Cal/OSHA
8-Hour HAZWOPER Refresher

Student Manual

16th Edition

NES
ENVIRONMENTAL HEALTH & SAFETY
SOLUTIONS

Cal/OSHA 8-Hour HAZWOPER Refresher
Student Manual
16th Edition
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ENVIRONMENTAL HEALTH & SAFETY
SOLUTIONS

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SECTION I: FEDERAL REGULATIONS

A. ENVIRONMENTAL PROTECTION AGENCY

The U.S. Environmental Protection Agency (U.S. EPA) was established on December 2, 1970 to consolidate in one agency a variety of federal research, monitoring, standard-setting, and enforcement activities to ensure environmental protection. Since its inception, U.S. EPA has been working for a cleaner, healthier environment for the American people.

- Solid waste regulations: 40 CFR §§239 – 259
- RCRA, CERCLA, SARA (hazardous waste regulations): 40 CFR §§260 – 279
- Underground storage tanks: 40 CFR §280
- FIFRA: 40 CFR §§150 – 189
- Clean Water Act: 40 CFR §402
- Clean Air Act: 40 CFR §§50 – 97

B. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

The Resource Conservation and Recovery Act (RCRA) of 1976, which amended the Solid Waste Disposal Act, was the first substantial effort by Congress to establish a regulatory structure for the management of solid and hazardous wastes. Subtitle C of RCRA addresses lifetime tracking ("cradle-to-grave") requirements for hazardous waste from the point of initial generation to ultimate disposal. Subtitle D of RCRA contains less restrictive requirements for non-hazardous solid waste. The Hazardous and Solid Waste Amendments (HSWA) of 1984 established additional waste management requirements and added Subtitle I, which imposes management requirements for underground storage tanks (USTs) that contain petroleum or hazardous substances. Most RCRA requirements are not industry-specific; rather, they apply to any company that transports, treats, stores, or disposes of hazardous waste.

C. COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as the "Superfund" Act, 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 from the tax was collected in a trust fund dedicated to 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
- Established a trust fund to provide for cleanup when no responsible party could be identified
- Enabled the revision of the National Contingency Plan (NCP), which provides the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants

The NCP also established U.S. EPA's National Priorities List (NPL).

CERCLA 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 the NPL

D. SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA)

The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986. SARA reflected U.S. 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
- Increased the size of the trust fund to $8.5 billion

SARA also required U.S. 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 NPL.

E. FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA) [40 CFR §§150 – 189]

The primary focus of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was to provide federal control of pesticide distribution, sale, and use. U.S. EPA was given authority under FIFRA not only to study the consequences of pesticide usage but also to require users (farmers, utility companies, and others) to register when purchasing pesticides.

Through later amendments to the law, users also must take exams for certification as applicators of pesticides. All pesticides used in the U.S. must be registered (licensed) by U.S. EPA. Registration assures that pesticides will be properly labeled and, if in accordance with specifications, will not cause unreasonable harm to the environment.

F. TOXIC SUBSTANCES CONTROL ACT (TSCA)

The Toxic Substances Control Act (TSCA) of 1976 provided U.S. EPA the authority to establish reporting, recordkeeping, and testing requirements and restrictions relating to chemical substances.

TSCA addresses the production, importation, use, and disposal of specific chemicals, including polychlorinated biphenyls (PCBs), asbestos, radon, and lead-based paint.

G. DEPARTMENT OF TRANSPORTATION (DOT)

The Department of Transportation (DOT) was established on October 15, 1966 by Congress.

The purpose of DOT is to develop policies to ensure a safe and efficient transportation system. The rules and regulations for the safe transport of hazardous materials are found in 49 CFR.

H. HAZARDOUS MATERIALS TRANSPORTATION UNIFORM SAFETY ACT (HMT-USA)

In 1990 Congress enacted the Hazardous Materials Transportation Uniform Safety Act (HMT-USA) to clarify the often conflicting state, local, and federal regulations. HMT-USA requires the Secretary of Transportation to promulgate regulations for the safe transport of hazardous materials in intrastate, interstate, and foreign commerce.

The Secretary of Transportation also retains the authority to designate materials as hazardous when they pose unreasonable risks to health, safety, or property.

The statute includes provisions to:

- Encourage uniformity among different state and local highway routing regulations
- Develop criteria for the issuance of federal permits to motor carriers of hazardous materials
- Regulate the transport of radioactive materials

I. HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE (HAZWOPER) [29 CFR §1910.120]

The federal OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation, 29 CFR §1910.120, regulates the safety and health of employees who are:

- Involved in cleanup operations at uncontrolled hazardous waste sites
- Working at RCRA hazardous waste sites
- Volunteers at cleanup operations recognized by government agencies
- Engaged in certain hazardous waste treatment, storage, and disposal operations
- Performing any emergency response activities involving hazardous substances

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SECTION II: CALIFORNIA STATE REGULATIONS

California's version of the HAZWOPER standard is found in 8 CCR §5192.

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

While its primary focus is to protect workers at abandoned hazardous waste sites, the HAZWOPER standard also has special provisions for on-site treatment, storage, and disposal of hazardous waste at facilities with RCRA licenses from U.S. EPA.

A. WHO IS COVERED

Hazardous Waste Site Workers

- At federal or state superfund sites
- At hazardous waste sites designated for cleanup by other government agencies, including during the initial site investigation stage
- 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
- At RCRA-permitted sites with waste areas in need of "corrective action"

Treatment, Storage, and Disposal Facility Workers

- Workers at RCRA-permitted treatment, storage, and disposal facilities (TSDFs)

Emergency Response Workers

- Anyone involved in on-site or off-site emergency response activities

How the standard applies to your facility will vary depending on whether you are an emergency responder and, if so, what the level of response is at which you are involved.

B. TRAINING REQUIREMENTS

Training is required for those involved in corrective actions involving hazardous waste cleanup operations at RCRA sites and for those involved in voluntary cleanup operations at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites.

All personnel need to be trained if they are participating in operations conducted at TSDFs that involve hazardous wastes.

General Site Workers

- 40 hours of general and site-specific training
- Eight hours of refresher training annually

Occasional Site Workers

- 24 hours of general training
- One day of supervised on-site training
- Eight hours of refresher training annually

NOTE: For supervisors/managers, eight hours of additional training is required.

Emergency Response Workers

Personnel who respond to emergencies at TSDFs and fixed facilities must be trained. The amount of training depends on the duties an individual is required to perform. There are five levels of training:

- First Responder Awareness (FRA)
  - » For individuals likely to witness a hazardous substance release
- First Responder Operations (FRO)
  - » For individuals who respond from a safe distance
- Hazardous Materials Technician (Hazmat Tech)
- Hazardous Materials Specialist (Specialist)
- Incident Commander (IC)

C. TSDF REQUIREMENTS

Facilities that are permitted under RCRA to treat, store, or dispose of hazardous waste must develop and implement the following components:

- Hazard Communication Program
  - » Cal/OSHA, 8 CCR §5194

- Safety and Health Program
  - » Must be written and designed to identify, evaluate, and control safety and health hazards in the facility
- Training Program
  - » To enable employees to perform duties in a safe and healthful manner so as not to endanger themselves or other employees
- Emergency Response Plan
  - » Must be rehearsed, reviewed, and updated and all emergency personnel trained
  - » An employee alarm system is mandatory
- Material Handling Program
  - » Covers the handling of drums and containers
- Medical Surveillance Program
- Decontamination Procedures

D. 8 CCR §5192 TOPIC OVERVIEW

a. Scope, application, and definitions

b. Safety and health program

c. Site characterization and analysis

d. Site control

e. Training

f. Medical surveillance

g. Engineering controls, work practices, and personal protective equipment for employee protection

h. Monitoring

i. Informational programs

j. Handling drums and containers

k. Decontamination

l. Emergency response by employees at uncontrolled hazardous waste sites

m. Illumination

n. Sanitation at temporary workplaces

o. New technology programs

p. Certain operations conducted under the Resource Conservation and Recovery Act of 1976:

- Safety and health program
- Hazard communication program
- Medical surveillance program
- Decontamination program
- New technology program
- Material handling program
- Training program
- Emergency response program

q. Emergency response to hazardous substance releases

Appendix A: Personal Protective Equipment (PPE) Test Methods

Appendix B: General Description and Discussion of the Levels of Protection and Protective Gear

Appendix C: Compliance Guidelines

Appendix D: References

E. HEALTH AND SAFETY PROGRAM (HASP)

Employers of employees involved in hazardous waste operations must develop and implement a written Health and Safety Program (HASP) designed to:

- Identify, evaluate, and control safety and health hazards
- Provide for emergency response for hazardous waste operations

After identifying hazards, employers are required to establish control measures to protect workers:

- Engineering controls
  - » Physical changes that eliminate or reduce workplace hazards
- Administrative controls
  - » Processes or procedures developed to eliminate or reduce exposure to hazards
- Personal protective equipment (PPE)

F. MEDICAL SCREENING & SURVEILLANCE

Medical screening and medical surveillance are two strategies for optimizing employee health.

The fundamental purpose of **medical screening** is early diagnosis and treatment of the individual.

The fundamental purpose of medical surveillance is to detect and eliminate the underlying causes, such as hazards or exposures to any discovered trends.

Medical Surveillance Program: B.E.A.T.

Within the Health and Safety Plan, employers need to include a Medical Surveillance Program. Medical exams are to be conducted:

- Prior to assignment: "**B**aseline"
- At the development of signs and symptoms of "**E**xposure"
- Once every 12 months: "**A**nnually"
  - » Not to exceed two years
- At "**T**ermination" of employment
- If a physician determines it is medically necessary

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SECTION III: CHEMICAL HAZARDS

Under specific circumstances, a substance's chemical hazard(s) may pose a more immediate and/or serious hazard to an individual than do its toxic properties. The ability to identify chemical hazard properties of substances is the basis for determining safe handling and chemical exposure prevention procedures for individual materials. Categorizing chemical materials by their chemical hazards (hazard categorization) organizes and simplifies field handling and reduces the likelihood of chemical injury or exposure.

CAUTION: Do not assume that chemicals will react in the same manner based on similar chemical name or physical state.

A. DEFINITIONS

Boiling Point: The temperature at which a liquid changes to a gas or vapor.

Melting Point: The temperature at which a solid changes to a liquid.

Freezing Point: The temperature at which a liquid changes to a solid.

Solubility: The ability of one substance to blend, mix, or combine uniformly with another substance.

Flash Point: The minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Flammable/Explosive Range: The concentration range of gas/vapor (fuel) that will burn or explode if an ignition source is introduced.

Density: Weight per unit volume.

Specific Gravity: Ratio of the density of a substance to the density of water.

WATER = 1 < 1 = FLOATS > 1 = SINKS

Vapor Density: Ratio of the density of a gas or vapor to the density of ambient air.

AIR = 1 < 1 = RISES > 1 = SETTLES

Vapor Pressure: The pressure exerted by a chemical vapor in air at a given temperature and pressure.

Corrosiveness: The ability of a substance to cause corrosion (destruction of metals and biological tissue).

Sublimation: Temperature at which a solid changes to a gas.

Auto-Ignition Temperature: The temperature at which combustion occurs without a source of ignition (expressed in mmHg).

Incompatibility: How substances adversely interact with other materials.

Separation: Establishing or providing a physical barrier (or distance) between segregated hazardous chemicals.

Segregation: Placing chemicals into distinct groups (i.e., categories) based on their hazardous properties.

B. CHEMICAL & PHYSICAL PROPERTIES

A **chemical property** may be observed by changing how the substance behaves with other substances. Some examples of chemical properties are:

- Reactivity
- Flammability
- Oxidation

A **physical property** is an aspect of matter that can be observed or measured without changing the material. Some examples of physical properties are:

- Odor
- Molecular weight
- Volume

C. INCOMPATIBLES

Under specific conditions, the commingling of incompatible chemicals may result in violent reactions. Incompatibility does not necessarily indicate a serious hazard, but many mixtures of incompatible chemicals can react violently. The ability to identify incompatible chemicals is a foundation for establishing proper chemical handling procedures.

Reaction Hazards

The reaction of two or more incompatible chemicals (including with water or air) may cause any of the following:

- Generation of heat
- Fire
- Explosion
- Toxic gas
- Formation of shock- or friction-sensitive compounds
- Solubilization of toxic substances
- Formation of a toxic byproduct

CAUTION: Chemicals in the same general hazard category may be incompatible (e.g., flammable & oxidizing compressed gases and hydrochloric & sulfuric acids).

SECTION IV: TOXICOLOGY

Toxicology is the study of adverse health effects on living organisms (human, animal, plant, or microbe) resulting from exposure to chemical substances.

A. PRINCIPLES OF TOXICOLOGY

Routes of Entry

Inhalation

Inhaling substances in the form of vapors, gases, mists, or particulates is one of the most common ways for a material (chemical) to enter a person's body system.

Absorption

Absorption via skin, eyes, or mucous membrane can cause effects that are relatively innocuous, such as redness or mild dermatitis. More severe effects include destruction of skin tissue and various debilitating conditions. Many chemicals can also cross the skin barrier and be absorbed into the blood system, which can be life-threatening in some cases.

Ingestion

Chemicals that inadvertently get into the mouth and are swallowed do not generally harm the gastrointestinal tract itself unless they are irritating or corrosive.

Injection

Substances may enter the body if the skin is penetrated or punctured by contaminated objects. Effects can then occur as the substance is circulated in the blood and deposited in the target organs. Injection can also occur at the microscopic level, e.g., when a high-pressure line ruptures and the rapid release of the material breaks through the skin.

Modes of Action

- Physical
- Chemical
- Physiological

Types of Exposure

Acute Exposure

- Short duration, often with high concentration
- One-time, limited, or short-term exposure
- Effects may not manifest immediately
- Usually reversible

Chronic Exposure

- Extended duration, often with low concentration
- Continuous, repeated, or long-term exposure
- Often irreversible damage

Degree of Exposure

The way a chemical will react with the body depends on a variety of different factors. These factors make up the degree of exposure:

- Route of exposure
- Properties of the chemical
- Dose
  - » Chemical + concentration + time = dose
- Frequency of exposure

Other factors that can affect the degree of exposure include:

- Genetics
- Sex (male/female)
- Health
- Age
- Environment
- Pregnancy

Measurements of Toxicity

The **dose-response** is a comparison of an organism's response to a given material at a specific dose.

An example would be inhaling ammonia gas. The response to inhaling ammonia might be watering of the eyes, irritation of the nose, mouth, and throat, and coughing.

The **dose-response curve** is used to identify when a material is safe if taken into the body system at a

specific dose. A material that is normally thought of as harmless may induce a toxic response if taken into the human body in sufficient amounts.

An example would be pain pills. If a person takes medication as prescribed by a doctor, it will help to reduce the pain, ultimately being a positive dose response. But if a person takes an excess of pills over a shorter period of time, the medication can cause a negative effect on the living system.

Other ways to measure toxicity include:

- Identifying dose threshold for adverse health effects
- Toxicity rating
- Sources of information
  - » Human
  - » Epidemiological
  - » Animal

Lethal Dose vs. Lethal Concentration

Lethal dose (LD_{50}) is the amount of a material, given all at once, that causes the death of 50% of a group of test animals.

	LETHAL DOSE (LD_{50})	LETHAL CONCENTRATION (LC_{50})
RESULTS MEASURED	Only deaths measured	Only deaths measured
EXPRESSED	mg/kg	ppm or mg/m^3
ROUTES OF ENTRY	Absorption, Ingestion	Inhalation

LD_{50} is one way to measure the short-term poisoning potential (acute toxicity) of a material.

Exposure Limits – Regulations

Permissible Exposure Limits (PELs): Regulated by OSHA, sets exposure limits for a time-weighted average (TWA), typically an 8-hour workday of a 40-hour workweek.

Short-Term Exposure Limits (STELs): Regulated by OSHA, sets 15-minute exposure limits.

Exposure Limits – Guidelines

Recommended Exposure Limits (RELs): The National Institute for Occupational Safety and Health (NIOSH) provides these recommendations to OSHA for a 10-hour workday during a 40-hour workweek.

Immediately Dangerous to Life or Health (IDLH): Defined by NIOSH as the level of exposure to airborne contaminants that is likely to cause death.

Threshold Limit Values (TLVs): Regulated by the American Conference of Governmental Industrial Hygienists (ACGIH) for an 8-hour workday of a 40-hour workweek.

Workplace Environmental Exposure Levels (WEELs): Regulated by the American Industrial Hygiene Association (AIHA) for an 8-hour workday of a 40-hour workweek.

New Chemical Exposure Limits (NCELs): Regulated by U.S. EPA under the Toxic Substances Control Act (TSCA) for an 8-hour workday of a 40-hour workweek.

Distribution, Biotransformation & Elimination

Distribution refers to the way in which a substance is circulated throughout the body. The most common distribution mechanisms are:

- Blood
- Lymphatic system
- Mucous membranes

Biotransformation is the process by which a chemical is transformed into another chemical within the body. Biotransformation includes:

- Metabolism
- Detoxification

Elimination is the removal of a substance (by metabolism or detoxification) via any of several different pathways, including:

- Perspiration
- Exhalation
- Excretion
- Expulsion

Bioaccumulation is the accumulation of substances within an organism.

B. RESPIRATORY TOXIC HAZARDS

Asphyxiants

Simple asphyxiants are gases that displace air at high concentrations.

Chemical asphyxiants are gases that prevent tissue from getting enough oxygen.

Irritants

Irritants are chemicals that aggravate the air passages, causing constriction of these pathways. Irritants can also cause fluid buildup or infection in the lungs.

Upper respiratory irritants are substances that affect the upper respiratory tract (nose, mouth, trachea, lungs). They are usually water-soluble.

Lower respiratory irritants are substances that affect the part of the lungs where oxygen exchanges with cells. They are usually not water-soluble.

C. SYSTEMIC TOXINS

Systemic toxins are chemicals that target specific organs or systems throughout the body. These chemicals will affect:

- Central nervous system
  - » Asphyxiants
  - » Hydrocarbons
  - » Metals
- Circulatory system
  - » Gases
  - » Aromatic solvents
- Liver
  - » Chlorinated solvents
  - » Hydrocarbons
  - » Aromatic compounds
- Kidney
  - » Halogenated compounds
  - » Metals
- Spleen
  - » Halogenated aromatic compounds
- Reproductive systems
  - » Aromatic hydrocarbons
  - » Pesticides
  - » Organic metals

D. EXTERNAL TOXINS

External toxins are chemicals outside the body that will target:

- Skin
  - » Solvents
  - » Oils
  - » Metals
  - » Corrosives
- Eyes
  - » Caustics
  - » Acids
  - » Solvents
  - » Oils
  - » Lachrymators

E. SPECIAL TOXINS

Carcinogens are materials that cause uncontrolled cell growth (cancer). Unlike with other toxins, carcinogen exposure often occurs in very small amounts over an extended period of time. The effects of carcinogens usually take many years to become evident and are more likely to occur after chronic exposure.

Mutagens are agents that cause changes in an organism's genetic code, which can affect an individual and/or be inherited by offspring.

Teratogens are agents that cause non-lethal congenital malformations.

Embryonic toxins are agents that cause lethal congenital malformations.

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SECTION V: PHYSICAL HAZARDS

Hazardous waste operations often involve potential exposure to a wide range of physical hazards associated with equipment operations, use of protective clothing, and worksite conditions.

A. APPLICATION

An **accident** is an undesired event that results in personal injury or property damage.

An **incident** is an unplanned, undesired event that adversely affects completion of a task.

A **near miss** is an incident in which no property was damaged and no personal injury was sustained, but damage and/or injury easily could have occurred given a slight shift in time or position.

Physical hazards can include slips, trips, falls, electrical shock, temperature and radiation stress, confined spaces, excavations, and drum handling.

B. HAZARDS

Personal Protective Equipment

The improper use of personal protective equipment (PPE) can add additional stress to the worker, increasing the possibility for accidents to occur. Improper PPE can interfere with:

- Vision
- Communication
- Mobility/dexterity
- Stress (physical/mental)
- Dehydration (air)

Material Handling

Accidents associated with the manual handling of materials are primarily the result of unsafe working habits, improper lifting, carrying a load that is too heavy, incorrect gripping, or failing to wear PPE.

Proper lifting techniques:

- Get a good footing
- Bend knees to pick up load
- Keep back straight
- Get a firm grip
- Lift gradually and keep materials close to the body
- Wear protective equipment, such as belts, safety shoes, and gloves

Compressed Gas

Compressed gas cylinders can contain many different chemicals. These chemicals can be toxic, flammable, oxidizing, corrosive, or inert. All compressed gas cylinders are hazardous because they are highly pressurized.

Damage can occur to a cylinder from falling / tipping over, heat, electrical circuits, motion, vibration, or anything that can cause weakness or cracks in the cylinder wall or shell.

Compressed gas cylinders must be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are being hoisted or carried.

Oxygen cylinders in storage must be separated from fuel-gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

Heat/Cold Stress

Excessive heat and humidity affect the body's blood circulation and can cause cramps, burns/rashes, and general discomfort. Employers are required to protect their employees from heat illness by:

- Providing heat illness prevention training
- Ensuring enough water is available
- Providing shade access and cool-down breaks
- Writing and enforcing heat illness prevention standard procedures

Cold exposure also affects the body's blood circulation and can cause hypothermia, loss of flexibility, distraction, and poor dexterity. A generally comfortable temperature range is 68 to 74 degrees Fahrenheit (+/- 10 degrees depending on the physical workload) with humidity between 20 and 60 percent.

HEAT ILLNESS PREVENTION	
HEAT	**COLD**
Acclimatize the body (5 – 10 days)	Dress in layers of clothes
Drink proper fluids	Stay active
Physiological monitoring	Avoid cold surfaces
Work/rest schedule	Maintain a good diet

Electrical Hazards

Electrical hazards can exist in the form of exposed wiring, improper use of electrical equipment, or the presence of underground electric lines when digging or excavating. Prevention methods include:

- Bond and ground equipment
- Use double-insulated tools
- Discard damaged power cords
- Use proper lockout/tagout procedures
- Check for underground/overhead services

Long Shifts

Employees are often required to work shifts longer than eight hours. The danger with working long shifts is that attention to possible hazards rapidly begins to decrease. Prevention methods include:

- Increase breaks/rest
- Pace meal breaks

Ultraviolet Radiation

Ultraviolet light is a type of non-ionizing radiation that can cause inflammation of the skin and/or cornea. People who are often exposed to the full light of the sun may develop skin cancer. Prevention methods include:

- Wear tinted protective eyewear
- Cover up your skin
- Use sunblock on your ears, nose, and other areas where the skin might burn
- Stay out of the sun when possible, especially between the hours of 10 a.m. and 2 p.m.

Noise

Noise levels at or above 90 decibels (dBA) and noise peaks above 100 dBA can cause headaches, increased blood pressure, muscle tension, and fatigue. High exposure over a long period of time can cause deafness and other audiological disorders. Short-term exposure causes irritability and distraction. Prevention methods include:

- Reduce loud noises (e.g., with noise barriers)
- Use hearing protection
- Establish a hearing conservation program
- Have an annual audiogram done to note any changes in hearing
- Reduce time of exposure
- Increase distance from noise source

NOTE: A hearing conservation program is required at 85 dBA (PEL: 90 dBA).

Fall Protection

Falls are the most common causes of work-related injuries and deaths. Employers must protect workers from falls by conventional means (e.g., guardrails, handrails, etc.) or by personal fall protection systems. Falls can occur when working on elevated working areas, ladders, or unstable walking-working surfaces.

The standards for fall protection are industry- and operation-specific. Regulated fall distances range from 2.5 to 30 feet.

Ladder Safety

Selecting the proper ladder for the job is the first step in preventing accidents and injuries when working on a ladder. Before using ladders, employees must be provided training in the safe use of ladders.

SECTION VI: SPECIAL HAZARDS

A. CONFINED SPACES

A **confined space** is a space that meets all three of the following criteria:

- Is large enough and so configured that an employee can enter bodily and perform work
- Has limited or restricted means of entry or exit
- Is not designed for continuous human occupancy

A **non-permit-required confined space** is a confined space that meets all of the following criteria:

- Does not contain or have the potential to contain any hazard capable of causing death or serious physical harm
- Has an acceptable oxygen level of 19.5% – 23.5%
- Has a flammable atmosphere of ≤ 10% of the lower explosive limit (LEL)

A **permit-required confined space** is a confined space that meets at least one of the following criteria:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that could potentially engulf an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; AND/OR
- Contains any other recognized serious safety or health hazard

Leading causes of confined space fatality are:

- Failure to recognize a confined space
- Failure to test the atmosphere prior to entry
- Failure to ventilate prior to and during entry
- Failure to recognize physical hazards

Employee Training

Train:

- Before assigning duties
- Before changing duties
- Whenever operations present a new hazard

Retrain whenever there is reason to believe:

- There are deviations from the established procedures
- There are inadequacies in an employee's knowledge of procedures

Confined Space Entry & Roles

Entry is the act by which a person intentionally passes through an opening into a permit-required confined space. Any part of the body passing through the opening is considered entry—even if just reaching in to test the atmosphere.

The **entrant** is the employee who will physically enter the confined space to perform the work for any amount of time. The entrant must:

- Know the hazards that may be faced during entry, including routes, signs, symptoms, and consequences of exposure
- Communicate with the attendant while in the space and alert the attendant if there are any warning signs or symptoms of exposure or if there is a prohibited condition
- Exit from space without question when an order is given by anyone involved in the operation or when there is a prohibited condition or an alarm
- Ensure that the space has been adequately ventilated, isolated, emptied, or otherwise made safe for entry
- Follow all applicable safety rules and procedures
- Be familiar with the work to be performed and the procedures that apply to the job
- Use the appropriate PPE whenever necessary

REMEMBER: If lockout/tagout is used, the key must be with the entrant while he/she is in the space.

The **attendant** is the employee who remains outside the confined space and monitors the entrant(s),

guards the space against unauthorized entry, warns the entrant(s) of any unusual conditions, and summons rescue personnel, if needed. The attendant must be in **constant communication** with the entrant(s) and must:

- Maintain accurate count of all entrants in the space
- Remain outside of the space the entire time, unless relieved by another attendant
- Remain in constant communication with the entrant(s) during the operation and provide an alert if there is a need to evacuate the space
- Monitor activities inside and outside the space to determine if it is safe for entrant(s) to remain inside
- Initiate on-site rescue procedures and summon additional rescue and other emergency services as soon as the need for assistance arises
- Keep unauthorized personnel away from / out of the permit space
- Perform non-entry rescue or other rescue services as part of the employer's on-site rescue procedures
- Perform no other duties that might interfere with the primary duty of monitoring and protecting the authorized entrant(s)
- NOT rely on 911 for rescue services

REMEMBER: As an attendant, you could be the only lifeline for the entrant(s) in an emergency.

The **entry supervisor** is 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, authorizing entry and overseeing entry operations, and terminating entry. The entry supervisor must:

- Sign the entry permit to authorize entry
- Verify that all tests specified by the permit have been conducted and all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry
- Terminate the entry and cancel the permit as required by regulations
- Verify that rescue services are available and the means for summoning additional services are operable
- Remove unauthorized individuals who enter or attempt to enter the permit space during entry operations
- Determine, 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 the terms of the entry permit and that acceptable entry conditions are maintained
- Verify that all personnel have exited prior to closing the space

B. TRENCHING & EXCAVATION

Trenching is one of the most hazardous construction operations of all. Most accidents occur in trenches between 5 and 15 feet deep, and there is usually no warning before a cave-in occurs.

A **competent person** performs daily inspections and has:

- Knowledge of the regulations
- Knowledge of soil analysis
- Knowledge of the use of protective systems
- The authority to take prompt corrective actions
- The ability to recognize and test for hazardous atmospheres

Overview

- The spoil pile needs to be at least 2 ft from the edge (may vary by county)
- When trench depth reaches 4 ft:
  - » Entry/egress must be within 25 ft
  - » Air monitoring and rescue equipment (SCBA, ventilation, rescue basket, etc.) are required for potentially hazardous atmospheres
- When trench depth reaches 5 ft or more:
  - » Protective systems are required
- When trench depth reaches 20 ft or more:
  - » All protective systems must be approved by a state-registered professional engineer

SECTION VII: BIOLOGICAL HAZARDS

There are a variety of biological hazards to which personnel may be exposed while performing work. These hazards include animal bites and stings, contact with poisonous plants, and exposure to pathogenic microorganisms.

A. HAZARDS

Animal Bites & Stings

- Animal bites
  - » Dogs
  - » Cats
  - » Rodents
- Snake bites: four common venomous snakes in the United States
  - » Rattlesnake
  - » Copperhead
  - » Coral snake
  - » Cottonmouth
- Bee, wasp, ant, hornet, and yellow jacket stings
  - » Approximately 5% of the population is allergic to bee, wasp, or ant venom
  - » May cause anaphylactic shock, which can be fatal if not treated immediately
- Scorpion stings
  - » May require medical attention, but usually are not life-threatening
- Spider bites
  - » Black widow
  - » Brown recluse
  - » Hobo spider
  - » Wolf spider

Poisonous Plants

Poisonous plants are plants that can produce skin irritations, blisters, and potentially life-threatening reactions. Poison oak and poison ivy are the most common types of poisonous plants.

Treatment of poison oak or poison ivy starts with washing the exposed area with soap and water to remove the oil of the plant from the skin. Remove contaminated clothes and separate from other clothing prior to washing. Use over-the-counter medications and prescriptions to ease itching and discomfort. See a doctor if symptoms become more severe, and call 911 if swallowing or breathing become difficult or if there is facial swelling.

Microbial Hazards

- Viral, bacterial, fungal, parasitic
- Rickettsial/chlamydial
- Waterborne diseases
  - » Cholera
  - » Giardiasis
- Bloodborne diseases
  - » Hepatitis B and C
  - » HIV/AIDS

B. BLOODBORNE DISEASES

Bloodborne diseases are addressed in 29 CFR §1910.1030 (OSHA) and 8 CCR §5193 (Cal/OSHA). These regulations require the employer to establish a written Exposure Control Program and to use **universal precautions**, meaning that all human blood and certain human body fluids are treated as if known to be infectious. This approach often utilizes "work practice controls" (including PPE) that minimize or eliminate employee exposure.

Hepatitis B is an infectious disease of the liver caused by the hepatitis B virus (HBV). It is transmitted through exposure to infected blood or body fluids. The virus can live for up to one month in dried blood and is 50 to 100 times more infectious than HIV. There is no cure, but there is a preventative vaccine.

Hepatitis C is an infectious disease of the liver caused by the hepatitis C virus (HCV). It is transmitted through exposure to infected blood or

body fluids. With four million infected, hepatitis C is the most common chronic bloodborne infection in the United States and is the leading cause of liver transplantation. There are 35,000 new infections and 8,000 – 10,000 deaths from chronic disease each year.

Human Immunodeficiency Virus (HIV) is a virus that leads to **acquired immunodeficiency syndrome (AIDS)**. HIV is spread through contact with infected blood and some body fluids. HIV infects cells involved with the body's immune system, lowering the ability to fight off infections. Early symptoms are fever, loss of appetite, weight loss, chronic fatigue, and skin rashes. Later, as the disease progresses, cancer or infections such as pneumonia cannot be fought off. There is no cure for HIV, but antiviral therapy is used to slow the progression of the disease.

C. VECTOR INFECTIOUS DISEASES

Hantavirus pulmonary syndrome (HPS) is a rare but potentially deadly disease transmitted by infected rodents through urine, droppings, or saliva. Humans can contract the disease when they breathe in the aerosolized virus. It was first recognized in 1993 and has since been identified throughout the United States. Rodent control in and around the home remains the primary strategy for preventing hantavirus infection.

Lyme disease is caused by the bacterium *Borrelia burgdorferi* and is transmitted to humans by the bite of infected blacklegged ticks. Typical symptoms include fever, headache, fatigue, and a characteristic skin rash called erythema migrans. If left untreated, infection can spread to joints, the heart, and the nervous system. Lyme disease is diagnosed based on symptoms, physical findings (e.g., rash), and the possibility of exposure to infected ticks; laboratory testing is helpful in the later stages of the disease. Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly (ticks that transmit Lyme disease can occasionally transmit other tick-borne diseases), landscaping, and integrated pest management.

Rocky Mountain spotted fever is the most severe and most frequently reported rickettsial illness in the United States. It also occurs in Mexico and in Central and South America. The disease is caused by *Rickettsia rickettsii*, a species of bacterium that is spread to humans by ixodid (hard-shelled) ticks. Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain followed by the development of a rash. The disease can be difficult to diagnose in the early stages and can be fatal without prompt and appropriate treatment.

SECTION VIII: PERSONAL PROTECTIVE EQUIPMENT

The harmful effects of specific chemical hazards may necessitate the use of personal protective clothing and equipment when responding to a chemical emergency. Protective equipment should only be used when engineering and administrative controls are not feasible or adequate.

To ensure proper effectiveness, safe work practices must always be implemented when using personal protective equipment. Proper use and selection are a balance between the protection afforded by the items and the potential hazards caused by their use. The various stages of chemical emergency response usually necessitate the use of different types of protective items.

A. CLOTHING TYPES

Levels of protection:

- Level A: Fully encapsulating suit and self-contained breathing apparatus (SCBA)
- Level B: Full-body suit and SCBA or airline respirator
- Level C: Protective suit and air-purifying respirator
- Modified level D: Chemical protective suit, no respiratory protection
- Level D: Work uniform, high-visibility vest, eye and head protection, no respiratory protection

B. SELECTION CRITERIA

Hazard assessment:

- Type of hazard
- Degree of hazard
- Duration of activity (exposure)
- Nature of activity

Performance requirements:

- Strength and resistance
- Flexibility
- Temperature limits
- Durability
- Cleanability

Chemical resistance:

- Degradation
- Permeation
- Penetration

Protective materials:

- Elastomers
- Laminates

C. ITEMS/EQUIPMENT

Disposable: Equipment that must be removed and disposed of after each use.

Reusable: Equipment that must be cleaned and inspected after each use.

Personal protective equipment may consist of suits, boots, booties, gloves, etc. Implementation and testing standards may be voluntary or required.

- ASTM International (formerly known as American Society for Testing and Materials)
- American National Standards Institute (ANSI)
- National Fire Protection Association (NFPA)
- NIOSH (National Institute for Occupational Safety and Health)

D. DETERMINING USE

Prior to use:

- Assess hazards and operational requirements
- Properly select equipment
- Plan and prioritize activities
- Anticipate emergencies

During use:

- Conduct periodic integrity checks
- Monitor for heat stress
- Implement safe work activities
- Avoid false sense of security
- Always use within limits

After use:

- Visual check
- Pressure check
- Store properly

E. PROTECTION TYPES

Hard Hats

- Class C: No voltage protection
- Class G: Limited protection (up to 2,200 volts)
- Class E: High protection (up to 20,000 volts)

Eye & Face Protection

Safety glasses:

- Minimum requirement

Goggles:

- Protection from chemicals, splashes, dust, or projectiles

Face shield:

- Protection from splashes or projectiles

Chemical splash hood:

- Shoulder-length or longer

Hand Protection

Gloves/sleeves:

- General duty
  - » Cotton
  - » Leather
- Sharp objects
  - » Leather
  - » Kevlar
- Chemical
  - » Multiple types

Foot Protection

Shoes/boots:

- Steel toe
  - » Compression, puncture
- Composite toe
  - » Compression, impact
- Metatarsal guards
  - » Protects top of foot behind the toe
- Chemical-resistant
  - » Prevents contact with chemicals

SECTION IX: RESPIRATORY PROTECTION

The regulations pertaining to respirator use are contained in 29 CFR §1910.134 (OSHA) and 8 CCR §5144 (Cal/OSHA). In order for an employee to be able to use a respirator, the employer needs to have a written respiratory program that includes policies and procedures, selection criteria (when to use equipment), and training. A medical evaluation needs to be performed on the employee before he/she can be authorized to wear a respirator. After the evaluation, the employee will be fit tested to the appropriate respirator.

A. TYPES OF RESPIRATORS

Air-Purifying Respirators

Air-purifying respirators (APRs):

- Particulate filter
- Gas & vapor filter
- Combination filter

Powered air-purifying respirators (PAPRs):

- Belt- or mask-mounted powered filter

APRs have various limitations, including:

- Concentration of contaminant
- Oxygen level (19.5% – 23.5%)
- Cartridge useful life
- Chemical warning properties
- Potential for flash fire
- Duration of work
- Proper training / fit test

Supplied-Air Respirators

Supplied-air respirators (SARs):

- Airline respirator
- Self-contained breathing apparatus
- Combination

SARs have various limitations, including:

- Concentration of contaminant
- Must provide "grade D" air source
- More cumbersome/unwieldy
- Mobility (airline style)
- Length of work time (SCBA style)
- Length of travel distance (300' airline)
- Proper training / fit test

Self-Contained Breathing Apparatuses

Self-contained breathing apparatuses (SCBAs):

- Backpack
- Air cylinder
- Regulator
- Facepiece

B. RESPIRATOR EQUIPMENT PARAMETERS & REQUIREMENTS

The employer's written respiratory program must include the following elements:

- Assigned protection factors
- Fit testing requirements
- Training
- Medical surveillance & evaluation protocols
- Hazard evaluation & assessment
- Maintenance, inspection & storage
- NIOSH-approved equipment
- Safe work practices

C. ASSIGNED PROTECTION FACTORS

Employers must use the assigned protection factors established by NIOSH to select a respirator (see Table 1 on page 24). Always check the manufacturer's guidelines for specific assigned protective factors.

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. Sample of the Assigned Protection Factors (APFs) Given to Certain Respirators

TYPE OF RESPIRATOR	QUARTER-MASK	HALF-MASK	FULL FACEPIECE	HELMET OR HOOD	LOOSE-FITTING FACEPIECE
Air-purifying respirator	5	10	50	.....	.....
Powered air-purifying respirator (PAPR)	.....	50	1,000	25/1,000	25
Supplied-air respirator (SAR) or airline respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	25/1,000	25
• Pressure demand or other positive pressure mode	.....	50	1,000	.....	.....
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	.....

See 29 CFR §1910.134(d)(3)(i)(A) & 8 CCR §5144(d)(3)(A) for more information.

SECTION X: AIR MONITORING

The data collected from air monitoring is critical to various phases of work remediation, including scene assessment, selection of personal protective measures, and the ability to re-enter evacuated areas. Therefore, knowledge of instrument capabilities, limitations, use, and maintenance is critical to ensuring that immediate air monitoring data may be provided when needed.

A. OVERVIEW

Purpose

Air monitoring provides critical information necessary for:

- Selecting personal protective clothing and equipment
- Specifying safe work practices
- Assessing the potential health effects of exposure
- Determining actions to mitigate the hazards
- Helping to determine work, decon, isolation, and evacuation areas
- Assessing efficiency of operations

B. PRINCIPLES OF DATA COLLECTION & MEASUREMENT

Methods

Field Monitoring: Sampling the air to obtain instantaneous results.

Air Sampling: Collecting air samples for laboratory analysis.

Requirements

- Select the appropriate instrument
- Consider the limitations of the instrument selected
- Use the instrument as specified by the manufacturer
- Use only properly calibrated instruments
- Take representative samples
- Consider any interferences, uncertainty, and the potential for error that may influence the results when making conclusions or interpretations

Data Types

Qualitative Data: Identify whether a hazard is present.

Quantitative Data: Specify the quantity or concentration.

Most field monitoring equipment provides both qualitative and semiquantitative data (**mixed data**). The data obtained by monitoring equipment can be characterized as follows:

- Accuracy: How close measured results are to actual conditions
- Precision: How close repeated measurements are to each other
- Representative: Whether sample results accurately characterize conditions
- Error: Conditions that can affect accuracy and/or precision

Equipment Characteristics

Careful consideration should be made with regard to the characteristics and capabilities of air monitoring instruments. Based on task requirements and conditions, assess the equipment for:

- Portability: Rugged or lightweight
- Useful results: Response time; direct, easy readings
- Selectivity: The ability to identify specific contaminants
- Sensitivity: The lowest concentration detectable
- Specification: Instrument use in hazardous environments (e.g., flammable)

Equipment is built to the standards established by the National Fire Protection Association (NFPA) and published in the National Electrical Code (NEC).

Hazards commonly encountered when performing field monitoring operations include:

- Explosive atmospheres
- Oxygen-deficient atmospheres
- Toxic atmospheres
- Radioactive hazards

C. INSTRUMENTATION PROGRAM

Selection

- Type of monitoring
- Continuous versus periodic

Field Applications

- Site survey
- Hazard identification and evaluation
- Operations monitoring

Maintenance

- Clean case, exterior, and accessories after each use
- Check alarm and meter after each use
- Check battery after each use
- Check general instrument operation after each use
- Replace hoses, filters, and sensors as needed
- Perform periodic manufacturer checkup (cleaning, inspection, calibration, etc.)
- Document all repair and maintenance work
- Store in a clean, dry, indoor, temperature-regulated environment

Calibration

Calibration: Sampling a known concentration of a chemical and comparing the instrument response.

Field Use

- All operators must be trained
- Instruments must be protected from damage, contamination, etc.
- Instruments must be warmed up and/or checked before use
- Instruments should be cleaned in the field after each use
- Instrument sensors must never be saturated

SECTION XI: HAZARD ASSESSMENT

A. DEFINITIONS

Ambient Conditions: Weather and off-site targets.

Analytical Sampling: Field sampling and analysis.

Field Monitoring Device: Portable, direct-reading instrument.

Field Testing: Field chemical test of obtained sample.

Field Observation: Direct visual observations.

Industrial Hygiene: Analysis of air samples.

Off-site: Initiation of the assessment.

On-site: Initial entry to systematically update the assessment.

Operations: The equipment, procedures, and tasks involved in a project.

Physical Environment: The physical surroundings.

Reconnaissance: On-site update of the initial assessment.

Site Characterization: Background data/research.

Update: Continuous update on new observations and findings.

Hazard vs. Risk

A **hazard** is something that can cause harm.

A **risk** is the likelihood or possibility that a hazard may cause harm.

The process of evaluating both of these together is called **hazard assessment**, the dynamic and continuous process of identifying hazards and evaluating risks for the purpose of safety decision-making.

B. OVERVIEW

Assessment Steps

1. Identify all actual and potential field hazards.

2. Measure the severity of each identified hazard.

3. Compare the measured value to safety standards and/or guidelines.

4. Prioritize or rank each hazard based on the severity.

5. Control by selecting measures necessary to protect people, the environment, and property.

6. Reevaluate the interaction of controls and hazards.

Signal Words

Companies are required to place a **signal word** on the labels and Safety Data Sheets for the materials that they distribute. The signal word indicates the relative degree of severity of a hazard. Signal words are standardized as follows:

- **"Danger"** for the **more** severe hazards
- **"Warning"** for the **less** severe hazards

Some lower-level hazard categories do not use signal words. Use only one signal word corresponding to the class of the most severe hazard.

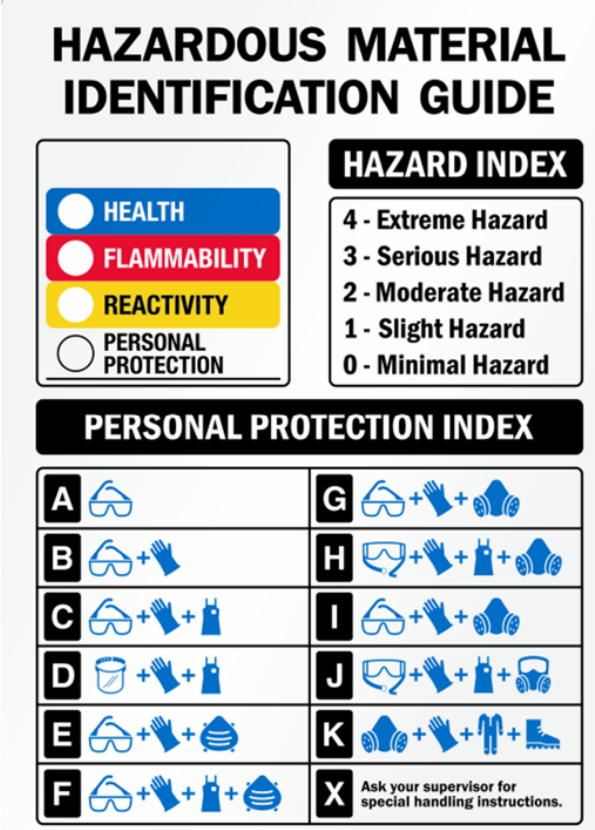
C. DOT/UN HAZARD CLASSES

The Department of Transportation mandates that certain packages, and vehicles involved in transporting hazardous materials in commerce are labeled and placarded according to the regulations. DOT identifies nine hazard classes, each with their own special properties. Some of these hazard classes are further broken down into divisions. DOT uses placards and labels to help easily identify the hazards associated with these materials.

DOT/UN HAZARD CLASSES (HMT-USA)	
Class 1: Explosive Materials	
	Division 1.1 consists of explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.
	Division 1.2 consists of explosives that have a projection hazard but not a mass explosion hazard.
	Division 1.3 consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.
	Division 1.4 consists of explosive devices that present a minor explosion hazard. No device in this division may contain more than 25 g (0.9 oz) of a detonating material.
	Division 1.5 consists of very insensitive explosives. This division comprises substances that have a mass explosion hazard but that are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions or transport.
	Division 1.6 consists of extremely insensitive articles that do not have a mass explosive hazard. This division comprises articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation.
Class 2: Gaseous Materials	
	Division 2.1 (Flammable Gas) consists of any material that is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psia) of pressure that: • Is ignitable when in a mixture of 13 percent or less by volume with air; OR • Has a flammable range with air of at least 12 percent, regardless of the lower limit
	Division 2.2 (Non-Flammable, Non-Poisonous Compressed Gas) includes compressed gas, liquefied gas, pressurized cryogenic gas, and compressed gas in solution. This division comprises any material or mixture that: • Exerts in the packaging an absolute pressure of 200 kPa (43.8 psia) or greater at 20°C (68°F) • Does not meet the definition of Division 2.1 or Division 2.3 and includes asphyxiant and oxidizing gases.
	Division 2.3 (Gas Poisonous by Inhalation) materials are gases at 20°C (68°F) or less and 101.3 kPa (14.7 psia) of pressure and are poisonous by inhalation. These are known to be so toxic to humans as to pose a hazard to health during transportation or, in the absence of adequate data on human toxicity, are presumed to be toxic to humans because, when tested on laboratory animals, the materials had an LC_{50} value not more than 5,000 mL/m^3.
Class 3: Flammable Liquid Materials	
	A **flammable liquid** is any liquid having a flash point of not more than 60°C (140°F). • Exceptions: Materials meeting the definition of any Class 2 material or a mixture having one or more components with a flash point greater than 60.5°C (141°F) or higher that makes up at least 99 percent of the total volume of the mixture or a distilled spirit of 140 proof or lower is considered to have a flash point of lower than 23°C (72°F) A **combustible liquid** is any liquid that does not meet the definition of any other hazard class and has a flash point above 60°C (140°F) and below 93°C (200°F).

DOT/UN HAZARD CLASSES (HMT-USA)	
Class 4: Flammable Solid, Spontaneously Combustible, and Dangerous When Wet Materials	
	Division 4.1 (Flammable Solid) includes any flammable solid material of the following three types: • Wetted explosives that, when dry, are explosive Class 1 other than those of compatibility group A, which, when wetted, suppress the explosive properties and materials specifically authorized by name in 49 CFR §171.101 or by the Associate Administrator for Hazardous Materials • Self-reactive materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermal decomposition caused by excessively high transport temperatures or by contamination • Readily combustible solids that may cause a fire through friction, show a burning rate faster than 2.2 mm (0.087 inches) per second under specified test procedures or any metal powder that can be ignited and will react over the whole length of a sample in 10 minutes or less under specified test procedures **Division 4.2 (Spontaneously Combustible)** material includes any pyrophoric material, liquid or solid, that even in small quantities and without an external ignition source can ignite within five minutes after coming in contact with air under specified test procedures. A self-heating material that, when in contact with air and without an energy supply, is liable to self-heat and that exhibits spontaneous ignition under specified test procedures would be classed as a Division 4.2 material. **Division 4.3 (Dangerous When Wet)** material is one that, by contact with water, is liable to become spontaneously flammable or gives off flammable or toxic gas at a rate greater than 1 liter per kilogram of material per hour under specified test procedures.
Class 5: Oxidizers and Organic Peroxides	
	Division 5.1 (Oxidizing) material means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials. **Division 5.2 (Organic Peroxide)** material is an organic compound containing oxygen in the bivalent -O-O- structure and that may be considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals (with some exceptions).
Class 6: Poisonous Materials and Infectious Substances	
	Division 6.1 (Poisonous) materials are those materials, other than gases, that are known to be so toxic to humans as to present a hazard to health during transportation or, in the absence of adequate data on human toxicity, are presumed to be toxic to humans when they fall within the specified oral, dermal, or inhalation toxicity ranges when tested on laboratory animals or is an irritating material, with properties similar to tear gas, that causes extreme irritation, especially in confined spaces. **Division 6.2 (Infectious Substance)** materials are infectious substances. An infectious substance is a viable microorganism or its toxin that causes or may cause disease in humans or animals, including those agents listed in 42 CFR §72.3 (*infectious substances* and *etiologic agents* are synonymous). **Diagnostic specimens** means any human or animal material including but not limited to excreta, secreta, blood and its components, tissue, and tissue fluids shipped for purposes of diagnosis or biological product prepared and manufactured in accordance with the provisions of 9 CFR parts 102 to 104 and 21 CFR parts 312 and 600 to 680 and that, in accordance with these provisions, may be shipped in interstate commerce.

DOT/UN HAZARD CLASSES (HMT-USA)	
Class 7: Radioactive Materials	
	Radioactive material means any material having a specific activity greater than 0.002 microcuries per gram.
Class 8: Corrosive Materials	
	A **corrosive material** is a liquid or solid that causes visible destruction or irreversible alteration in human skin tissue at the site of contact or a liquid that has a severe corrosion rate on steel or aluminum in accordance with specified criteria.
Class 9: Miscellaneous Materials	
	A **miscellaneous hazardous material** is a material that presents a hazard during transport but that is not included in any other hazard class. Class 9 includes any material that has an anesthetic, noxious, or other similar property that could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties and any material that is not included in any other hazard class but is subject to regulatory requirements because it meets the definition in 49 CFR §171.8 for a hazardous substance or a hazardous waste.

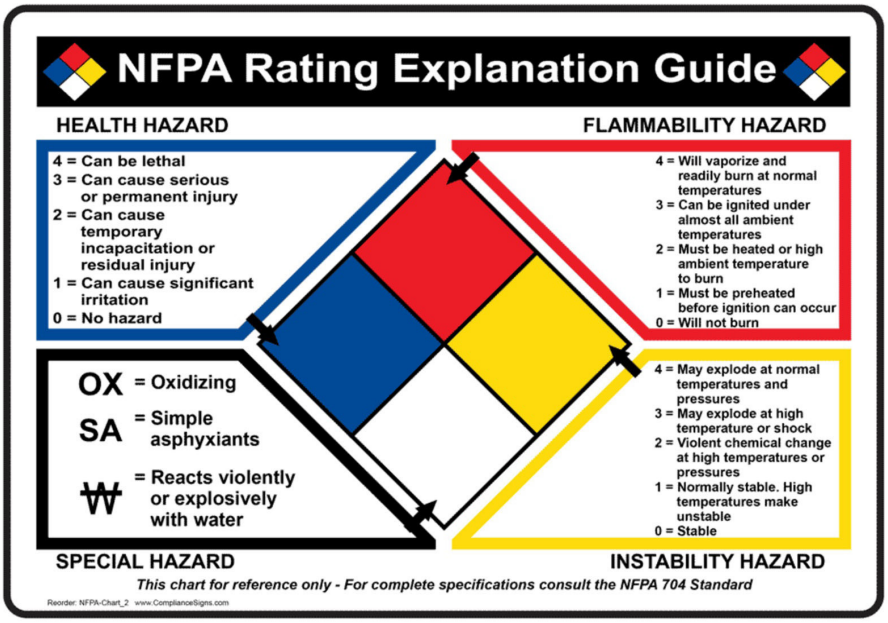


D. SAFETY DATA SHEETS

Safety Data Sheets (SDSs), formerly called Material Safety Data Sheets (MSDSs), are produced for each hazardous chemical to communicate information on physical, health, and environmental hazards.

The information on the SDS is presented using the following 16 headings.

Sections 1 – 8: • General information about the chemical	1. Identification 2. Hazard(s) identification 3. Composition/information on ingredients 4. First aid measures 5. Firefighting measures 6. Accidental release measures 7. Handling and storage 8. Exposure controls/personal protection
Sections 9 – 11: • Technical and scientific information • Date of preparation or last revision	9. Physical and chemical properties 10. Stability and reactivity 11. Toxicological information
Sections 12 – 15: • OSHA will not enforce the contents of these sections • Contents of these sections are handled by other agencies	12. Ecological information 13. Disposal considerations 14. Transport information 15. Regulatory information
Section 16: • Other information	16. Other information



Hazard Communication Standard – Globally Harmonized System

HEALTH HAZARD	FLAME	EXCLAMATION MARK
• Carcinogens • Mutagenicity • Reproductive toxicity • Respiratory sensitizer • Target organ toxicity • Aspiration toxicity	• Flammables • Pyrophorics • Self-heating • Emits flammable gas • Self-reactives • Organic peroxides	• Irritants (skin and eye) • Skin sensitizers • Acute toxicity (harmful) • Narcotic effects • Respiratory tract irritants • Hazardous to ozone layer [non-mandatory]
GAS CYLINDER	**CORROSION**	**EXPLODING BOMB**
• Gases under pressure	• Skin corrosion / burns • Eye damage • Corrosive to metals	• Explosives • Self-reactives • Organic peroxides
FLAME-OVER-CIRCLE	**ENVIRONMENT [NON-MANDATORY]**	**SKULL-AND-CROSSBONES**
• Oxidizers	• Aquatic toxicity	• Acute toxicity (fatal or toxic)

SECTION XII: SITE CONTROL

The purpose of **site control** is to reduce or prevent the spread of contamination by establishing artificial and/or physical barriers to isolate the site from potential targets. Site control must be site-specific.

A. DEFINITIONS

Exclusion Zone / Hot Zone: Encompasses all known or suspected hazardous materials.

Contamination Reduction Zone (CRZ) / Warm Zone: Between the exclusion zone and the support zone. The **contamination reduction corridor**, or decon area, is established within this zone.

Support Zone / Cold Zone: The area outside the contamination reduction zone where equipment and rescue personnel are stationed.

Decontamination (Decon): The removal of hazardous substances; involves primary and backup emergency decon personnel.

Buddy System: Paired personnel system that promotes communication, safety, integrity checks, and shared work load.

Site Security: System that keeps out unauthorized personnel.

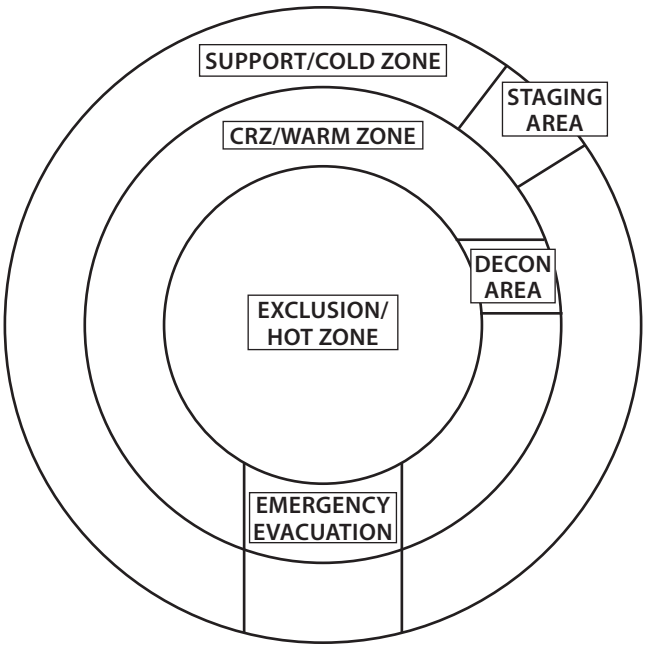
Communication System: System that promotes communication, such as safety briefings, barrier tapes, radios, air horns, etc.

Safe Work Practices / Exposure Minimization: Actions used to prevent contamination.

Emergency Plans: Site evacuation routes, emergency decontamination, regroup area, etc.

B. APPLICATION

Site control is implemented by establishing work zones, decontamination practices, communication procedures, and safe work practices.



C. IMPLEMENTATION

Site Map

A **site map** is a communication tool that is essential to site control. The site map shows a variety of information, including:

- Access and evacuation routes
- Areas requiring special PPE
- Landmarks and topographical features

Maps are ever-changing and are influenced by:

- Changes in site activities
- Unanticipated hazards
- Accidents and emergencies

Site Preparation

The key focus of site preparation is worker safety. Some of the major steps for site preparation include:

- Constructing roadway(s)
- Arranging traffic flow patterns
- Eliminating physical hazards (when possible)

Site Zones

Site zones are developed to ensure that:

- Personnel are protected against hazards specific to where they are working
- Contamination is confined to designated areas
- Personnel can be located and evacuated in an emergency

The size and shape of each zone depends on the hazards present, such as:

- The nature and extent of the chemical hazard(s)
- Features of the site
- Potential for other accidents to occur
- Weather conditions
- Nature of the work
- Size of the contaminated area
- Off-site hazards

NOTE: Zones can change at any time during the operation.

SECTION XIII: DECONTAMINATION

Decontamination is the process of reducing the amount of contamination on a surface to a safe, negligible level. The process of personal decontamination involves the cleaning and/or removal of protective clothing and equipment in a specific order and by specific methods so as to prevent contamination of clean surfaces.

A. PREPARATION

Preparation starts with anticipating the need for decontamination and ensuring that the necessary items are available and accessible. The type and extent of decontamination depends on the following:

- Toxicity: chemical and physical properties of the contaminants
- Amount of contaminants
- Type of personal protective clothing and equipment required
- Work activities
- Anticipated use

B. CONTAMINATION

Contamination can occur when:

- Entry is gained to the exclusion zone without proper personal protective equipment
- Improper decontamination methods are used
- Wind direction or other environmental changes occur

The methods of contamination are:

- Direct contamination (heaviest levels of contamination)
  - » High-contact surfaces
  - » Hands
  - » Feet
- Indirect contamination (can adhere to PPE)
  - » Gases
  - » Vapors
  - » Dust

Prevention of contamination:

- Exposure minimization
- Safe work practices

C. DECONTAMINATION METHODS

There are two primary methods of decontamination: physical and chemical.

The **physical decon** (dry) method involves removing PPE to prevent cross-contamination.

The **chemical decon** (wet) method involves washing with a decon solution.

At a minimum, field decontamination must:

- Isolate the worker
- Provide a clearly designated zone with identified areas for each task
- Provide containment for disposable items
- Contain all waste streams and/or runoff
- Apply field practicality

D. DECONTAMINATION EMERGENCIES

Mild Emergencies

In mild emergencies, go to the decon station and perform decon procedures to exit the exclusion zone. The decon station must be set up a safe distance from the hazard. Mild emergencies include:

- Container spills
- Minor injury

Moderate Emergencies

In moderate emergencies, either go to the decon station and quickly perform decon procedures or bypass the decon station and move to a safer distance before removing PPE. Use your personal

judgment to decide between the options. Moderate emergencies include:

- Large spills
- Potentials for fire

Serious Emergencies

In serious emergencies, bypass the decon station and immediately move to a safer location. Then remove PPE and leave for later cleanup. Hands and face should be washed as soon as practical. Serious emergencies include:

- Fire or explosions
- Large chemical reactions

Medical Emergencies

In a medical emergency, the following guidelines should be implemented:

- Remove protective clothing, unless the removal interferes with treatment, delays treatment, or aggravates the medical incident; flush with copious amounts of water or soap and water solution
- Protect yourself while handling/treating the victim
- Alert the ambulance and medical personnel of the contaminant(s)

Whenever possible, decontamination procedures should be implemented in a medical emergency situation.