. An atmosphere containing more than 23.5 percent oxygen by volume.

(c) Operation Procedures and Employee Training. The employer shall implement the provisions of this subsection before any employee is permitted to enter a confined space.

(1) Operating Procedures.

(A) Written, understandable operating and rescue procedures shall be developed and shall be provided to affected employees.

(B) Operating procedures shall conform to the applicable requirements of this section and shall include provision for the surveillance of the surrounding area to avoid hazards such as drifting vapors from tanks, piping and sewers.

(C) For multi-employer worksites, the procedures shall address how all the affected employers will coordinate their work activities, so that operations of one employer will not endanger the employees of any other employer. If the permit-required confined space requirements of section 5157 or the requirements of section 8355 apply to one or more of the other employers, then the procedures shall also include coordination with those employers;

(2) Employee Training. Employees, including standby persons required by subsection (e)(1)(D), shall be trained in the operating and rescue procedures, including instructions as to the hazards they may encounter.

(d) Pre-entry. The applicable provisions of this subsection shall be implemented before entry into a confined space.

(1) Lines which may convey flammable, injurious, or incapacitating substances into the space shall be disconnected, blinded, or blocked off by other positive means to prevent the development of dangerous air contamination, oxygen enrichment and/or oxygen deficiency within the space. The disconnection or blind shall be so located or done in such a manner that inadvertent reconnection of the line or removal of the blind are effectively prevented.

Exception: This subsection does not apply to public utility gas distribution systems.

NOTE: This subsection does not require blocking of all laterals to sewers or storm drains. Where experience or knowledge of industrial use indicates materials resulting in dangerous air contamination may be dumped into an occupied sewer, all such laterals shall be blocked.

(2) The space shall be emptied, flushed, or otherwise purged of flammable, injurious or incapacitating substances to the extent feasible.

(3) The air shall be tested with an appropriate device or method to determine whether dangerous air contamination, oxygen enrichment and/or an oxygen deficiency exists. A written record of such testing results shall be made and kept at the work site for the duration of the work. Affected employees and/or their representative shall be afforded an opportunity to review and record the testing results. If an electronic or thermal device is used to test a confined space that contains or is likely to develop a dangerous air contamination due to flammable and/or explosive substances, then the device must be approved for use in such explosive or flammable conditions as required by section 2540.2.

(4) Where interconnected spaces are blinded off as a unit, each space shall be tested and the results recorded, in accordance with subsection (d)(3), and the most hazardous condition so found shall govern procedures to be followed.

(5) If dangerous air contamination, oxygen enrichment and/or oxygen deficiency does not exist within the space, as demonstrated by tests performed in accordance with subsection (d)(3), entry into and work within the space may proceed subject to the following provisions:

(A) Testing, in accordance with subsection (d)(3), shall be conducted with sufficient frequency to ensure that the development of dangerous air contamination, oxygen enrichment and/or oxygen deficiency does not occur during the performance of any operation.

(B) If the development of dangerous air contamination, oxygen enrichment and/or an oxygen deficiency is imminent, the requirements prescribed by subsection (e) shall also apply.

(6) Where the existence of dangerous air contamination, oxygen enrichment and/or oxygen deficiency is demonstrated by tests performed in accordance with subsection (d)(3), existing ventilation shall be augmented by appropriate means.

(7) When additional ventilation provided in accordance with subsection (d)(6) has removed dangerous air contamination, oxygen enrichment and/or oxygen deficiency as demonstrated by additional testing conducted (and recorded) in accordance with subsection (d)(3), entry into and work within the space may proceed subject to the provisions of subsection (d)(5).

(8) No source of ignition shall be introduced until the implementation of appropriate provisions of this section have ensured that dangerous air contamination due to oxygen enrichment, flammable and/or explosive substances does not exist.

(9) Whenever oxygen-consuming equipment such as salamanders, plumbers' torches or furnaces, and the like, are to be used, measures shall be taken to ensure adequate combustion air and exhaust gas venting.

(10) To the extent feasible, provision shall be made to permit ready entry and exit.

(11) Where it is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems employing harmful design concentrations of toxic or oxygen-displacing gases, or total foam flooding, such systems shall be deactivated. Where it is not practical or safe to deactivate such systems, the provisions of subsection (e) related to the use of respiratory protective equipment shall apply during entry into and work within such spaces.

(e) Confined Space Operations.

(1) Entry Into and Work Within Confined Spaces. The requirements of this subsection apply to entry into and work within a confined space whenever an atmosphere free of dangerous air contamination, oxygen enrichment and/or oxygen deficiency cannot be ensured through the implementation of the applicable provisions of subsection (d), or whenever, due to the existence of an emergency, it is not feasible to ensure the removal of dangerous air contamination, oxygen enrichment and/or an oxygen deficiency through the implementation of the applicable provisions of subsection (d).

(A) Tanks, vessels, or other confined spaces with side and top openings shall be entered from side openings when practicable.

Note: For the purposes of this Order, side openings are those within 3 1/2 feet of the bottom.

(B) Appropriate, approved respiratory protective equipment, in accordance with Section 5144, shall be provided and worn.

(C) An approved safety belt with an attached line shall be used. The free end of the line shall be secured outside the entry opening. The line shall be at least 1/2-inch diameter and 2,000-pounds test.

Exception: Where it can be shown that a safety belt and attached line would further endanger the life of the employee.

(D) At least one employee shall stand by on the outside of the confined space ready to give assistance in case of emergency. At least one additional employee who may have other duties shall be within sight or call of the standby employee(s).

1. The standby employee shall have appropriate, approved, respiratory protective equipment, including an independent source of breathing air which conforms with Section 5144(e), available for immediate use.

2. A standby employee (or employees) protected as prescribed by subsection (e)(1)(D) 1. may enter the confined space but only in case of emergency and only after alerting at least one additional employee outside of the confined space of the existence of an emergency and of the standby employee's intent to enter the confined space.

(E) When entry must be made through a top opening, the following requirements shall also apply.

1. The safety belt shall be of the harness type that suspends a person in an upright position.

2. A hoisting device or other effective means shall be provided for lifting employees out of the space.

(F) Work involving the use of flame, arc, spark, or other source of ignition is prohibited within a confined space (or any adjacent space having common walls, floor, or ceiling with the confined space) which contains, or is likely to develop, oxygen enrichment or dangerous air contamination due to flammable and/or explosive substances.

(G) Whenever gases such as nitrogen are used to provide an inert atmosphere for preventing the ignition of flammable gases or vapors, no flame, arc, spark, or other source of ignition shall be permitted unless the oxygen concentration is maintained at less than 20 percent of the concentration which will support combustion.

1. Testing of the oxygen content shall be conducted with sufficient frequency to ensure conformance with this paragraph.

2. A written record of the results of such testing shall be made and kept at the work site for the duration of the work.

3. Affected employees and/or their representative shall be provided an opportunity to review and record the testing results.

(H) Only approved lighting and electrical equipment, in accordance with the Low-Voltage Electrical Safety Orders, shall be used in confined spaces subject to oxygen enrichment or dangerous air contamination by flammable and/or explosive substances.

(I) Employees working in confined spaces which have last contained substances corrosive to the skin or substances which can be absorbed through the skin shall be provided with, and shall be required to wear, appropriate personal protective clothing or devices in accordance with Article 10.

(J) When an employer (host employer) arranges to have employees of another employer (contractor) perform work that involves a confined space entry covered by this standard or by sections 5157 or 8355, the host employer shall:

1. Inform the contractor that the workplace contains a confined space and that confined space entry is allowed only through compliance with a confined space program meeting the requirements of this section, section 5157 or section 8355, depending on which section applies to the contractor;

2. Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the confined space, that make the space in question a confined space;

3. Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near the confined space where the contractor's personnel will be working;

4. Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near the confined space, as required by subsection (c)(1)(C); and

5. Debrief the contractor at the conclusion of the confined space operation regarding the confined space program followed and any hazards confronted or created in the confined space during entry operations.

(K) In addition to complying with the confined space requirements that apply to all employers, each contractor who is retained to perform confined space entry operations shall:

1. Obtain any available information regarding confined space hazards and entry operations from the host employer;

2. Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near a confined space, as required by subsection (c)(1)(C); and

3. Inform the host employer of the confined space program that the contractor will follow and of any hazards confronted or created in the confined space, either through a debriefing or during the entry operation.

(2) Precautions for Emergencies Involving Work in Confined Spaces.

(A) At least one person trained in first aid and cardiopulmonary resuscitation (CPR) shall be immediately available whenever the use of respiratory protective equipment is required subsection (e)(1). Standards for CPR training shall follow the principles of the American Heart Association or the American Red Cross.

(B) An effective means of communication between employees inside a confined space and a standby employee shall be provided and used whenever the provisions of subsection (e)(1) require the use of respiratory protective equipment or whenever employees inside a confined space are out of sight of the standby employee(s). All affected employees shall be trained in the use of such communication system and the system shall be tested before each use to confirm its effective operation.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

GISO 5192

HAZWOPER

CALIFORNIA CODE OF REGULATIONS

TITLE 8 SECTION 5192

OF THE

GENERAL INDUSTRY SAFETY ORDERS

å 5192. Hazardous Waste Operations and Emergency Response.

Appendices to 5192
Hazardous Waste Operations and Emergency Response.

§ 5192. Hazardous Waste Operations and Emergency Response.

(a) Scope, Application and Definitions.

(1) Scope:

This section covers the following operations, unless the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards:

(A) Clean-up operations or hazardous substance removal work required by a governmental body, whether Federal, state, local or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the Environmental Protection Agency's (EPA) National Priority Site List (NPL), state priority site lists, sites recommended for the EPA, NPL, and initial investigations of government identified sites which are conducted before the presence or absence of hazardous substances has been ascertained);

(B) Corrective actions involving hazardous waste clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901.et seq.) and Chapters 6.5 and 6.8 of Division 20 of the California Health and Safety Code;

(C) Voluntary clean-up operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites;

(D) Operations involving hazardous wastes that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA; or facilities regulated by Chapter 6.5 of Division 20 of the California Health and Safety Code; or by agencies under agreement with U.S.E.P.A. to implement RCRA regulations; and

(E) Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

(2) Application:

(A) All requirements of Title 8 of the California Code of Regulations apply pursuant to their terms to hazardous waste operations (whether covered by this section or not). If there is a conflict or overlap, the provision more protective of employee safety and health shall apply without regard to 8 CCR 3202(a).

(B) Hazardous substance clean-up operations within the scope of subsections (a)(1)(A) through (a)(1)(C) of this section must comply with all subsections of this section except subsections (p) and (q);

(C) Operations within the scope of subsection (a)(1)(D) of this section must comply only with the requirements of subsection (p) of this section.

NOTES AND EXCEPTIONS TO (a)(2)(C):

A. All provisions of subsection (p) of this section cover any treatment, storage, or disposal (TSD) operation regulated by 40 CFR parts 264 and 265 or by Chapter 6.5 of Division 20 of the California Health and Safety Code, and required to have a permit or interim status from EPA pursuant to 40 CFR 270.1 or from the Department of Health Services (DHS) pursuant to Chapter 6.5 of Division 20 of the California Health and Safety Code.

B. Employers who are not required to have a permit or interim status because they are conditionally exempt small quantity generators under 40 CFR 261.5 or are generators who qualify under 40 CFR 262.34 for exemptions from regulations under 40 CFR parts 264, 265 and 270 ("excepted employers") are not covered by subsections (p)(1) through (p)(7) of this section. Excepted employers who are required by the EPA or state agency such as the Department of Health Services (DHS) to have their employees engage in emergency response or who direct their employees to engage in emergency response are covered by subsection (p)(8) of this section, and cannot be exempted by (p)(8)(A) of this section. Excepted employers who are not required to have employees engage in emergency response, who direct their employees to evacuate in the case of such emergencies and who meet the requirements of subsections (p)(8)(A) of this section are exempt from the balance of subsection (p)(8) of this section.

C. If an area is used for hazardous waste treatment, storage, or disposal, any emergency response operations in that area shall comply with subsection (p)(8) of this section. In other areas not used for treatment storage, or disposal of hazardous waste, any emergency response operation shall comply with subsection (q) of this section. Compliance with the requirements of subsection (q) of this section shall be deemed to be in compliance with the requirements of subsection (p)(8) of this section.

(D) Emergency response operations for releases of, or substantial threats of releases of, hazardous substances which are not covered by subsections (a)(1)(A) through (a)(1)(D) of this section must only comply with the requirements of subsection (q) of this section.

(3) Definitions:

Buddy system: A system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide quick assistance to employees in the event of an emergency.

Certified employee: An employee that has completed all of the requirements for training certification delineated in subsection (e)(6) of this section.

Certified supervisor: A supervisor that has completed all of the requirements for training certification delineated in subsection (e)(6) of this section.

Clean-up operation: An operation where hazardous substances are removed, contained, incinerated, neutralized, stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of making the site safer for people or the environment.

Decontamination: The removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

Emergency response, or responding to emergencies: A response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release, which may cause high levels of exposure to toxic substances, or which poses danger to employees requiring immediate attention. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no immediate safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

NOTE: The "immediate release area" can be the entire geographic boundary of the employee's assigned work area.

Facility.

A. Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or

B. any site or area where a hazardous substance has been deposited, stored, disposed of, placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel.

Hazardous materials response (HAZMAT) team: An organized group of employees, designated by the employer, which is expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance. The team members perform responses to releases or potential releases of hazardous substances for the purpose of control or stabilization of the incident. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade or fire department.

Hazardous substance: Any substance designated or listed under A. through D. below, exposure to which results or may result in adverse affects on the health or safety of employees:

A. Any substance defined under Section 101(14) of CERCLA or under Sections 25316 and 25317 of the California Health and Safety Code;

B. Any biological agent and other disease-causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring;

C. Any substance listed by the U.S. Department of Transportation and regulated as hazardous materials under 49 CFR 172.101 and appendices; and

D. Hazardous waste as herein defined.

Hazardous substance removal work: Clean-up work at any of the following:

A. A site where removal or remedial action is taken pursuant to any of the following:

   1. Chapters 6.8 (commencing with Section 25300) of Division 20 of the Health and Safety Code, regardless of whether the site is listed pursuant to Section 25356 of the Health and Safety Code.

   2. The federal Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. Sec. 9601 et. seq.).

   3. Any operations covered under subsections (a)(1)(A) through (a)(1)(C) of this section.

B. A site where corrective action is taken pursuant to Section 25187 or 25200.10 of the Health and Safety Code or the federal Resource Conservation and Recovery Act of 1976 (42 U.S.C. Sec. 6901 et seq.)

C. A site where clean-up of a discharge of a hazardous substance is required pursuant to Division 7 (commencing with Section 13000) of the Water Code.

D. A site where removal or remedial action is taken because a hazardous substance has been discharged or released in an amount that is reportable pursuant to Section 13271 of the Water Code or the federal Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. Sec 6901 et seq.). Hazardous substance removal work does not include work related to a hazardous substance spill on a highway.

Hazardous waste: A waste or combination of wastes as defined in 40 CFR 261.3, or regulated as hazardous waste in California pursuant to Chapter 6.5, Division 20, California Health and Safety Code, or B. those substances defined as hazardous wastes in 49 CFR 171.8

Hazardous waste operation: Any operation conducted within the scope of this regulation including hazardous substance removal work as defined in Labor Code Section 142.7(b).
Hazardous waste site, or site: Any facility or location at which hazardous waste operations within the scope of this regulation take place.

Health hazard: A chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens; toxic or highly toxic agents; reproductive toxins; irritants; corrosives; sensitizes; hepatotoxins; nephrotoxins; neurotoxins; agents which act on the hematopoietic system; and agents which damage the lungs, skin, eyes, or mucous membranes. It also includes stress due to temperature extremes. Further definition of the terms used above can be found in Title 8, California Code of Regulations, Section 5194.

IDLH or Immediately dangerous to life or health: An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

Incidental release: An incidental release is one that does not cause a health or safety hazard to employees and does not need to be cleaned up immediately to prevent death or serious injury to employees.

Oxygen deficiency: That concentration of oxygen by volume below which air supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

Permissible exposure limit (PEL): The exposure, inhalation or dermal permissible exposure limit specified in 8 CCR, Chapter 4, Subchapter 7, Groups 14 and 15; and Group 16, Articles 107, 109, and 110.

Post-emergency response: That portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees who were part of the initial emergency response, it is considered to be part of the initial response and not post-emergency response. However, if a group of an employer's own employees, separate from the group providing initial response, performs the clean-up operation, then the separate group of employees would be considered to be performing post-emergency response and subject to subsection (q)(11) of this section.

Pre-job health and safety conference: A health and safety conference or briefing held prior to entering a site for the purpose of initiating hazardous substance removal work.

Published exposure level: The exposure limits published in "NIOSH Recommendations for Occupational Safety and Health Standards 1988" incorporated by reference, or if no limit is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1989-90" dated 1989 incorporated by reference.

Qualified person: A person with specific training, knowledge and experience in the area for which the person has the responsibility and the authority to control.

Site safety and health supervisor (or official): The individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

Small quantity generator: A generator of hazardous wastes who in any calendar month generates no more than 1,000 kilograms (2,205 pounds) of hazardous waste in that month.

Uncontrolled hazardous waste site: An area where an accumulation of hazardous waste creates a threat to the health and safety of individuals or the environment or both. Some sites are found on public lands, such as those created by former municipal, county, or state landfills where illegal or poorly managed waste disposal has taken place. Other sites are found on private property, often belonging to generators or former generators of hazardous waste. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSD sites are not covered by this definition.

Uncontrolled release: An uncontrolled release is the accidental release of a hazardous substance from its container. If not contained, stopped, and removed, the release would pose a hazard to the employees in the immediate area or in areas in the path of the release, or from its byproducts or its effects (such as toxic vapors, fire, over-pressurization, toxic gases, or toxic particulates).

(b) Safety and health program.

NOTE TO (b): Safety and health programs developed and implemented to meet other Federal, state, or local regulations are considered acceptable in meeting this requirement if they cover or are modified to cover the topics required in this subsection. An additional or separate safety and health program is not required by this subsection.

(1) General:

(A) Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations.

(B) The written safety and health program shall incorporate the following:

1. An organization structure;

2. A comprehensive workplan;

3. A site-specific safety and health plan which need not repeat the employer's standard operating procedures required in subsection (b)(1)(B)6. of this section;

4. The safety and health training program;

5. The medical surveillance program;

6. The employer's standard operating procedures for safety and health; and

7. Any necessary interface between general program and site specific activities.

(C) Site excavation. Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with 8 CCR, Chapter 4, Subchapter 4, Article 6.

(D) Contractors and sub-contractors. An employer who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer, including those identified in the employer's information program. Each contractor/sub-contractor is responsible for compliance with all safety and health protection requirements for its employees. An employer's safety and health plan can be used by contractors/sub-contractors at the site if it appropriately addresses their activity and potential safety and health hazards.

(E) Program availability. The written safety and health program shall be made available to any contractor or subcontractor or their representative who will be involved with the hazardous waste operation; to employees; to employee designated representatives; to Division representatives, and to personnel of other Federal, state, or local agencies with regulatory authority over the site.

(2) Organizational structure part of the site program:

(A) The organizational structure part of the program shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees . It shall include, at a minimum, the following elements:

1. A general supervisor (or Certified supervisor for hazardous substance removal work) who has the responsibility and authority to direct all hazardous waste operations.

2. A Site Safety and Health Supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance.

3. A Qualified Person for operations defined as hazardous substance removal work, who shall be responsible for scheduling any air sampling, laboratory calibration of sampling equipment, evaluation of soil or other contaminated materials testing and evaluating the result of the tests.

4. All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.

5. The lines of authority, responsibility, and communication.

(B) The organizational structure shall be reviewed and updated as necessary to reflect the current status or waste site operations.

(3) Comprehensive workplan part of the site program:

The comprehensive workplan part of the program shall address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives.

(A) The comprehensive workplan shall address anticipated clean-up activities, as well as normal operating procedures, which need not repeat the employer's procedures available elsewhere.

(B) The comprehensive workplan shall define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.

(C) The comprehensive workplan shall establish personnel requirements for implementing the plan.

(D) The comprehensive workplan shall provide for the implementation of the training required to subsection (e) of this section.

(E) The comprehensive workplan shall provide for the implementation of the required informational programs required in subsection (i) of this section.

(F) The comprehensive workplan shall provide for the implementation of the medical surveillance program described in subsection (f) of this section.

(4) Site-specific safety and health plan part of the program:

(A) General: The site safety and health plan, which must be kept on site, shall address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection.

NOTE TO (A): In general, a site plan organized as a single document, with component sections/appendices covering all tasks, operations, and contractors/sub-contractors, may be used to promote use efficiency, and enhance completeness, clarity, and coordination.

(B) Elements: The site safety and health plan, as a minimum, shall address the following:

1. A safety and health risk or hazard analysis for each site task and operation found in the workplan.

2. Employee training assignments to assure compliance with subsection (e) of this section.

3. Personal protective equipment (PPE) to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in subsection (g)(5) of this section.

4. Medical surveillance requirements in accordance with the program in subsection (f) of this section.

5. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.

6. Site control measures in accordance with the site control program required in subsection (d) of this section.

7. Decontamination procedures in accordance with subsection (k) of this section.

8. An emergency response plan meeting the requirements of subsection (l) of this section for safe and effective responses to emergencies, including the necessary PPE and other equipment.

9. Confined space entry procedures.

10. A spill containment program meeting the requirements of subsection (j) of this section.

(C) Pre-entry briefing: The site-specific safety and health plan shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed. The information and data obtained from site characterization and analysis work required in subsection (c) of this section shall be used to prepare and update the site safety and health plan.

(D) For operations defined as Hazardous substance removal work, a Pre-job health and safety conference shall be held before the start of actual work. The conference shall include representatives of the owner or contracting agency, the contractor, the employer, employees, and employee representatives; and shall include a discussion of the employer's safety and health program and the means, methods, devices, processes, practices, conditions, or operations which the employer intends to use in providing safe and healthy place of employment.

(E) Effectiveness of site safety and health plan: Inspections shall be conducted by the site safety and health supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on behalf of the employers as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.

(c) Site Characterization and Analysis.

(1) General:

Hazardous waste sites shall be evaluated in accordance with this subsection to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.

(2) Preliminary evaluation:

A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

(3) Hazard identification:

All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

(4) Required information:

The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:

(A) Location and approximate size of the site.

(B) Description of the response activity and/or the job task to be performed.

(C) Duration of the planned employee activity.

(D) Site topography and accessibility by air and roads.

(E) Safety and health hazards expected at the site.

(F) Pathways for hazardous substance dispersion.

(G) Present status and capabilities of emergency response teams that would provide assistance to hazardous waste clean-up site employees at the time of an emergency.

(H) Hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties.

(5) Personal protective equipment:

Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

(A) Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below PELs and published exposure levels for known or suspected hazardous substances and health hazards and will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no PEL or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.

(B) If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by employees during initial site entry.

(C) If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE shall be provided as minimum protection and direct reading instruments shall be used as appropriate for identifying IDLH conditions. (See Appendix B for guidelines on Level B protective equipment, and a description of Level B hazards.)

(D) Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with subsection (g).

(6) Monitoring:

The following monitoring shall be conducted during initial site entry when the site evaluation produces information that shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient to rule out these possible conditions:

(A) Monitoring with direct reading instruments for hazardous levels of ionizing radiation.

(B) Monitoring the air with appropriate direct reading test equipment (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances.)

(C) Visually observing for signs of actual or potential IDLH or other dangerous conditions.

(D) An on-going air monitoring program in accordance with subsection (h) shall be implemented after site characterization has determined the site is safe for the start-up of operations.

(7) Risk identification:

Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication standard, 8 CCR 5194, training required by that standard need not be duplicated.

NOTE TO (c)(7): Risks to consider include, but are not limited to:

A. Exposures exceeding the PELs, and published exposure levels.

B. IDLH concentrations.

C. Potential skin absorption and irritation sources.

D. Potential eye irritation sources.

E. Explosion sensitivity and flammability ranges.

F. Oxygen deficiency.

(8) Employee notification:

Any information concerning the chemical, physical, and toxicological properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities. The employer may utilize information developed for the hazard communication standard, 8 CCR 5194, for this purpose.

(d) Site Control.

(1) General:

Appropriate site control procedures shall be implemented to control employee exposure to hazardous substances before clean-up work begins.

(2) Site control program:

A site control program for protecting employees which is part of the employer's site safety and health program required in subsection (b) of this section shall be developed during the planning stages of a hazardous waste clean-up operation and modified as necessary as new information becomes available.

(3) Elements of the site control program:

The site control program shall, as a minimum, include: A site map; site work zones, the use of a "buddy system;" site communications including alerting means for emergencies; the standard operating procedures or safe work practices; and, identification of nearest medical assistance. Where these requirements are covered elsewhere they need not be repeated.

(e) Training.

(1) General:

(A) All employees working on site (such as but not limited to equipment operators, general laborers, and others) exposed to hazardous substances, health hazards, or safety hazards, and their supervisors and management responsible for the site shall receive training meeting the requirements of this subsection before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training as specified in this subsection.

(B) Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.

(2) Elements to be covered:

The training shall thoroughly cover the following:

(A) Names of personnel and alternates responsible for site safety and health;

(B) Safety, health and other hazards present on the site;

(C) Use of PPE;

(D) Work practices by which the employee can minimize risks from hazards;

(E) Safe use of engineering controls and equipment on the site;

(F) Medical surveillance requirements including recognition of symptoms and signs which might indicate overexposure to hazards; and

(G) Subsections 7 through 10 of the site safety and health plan set forth in subsection (b)(4)(B) of this section.

(3) Initial training:

(A) General site workers (such as equipment operators, general laborers, and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

(B) Workers on site only occasionally for a specific limited task (such as, but not limited to, ground water monitoring, land surveying, or geophysical surveying) and who are unlikely to be exposed over PELs and published exposure levels shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

(C) Workers regularly on site who work in areas which have been monitored and fully characterized indicating that exposures are under PELs and published exposure levels where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

(D) Workers with 24 hours of training who are covered by subsections (e)(3)(B) and (e)(3)(C) of this section, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified in subsection (e)(3)(A).

(4) Management and supervisor training:

On-site management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations shall receive 40 hours initial training, and three days of supervised field experience (the training may be reduced to 24 hours and one day if the only area of their responsibility is employees covered by subsections (e)(3)(B) and (e)(3)(C) and at least eight additional hours of specialized hazardous waste operations management training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program, PPE program, spill containment program, and health hazard monitoring procedure and techniques.

(5) Qualifications for trainers:

Trainers shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactory completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.

(6) Training certification:

Employees and supervisors that have received and successfully completed the training and field experience specified in subsections (e)(1) through (e)(4) of this section shall be certified by their instructor or the head instructor and trained supervisor as having successfully completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified or who does not meet the requirements of subsection (e)(9) of this section shall be prohibited from engaging in hazardous waste operations.

(7) Emergency response:

Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to such expected emergencies.

(8) Refresher training:

Employees specified in subsection (e)(1) of this section, and managers and supervisors specified in subsection (e)(4) of this section, shall receive eight hours of refresher training annually on the items specified in subsection (e)(2) and/or (e)(4) of this section, any critique of incidents that have occurred in the past year that can serve as training examples of related work, and other relevant topics.

(9) Equivalent training:

Employers who can show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to that training required in subsections (e)(1) through (e)(4) of this section shall not be required to provide the initial training requirements of those subsections to such employees. However, certified employees or employees with equivalent training new to a site shall receive appropriate, site specific training before site entry and have appropriate supervised field experience at the new site. Equivalent training includes any academic training or the training that existing employees might have already received from actual hazardous waste site work experience.

(f) Medical Surveillance:

(1)General:

Employers engaged in operations specified in subsections (a)(1)(A) through (a)(1)(D) of this section and not covered by (a)(2)(C) exceptions, and employers of employees specified in subsection (q)(9) shall institute a medical surveillance program in accordance with this subsection.

(2)Employees covered:

The medical surveillance program shall be instituted by the employer for the following employees:

(A) Any employee who is or may be exposed to hazardous substances or health hazards at or above the PELs or, if there is no PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year.

(B) Any employee who wears a respirator during any part of a day for a period of 30 days or more in a year, or as required by 8 CCR 5144.

(C) Any employee who is injured, becomes ill or develops signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and

(D) Members of HAZMAT teams.

(3) Frequency of medical examinations and consultations:

Medical examinations and consultations shall also be made available by the employer to each employee covered under subsection (f)(2) on the following schedules:

(A) For employees covered under subsections (f)(2)(A), (f)(2)(B), and (f)(2)(D):

1. Prior to assignment.

2. At least once every twelve months for each employee covered, unless the attending physician believes a longer interval (not greater than biennially) is appropriate.

3. At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.

4. As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards or that the employee has been injured or exposed above the PELs or published exposure levels in an emergency situation.

5. At more frequent times, if the examining physician determines that an increase frequency of examination is medically necessary.

(B) For employees covered under subsection (f)(2)(C) and for all employees including those of employers covered by subsection (a)(1)(E) who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the PELs or the published exposure levels without the necessary personal protective equipment being used:

1. As soon as possible following the emergency incident or development of signs or symptoms;

2. At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

(4) Content of medical examinations and consultations:

(A) Medical examinations required by subsection (f)(2) of this section shall include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (e.g., temperature extremes) that may be expected at the work site.

(B) The content of medical examinations or consultations made available to employees pursuant to subsection (f) shall be determined by the examining physician. The guidelines in the Occupational Safety and Health Guidance manual for Hazardous Waste Site A Activities (see Appendix D, Reference #10) should be consulted.

(5) Examination by a physician and costs:

All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to employee, without loss of pay, and at a reasonable time and place.

(6) Information provided to the physician:

The employer shall provide one copy of this standard and its appendices to the attending physician, and in addition, the following for each employee:

(A) A description of each employee's duties as they relate to the employee's exposures.

(B) Each employee's exposure levels or anticipated exposure levels.

(C) A description of any PPE used or to be used by each employee.

(D) Information from previous medical examinations of each employee which is not readily available to the examining physician.

(E) Information required by 8 CCR 5144 for each employee.

(7) Physician's written opinion:

(A) The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

1. The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

2. The physician's recommended limitations upon the employee's assigned work.

3. A statement of the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(B) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposures.

(C) The physician shall provide the results of the medical examination and tests to the employee if requested.

(8) Record Keeping:

(A) An accurate record of the medical surveillance required by subsection (f) shall be retained. This record shall be retained for the period specified and meet the criteria of 8 CCR 3204.

(B) The record required in subsection (f)(8)(A) shall include at least the following information:

1. The name and social security number of the employee.

2. Physician's written opinions, recommended limitations, and results of examinations and tests.

3. Any employee medical complaints related to exposure to hazardous substances.

4. A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.

(g) Engineering Controls, Work Practices, and Personal Protective Equipment for Employee Protection:

Engineering controls, work practices, PPE, or combination of these shall be implemented in accordance with this subsection to protect employees from exposure hazardous substances and safety and health hazards.

(1) Engineering controls, work practices and PPE for substances regulated in 8 CCR, Ch. 4, Subch. 7, Groups 14, 15, 16:

(A) Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the PELs of substances regulated by 8 CCR 5155, except to the extent that such controls and practices are not feasible.

NOTE TO (g)(1)(A): Engineering controls which may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all non-essential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

(B) Whenever engineering controls and work practices are not feasible or not required, any reasonable combination of engineering controls, work practices, and PPE shall be used to protect employees to reduce exposure to or below established PELs or exposed limits for substances regulated by 8 CCR, Ch. 4, Subch. 7, Group 16.

(C) The employer shall not implement a schedule of employee rotation as a means of compliance with PELs or exposure limits except when there is no other feasible way of complying with the applicable ionizing radiation exposure standards.

(D) The provisions of 8 CCR, Ch. 4, Subch. 7, Groups 14 and 15 shall be followed.

(2) Engineering controls, work practices, and PPE for substances not regulated in 8 CCR, Ch. 4, Such. 7, Groups 14, 15, and 16:

An appropriate combination of engineering controls, work practices, and personal protective equipment shall be used to reduce and maintain employee exposure to or below the published exposure levels for hazardous substances and health hazards not regulated by 8 CCR, Ch. 4, Subch. 7, Groups 14, 15, and 16. The employer may use the published literature and Material Safety Data Sheets (MSDS'S) as a guide in making the employer's determination as to what level of protection the employer believes is appropriate for hazardous substances and health for which there is not PEL or published exposure level.

(3) Personal protective equipment selection:

(A) Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

(B) Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

(C) Positive pressure self-contained breathing apparatus (SCBA) or positive pressure airline respirators equipped with an escape air supply shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

(D) Totally-encapsulating chemical protective suits (protection equivalent to Level A protection as recommended in Appendix B) shall be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

(E) The level of protection provided by PPE selection shall be increased when additional information on site conditions shows that increased protection is necessary to reduce employee exposures below established PELs and published exposure levels for hazardous substances and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

(F) Personal protective equipment shall be selected and used to meet the requirements of 8 CCR, Ch. 4, Subch. 7, Group 2, Articles 10 and 10.1, and 8 CCR 5144 of the General Industry Safety Orders, and additional requirements specified in this section.

NOTE TO (g)(3): The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

(4) Totally-encapsulating chemical protective suits:

(A) Totally-encapsulating suits shall protect employees from the particular hazards which are identified during site characterization and analysis.

(B) Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A for a test method which may be used to evaluate this requirement.)

(C) Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A for a test method which may be used to evaluate this requirement.)

(5) Personal protective equipment (PPE) program:

A written personal protective equipment program, which is part of employer's safety and health program required in subsection (b) of this section or required in subsection (p)(1) of this section and which is also a part of the site-specific safety and health plan shall be established. The PPE program shall address the elements listed below. When elements, such as donning and doffing procedures, are provided by the manufacturer of a piece of equipment and are attached to the plan, they need not be rewritten into the plan as long as they adequately address the procedure or element.

(A) PPE selection based upon site hazards,

(B) PPE use and limitations of the equipment,

(C) Work mission duration,

(D) PPE maintenance and storage,

(E) PPE decontamination and disposal,

(F) PPE training and proper fitting,

(G) PPE donning and doffing procedures,

(H) PPE inspection procedures prior to, during, and after use,

(I) Evaluation of the effectiveness of the PPE program, and

(J) Limitations during temperature extremes, heat stress, and other appropriate medical considerations.

(h) Monitoring.

(1) General:

(A) Monitoring shall be performed in accordance with this subsection where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices, and PPE so that employees are not exposed to levels which exceed PELs, or published exposure levels if there are no PELs, for hazardous substances.

(B) Air monitoring shall be used to identify and quantify airborne levels of hazardous substances, and health and safety hazards in order to determine the appropriate level of employee protection needed on site.

(2) Initial entry:

Upon initial entry, representative air monitoring shall be conducted to identify and IDLH conditions, exposure over PELs or published exposure levels, exposure over a radioactive material's dose limits, or other dangerous situations such as the presence of flammable atmospheres or oxygen-deficient environments.

(3) Periodic monitoring:

Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposure may have risen over PELs or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

(A) When work begins on a different portion of the site.

(B) When contaminants other than those previously identified are being handled.

(C) When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.

(D) When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon).

(4) Monitoring of high-risk employees:

After the actual clean-up phase of any hazardous waste operation commences; for example, when soil, surface water or containers are moved or disturbed; the employer shall monitor those employees likely to have the higher exposures to hazardous substances and health hazards likely to be present above PELs or published exposure levels by using personal sampling frequently enough to characterize employee exposures. If the employees likely to have the highest exposure are over PELs or published exposure levels, then monitoring shall continue in order to identify all employees likely to be above those limits. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria state above.

NOTE TO (h): It is not required to monitor employees engaged in site characterization operations covered by subsection (c) of this section.

(i) Information Programs:

Employers shall develop and implement a program, which is part of the employer's safety and health program required in subsection (b) of this section, to inform employees, contractors, and subcontractors (or their representatives) actually engaged in hazardous waste operations of the nature, level, and degree of exposure likely as a result of participation in such hazardous waste operations. Employees, contractors, and subcontractors working outside of the operations part of a site are not covered by this regulation.

(j) Handling Drums and Containers.

(1) General:

(A) Hazardous substances and contaminated soils, liquids, and other residues shall be handled, transported, labeled, and disposed of in accordance with this subsection.

(B) Drums and containers used during the clean-up shall meet the appropriate U.S. Department of Transportation (DOT), OSHA, and EPA regulations for the wastes that they contain.

(C) When practical, drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.

(D) Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

(E) Site operations shall be organized to minimize the amount of drum or container movement.

(F) Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.

(G) U.S. Department of Transportation (DOT) specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

(H) Where major spills may occur, a spill containment program which is part of the employer's safety and health program required in subsection (b) of this section shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

(I) Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

(J) A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of buried drums or containers.

(K) Soil or covering material shall be removed with caution to prevent drum or container rupture.

(L) Fire extinguishing equipment meeting the requirements of 8 CCR, Ch. 4, Subch. 7, Group 27 of the General Industry Safety Orders shall be on hand and ready for use to control incipient fires.

(2) Opening drums and containers:

The following procedures shall be followed in areas where drums or containers are being opened:

(A) Where an airline respirator system is used, connections to the bank of air cylinders shall be protected from contamination and the entire system shall be protected from physical damage.

(B) Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

(C) If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.

(D) Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.

(E) When there is reasonable possibility of flammable atmosphere being present, material handling equipment and hand tools shall be of the type to prevent sources of ignition.

(F) Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

(G) Employees shall be instructed not to stand upon or work from drums or containers.

(3) Material handling equipment:

Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers.

(4) Radioactive wastes:

Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.

(5) Shock sensitive wastes:

As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:

(A) All non-essential employees shall be evacuated from the area of transfer.

(B) Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

(C) An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.

(D) Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and both the site safety and health supervisor and the command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.

(E) Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

(F) Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

CAUTION: Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation (DOT) regulations. Employers and shippers should refer to 49 CFR 173.21 and 173.50.

(6) Laboratory waste packs:

In addition to the requirements of subsection (j)(5), the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs).

(A) Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes.

(B) If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste until the contents are identified.

(7) Sampling of drum and container contents:

Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.

(8) Shipping and transport:

(A) Drums and containers shall be identified and classified prior to packaging for shipment.

(B) Drum or container staging areas shall be kept to the minimum number necessary to safely identify and classify materials and prepare them for transport.

(C) Staging areas shall be provided with adequate access and egress routes.

(D) Bulking of hazardous wastes shall be permitted only after a thorough characterization of the material has been completed.

(9) Tank and vault procedures:

(A) Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

(B) Appropriate tank or vault entry procedures as described in the employer's safety and health plan and meeting the requirements of 8 CCR, Ch. 4, Subch. 7, Article 108 of the General Industry Safety Orders shall be followed whenever employees must enter a tank or vault.

(k) Decontamination.

(1) General:

Procedures for all phase of decontamination shall be developed and implemented in accordance with this subsection.

(2) Decontamination procedures:

(A) A decontamination procedure shall be developed, communicated to employees, and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.

(B) Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

(C) All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

(D) Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.

(3) Location:

Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.

(4) Equipment and solvents:

All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.

(5) Personal protective clothing and equipment:

(A) Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain its effectiveness.

(B) Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.

(6) Unauthorized employees:

Unauthorized employees shall be instructed not to remove protective clothing or equipment from change rooms.

(7) Commercial laundries or cleaning establishments:

Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.

(8) Showers and change rooms:

Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of 8 CCR, Ch. 4, Subch. 7, Article 9 of the General Industry Safety Orders. If temperature conditions prevent the effective use of water, then other effective means for cleansing shall be provided and used.

(l) Emergency Response by Employees at Uncontrolled Hazardous Waste Sites.

(1) Emergency response plan:

(A) An emergency response plan shall be developed and implemented by all employers within the scope of subsections (a)(1)(A)-(B) of this section to handle anticipated emergencies prior to the commencement of hazardous waste operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, Division personnel, and other governmental agencies with relevant responsibilities.

(B) Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this subsection if they provide an emergency action plan complying with 8 CCR 3220 of the General Industry Safety Orders.

(2) Elements of an emergency response plan:

The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following:

(A) Pre-emergency planning.

(B) Personnel roles, lines of authority, and communication.

(C) Emergency recognition and prevention.

(D) Safe distances and places of refuge.

(E) Site security and control.

(F) Evacuation routes and procedures.

(G) Decontamination procedures which are not covered by the site safety and health plan.

(H) Emergency medical treatment and first aid.

(I) Emergency alerting and response procedures.

(J) Critique of response and follow-up.

(K) Personal protective equipment (PPE) and emergency equipment.

(3) Procedures for handling emergency incidents:

(A) In addition to the elements for the emergency response plan required in subsection (l) (2), the following elements shall be included for emergency response plans:

1. Site topography, layout, and prevailing weather conditions.

2. Procedures for reporting incidents to local , state, and federal governmental agencies.

(B) The emergency response plan shall be a separate section of the Site Safety and Health Plan.

(C) The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

(D) The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

(E) The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(F) An employee alarm system shall be installed in accordance with 8 CCR, Ch. 4, Subch. 7, Article 165 of the General Industry Safety Orders to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication, and to begin emergency procedures.

(G) Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

(m) Illumination:

Areas accessible to employees shall be lighted to not less than the minimum illumination intensities listed in Table H-1 while any work is in progress:

Table H-1

Minimum Illumination Intensity in Foot-Candles

Foot Candles	*Area or operations*
5	General site areas.
3	Excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: Warehouses, corridors, hallways, and exit ways.
5	Tunnels, shafts, and general under-ground work areas. (EXCEPTION: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.)
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

(n) Sanitation at Temporary Workplaces.

(l) Potable water:

(A) An adequate supply of potable water shall be provided on the site.

(B) Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap, and shall be otherwise designed, constructed, and serviced so that sanitary conditions are maintained. Water shall not be dipped from containers.

(C) Any container used to store, dispense or distribute drinking waste shall be clearly marked as to the nature of its contents and not used for any other purpose.

(D) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(2) Non potable water:

(A) Outlets for non potable water, such as water for industrial or fire fighting purposes, shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

(B) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.

(3) Toilet facilities:

(A) A minimum of one separate toilet facility shall be provided for each 20 employees or fraction thereof of each sex. Such facilities may include both toilets and urinals provided that the number of toilets shall not be less than one half of the minimum required number of facilities.

EXCEPTION: Where there are less than 5 employees, separate toilet facilities for each sex are not required provided the toilet facilities can be locked from the inside and contain at least one toilet.

(B) Under temporary field conditions, provisions shall be made to assure that at least one toilet facility is available.

(C) Hazardous waste sites, not provided with a sanitary sewer, shall be provided with the following toilet facilities unless prohibited by local codes:

1. Chemical toilets;

2. Recirculating toilets;

3. Combustion toilets, or

4. Flush toilets.

(D) The requirements of this subsection for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.

(E) Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.

(F) Toilet facilities shall be kept clean, maintained in good working order, and provided with an adequate supply of toilet paper.

(4) Food handling:

All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.

(5) Temporary sleeping quarters:

When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.

(6) Washing facilities:

The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below PELs and published exposure levels and which are under the control of the employer, and shall be so equipped as to enable employees to remove hazardous substances from themselves.

(7) Showers and change rooms:

When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.

(A) Showers shall be provided and shall meet the requirements of 8 CCR 3366(f).

(B) Change rooms shall be provided and shall meet the requirements of 8 CCR 3367. Change rooms shall consist of two separate change areas separated by the shower area required in subsection (n)(7)(A) of this section. One change area, with an exit leading off the worksite, shall provide employees with a clean area where they can remove, store, and put on street clothing. The second area, with an exit to the worksite, shall provide employees with an area where they can put on, remove, and store work clothing and personal protective equipment.

(C) Showers and change rooms shall be located in areas where exposures are below the PELs and published exposure levels. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the PELs and published exposure levels.

(D) Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.

(o) New Technology Programs.

(1) The employer shall develop and implement procedures for the introduction of effective new technologies and equipment developed for the improved protection of employees working with hazardous waste clean-up operations, and the same shall be implemented as part of the site safety and health program to assure that employee protection is being maintained.

(2) New technologies, equipment, or control measures available to the industry, such as the use of foams, absorbents, adsorbents, neutralizers, or other means to suppress the level of air contaminants while excavating the site or for spill control, shall be evaluated by employers or their representatives. Such an evaluation shall be done to determine the effectiveness of the new methods, materials, or equipment before implementing their use on a large scale for enhancing employee protection. Information and data from manufacturers or suppliers may be used as part of the employer's evaluation effort. Such evaluations shall be made available to the Division upon request.

(p) Certain Operations conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA):

Employers conducting operations at treatment, storage, and disposal (TSD) facilities specified in subsection (a)(1)(D) of this section shall provide and implement the programs specified in this subsection. (See the "NOTES AND EXCEPTIONS" to subsection (a)(2)(C) of this section for employers not covered.)

(1) Safety and health program:

The employer shall develop and implement a written safety and health program for employees involved in hazardous waste operations that shall be available for inspection by employees, their representatives, and Division personnel. The program shall be designed to identify, evaluate, and control safety and health hazards in their facilities for the purpose of employee protection; to provide for emergency response meeting the requirements of subsection (p)(8) of this section; and to address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures, and uses of new technologies.

(2) Hazard communication program:

The employer shall implement a hazard communication program meeting the requirements of 8 CCR 5194 as part of the employer's safety and health program.

NOTE TO 8 CCR 5192: The exemption for hazardous waste provided in 8 CCR 5194 is applicable to this section.

(3) Medical surveillance program:

The employer shall develop and implement a medical surveillance program meeting the requirements of subsection (f) of this section.

(4) Decontamination program:

The employer shall develop and implement a decontamination procedure in accordance with subsection (k) of this section.

(5) New technology program:

The employer shall develop and implement procedures meeting the requirements of subsection (o) of this section for introducing new and innovative equipment into the workplace.

(6) Material handling program:

Where employees will be handling drums or containers, the employer shall develop and implement procedures meeting the requirements of subsections (j)(1)(B) through (h), and (K) of this section, as well as (j)(3) and (j)(8) of this section prior to starting such work.

(7) Training program.:

(A) New employees:

The employer shall develop and implement a training program, which is part of the employer's safety and health program, for employees exposed to health hazards or hazardous substances at TSD operations to enable employees to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually. Employees who have received the initial training required by this subsection shall be given a written certificate attesting that they have successfully completed the necessary training.

(B) Current employees:

Employers who can show by an employee's previous work experience and/or training that the employee has had training equivalent to the initial training required by this subsection, shall be considered as meeting the initial training requirements of this subsection with respect to that employee. Equivalent training includes the training that existing employees might have already received from actual site work experience. Current employees shall receive eight hours of refresher training annually.

(C) Trainers:

Trainers who teach initial training shall have satisfactory completed a training course for teaching the subjects they are expected to teach, or they shall have the academic credentials and instruction experience necessary to demonstrate a good command of the subject matter of the course and competent instructional skills.

(8) Emergency response program:

(A) Emergency response plan:

An emergency response plan shall be developed and implemented by all employers. Such plans need not duplicate any of the subjects fully addressed in the employer's contingency planning required by permits, such as those issued by the U.S. Environmental Protection Agency, provided that the contingency plan is made part of the emergency response plan. The emergency response plan shall be a written portion of the employer's safety and health program required in subsection (p)(1) of this section. Employers who will evacuate their employees from the worksite location when an emergency occurs and who do not permit any of their employees to assist in handling the emergency are exempt from the requirements of subsection (p)(8) if they provide an emergency action plan complying with 8 CCR 3220.

(B) Elements of an emergency response plan:

The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this subsection:

1. Pre-emergency planning and coordination with outside parties.

2. Personnel roles, line of authority, and communication.

3. Emergency recognition and prevention.

4. Safe distances and places of refuge.

5. Site security and control.

6. Evacuation routes and procedures.

7. Decontamination procedures.

8. Emergency medical treatment and first aid.

9. Emergency alerting and response procedures.

10. Critique of response and follow-up.

11. Personal protective equipment (PPE) and emergency equipment.

(C) Training.

1. Training for emergency response employees shall be completed before they are called upon to perform in real emergencies. Such training shall include the elements of the emergency response plan, standard operating procedures the employer has established for the job, the PPE to be worn and procedures for handling emergency incidents.

EXCEPTION #1: An employer need not train all employees to the degree specified if the employer divides the work force in a manner such that a sufficient number of employees who have responsibility to control emergencies have the training specified, and all other employees, who may first respond to an emergency incident, have sufficient awareness training to recognize that an emergency response situation exists and that they are instructed in that case to summon the fully trained employees and not attempt control activities for which they are not trained.

EXCEPTION #2: An employer need not train all employees to the degree specified if arrangements have been made in advance for an outside fully-trained emergency response team to respond in a reasonable period and all employees, who may come to the incident first, have sufficient awareness training to recognize that an emergency response situation exists and they have been instructed to call the designated outside fully-trained emergency response team for assistance.

2. Employee members of TSD facility emergency response organizations shall be trained to a level of competence in the recognition of health and safety hazards to protect themselves and other employees. This would include training in the methods used to minimize the risk from safety and health hazards; in the safe use of control equipment; in the selection and use of appropriate personal protective equipment; in the safe operating procedures to be used at the incident scene; in the techniques of coordination with other employees to minimize risks; in the appropriate response to over-exposure from health hazards or injury to themselves and other employees; and in the recognition of subsequent symptoms which may result from over-exposures.

3. The employer shall certify that each covered employee has attended and successfully completed the training required in subsection (p)(8)(C) of this section, or shall certify the employee's competency at least yearly. The method used to demonstrate competency for certification of training shall be recorded and maintained by the employer.

(D) Procedures for handling emergency incidents.

1. In addition to the elements for the emergency response plan required in subsection (p)(8)(B) of this section, the following elements shall be included for emergency response plans to the extent that they do not repeat any information already contained in the emergency response plan:

   a. Site topography, layout, and prevailing weather conditions.

   b. Procedures for reporting incidents to local, state, and federal government agencies.

2. The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.

3. The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

4. The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

5. An employee alarm system shall be installed in accordance with 8 CCR 6184 to notify employees of an emergency situation; to stop work activities if necessary; to lower background noise in order to speed communication; and to begin emergency procedures.

6. Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

(q) Emergency Response to Hazardous Substance Release:

This subsection covers employers whose employees are engaged in emergency response no matter where it occurs except that it does not cover employees engaged in operations specified in subsections (a)(1)(A) through (a)(1)(D) of this section. Those emergency response organizations who have developed and implemented programs equivalent to this subsection for handling releases of hazardous substances pursuant to Section 303 of the Superfund Amendments and Reauthorization Act of 1986 (Emergency Planning and Community Right-to-Know Act 1986, 42 U.S.C. 11003) shall be deemed to have met the requirements of this subsection.

(1) Emergency response plan:

An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, and Division personnel. Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this subsection if they provide an emergency action plan in accordance with 8 CCR 3220.

(2) Elements of an emergency response plan:

The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following to the extent that they are not addressed elsewhere:

(A) Pre-emergency planning and coordination with outside parties.

(B) Personnel roles, lines of authority, training, and communication.

(C) Emergency recognition and prevention.

(D) Safe distances and places of refuge.

(E) Site security and control.

(F) Evacuation routes and procedures.

(G) Decontamination.

(H) Emergency medical treatment and first aid.

(I) Emergency alerting and response procedures.

(J) Critique of response and follow-up.

(K) Personal protective equipment (PPE) and emergency equipment.

(L) Emergency response organizations may use the local emergency response plan or the state emergency response plan or both, as part of their emergency response plan, to avoid duplication. Those items of the emergency response plan that are being properly addressed by the SARA Title III plans may be substituted into their emergency plan or otherwise kept together for the employer and employee's use.

(3) Procedures for handling emergency response:

(A) The senior emergency response official who has ultimate site control responsibility shall confirm that the Incident Command System (ICS) is in place and the position of Incident Commander (IC) instituted. All emergency responders and their communications shall be coordinated and controlled through the ICS.

NOTE TO (q)(3)(A): The "senior official" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site until the emergency response official who is determined to have ultimate incident control authority arrives. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene, usually a police or fire vehicle. As more senior officials arrive the position is passed up the line of authority which has been previously established. As there may be several separate spheres of responsibility at a given site (police, fire, CalTrans, for example), there may be several "senior officials," each responsible for his/her own employees. The "senior emergency response official" who will have ultimate site control responsibility is established in the Hazardous Material Incident Contingency Plan for the State of California (January 1991), promulgated by the State Office of Emergency Services (OES) as directed by Health and Safety Code, Sec. 25503 (HS 25503), and California Code of Regulations, Title 19, Division 2 (19 CCR, Div. 2: Office of Emergency Services) and in coordination with the various city and county, i.e., area emergency response plans.

(B) The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies.

(C) Based on hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the PPE worn is appropriate for the hazards to be encountered. However, PPE shall meet, at a minimum, the criteria contained in 8 CCR 3401-3408 when worn is appropriate for the hazards to be encountered. However, PPE shall meet, at a minimum, the criteria contained in 8 CCR 3401-3408 when worn while performing fire fighting operations beyond the incipient stage for any incident.

(D) Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus (SCBA) while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.

(E) The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.

(F) Back-up personnel shall stand by with equipment ready to provide assistance or rescue, and shall not engage in activities that will detract from that mission. Back-up personnel shall be protected, at a minimum, as the same level as the entry team. Advance first aid support personnel, at a minimum, shall also stand by with medical equipment and transportation capability.

(G) The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

(H) When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene.

(I) After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.

(J) When deemed necessary for meeting the tasks at hand, approved SCBA may be used with approved cylinders from other approved SCBA, provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with SCBA shall meet U.S. Department of Transportation (DOT) and National Institute for Occupational Safety and Health (NIOSH) criteria.

(4) Skilled support personnel:

Personnel, not necessarily an employer's own employees, who are skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment or crane and hoisting equipment and who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may be exposed to the hazards at an emergency response scene, are not required to meet the training required in this subsection for the employer's regular employees. However, these personnel shall be given an initial briefing at the site prior to their participation in any emergency response. The initial briefing shall include instruction in the wearing of appropriate personal protective equipment, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety and health precautions provided to the employer's own employees shall be used to assure the safety and health of these support personnel.

(5) Specialist employees:

Employees who, in the course of their regular job duties, work with and are trained in the hazard of specific hazardous substances, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge, shall receive training or demonstrate competency in the area of their specialization annually.

(6) Training:

Training shall be based on the duties and functions to be performed by each responder of an emergency response organization. The skill and knowledge levels required for all new responders (those hired after the effective date of this standard) shall be conveyed to them through training before they are permitted to take apart in actual emergency operations on an incident. Employees who participate, or are expected to participate, in emergency response, shall be given training in accordance with the following subsections:

(A) First Responder, Awareness Level (FRA):

First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond notifying the authorities of the release. First responders at the awareness level shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:

1. An understanding of what hazardous substances are, and the risks associated with them in an incident.

2. An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.

3. The ability to recognize the presence of hazardous substances in an emergency.

4. The ability to identify the hazardous substance, if possible.

5. An understanding of the role of the first responder awareness individual in the employer's emergency response plan (including site security and control), and the U.S. Department of Transportation's Emergency Response Guidebook.

6. The ability to realize the need for additional resources, and to make appropriate notifications to the communications center.

(B) First Responder, Operations Level (FRO):

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level; and the employer shall so certify:

1. Knowledge of the basic hazard and risk assessment techniques.

2. Know how to select and use proper PPE provided to the first responder operational level.

3. An understanding of basic hazardous materials terms.

4. Know how to perform basic control, containment, and/or confinement operations and rescue injured or contaminated persons within the capabilities of the resources and PPE available with their unit.

5. Know how to implement basic equipment, victim, and rescue personnel decontamination procedures.

6. An understanding of the relevant standard operating procedures and termination procedures.

(C) Hazardous Materials Technician:

Hazardous materials technicians are individuals who respond to releases or potential releases of hazardous substances for the purpose of stopping the release. They assume a more aggressive role than the first responder at the operations level in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance. Hazardous materials technicians shall have received at least 24 hours of training of which 8 hours shall be equivalent to the first responder operational level and in addition have competency in the following areas; and the employer shall so certify:

1. Know how to implement the employer's emergency response plan.

2. Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.

3. Be able to function within an assigned role in the ICS.

4. Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.

5. Understand hazard and risk assessment techniques.

6. Be able to perform advanced control, containment, and/or confinement operations and rescue injured or contaminated persons within the capabilities of the resources and PPE available with the unit.

7. Understand and implement equipment, victim, and rescue personnel decontamination procedures.

8. Understand termination procedures.

9. Understand basic chemical and toxicological terminology and behavior.

(D) Hazardous Materials Specialist:

Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician, however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with Federal, state, local, and other government authorities in regards to site activities. Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competencies in the following areas; and the employer shall so certify:

1. Know how to implement the local emergency response plan.

2. Understand classification, identification and verification of known and unknown materials by using advanced survey instruments and equipment.

3. Know the state emergency response plan.

4. Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.

5. Understand in-depth hazard and risk assessment techniques.

6. Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and PPE available.

7. Be able to determine and implement decontamination procedures.

8. Have the ability to develop a site safety and health control plan.

9. Understand chemical, radiological, and toxicological terminology and behavior.

(E) Incident Commander/On-scene manager:

Incident commanders, who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas; and the employer shall so certify:

1. Know and be able to implement the employer's incident command system.

2. Know how to implement the employer's emergency response plan.

3. Know how to understand the hazards and risks associated with employees working in chemical protective clothing.

4. Know how to implement the local emergency response plan.

5. Know of the state emergency response plan and of the Federal Regional Response Team.

6. Know and understand the importance of decontamination procedures.

NOTE TO (q)(6)(E): Management personnel who, during an emergency situation, stay out of the hazardous area and who are not taking charge of the incident, and are not a "specialist" employee under subsection (q)(5) of this section are not subject to the provisions of this section.

(7) Trainers:

Trainers who teach any of the above training subjects shall have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the California Specialized Training Institute, the California State Fire Marshal's Office, the University of California, or the U.S. National Fire Academy; or they shall have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach.

(8) Refresher Training:

(A) Those employees who are trained in accordance with subsection (q)(6) of this section shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.

(B) A statement shall be made of the training or competency; and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate the competency.

(9) Medical Surveillance and Consultation:

(A) Members of an organized and designated HAZMAT team, and hazardous materials specialist shall receive a baseline physical examination and be provided with medical surveillance as required in subsection (f) of this section.

(B) Any emergency response employee who exhibits signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident, either immediately or subsequently, shall be provided with medical consultation as required in subsection (f)(3)(B) of this section.

(10) Chemical Protective Clothing:

Chemical protective clothing and equipment to be used by organized and designated HAZMAT team members, or to be used by hazardous materials specialists shall meet the requirements of subsections (g)(3) through (5) of this section.

(11) Post-emergency response operations:

Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards, and materials contaminated with them (such as contaminated soil or other elements of the natural environment) from the site of the incident, the employer conducting the clean-up shall comply with one of the following:

(A) Meet all of the requirements of subsections (b) through (o) of this section; or

(B) Where the clean-up is done on plant property using plant or workplace employees, such employees shall have completed the training requirements of the following: 8 CCR 3220, 8 CCR 5144, 8 CCR 5194, and other appropriate safety and health training made necessary by the tasks that they are expected to perform such as the use of PPE, and decontamination procedures. All equipment to be used in the performance of the clean-up work shall be in serviceable condition and shall have been inspected prior to use.

Note: Authority cited: Sections 142.3 and 142.7, Labor Code. References: Sections 142.3 and 142.7, Labor Code.

History

1. New section including Appendices A-D filed 8-26-91; operative 9-25-91 (Register 92, No. 12).

Appendices to 5192

Hazardous Waste Operations and Emergency Response

Note: The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section. However, subsection 5192(g) makes mandatory in certain circumstances the use of Level A and level B PPE protection.

Appendix A

Personal Protective Equipment (PPE) Test Methods (Non-Mandatory)

This appendix sets forth the non-mandatory examples of tests which may be used to evaluate compliance with subsections (g)(4)(B) and (C). Other tests and other challenge agents may be used to evaluate compliance.

A. Totally-encapsulating chemical protective suit pressure test.

1.0 Scope.

1.1 This practice measures the ability of a gas tight totally-encapsulating chemical protective suit material, seams, and closures to maintain a fixed positive pressure. The results of this practice allow the gas tight integrity of a totally-encapsulating chemical protective suit to be evaluated.

1.2 Resistance of the suit materials to permeation, penetration, and degradation by specific hazardous substances is not determined by this test method.

2.0 Definition of terms.

2.1 “Totally-encapsulated chemical protective suit (TECP suit)” means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator, may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves and boots.

2.2 “Protective clothing material” means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with potentially hazardous liquid or gaseous chemicals.

2.3 “Gas tight” means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

3.0 Summary of test method.

3.1 The TECP suits is visually inspected and modified for the test. The test apparatus is attached to the suit to permit inflation to the pre-test suit expansion pressure for removal of suit wrinkles and creases. The pressure is lowered to the test pressure and monitored for three minutes. If the pressure drop is excessive, the TECP suit fails the test and is removed from service. The test is repeated after leak location and repair.

4.0 Required Supplies.

4.1 Source of compressed air.

4.2 Test apparatus for suit testing including a pressure measurement device with a sensitivity of at least 1/4 inch water gauge.

4.3 Vent valve closure plugs or sealing tape.

4.4 Soapy water solution and soft brush.

4.5 Stop watch or appropriate timing device.

5.0 Safety Precautions.

5.1 Care shall be taken to provide the correct pressure safety devices required for the source of compressed air used.

6.0 Test procedure.

6.1 Prior to each test, the tester shall perform a visual inspection of the suit. Check the suit for seam integrity by visually examining the seams and gently pulling on the seams. Ensure that all air supply lines, fittings, visor, zippers, and valves are secure and show no signs of deterioration.

6.1.1 Seal off the vent valves along with any other normal inlet or exhaust points (such as umbilical air line fittings or face piece opening) with tape or other appropriate means (caps, plugs, fixture, etc.). Care should be exercised in the sealing process not to damage any of the suit components.

6.1.2 Close all closure assemblies.

6.1.3 Prepare the suit for inflation by providing an improvised connection point on the suit for connecting an airline. Attach the pressure test apparatus to the suit to permit suit inflation from a compressed air couch equipped with a pressure indicating regulator. The leak tightness of the pressure test apparatus should be tested before and after each test by closing off the end of the tubing attached to the suit and assuring a pressure of three inches water gauge for three minutes can be maintained. If a component is removed for the test, that component shall be replaced and a second test conducted with another component removed to permit a complete test of the ensemble.

6.1.4 The pre-test expansion pressure (A) and the suit test pressure (B) shall be supplied by the suit manufacturer but in no case shall they be less than: (A) - 3 inches water gauge; and (B) - 2 inches water gauge. The ending suit pressure (C) shall be no less than 80 percent of the test pressure (B); i.e., the pressure drop shall not exceed 20- percent of the test pressure (B).

6.1.5 Inflate the suit until the pressure inside is equal to pressure (A), the pre-test expansion suit pressure. Allow at least one minute to fill out the wrinkles in the suit. Release sufficient air to reduce the suit pressure to pressure (B), the suit test pressure. Begin timing. At the end of three minutes, record the suit pressure as pressure (C), the ending suit pressure. The difference between the suit test pressure and the ending suit test pressure (B-C) shall be defined as the suit pressure drop.

6.1.6 If the suit pressure drop is more than 20 percent of the suit test pressure (B) during the three-minute test period, the suit fails the test and shall be removed from service.

7.0 Retest Procedure.

7.1 If the suit fails the test, check for leaks by inflating the suit to pressure (A) and brushing over or wiping the entire suit (including seams, closures, lens gaskets, glove-to-sleeve joints, etc.) with a mild soap and water solution. Observe the suit for the formation of soap bubbles, which is an indication of a leak. Repair all identified leaks.

7.2 Retest the TECP suit as outlined in Test Procedure 6.0.

8.0 Report.

8.1 Each TECP suit tested by this practice shall have the following information recorded:

8.1.1 Unique identification number identifying brand name, date of purchase, material of construction, and unique fit features, e.g., special breathing apparatus.

8.1.2 The actual values for test pressures (A), (B), and (C) shall be recorded along with the specific observation times. If the ending pressure (C) is less than 80 percent of the test pressure (B), the suit shall be identified as failing the test. When possible, the specific leak location shall be identified in the test records. Retest pressure data shall be recorded as an additional test.

8.1.3 The source of the test apparatus used shall be identified and the sensitivity of the pressure gauge shall be recorded.

8.1.4 Records shall be kept for each pressure test even if repairs are being made at the test locations.

CAUTION

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked. Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

B. Totally-encapsulated chemical protective suit qualitative leak test.

1.0 Scope.

1.1 This practice semi-qualitatively tests gas tight totally-encapsulating chemical protective suit integrity by detecting inward leakage of ammonia vapor. Since no modifications are made to the suit to carry out this test, the results from this practice provide a realistic test for the integrity of the entire suit.

1.2 Resistance of the suit materials to permeation, penetration, and degradation is not determined by this test method. ASTM test methods are available to test suit materials for these characteristics and the tests are usually conducted by the manufacturers of the suits.

2.0 Definition of terms.

2.1 “Totally-encapsulated chemical protective suit (TECP suit)” means a full body garment which is constructed of protective clothing materials; covers the wearer's torso, head, arms, legs and respirator; may cover the wearer's hands and feet with tightly attached gloves and boots; completely encloses the wearer and respirator by itself or in combination with the wearer's gloves and boots.

2.2. “Protective clothing material” means any material or combination of materials used in an item of clothing for the purpose of isolating parts of the body from direct contact with potentially hazardous liquid or gaseous chemicals.

2.3 "Gas tight" means, for the purpose of this test method, the limited flow of a gas under pressure from the inside of a TECP suit to atmosphere at a prescribed pressure and time interval.

2.4 "Intrusion Coefficient" means a number expressing the level of protection provided by a gas tight totally-encapsulating chemical protective suit. The intrusion coefficient is calculated by dividing the test room challenge agent concentration by the concentration of challenge agent found inside the suit. The accuracy of the intrusion coefficient is dependent on the challenge agent monitoring methods. The larger the intrusion coefficient the greater the protection provided by the TECP suit.

3.0 Summary of recommended practice.

3.1 The volume of concentrated aqueous ammonia solution (ammonium hydroxide, NH_4OH) required to generate the test atmosphere is determined using the directions outlined in 6.1. The suit is donned by a person wearing the appropriate respiratory equipment (either positive-pressure self-contained breathing apparatus or a positive-pressure supplied air respirator) and worn inside the enclosed test room. The concentrated aqueous ammonia solution is taken by the suited individual into the test room and poured into an open plastic pan. A two-minute evaporation period is observed before the test room concentration is measured using a high range ammonia length of stain detector tube. When the ammonia vapor reaches a concentration of between 1000 and 1200 ppm, the suited individual starts a standardized exercise protocol to stress and flex the suit. After this protocol is completed, the test room concentration is measured again. The suited individual exits the test room and his stand-by person measures the ammonia concentration inside the suit using a low range ammonia length of stain detector tube or other more sensitive ammonia detector. A stand-by person is required to observe the test individual during the test procedure; aid the person in donning and doffing the TECP suit; and monitor the suit interior. The intrusion coefficient of the suit can be calculated by dividing the average test area concentration by the interior suit concentration. A colorimetric ammonia indicator strip of bromophenol blue or equivalent is placed on the inside of the suit face piece lens so that the suited individual is able to detect a color change and know if the suit has a significant leak. If a color change is observed the individual shall leave the test room immediately.

4.0 Required supplies.

4.1 A supply of concentrated aqueous ammonium hydroxide (58% ammonia by weight.)

4.2 A supply of bromophenol blue indicating paper or equivalent, sensitive to 5-10 ppm ammonia or greater over a two-minute period of exposure. (pH 3.0 (yellow) to pH 4.6 (blue))

4.3 A supply of high range (0.5-10 volume percent) and low range (5-700 ppm) detector tubes for ammonia and the corresponding sampling pump. More sensitive ammonia detectors can be substituted for the low range detector tubes to improve the sensitivity of this practice.

4.4 A shallow plastic pan (PVC) at least 12":14":1" and a half pint plastic container (PVC) with tightly closing lid.

4.5 A graduated cylinder or other volumetric measuring devices at least 50 milliliters in volume with an accuracy of at least ± 1 milliliters.

5.0 Safety precautions.

5.1 Concentrated aqueous ammonium hydroxide, NH_4OH, is a corrosive volatile liquid requiring eye, skin, and respiratory protection. The person conducting the test shall review the MSDS for aqueous ammonia.

5.2 Since the established short term exposure limit (STEL) for ammonia is 35 ppm as a 15 minute STEL, only persons wearing positive pressure self-contained breathing apparatus or a positive pressure supplied air respirator shall be in the chamber. Normally only the person wearing the totally-encapsulating suit will be inside the chamber. A stand-by person shall have a positive pressure self-contained breathing apparatus, or a positive pressure supplied air respirator available to enter the test area should the suited individual need assistance.

5.3 A method to monitor the suited individual must be used during this test. Visual contact is the simplest but other methods using communication devices are acceptable.

5.4 The test room shall be large enough to allow the exercise protocol to be carried out and then to be ventilated to allow each exhaust of the ammonia test atmosphere after the test(s) are completed.

5.5 Individuals shall be medically screened for the use of respiratory protection and checked for allergies to ammonia before participating in this test procedure.

6.0 Test procedure.

6.1 NO TEXT PRINTED HERE IN THE REGULATIONS

6.1.1 Measure the test area to the nearest foot and calculate its volume in cubic feet. Multiply the test area volume by 0.2 milliliters of concentrated aqueous ammonia solution per cubic foot of test area volume to determine the approximate volume of concentrated aqueous ammonia required to generate 1000 ppm in the test area.

6.1.2 Measure this volume from the supply of concentrated aqueous ammonia and place it into a closed plastic container.

6.1.3 Place the container, several high range ammonia detector tubes, and the pump in the clean test pan and locate it near the test area entry door so that the suited individual has easy access to these supplies.

6.2 NO TEXT PRINTED HERE IN THE REGULATIONS

6.2.1 In a non-contaminated atmosphere, open a pre-sealed ammonia indicator strip and fasten one end of the strip to the inside of suit face shield lens where it can be seen by the wearer. Moisten the indicator strip with distilled water. Care shall be taken not to contaminate the detector part of the indicator paper by touching it. A small piece of masking tape or equivalent should be used to attach the indicator strip to the interior of the suit face shield.

6.2.2 If problems are encountered with this method of attachment, the indicator strip can be attached to the outside of the respirator face piece lens being used during the test.

6.3 Don the respiratory protective device normally used with the suit, and then don the TECP suit to be tested. Check to be sure all openings which are intended to be sealed (zipper, gloves, etc.) are completely sealed. DO NOT, however, plug off any venting valves.

6.4 Step into the enclosed test room such as a closet, bathroom, or test booth, equipped with an exhaust fan. No air should be exhausted from the chamber during the test because this will dilute the ammonia challenge concentrations.

6.5 Open the container with the pre-measured volume of concentrated aqueous ammonia within the enclosed test room, and pour the liquid into the empty plastic test pan. Wait two minutes to allow for adequate volatilization of the concentrated aqueous ammonia. A small mixing fan can be used near the evaporation pan to increase the evaporation rate of the ammonia solution.

6.6 After two minutes a determination of the ammonia concentration within the chamber should be made using the high range colorimetric detector tube. A concentration of 1000 ppm ammonia or greater shall be generated before the exercises are started.

6.7 To test the integrity of the suit the following four-minute exercise protocol should be followed:

6.7.1 Raising the arms above the head with at least 15 raising motions completed in one minute.

6.7.2 Walking in place for one minute with at least 15 raising motions of each leg in a one-minute period.

6.7.3 Touching the toes with at least 10 complete motions of the arms from above the head to touching of the toes in a one-minute period.

6.7.4 Deep knee bends with at least 10 complete standing and squatting motions in a one-minute period.

6.8 If at any time during the test the colorimetric indicating paper should change colors, the test should be stopped and section 6.10 and 6.12 initiated (See paragraph 4.2).

6.9 After completion of the test exercise, the test area concentration should be measured again using the high range colorimetric detector tube.

6.10 Exit the test area.

6.11 The opening created by the suit zipper or other appropriate suit penetration should be used to determine the ammonia concentration in the suit with the low range length of stain detector tube or other ammonia monitor. The internal TECP suit air should be sampled for enough from the enclosed test area to prevent a false ammonia reading.

6.12 After completion of the measurement of the suit interior ammonia concentration the test is concluded and the suit is doffed and the respirator removed.

6.13 The ventilating fan for the test room should be turned on and allowed to run for enough time to remove the ammonia gas. The fan shall be vented to the outside of the building.

6.14 Any detectable ammonia in the suit interior (five ppm ammonia (NH_3) or more for the length of stain detector tube) indicates that the suit has failed the test. When other ammonia detectors are used a lower level of detection is possible, and it should be specified as the pass/fail criteria.

6.15 By following this test method, an intrusion coefficient of approximately 200 or more can be measured with the suit in a completely operational condition. If the intrusion coefficient is 200 or more, then the suit is suitable for emergency response and field use.

7.0 Retest procedures.

7.1 If the suit fails this test, check for leaks by following the pressure test in test A above.

7.2 Retest the TECP suit as outlined in the test procedure 6.0.

8.0 Report.

8.1 Each gas tight totally-encapsulating chemical protective suit tested by this practice shall have the following information recorded.

8.1.1 Unique identification number identifying brand name, date of purchase, material of construction, and unique suit features, e.g., special breathing apparatus.

8.1.2 General description of test room used for test.

8.1.3 Brand name and purchase date of ammonia detector strips and color change data.

8.1.4 Brand name, sampling range, and expiration date of the length of stain ammonia detector tubes. The brand name and model of the sampling pump should also be recorded. If another type of ammonia detector is used, it should be identified along with its minimum detection limit for ammonia.

8.1.5 Actual test results shall list the two test area concentrations, their average, the interior suit concentration, and the calculated intrusion coefficient. Retest data shall be recorded as an additional test.

8.2 The evaluation of the data shall be specified as “suit passed” or “suit failed” and the date of the test. Any detectable ammonia (five ppm or greater for the length of stain detector tube) in the suit interior indicates the suit has failed this test. When other ammonia detectors are used, a lower level of detection is possible and it should be specified as the pass/fail criteria.

CAUTION

Visually inspect all parts of the suit to be sure they are positioned correctly and secured tightly before putting the suit back into service. Special care should be taken to examine each exhaust valve to make sure it is not blocked. Care should also be exercised to assure that the inside and outside of the suit is completely dry before it is put into storage.

Appendix B

General Description and Discussion of the Levels of Protection and Protective Gear (Non-Mandatory)

This appendix sets forth information about personal protective equipment (PPE) protection levels which may be used to assist employers in complying with the PPE requirements of this section.

As required by the standard, PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Selection of the appropriate PPE is a complex process which must take into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards; their routes of potential hazard to employees (inhalation, skin absorption, ingestion, and eye or skin contact); and the performance of the PPE materials (and seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, again others. In many instances, protective equipment materials cannot be found which will provide continuous protection from the particular hazardous substance. In these cases the breakthrough time of the protective material should exceed the work durations.

Other factors in this selection process to be considered are matching the PPE to the employees work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, should be considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE. In some cases layers of PPE may be necessary to provide sufficient protection, or to protect expensive PPE inner garments, suits or equipment.

The more that is known about the hazards at the site, the easier the job of PPE selection becomes. As more information about the hazards and conditions at the site becomes available, the site supervisor can make decisions to upgrade or downgrade the level of PPE protection to match the tasks at hand.

The following are guidelines which an employer can use to begin the selection of the appropriate PPE. As noted above, the site information may suggest the use of combinations of PPE selected from the different protection levels (i.e., A,B,C, or D) as being more suitable to the hazards of the work. It should be cautioned that the listing below does not fully address the performance of the specific PPE material in relation to the specific hazards at the job site, and that PPE selection, evaluation, and reselection is an ongoing process until sufficient information about the hazards and PPE performance is obtained.

Part A.

Personal protection equipment is divided into four categories based on the degree of protection afforded. (See Part B of this appendix for further explanation of Levels A,B,C, and D hazards):

I. Level A:

To be selected when the greatest level of skin, respiratory, and eye protection is required. The following constitute Level A equipment; it may be used as appropriate.

1. Positive-pressure, full face-piece, self-contained breathing apparatus (SCBA), or positive pressure supplied-air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.*
4. Long underwear.*
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.

7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).*
9. Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).

II. Level B:

The highest level of respiratory protection is necessary but a lesser level of skin protection is needed. The following constitute Level B equipment; it may be used as appropriate.

1. Positive-pressure, full face-piece, self-contained breathing apparatus (SCBA), or positive-pressure supplied-air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots, outer, chemical-resistant steel toe and shank.
7. Boots-covers, outer, chemical-resistant (disposable).*
8. Hard hat.*
9. Face shield.*

III. Level C:

The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met. The following constitute Level C equipment; it may be used as appropriate.

1. Full-face or half-mask, air-purifying respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant steel toe and shank.*
7. Boot-covers, outer, chemical-resistant (disposable).*
8. Hard hat.*
9. Escape mask.*
10. Face shield.*

IV. Level D:

A work uniform affording minimal protection; used for nuisance contamination only.
The following constitute Level D equipment; it may be used as appropriate.

1. Coveralls.
2. Gloves.*
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).*
5. Safety glasses or chemical splash goggles.*
6. Hard hat.*
7. Escape mask.*
8. Face shield.*

*Optional, as applicable.

Part B.

The types of hazards for which levels A,B,C, and D protection are appropriate are described below:

I. Level A:

Level A protection should be used when:

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed though the skin.

2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or

3. Operations are being conducted in confined, poorly ventilated areas, and the absence of conditions require Level A have not yet been determined.

II. Level B:

Level B protection should be used when:

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection; and/or

2. The atmosphere contains less than 19.5 percent oxygen; or

3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin.

Note: This involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.

III. Level C:

Level C protection should be used when:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;

2. The type of air contaminates have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and

3. All criteria for the use of air-purifying respirators are met.

IV. Level D:

Level D protection should be used when:

1. The atmosphere contains no known hazard; and

2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Note: As stated before, combinations of personal protective equipment other than those described for Levels A,B,C, or D protection may be more appropriate and may be used to provide the proper level of protection.
As an aid in selecting suitable chemical protective clothing, it should be noted that the National Fire Protection Association has developed standards on chemical protective clothing, including:

NFPA 1991 Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A Protective Clothing)

NFPA 1992 Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B Protective Clothing)

NFPA 1993 Standard on Support Function Protective Garments for Hazardous Chemical Operations. (EPA Level B Protective Clothing)

These standards apply documentation and performance requirements to the manufacture of chemical protective suits. Chemical protective suits meeting these requirements are labeled as compliant with the appropriate standard. As these standards, have been adopted by the National Fire Protection Association, it is recommended that chemical protective suits which meet these standards be used.

Appendix C

Compliance Guidelines
(Non-Mandatory)

1. Occupational Safety and Health Program:

Each hazardous waste site clean-up effort will require an occupational safety and health program headed by the site coordinator or the employer's representative. The purpose of the program will be the protection of employees at the site and will be an extension of he employer's overall safety and health program. The program will need to be developed before work begins on the site and implemented as work proceeds as stated ion subsection (b). The program is to facilitate coordination and communication of safety and health issues among personnel responsible for the various activities which will take place at the site. The program will provide the means for identifying and controlling worksite hazards and the means for monitoring program effectiveness. It will provide the overall means for planning and implementing the needed safety and health training and job orientation of employees, who will be working at the site. The program will need to cover the responsibilities and authority of the site coordinator or the employer's manager on the site for the safety and health of employees at the site, and the relationships with contractors or support services as to what each employer's safety and health responsibilities are for their employees on the site. Each contractor on the site needs to have its own safety and health program so structured that it will smoothly interface with the program of the site coordinator or principal contractor.

Also those employers involved with treating, storing or disposal of hazardous waste as covered in subsection (p) must have implemented a safety and health program for their employees. This program is to include the hazard communication program required in subsection (p)(1) and the training required in subsections (p)(7) and (p)(8) as parts of the employer's comprehensive overall safety and health program. This program is to be in writing.

Each site or workplace safety and health program will need to include the following: (1) Policy statements of the line of authority and accountability for implementing the program, the objectives of the program, and the role of the site safety and health supervisor or manager and staff; (2) means or methods for the development of procedures for identifying and controlling workplace hazards at the site; (3) means or methods for the development and communication to employees of the various plans, work rules, standard operating procedures and practices that pertain to individual employees and supervisors; (4) means for the training of supervisors and employees to develop the needed skills and knowledge to perform their work in a safe and healthful manner; (5) means to anticipate and prepare for emergency situations; and (6) means for obtaining information feedback to aid in evaluating the program and for improving the effectiveness of the program. The management and employees should be trying continually to improve the effectiveness of the program thereby enhancing the protection being afforded those working on the site.

Accidents on the site should be investigated to provide information on how such occurrences can be avoided in the future. When injuries or illnesses occur on the site or workplace, they will need to be investigated to determine what needs to be done to prevent this incident from occurring again. Such information will need to be used as feedback on the effectiveness of the program and the information turned into positive steps to prevent any reoccurrence. Receipt of employee suggestions or complaints relating to safety and health issues involved with site or workplace activities is also a feedback mechanism can be used effectively to improve the program and may serve as part as an evaluative tool(s).

For the development and implementation of the program to be the most effective, professional safety and health personnel should be used. Personnel such as, but not necessarily limited to Certified Safety Professionals, Board Certified Industrial Hygienists, or Registered Professional Safety Engineers are good examples of professional stature for safety and health managers who will administer the employer's program.

2. Training:

The training programs for employees subject to the requirements of subsection (e) of this standard should address: The safety and health hazards employees should expect to find our hazardous waste clean-up sites; what control measures or techniques are effective for those hazards; what monitoring procedures are effective in characterizing exposure levels; what makes an effective employer's safe and health program; what a site safety and health plan should include; hands on training with personal protective equipment and clothing they may be expected to use; the contents of OSHA standard relevant to the employee's duties and function; and employee's responsibilities under OSHA and other regulations. Supervisors will need training in their responsibilities under the safety and health program and its subject areas such as the spill containment program, the personal protective equipment program, the medical surveillance program, the emergency response plan, and other areas.

The training programs for employees subject to the requirements of subsection (p) of this standard should address: The employer's safety and health program elements impacting employees; the hazard communication program; the medical surveillance program; the hazards and the controls for such hazards that employees need to know for their job duties and functions. All require annual refresher training.

The training programs for employees covered by the requirements of subsection (q) of this standard should address those competencies required for the various levels of response such as: The hazards associated with hazardous substances; hazard identification and awareness; notification of appropriate persons; the need for and use of personal protective equipment including respirators; the decontamination procedures to be used; preplanning activities for hazardous substance incidents including the emergency response plan; company standard operating procedures for hazardous substance emergency responses; the use of incident command system; and other subjects. Hands-on training should be stressed whenever possible. Critiques done after an incident which include an evaluation of what worked and what did not, and how could the incident be better handled the next time may be counted as training time.

For hazardous materials specialists (usually members of hazardous materials teams), the training should address the care, use, and/or testing of chemical protective clothing including totally encapsulating suits; the medical surveillance program; the standard operating procedures of the hazardous materials team including the use of plugging and patching equipment; and other subject areas.

Officers and leaders who may be expected to be in charge at an incident should be fully knowledgeable of their company's incident command system. They should know where and how to obtain additional assistance and be familiar with the local district's emergency response plan and the state emergency response plan.

Specialists employees such as technical experts, medical experts, or environmental experts that work with hazardous materials in their regular jobs, who may be sent to the incident scene by the shipper, manufacturer, or governmental agency to advise and assist the person in charge of the incident should have training on an annual basis. Their training should include the care and use of personal protective equipment (PPE) including respirators; knowledge of the incident command system and how they are to relate to it; and those areas needed to keep them current in their respective fields as it relates to safety and health involving specific hazardous substances.

Those skilled support personnel, such as employees who work for public works departments or equipment operators who operate bulldozers, sand trucks, backhoes, etc., who may be called to the incident scene to provide emergency support assistance, should have at least a safety and health briefing before entering the area of potential or actual exposure. These skilled support personnel, who have not been a part of the emergency response plan and do not meet the training requirements, should be made aware of the hazards they face and should be provided all necessary protective clothing and equipment required for their tasks.

There are two National Fire Protective Association standards, NFPA 472 - Standard for Professional Competence of Responders to Hazardous Material Incidents and NFPA 471 - Recommended Practice for Responding to Hazardous Material Incidents, which are excellent resource documents to aid fire departments and other emergency response organizations in developing their training program materials. NFPA 472 provides guidance on the skills and knowledge needed for the first responder awareness level, first responder operations level, HAZMAT technicians, and HAZMAT specialists. It also offers guidance for the officer corps who will be in charge of hazardous substance incidents.

3. Decontamination:

Decontamination procedures should be tailored to the specific hazards of the site and may vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method may not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to assure that employees are not exposed to hazards by reusing PPE. References in Appendix D may be used for guidance in establishing an effective decontamination program. In addition, the U.S. Coast Guard's Manual, Policy Guidance for Response to Hazardous Chemical Releases, U.S. Department of Transportation, Washington, DC 9COMDTINST M16465.30) is a good reference for establishing an effective decontamination program.

4. Emergency response plans:

The state, along with designated districts within the state, will be developing or have developed local emergency response plans. These state and district plans should be utilized in the emergency response plans called for in this standard. Each employer should assure that its emergency response plan is compatible with the local plan. The major reference being use to aid in developing the state and local district plans is the Hazardous Materials Emergency Planning Guide, NRT-1.

The current Emergency Response Guidebook from the U.S. Department of Transportation, CMA's CHEMTREC, and the Fire Service Emergency Management Handbook may also be used as resources.

Employers involved with treatment, storage, and disposal facilities for hazardous waste, which have the required contingency plan called for by their permit, would not need to duplicate the same planning elements. Those items of the emergency response plan that are properly addressed in the contingency plan may be substituted into the emergency response plan required in 8 CCR 5192 or otherwise kept together for employer and employee use.

5. Personal protective equipment programs:

The purpose of personal protective clothing and equipment (PPE) is to shield or isolate individuals from the chemical, physical, and biologic hazards that may be encountered at a hazardous substance site.

As discussed in Appendix B, no single combination of protective equipment and clothing is capable of protecting against all hazards. Thus PPE should be used in conjunction with other protective methods and its effectiveness evaluated periodically. The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. However, over-protection, as well as under-protection, can be hazardous and should be avoided where possible.

Two basic objectives of any PPE program should be to protect the wearer from safety and health hazards, and to prevent injury to the wearer from incorrect use and/or malfunction of the PPE. To accomplish these goals, a comprehensive PPE program should include hazard identification; medical monitoring; environmental surveillance; selection, use, maintenance, and decontamination of PPE; and its associated training.

The written PPE program should include policy statements, procedures, and guidelines. copies should be made available to all employees, and a reference copy should be made available at the worksite. Technical data on equipment, maintenance manuals, relevant regulations, and other essential information should also be collected and maintained.

6. Incident command system (ICS):

Subsection 5192(q)(3)(B) requires the implementation of an ICS. The ICS is an organized approach to effectively control and manage operations at an emergency incident. The individual in charge of the ICS is the senior official responding to the incident. The ICS was originated be the California fire service. During large complex fires involving several companies and many pieces of apparatus, a command post would be established. This enabled one individual to be in charge of managing the incident, rather than having several officers from different companies making separate, and sometimes conflicting, decisions. The individual in charge of the command post would delegate responsibility for performing various tasks to subordinate officers. Additionally, all communications were routed through the command post to reduce the number of radio transmissions and eliminate confusion. However, strategy, tactics, and all decisions were made by one individual.

The ICS is also implemented for emergency response to all incidents, both large and small, that involve hazardous substances.

For a small incident, the individual in charge of the ICS may perform many tasks of the ICS. There may not be any, or little delegation of tasks to subordinates. For example, in response to a small incident, the individual in charge of the ICS, in addition to normal command activities, may become the safety officer.

To illustrate the operation of the ICS, the following scenario might develop during a small incident, such as an overturned tank truck with a small leak of flammable liquid.

The first responding senior officer would implement and take command of the ICS. That person would size-up the incident and determine if additional personnel and apparatus were necessary; would determine what actions to take to control the leak; and determine the proper level of personal protective equipment. If additional assistance is not needed, the individual in charge of the ICS would implement actions to stop and control the leak using the fewest number of personnel that can effectively accomplish tasks. The individual in charge of the ICS then would designate himself as the safety officer and two other employees as a back-up in case rescue may become necessary. In this scenario, decontamination procedures may not be necessary.

A large complex incident may require many employees and difficult, time-consuming efforts to control. In these situations, the individual in charge of the ICS will want to delegate different tasks to subordinates in order to maintain a span of control that will keep the number of subordinates that are reporting, to a manageable level.

Delegation of tasks at large incidents may be by location, where the incident scene is divided into sectors, and subordinate officers coordinate activities within the sector that they have been assigned.

Delegation of tasks can also be by function. Five major functional areas (Incident Command, Operations, Planning, Logistic, and Finance) are activated at major incidents addressing such issues as: medical services; evacuation; water supply; resources (equipment, apparatus); media relations; safety; and site control (integrate activities with police for crowd and traffic control). Also for a large incident, the individual in charge of the ICS will designate several employees as back-up personnel; and a number of safety officers to monitor conditions and recommend safety precautions.

Therefore, no matter what size or complexity an incident may be, by implementing an ICS there will be one individual in charge who makes the decisions and gives directions; and, all actions, and communications are coordinated through one central point of command. Such a system should reduce confusion, improve safety, organize and coordinate actions, and should facilitate effective management of the incident.

The details of the ICS as well as several different scenarios are incorporated into the California Hazardous Material Incident Contingency Plan (HMICP) developed by the State's Office of Emergency Services (OES). The HMICP is written primarily for agencies of the State of California to guide them in understanding the state's role in hazardous material emergencies. Secondarily, the HMICP is anticipated to be utilized by local and federal governments, and private organizations to clarify their roles and relationships concerning hazardous material emergencies. This plan should be used for pre-incident planning; or during a hazardous material emergency for guidance and clarification where a state agency has responsibility (i.e., State Agency Coordination) or jurisdiction (i.e., on the right of way of a state highway), or the incident exceeds local resources beyond those of the SARA Title III Regional Plan.

7. Site Safety and Control Plans:

The safety and security of response personnel and others in the area of an emergency response incident site should be of primary concern to the incident commander. The use of a site safety and control plan could greatly assist those in charge of assuring the safety and health of employees on the site.

A comprehensive site safety and control plan should include the following: Summary analysis of hazards on the site and a risk analysis of those hazards; site map or sketch; site work zones (clean zone, transition or decontamination zone, work or hot zone); use of the buddy system; site communications; command post or command center; standard operating procedures and safe work practices; medical assistance and triage area; hazard monitoring plan (air contaminant monitoring, etc.); decontamination procedures and area; and other relevant areas. This plan should be a part of the employer's emergency response plan or an extension of it to the specific site.

8. Medical surveillance program:

Workers handling hazardous substances may be exposed to toxic chemicals, safety hazards, biologic hazards, and radiation. Therefore, a medical surveillance program is essential to assess and monitor worker's health and fitness for employment in hazardous waste operations and during the course of work; to provide emergency and other treatment as needed; and to keep accurate records for future reference.

The Occupational Safety and Health Guidance Manuals for Hazardous Waste Site Activities developed by the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (Federal OSHA), the U.S. Coast Guard (USCG), and the Environmental Protection Agency (EPA), October 1985, provides an excellent example of the types of medical testing that should be done as part of a medical surveillance program.

9. New Technology and Spill Containment Programs:

Where hazardous substances may be released by spilling from a container that will expose employees to the hazards of the material, the employer will need to implement a program to contain and control the spilled material. Diking and ditching, as well as use of absorbents like diatomaceous earth, are traditional techniques which have proven to be effective over the years. However, in recent years new products have come into the marketplace, the use of which complement and increase the effectiveness of these traditional methods. These new products also provide emergency responders and other with additional tools or agents to use to reduce the hazards of spilled materials.

These agents can be rapidly applied over a large area and can be uniformly applied or otherwise can be used to build a small dam, thus improving the worker's ability to control spilled material. These application techniques enhance the intimate contact between the agent and the spilled material allowing for the quickest effect by the agent or quickest control of the spilled material. Agents are available to solidify liquid spilled material, to suppress vapor generation from spilled materials, and to do both. Some special agents, which when applied as recommended by the manufacturer, will react in a controlled manner with the spilled material to neutralize acids or caustics, or greatly reduce the level of hazard of the spilled material.

There are several modern methods and devices for use by emergency response personnel or others involved with spill control efforts to safely apply spill control gents to control spilled material hazards. These include portable pressurized applicators similar to hand-held portable fire extinguishing devices, and nozzle and hose systems similar to portable fire fighting foam systems which allow the operator to apply the agent without having to come into contact with the spilled material. The operator is able to apply the agent to the spilled material from a remote position.

The solidification of liquids provides for rapid containment and isolation of hazardous substance spills. By directing the agent at run-off points or at the edges of the spill, the reactant solid will automatically create a barrier to slow or stop the spread of the material. Clean-up of hazardous substances is greatly improved when solidifying agents, acid or caustic neutralizers, or activated carbon adsorbents are used. Properly applied, these agents can totally solidify liquid hazardous substances or neutralize or absorb them, which results in materials which are less hazardous and easier to handle, transport, and dispose of. The concept of spill treatment, to create less hazardous substances, will improve the safety and level of protection of employees working at spill clean-up operations or emergency response operations to spills of hazardous substances.

The use of vapor suppression agents for volatile hazardous substances, such as flammable liquids and those substances which present an inhalation hazard, is important for protecting workers. The rapid and uniform distribution of the agent over the surface of the spilled material can provide quick vapor knockdown. There are temporary and long-term foam-type agents which are effective on vapors and dusts, and activated carbon adsorption agents which are effective for vapor control and soaking-up of the liquid. The proper use of hose lines or hand-held portable pressurized applicators provides good mobility and permits the worker to deliver the agent from a safe distance without having to step into the untreated spilled material. Some of these systems can be recharged in the field to provide coverage of larger spill areas than the design limits of a single charged applicator unit. Some of the more effective agents can solidify the liquid flammable hazardous substances and at the same time elevate the flash point above 140F so the resulting substance may be handled as a nonhazardous waste material if it meets the U.S. Environmental Protection Agency's 40 CFR Part 261 requirements (See particularly § 261.21).

All workers performing hazardous substance spill control work are expected to wear the proper protective clothing and equipment for the materials present and to follow the employer's established standard operating procedures for spill control. All involved workers need to be trained in the established operating procedures; in the use and care of spill control equipment; and in the associated hazards and control of such hazards of spill containment work.

These new tools and agents are the things that employers will want to evaluate as part of their new technology program. The treatment of spills of hazardous substances or wastes at an emergency incident as part of the immediate spill containment and control efforts is sometimes acceptable to EPA and a permit exception is described in 40 CFR § 264.1(g)(8) and 265.1(c)(11).

Appendix D

References
(Non-Mandatory)

The following references may be consulted for further information on the subject of this standard:

1. OSHA Instruction DFO CPL 2.70-January 29, 1986; Special Emphasis Program: Hazardous Waste Sites.
2. OSHA Instructed DFO CPL 2-2.37A-January 29, 1986; Technical Assistance and Guidelines for Superfund and Other Hazardous Waste Site Activities.
3. OSHA Instruction DTS CPL 2.74-January 29, 1986; Hazardous Waste Activity Form, OSHA 175.
4. Hazardous Waste Inspections Reference Manual; U.S. Department of Labor, Occupational Safety and Health Administration, 1986.
5. Memorandum of Understanding Among the National Institute for Occupational Safety and Health, the Occupational Safety and Health Administration, the United States Coast Guard, and the United States Environmental Protection Agency: Guidance for Worker Protection During Hazardous Waste Site Investigations and Clean-up and Hazardous Substances Emergencies, December 18, 1980.
6. National Priorities list, 1st Edition; October 1984; U.S. Environmental Protection Agency, revised periodically.
7. The Decontamination of Response Personnel; Field Standard Operating Procedures (F.S.O.P.) 7; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, December 1984.
8. Preparation of a Site Plan; Field Standard Operating Procedures (F.S.O.P.) 9; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, hazardous Response Support Division, April 1984.
9. Standard Operating Safety Guidelines; U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Hazardous Response Support Division, Environmental Response Team; November 1984.
10. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities; National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and Environmental Protection Agency (EPA); October 1985.
11. Protecting Health and Safety at Hazardous Waste Sites: An overview; U.S. Environmental Protection Agency, EPA A/625/9-85/006; September 1985.
12. Hazardous Waste Sites and Hazardous Substance Emergencies; NIOSH Worker Bulletin, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; December 1982.
13. Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide; U.S., Department of Health and Human Services, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health; October 1984.
14. Fire Service Emergency Management Handbook ; International Association of Fire Chiefs Foundation, 101 East Holly Avenue, Unit 108, Sterling, VA 22170; January, 1985.
15. Emergency Response Guidebook; U.S. Department of Transportation, Washington, DC, 1990.
16. Report to the Congress on Hazardous Materials Training, Planning and Preparedness; Federal Emergency Management Agency, Washington, DC, July 1986.
17. Workbook for Fire Command; Alan V. Brunacini and J. David Beageron, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269, 1985.
18. Site Emergency Response Planning; Chemical Manufacturers Association, Washington, DC, 20037, 1986.
19. Hazardous Materials Emergency Planning Guide; NRT-1, Environmental Protection Agency, Washington, DC, March 1987.
20. Community Teamwork: Working Together to Promote Hazardous Materials Transportation Safety; U.S. Department of Transportation, Washington, DC, May 1983.

21. Disaster Planning Guide for Business and Industry; Federal Emergency Management Agency, Publication No. FEMA 141, August 1987.
22. Hazardous Materials Medical Management Protocols; State Emergency Medical Services Authority, Publication #231, March 1989; 1030 15th Street, Suite 302, Sacramento, CA 95814.
23. Hazardous Material Incident Contingency Plan; Office of Emergency Services, Hazardous Materials Division, Sacramento; January 1991.
24. Hazardous Materials Handbook; National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NOTE: Authority cited: Sections 142.3 and 142.7, Labor Code. Reference: Sections 142.3 and 142.7, Labor Code.