

TRAINEE MANUAL

HAZMAT



HAZMAT

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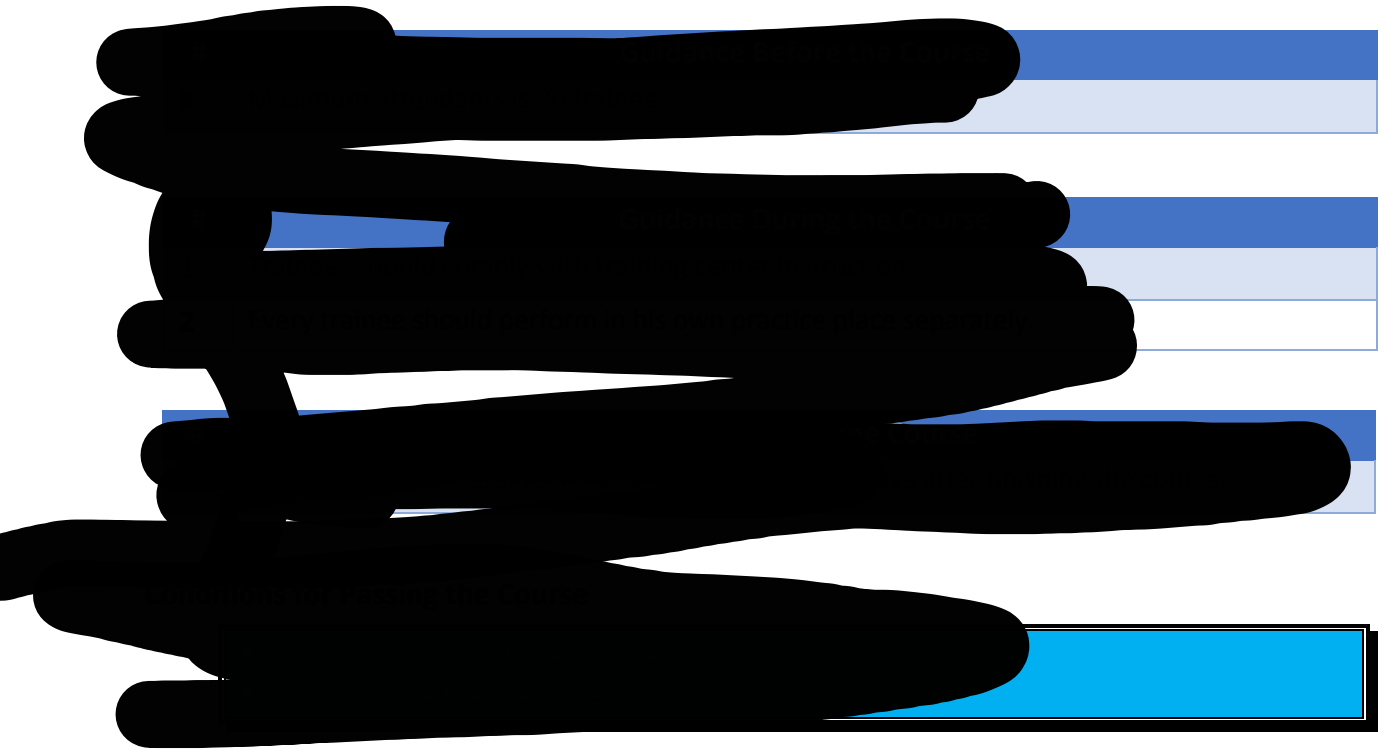
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Who Should Attend

The Sub Objectives

#	Sub Objective	K	S	A	Note
1	Knowing chemical materials	√			
2	Understanding how to protect yourself.	√			
3	Identifying chemical dangers.	√			
4	Practicing reading MSDS and ERG.	√	√		



INTRODUCTION TO OSHA AND NFPA

1

Structure

- 1.0 introduction**
- 1.1 learning objectives**
- 1.2 definition**
- 1.3 osha purpose**
 - 1.3.1 osha standards
 - 1.3.2 horizontal and vertical standards
- 1.4 workplace inspections**
 - 1.4.1 authority to inspect
 - 1.4.2 inspection priorities
- 1.5 citations and penalties**
 - 1.5.1 penalties
- 1.6 services available by osha**
 - 1.6.1 consultation assistance
 - 1.6.2 voluntary protection programs
 - 1.6.3 training and education
- 1.7 summary**
- 1.8 key terms**
- 1.9 answers to check your progress**
- 1.10 questions and exercises**

1.0 INTRODUCTION

OSHA

More than 90 million Americans spend their days on the job. Until 1970, no uniform and comprehensive provisions existed for their protection against workplace safety and health hazards. The Occupational Safety and Health Act (OSH ACT) was approved by Congress in 1970, to assure so far as possible every working man and woman safe and healthful working conditions. In general, coverage of the Act extends to all employers in the 50 states, the District of Columbia, Puerto Rico, and all other territories under Federal Government.



NFPA

The NFPA is a global organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards.



1.1 LEARNING OBJECTIVES

After going through this unit, the trainee should be able to:

- ▶ Knowing OSHA Organization
- ▶ Knowing NFPA Organization
- ▶ Knowing CFR

1.2 DEFINITION:

OSHA: Occupational Safety and Health Administration US Department of Labor.

Employers: As defined by the Act, an employer is any "person engaged in a business affecting commerce who has employees.

A competent person: is defined as "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them"

CFR: Code of Federal Regulations is a codification of the general and permanent rules published in the Federal Register by Executive departments and agencies of the Federal Government. The code is divided into 50 titles which represent broad areas subject to Federal regulations. Each title is divided into chapters which usually bear the name of the issuing agency. Each chapter is further subdivided into parts covering specific regulatory areas. Based on this breakdown, OSHA is designated title 29-Labor, Chapter XVII.

Under Chapter XVII, the regulations are broken down into parts. (Occupational Safety and Health Standards)

For example:

- Part 1910: General Industry Standards
- Part 1926: Construction Safety Standards

Under each part, such as Part 1910, major blocks information is broken into subparts. The major subparts in the 1910 standards include:

1.3 OSHA PURPOSE

Under the OSH ACT (1970), the Occupational Safety and Health Administration (OSHA) was created within the Department of Labor in 1971 to:

- 1- Encourage employers and employees to reduce workplace hazards and to implement new or improve existing safety and health programs.
 - 2- Provide for research in occupational safety and health to develop innovative ways of dealing with occupational safety and health problems.
 - 3- Establish “separate but dependent responsibilities and rights” for employers and employees for the achievement of better safety and health conditions.
 - 4- Maintain a reporting and record-keeping system to monitor job-related injuries and illnesses.
 - 5- Establish training programs to increase the number and competence of occupational safety and health personnel.
 - 6- Develop mandatory job safety and health standards and enforce them effectively
- Provide for the development, analysis, evaluations and approval of state occupational safety and health programs

OSHA STANDARDS

In carrying out its duties, OSHA is responsible for promulgating legally enforceable standards. OSHA standards may require conditions, or the adoption or use of or more practices, means, methods or processes reasonably necessary and appropriate to protect workers on the job. It is the responsibility of employers to become familiar with standards applicable to their establishments and to ensure that employees have and use personal protective equipment when required for safety.

Employees must comply with all rules and regulation which are applicable to their own actions and conduct.

The OSHA standards were taken from three sources: consensus standards, proprietary standards, and federal laws in effect when the Occupational Safety and Health Act become law.

- 1- Consensus Standards: are developed by industry-wide standard-developing organizations and are discussed and substantially agreed upon through consensus by industry. OSHA has incorporated the standards of the two primary standards groups, the American National Standards Institute (ANSI) and the National Fire Protection Association (NFPA), into its set of standards.
- 2- Proprietary Standards: are prepared by professional experts within specific industries, professional societies, and associations. The proprietary standards are determined by a straight membership vote, not by consensus. (An example is the Compressed Gas Association)
- 3- Federal Law: Some preexisting federal laws are enforced by OSHA, including the Federal Supply Contracts; the Federal Service Contracts Act; the Contract Work Hours and Safety Standards Act; and the National Foundation on the Arts and Humanities Act. Standards issued under these Acts are now enforced in all industries where they apply.

VOLUNTARY PROTECTION PROGRAMS

The Voluntary Protection Programs (VPPs) represent one part of OSHA’s effort to extend worker protection beyond the minimum required by OSHA standards. These programs, along with others such as expanded onsite consultation services and full-service area offices, are cooperative approaches which, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the Occupational Safety and Health Act of 1970.

TRAINING AND EDUCATION

OSHA’s area offices are full-service centers offering a variety of informational services such as availability for speaking engagements, publication, audiovisual aids on workplace hazards, and technical advice.

OSHA

The OSHA Training Institute in Des Plaines, IL, provide basic and advanced training and education in safety and health for federal and state compliance officers; state consultants; other federal agency personnel; and private sector employees, employees and their representatives. Institute courses cover areas such as electrical hazards, machine guarding, ventilation and ergonomics.

NFPA

The National Fire Protection Association (NFPA) is a United States trade association, albeit with some international members, that creates and maintains private, copyrighted standards and codes for usage and adoption by local governments. The association was formed in 1896 by a group of insurance firms.

	Check Your Progress
1	How many part for OSHA slandered?
2	What extra programs OSHA support?

1.4 SUMMARY...

- ▶ OSHA: Occupational Safety and Health Administration US Department of Labor.
- ▶ The National Fire Protection Association (NFPA) is a United States trade association

1.5 KEY TERMS

- ▶ **OSHA:** The Occupational Safety and Health Administration
- ▶ **NFPA:** The National Fire Protection Association.

1.6 ANSWERS TO CHECK YOUR PROGRESS

1. Divided to two parts:
 - a. Part 1910: General Industry Standards
 - b. Part 1926: Construction Safety Standards
2.
 - a. Voluntary protection programs
 - b. Training and education
 - c. Awareness programs

1.7 QUESTIONS AND EXERCISES

SHORT ANSWER QUESTIONS

1. What is OSHA organization?

LONG ANSWER QUESTIONS

1. What is the difference between OSHA and NFPA?

HAZARD COMMUNICATION

2

Structure

- 2.0** introduction
- 2.1** learning objectives
- 2.2** chemicals in the workplace
 - 2.2.1 hazard evaluation
 - 2.2.2 written hazard communication program
 - 2.2.3 labels and others forms of warning
 - 2.2.4 material safety data sheets
 - 2.2.5 list of hazardous chemicals
- 2.3** employee information and training
 - 2.3.1 information
 - 2.3.2 training
 - 2.3.3 trade secrets
 - 2.3.4 medical emergency
 - 2.3.5 non-emergency situation
- 2.4** summary
- 2.5** key terms
- 2.6** answers to check your progress
- 2.7** questions and exercises

2.0 INTRODUCTION

Chemicals pose a wide range of health hazards (such as irritation, sensitization, and carcinogenicity) and physical hazards (such as flammability, corrosion, and reactivity). OSHA's Hazard Communication Standard (HCS) is designed to ensure that information about these hazards and associated protective measures is disseminated. This is accomplished by requiring chemical manufacturers and importers to evaluate the hazards of the chemicals they produce or import, and to provide information about them through labels on shipped containers and more detailed information sheets called material safety data sheets (MSDS) (SDS). All employers with hazardous chemicals in their workplaces must prepare and implement a written hazard communication program, and must ensure that all containers are labeled, employees are provided access to MSDSs, and an effective training program is conducted for all potentially exposed employees.

The HCS provides people the right-to-know the hazards and identities of the chemicals they are exposed to in the workplace. When employees have this information, they may effectively participate in their employers' protective programs and take steps to protect themselves. In addition, the standard gives employers the information they need to design and implement an effective protective program for employees potentially exposed to hazardous chemicals. Together these actions will result in a reduction of chemical source illnesses and injuries in American workplaces.

2.1 LEARNING OBJECTIVES

After going through this unit, the trainee should be able to:

- ▶ Knowing chemical material in work place.
- ▶ First aide response in case of chemical hazard.
- ▶ Handling with emergency case.

2.2 CHEMICALS IN THE WORKPLACE

About 32 million workers are potentially exposed to one or more chemical hazards. There are an estimated 575,000 existing chemical products, and hundreds of new ones being introduced annually. This poses a serious problem for exposed workers and their employers.

Chemical exposure may cause or contribute to many serious health effects such as heart ailments, kidney and lung damage, sterility, cancer, burns, and rashes. Some chemicals may also be safety hazards and have the potential to cause fires and explosions and other serious accidents.

Because of the seriousness of these safety and health problems, and because many employers and employees know little or nothing about them, the Occupational Safety and Health Administration (OSHA) has issued a rule called "Hazard Communication." The basic goal of the standard is to be sure employers and employees know about work hazards and how to protect themselves; this should help to reduce the incidence of chemical source illness and injuries.

The Hazard Communication Standard establishes uniform requirements to make sure that the hazards of all chemicals imported into, produced, or used in U.S. workplaces are evaluated, and that this hazard information is transmitted to affected employers and exposed employees.



HAZARD EVALUATION

The quality of the hazard communication program depends on the adequacy and accuracy of the hazard assessment. Chemical manufacturers and importers are required to review available scientific evidence concerning the hazards of the chemicals they produce or import, and to report the information they find to their employees and to employers who distribute or use their products. Downstream employers can rely

on the evaluations performed by the chemical manufacturers or importers to establish the hazards of the chemicals they use.

The chemical manufacturers, importers, and any employers who choose to evaluate hazards are responsible for the quality of the hazard determinations they perform. Each chemical must be evaluated for its potential to cause adverse health effects and its potential to pose physical hazards such as flammability. (Definitions of hazards covered are included in the standard.) Chemicals that are listed in one of the following sources are to be considered hazardous in all cases:

- 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration, (OSHA) and
- Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, American Conference of Governmental Industrial Hygienists (ACGIH).

In addition, chemicals that have been evaluated and found to be a suspect or confirmed carcinogen in the following sources must be reported as such:

- National Toxicology Program (NTP), Annual Report on Carcinogens,
- International Agency for Research on Cancer (IARC), Monographs, and
- Regulated by OSHA as a carcinogen.

WRITTEN HAZARD COMMUNICATION PROGRAM

Employers must develop, implement, and maintain at the workplace a written, comprehensive hazard communication program that includes provisions for container labeling, collection and availability of material safety data sheets, and an employee training program. It also must contain a list of the hazardous chemicals in each work area, the means the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals in unlabeled pipes. If the workplace has multiple employers on-site (for example, a construction site), the rule requires these employers to ensure that information regarding hazards and protective measures be made available to the other employers on-site, where appropriate.

The written program does not have to be lengthy or complicated, and some employers may be able to rely on existing hazard communication programs to comply with the above requirements. The written program must be available to employees, their designated representatives, the Assistant Secretary of Labor for Occupational Safety and Health, and the Director of the National Institute for Occupational Safety and Health (NIOSH).

LABELS AND OTHERS FORMS OF WARNING

Chemical manufacturers, importers, and distributors must be sure that containers of hazardous chemicals leaving the workplace are labeled, tagged or marked with the

identity of the chemicals, appropriate hazard warnings, and the name and address of the manufacturer or other responsible party.

In the workplace, each container must be labeled, tagged or marked with the identity of hazardous chemicals contained therein, and must show hazard warnings appropriate for employee protection. The hazard warning can be any type of message, words, pictures, or symbols that convey the hazards of the chemical(s) in the container. Labels must be legible, in English (plus other languages, if desired), and prominently displayed.

Exemptions to the requirement for in-plant individual container labels are as follows:

- Employers can post signs or placards that convey the hazard information if there are a number of stationary containers within a work area that have similar contents and hazards.
- Employers can substitute various types of standard operating procedures, process sheets, batch tickets, blend tickets, and similar written materials for container labels on stationary process

equipment if they contain the same information and are readily available to employees in the work area.

- Employers are not required to label portable containers into which hazardous chemicals are transferred from labeled containers and that are intended only for the immediate use of the employee who makes the transfer.
- Employers are not required to label pipes or piping systems.

MATERIAL SAFETY DATA SHEETS

Chemical manufacturers and importers must develop an MSDS for each hazardous chemical they produce or import, and must provide the MSDS automatically at the time of the initial shipment of a hazardous chemical to a downstream distributor or user. Distributors must also ensure that downstream employers are similarly provided an MSDS.

Each MSDS must be in English and include information regarding the specific chemical identity of the hazardous chemical(s) involved and the common names. In addition, information must be provided on the physical and chemical characteristics of the hazardous chemical; known acute and chronic health effects and related health information; exposure limits; whether the chemical is considered to be a carcinogen by NTP, IARC, or OSHA; precautionary measures; emergency and first-aid procedures; and the identification of the organization responsible for preparing the sheet.

Copies of the MSDS for hazardous chemicals in a given work site are to be readily accessible to employees in that area. As a source of detailed information on hazards, they must be located close to workers, and readily available to them during each workshift.

A copy of the non-mandatory MSDS form (OSHA 174) can be obtained from OSHA field offices.

LIST OF HAZARDOUS CHEMICALS

Employers must prepare a list of all hazardous chemicals in the workplace. When the list is complete, it should be checked against the collected MSDS's that the employer has been sent. If there are hazardous chemicals used for which no MSDS has been received, the employer must write to the supplier, manufacturer, or importer to obtain the missing MSDS. If employers do not receive the MSDS within a reasonable period of time, they should contact the nearest OSHA office

2.3 EMPLOYEE INFORMATION AND TRAINING

Employers must establish a training and information program for employees exposed to hazardous chemicals in their work area at the time of initial assignment and whenever a new hazard is introduced into their work area.

INFORMATION

At a minimum, the discussion topics must include the following:

- The existence of the hazard communication standard and the requirements of the standard.
- The components of the hazard communication program in the employees' workplaces.
- Operations in work areas where hazardous chemicals are present.
- Where the employer will keep the written hazard evaluation procedures, communications program, lists of hazardous chemicals, and the required MSDS forms.

TRAINING

The employee training plan must consist of the following elements:

- How the hazard communication program is implemented in that workplace, how to read and interpret information on labels and the MSDS, and how employees can obtain and use the available hazard information.

- The hazards of the chemicals in the work area. (The hazards may be discussed by individual chemical or by hazard categories such as flammability.)
- Measures employees can take to protect themselves from the hazards.
- Specific procedures put into effect by the employer to provide protection such as engineering controls, work practices, and the use of personal protective equipment (PPE).
- Methods and observations--such as visual appearance or smell--workers can use to detect the presence of a hazardous chemical to which they may be exposed.

TRADE SECRETS

A "trade secret" is something that gives an employer an opportunity to obtain an advantage over competitors who do not know about the trade secret or who do not use it. For example, a trade secret may be a confidential device, pattern, information, or chemical make-up. Chemical industry trade secrets are generally formulas, process data, or a "specific chemical identity." The latter is the type of trade secret information referred to in the hazard communication standard. The term includes the chemical name, the Chemical Abstracts Services (CAS) Registry Number, or any other specific information that reveals the precise designation. It does not include common names.

The standard strikes a balance between the need to protect exposed employees and the employer's need to maintain the confidentiality of a bona fide trade secret. This is achieved by providing for limited disclosure to health professionals who are furnishing medical or other occupational health services to exposed employees, employees and their designated representatives, under specified conditions of need and confidentiality.

MEDICAL EMERGENCY

The chemical manufacturer, importer, or employer must immediately disclose the specific chemical identity of a hazardous chemical to a treating physician or nurse when the information is needed for proper emergency or first-aid treatment. As soon as circumstances permit, the chemical manufacturer, importer, or employer may obtain a written statement of need and a confidentiality agreement.

Under the contingency described here, the treating physician or nurse has the ultimate responsibility for determining that a medical emergency exists. At the time of the emergency, the professional judgement of the physician or nurse regarding the situation must form the basis for triggering the immediate disclosure requirement. Because the chemical manufacturer, importer, or employer can demand a written statement of need and a confidentiality agreement to be completed after the emergency is abated, further disclosure of the trade secret can be effectively controlled.

NON-EMERGENCY SITUATION

In non-emergency situations, chemical manufacturers, importers, or employers must disclose the withheld specific chemical identity to health professionals providing medical or other occupational health services to exposed employees, and to employees and their designated representatives, if certain conditions are met. In this context, "health professionals" include physicians, occupational health nurses, industrial hygienists, toxicologists, or epidemiologists.

The request for information must be in writing and must describe with reasonable detail the medical or occupational health need for the information. The request will be considered if the information will be used for one or more of the following activities:

- To assess the hazards of the chemicals to which employees will be exposed.
- To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels.
- To conduct pre-assignment or periodic medical surveillance of exposed employees.
- To provide medical treatment to exposed employees.
- To select or assess appropriate personal protective equipment for exposed employees.

- To design or assess engineering controls or other protective measures for exposed employees.
- To conduct studies to determine the health effects of exposure.

The health professional, employee, or designated representative must also specify why alternative information is insufficient. The request for information must explain in detail why disclosure of the specific chemical identity is essential, and include the procedures to be used to protect the confidentiality of the information. It must include an agreement not to use the information for any purpose other than the health need stated or to release it under any circumstances, except to OSHA.

The standard further describes in detail the steps that will be followed in the event that an employer decides not to disclose the specific chemical identity requested by the health professional, employee, or designated representative.



CHECK YOUR PROGRESS

- 1 What does trade secret mean?
- 2 What the importance of First Aid?

2.4 SUMMARY...

- ▶ The quality of the hazard communication program depends on the adequacy and accuracy of the hazard assessment.
- ▶ In non-emergency situations, chemical manufacturers, importers, or employers must disclose the withheld specific chemical identity to health professionals providing medical or other occupational health services to exposed employees, and to employees and their designated representatives, if certain conditions are met.

2.5 KEY TERMS

- ▶ **MSDS:** material safety data sheet .
- ▶ **SDS:** safety data sheet

2.6 ANSWERS TO CHECK YOUR PROGRESS

1. "trade secret" is something that gives an employer an opportunity to obtain an advantage over competitors who do not know about the trade secret or who do not use it.
2. is an acute injury or illness that poses an immediate risk to a person's life or long-term health, sometimes referred to as a situation risking "life or limb."

2.7 QUESTIONS AND EXERCISES

SHORT ANSWER QUESTIONS

1. What do you know about trade secrets?

LONG ANSWER QUESTIONS

1. What do you know about MSDS?

SDS AND 704 LABEL & Placard

3

Structure

- 3.0 introduction**
- 3.1 learning objectives**
- 3.2 recognizing an nfpa 704 label**
 - 3.2.1 left diamond | health hazard | blue
 - 3.2.2 top diamond | flammability | red
 - 3.2.3 right diamond | instability | yellow
 - 3.2.4 bottom diamond | special precautions | white
- 3.3 hazard communication standard: safety data sheets**
 - 3.3.1 section 1: identification
 - 3.3.2 section 2: hazard(s) identification
 - 3.3.3 section 3: composition/information on ingredients
 - 3.3.4 section 4: first-aid measures
 - 3.3.5 section 5: fire-fighting measures
 - 3.3.6 section 6: accidental release measures
 - 3.3.7 section 7: handling and storage
 - 3.3.8 section 8: exposure controls/personal protection
 - 3.3.9 section 9: physical and chemical properties
 - 3.3.10 section 10: stability and reactivity
 - 3.3.11 section 11: toxicological information
 - 3.3.12 section 12: ecological information (non-mandatory)
 - 3.3.13 section 13: disposal considerations (non-mandatory)
 - 3.3.14 section 14: transport information (non-mandatory)
 - 3.3.15 section 15: regulatory information (non-mandatory)
 - 3.3.16 section 16: other information
- 3.4 hazmat labels**

3.5	summary...
3.6	key terms
3.7	answers to check your progress
3.8	questions and exercises

3.0 INTRODUCTION

A Safety Data Sheet (SDS) is a document in a standard format designed to identify the intrinsic hazards associated with chemical products for users of these products. It also indicates appropriate responses to spills, fires, environmental releases, and other types of incidents involving the product. Information for contacting the manufacturer and/or importer, and emergency response personnel also appear on the document.

NFPA 704 rating system is a standard system developed by the U.S.-based National Fire Protection Association (NFPA) for indicating the health, flammability, reactivity and special hazards for many hazardous chemicals through the use of the

*The Department of Transportation (DOT) mandates that Hazmat Placards be used when transporting hazardous materials and dangerous goods in the United States. These DOT Placards and Hazardous Materials Placards have numbers on them specific chemicals or groups of chemicals being transported. Clear marking trucks as carrying hazardous materials with hazmat placards ensures the proper and safe transportation of such cargo.

SafetySign.com offers Hazmat Placards and DOT Placards for the transportation of hazardous materials. Select from all hazard classes and custom sign options. In addition, we offer appropriate Holders and Sets for each of these critical safety signs. Follow DOT regulations by ordering our Hazmat Placards today!

3.1 LEARNING OBJECTIVES

After going through this unit, the trainee should be able to:

- ▶ Knowing an NFPA 704 label
- ▶ Knowing SDS
- ▶ Knowing placard.

3.2 RECOGNIZING AN NFPA 704 LABEL

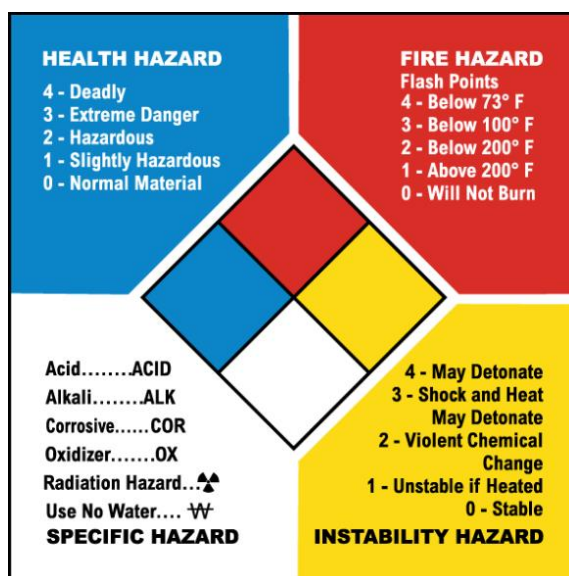


Figure 4.1: The NFPA 704 label.

The NFPA 704 label contains lots of information in a compact and easy-to-understand format, which is essential in emergency situations. The most recognizable part of the label is the diamond, which is further

broken up into four smaller diamonds. Each of the diamonds is color-coded and represents a different type of hazard. Within the diamond is a number (with the exception of the white diamond). The number corresponds to the level of danger a chemical poses.

The lower the number, the lower the hazard. The numbers range from zero to four, with zero representing no hazard at all, and four representing an extreme hazard. Each number also has a specific meaning based on which diamond it is in.

LEFT DIAMOND | HEALTH HAZARD | BLUE

The small diamond on the left side of the larger diamond has a blue background and is used to alert people to health hazards. Health hazards can include skin reactions, diseases such as cancer, respiratory issues, or any number of other health related issues. The higher the number, the more precautions someone should take when working with the chemical, and the more protective equipment needs to be used when dealing with an emergency.

The numerical codes used in this section are broken down as follows:

- Zero - Chemicals in this level pose no health hazard and there is no precaution necessary. Chemicals like water and others that are entirely safe under normal use can be labeled with a zero in this category.
- One - Level one for the health hazard category is for any chemical that can only cause a mild reaction or injury due to exposure. In most situations, no extra personal protective equipment is needed beyond perhaps gloves.
- Two - Level two is for chemicals that can cause temporary incapacitation or residual injury, but only if there is intense or prolonged exposure to the chemical.
- Three - This level is for chemicals that can cause either a temporary or a moderate residual injury when there is even a short exposure period.
- Four - Level four chemicals can cause serious injury or death with even brief or limited exposure. Extreme precaution is necessary at this level. Personal protective equipment needs to be worn before working with this chemical or even the container that holds it. This is especially true during an emergency such as a chemical spill.

TOP DIAMOND | FLAMMABILITY | RED

The top diamond has a red background and lets people know whether the chemical being labeled is flammable. Chemicals that cannot burn will have a zero in this diamond, and those that are extremely flammable will have a four. Most chemicals will have a rating somewhere in between.

If a fireman responding to an emergency sees that a chemical barrel has a flammability level above zero, they will immediately know they need to take precautions to keep sparks, flames, or heat away from that chemical.

The number breakdown for this section is as follows:

- Zero - Any label that has a zero in this diamond is a material that will not burn, even in typical fire conditions. The specific standards followed for this level state that this is for materials that will not burn while in the air and exposed to a temperature of 1500 F for five minutes.
- One - Any material or chemical that will burn, but only when heated significantly. These materials must have a flash point of 200 F or higher.
- Two - Any material or chemical that needs to be exposed to a "relatively" high temperature before it will ignite. Flash points between 100 and 200 F are in this level.
- Three - Any material or chemical that can ignite under most ambient temperatures and has a flash point below 73 F, and also has a boiling point of at least 100 F.

- Four - Items found in this category will readily burn and have a flash point that is below normal room temperatures (73 degrees). These are the most dangerous and include chemicals like acetylene and propane.

RIGHT DIAMOND | INSTABILITY | YELLOW

The right diamond has a yellow background and lets people know how stable the chemical is. Stability refers to how easily the chemical can change or have some type of reaction. Highly unstable chemicals can react from something as simple as being exposed to air or being shaken.

This particular box on the label does not provide any information about what causes the chemical to be unstable. Emergency responders will need to look further on the label to learn this, and if chemicals are unstable, responders should take extreme precaution to avoid any type of reaction.

The levels for this section are:

- Zero - Any chemical that is normally very stable and won't react even under conditions such as fire or immersion in water.
- One - This level is for chemicals that are stable in most situations, but when temperatures or pressures are elevated significantly, they can become unstable.
- Two - Chemicals with this level can have a violent chemical change when exposed to elevated pressures or temperatures. In addition, they may have serious reactions when exposed to water.
- Three - Any chemical that can explode or detonate after an initiation or when exposed to heat. This type of chemical may also have a serious reaction to water or a shock.
- Four - Chemicals at this level can react or detonate even at normal pressures and temperatures. They need to be kept in a very well regulated environment at all times to ensure a dangerous reaction doesn't occur.

BOTTOM DIAMOND | SPECIAL PRECAUTIONS | WHITE

The white diamond, which is at the bottom, does not contain a number like the others because it does not list the severity of a particular type of hazard. Instead, this diamond contains symbols that convey special precautions or hazards that exist.

There are three symbols approved by the NFPA 704 system:

- W - The W symbol indicates that the chemical being labeled has a strong reaction to water. Chemicals like potassium, magnesium, rubidium, and cesium that will explode, burn, or give off dangerous gases when exposed to water have this symbol. This is an important warning to firemen and other emergency responders not to use water on or around this chemical.
- OX - This symbol indicates that the chemical will have a violent reaction if exposed to oxygen. Strong oxidizers like ammonium nitrate, ketone peroxides, bromates, and chromates should be labeled with this symbol so the container is not opened or punctured.
- SA - SA is a symbol for simple asphyxiate gases. These gases reduce or displace the oxygen in the area, which can be extremely dangerous for people nearby, as they could suffocate from having no access to oxygen. Chemicals that can cause this reaction include nitrogen, helium, neon, and argon.
- There are also several "non-standard" symbols commonly used by facilities. While not officially a part of the NFPA 704 system, it is a good idea to be aware of their existence because of their widespread use. These symbols are:

- COR, ACID, ALK - These symbols are used for any chemical that is corrosive, including strong acids and bases.
- BIO - Any chemical that presents a biological hazard may be labeled with this symbol.
- POI - All poisonous chemicals fall under this symbol.
- RA or RAD - Any radioactive chemicals can be labeled with this symbol.
- CRY or CRYO - Cryogenic chemicals may have this symbol listed in the white diamond.

3.3 HAZARD COMMUNICATION STANDARD: SAFETY DATA SHEETS

The Hazard Communication Standard (HCS) (29 CFR 1910.1200(g)), revised in 2012, requires that the chemical manufacturer, distributor, or importer provide Safety Data Sheets (SDSs) (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to downstream users to communicate information on these hazards. The information contained in the SDS is largely the same as the MSDS, except now the SDSs are required to be presented in a consistent user-friendly, 16-section format. This brief provides guidance to help workers who handle hazardous chemicals to become familiar with the format and understand the contents of the SDSs.

The SDS includes information such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. The information contained in the SDS must be in English (although it may be in other languages as well). In addition, OSHA requires that SDS preparers provide specific minimum information as detailed in Appendix D of 29 CFR 1910.1200. The SDS preparers may also include additional information in various section(s).

Sections 1 through 8 contain general information about the chemical, identification, hazards, composition, safe handling practices, and emergency control measures (e.g., firefighting). This information should be helpful to those that need to get the information quickly. Sections 9 through 11 and 16 contain other technical and scientific information, such as physical and chemical properties, stability and reactivity information, toxicological information, exposure control information, and other information including the date of preparation or last revision. The SDS must also state that no applicable information was found when the preparer does not find relevant information for any required element.

The SDS must also contain Sections 12 through 15, to be consistent with the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS), but OSHA will not enforce the content of these sections because they concern matters handled by other agencies.

A description of all 16 sections of the SDS, along with their contents, is presented below:

SECTION 1: IDENTIFICATION

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier). 1

SECTION 2: HAZARD(S) IDENTIFICATION

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid, category1).

- Signal word.
- Hazard statement(s).
- Pictograms (the pictograms or hazard symbols may be presented as graphical reproductions of the symbols in black and white or be a description of the name of the symbol (e.g., skull and crossbones, flame).
- Precautionary statement(s).
- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and not tied to the individual ingredient(s).

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. This section includes information on substances, mixtures, and all chemicals where a trade secret is claimed. The required information consists of: Substances

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.

Mixtures

- Same information required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are:
 - Present above their cut-off/concentration limits or
 - Present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified except concentration ranges may be used in the following situations:
 - A trade secret claim is made,
 - There is batch-to-batch variation, or
 - The SDS is used for a group of substantially similar mixtures.

Chemicals where a trade secret is claimed

- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

SECTION 4: FIRST-AID MEASURES

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin and eye contact, and ingestion).
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

SECTION 5: FIRE-FIGHTING MEASURES

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.
- Recommendations on special protective equipment or precautions for firefighters.

SECTION 6: ACCIDENTAL RELEASE MEASURES

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills where the spill volume has a significant impact on the hazard. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures).
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up)

SECTION 7: HANDLING AND STORAGE

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
- Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements)

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:

- OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.
- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate

types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).

- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.);
- Upper/lower flammability or explosive limits;
- Odor;
- Vapor pressure;
- Odor threshold;
- Vapor density;
- pH;
- Relative density;
- Melting point/freezing point;
- Solubility(ies);
- Initial boiling point and boiling range;
- Flash point;
- Evaporation rate;
- Flammability (solid, gas);
- Partition coefficient: n-octanol/water;
- Auto-ignition temperature;
- Decomposition temperature; and
- Viscosity.

The SDS may not contain every item on the above list because information may not be relevant or is not available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index (K_{st}) for combustible dust, used to evaluate a dust's explosive potential

SECTION 10: STABILITY AND REACTIVITY

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

Reactivity

- Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s), where available.

Chemical stability

- Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
- Description of any stabilizers that may be needed to maintain chemical stability.
- Indication of any safety issues that may arise should the product change in physical appearance.

- Other
- Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
- List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).
- List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
- List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

SECTION 11: TOXICOLOGICAL INFORMATION

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
- The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50 (median lethal dose)) - the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA

SECTION 12: ECOLOGICAL INFORMATION (NON-MANDATORY)

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
- Whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
- Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (K_{ow}) and the bioconcentration factor (BCF), where available.
- The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

SECTION 13: DISPOSAL CONSIDERATIONS (NON-MANDATORY)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. To minimize exposure, this section should also refer the reader to Section 8 (Exposure Controls/Personal Protection) of the SDS. The information may include:

- Description of appropriate disposal containers to use.
- Recommendations of appropriate disposal methods to employ.
- Description of the physical and chemical properties that may affect disposal activities.
- Language discouraging sewage disposal.
- Any special precautions for landfills or incineration activities

SECTION 14: TRANSPORT INFORMATION (NON-MANDATORY)

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance)¹.
- UN proper shipping name¹.
- Transport hazard class(es)¹.
- Packing group number, if applicable, based on the degree of hazard².
- Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
- Guidance on transport in bulk (according to Annex II of MARPOL 73/783 and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code))).
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

SECTION 15: REGULATORY INFORMATION (NON-MANDATORY)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include:

- Any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations)

SECTION 16: OTHER INFORMATION

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

3.4 HAZMAT LABELS

Hazard Class Labels are standard hazmat identifiers, designed to meet regulations. Each label has markings that tell what type of hazard is identified on the label. They help identify what type of hazardous material is in a package. These hazmat labels and handling labels are placed on hazardous material packaging such as UN certified packaging, or over packs.

Shippers are responsible for choosing the correct labels for their shipments. Labeling a material incorrectly can result in costly shipping delays, fines, and injuries. If you're not sure which hazard class label fits your needs, use Label master's.

Why are labels important?

- They communicate universally - labels relate information about the hazards of a chemical inside a package internationally, regardless of language. This helps determine what type of hazard is identified on the label.
- They offer special handling instructions - labels clarify handling requirements for a package, making shipping and handling dangerous goods a safer process.
- They help employers communicate hazards - employers use hazard labels to alert employees of potential hazards of materials.
- They help carriers decide where to place packages - hazmat labels help carriers determine stowage and segregation onboard planes, trucks and vessels.
- They inform emergency responders - emergency responders use hazard labels for accident clean-up and potential evacuations.

What do hazmat labels look like?

- It depends on the hazard - there are 9 different classes of hazardous materials. The labels for each class are a different color. To learn more, read our complete breakdown of hazard class markings. These labels must be a specific size, shape and color.
- They stand out - labels must have contrasting background and a dotted line border should be used if the label is not distinguishable from the package. The symbols and text on the labels must be either black or white.



Figure4.2:

Where are hazmat labels placed?

On Hazmat Packaging & Overpacks - hazmat labels are affixed to packaging offered for transport. They must be printed on or permanently attached to one side of the packaging. Labeling should be on the outside of overpacks unless it is visible through the overpack.

Near the UN Number - the hazmat label should be attached as close to the proper shipping name and UN number as possible. They should never fold around the corner. If that happens they can be attached using a tag.

Internationally - for international shipments of hazardous materials, the hazard class number must be displayed in the bottom corner of both primary and subsidiary labels.

In the US - since October 1, 2005, the U.S. has required a hazard class number displayed in the bottom corner of a subsidiary risk label.

Below, find examples of properly labeled packages:

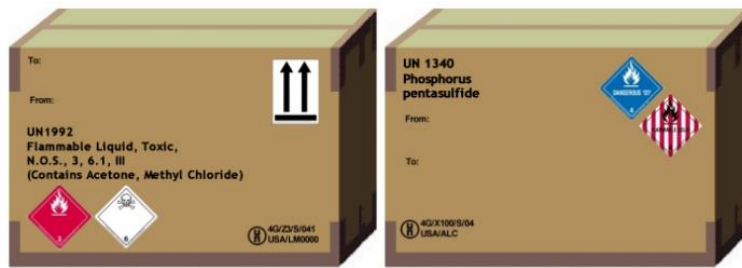


Figure4.3:

Why Are Dot Placards Important?

They inform the public - dangerous goods are regulated in transportation because they pose an increased safety risk to property and the public. Placards warn the people of the presence of hazards while they're driving or near large quantities of hazmat being transported.

They inform emergency responders - if shipping papers aren't available at the scene of an accident, a placard may be the only way responders know what materials are involved in the accident.

They are required - within the United States, certain quantities of hazardous materials within a transport vehicle or bulk packaging must be placarded, although there are several cases where placarding exceptions come into play.

If you want to ship hazmat, you are responsible for providing the carrier with the appropriate placards unless they already have the correct placards on the vehicle or freight container. Otherwise, the motor or rail carrier cannot transport the shipment of hazardous materials.

What do dot placards look like?

Larger, durable labels - placards look a lot like labels, but they are larger and more durable.

They meet design and durability regulations - placards must be printed in the square-on-point configuration measuring 250 mm on all sides and include a solid inner border that is approximately 12.7 mm from the edge of the placard. The hazard class number in the bottom corner of the placard must measure at least 41 mm.

They are legible - text used on a hazard placard must be in English unless otherwise required by a competent authority. Any text, borders, symbols, and hazard classes may be either black or white.

Where are dot placards placed?

On transport vehicles or bulk packages - rather than being placed on a smaller individual package, placards are used for larger amounts of hazardous materials being transported. Often they are placed on the exterior of transport vehicles.

They must be on all 4 sides - placards need to be displayed on all four sides of a transport vehicle or bulk packaging. They must always be displayed in the square-on-point configuration and be located at least 3 inches away from any other marking that may reduce its effectiveness. This is what a compliant placard vehicle is.



Figure4.4:

Why are hazmat markings important?

They identify materials and specify handling - markings provide information to supplement hazard or handling labels. Carriers and consignees refer to markings when accepting hazardous materials to ensure proper handling of the material as well as regulatory compliance.

They help you comply with hazmat transport regulation - incorrectly identifying a hazard is a serious infraction. The Department of transportation and 49 CFR take marking rules seriously. Many penalties and fines are imposed each year for marking violations.

They inform emergency responders - just like labels and placards, marking provided additional information on what materials are involved and what safety precautions need to be taken. Most responders use markings to reference an emergency response guidebook for further information.

What do hazmat markings look like?

They use proper shipping names - markings identify a material or hazard using proper shipping names, UN numbers, or other descriptors required in the regulations.

No specific size, shape or color - unlike labels and placards, markings are not specific to a certain style. However, they must have a sharply contrasting background and they may not be covered by labels or anything else that would reduce their effectiveness.

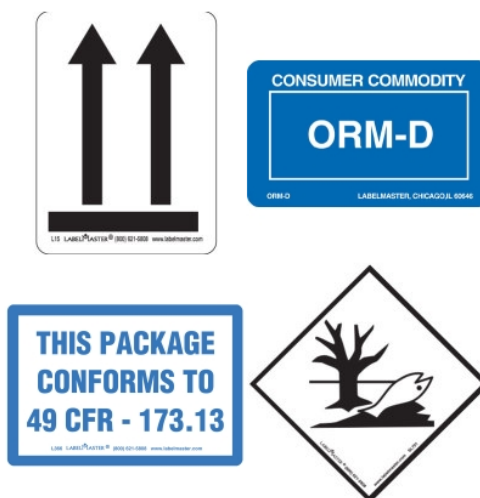


Figure4.5:



CHECK YOUR PROGRESS

- 1 What does 704 label mean?
- 2 What does SDS mean?
- 3 What does placard mean?

3.5 SUMMARY...

- ▶ **hazmat labels placed:** On Hazmat Packaging & Overpacks - hazmat labels are affixed to packaging offered for transport. They must be printed on or permanently attached to one side of the packaging. Labeling should be on the outside of overpacks unless it is visible through the overpack.

3.6 KEY TERMS

- ▶ LEPEL 704
- ▶ MSDS

3.7 ANSWERS TO CHECK YOUR PROGRESS

1. NFPA 704 is a labeling system used to identify hazardous materials. It is published by the National Fire Protection Association (NFPA). NFPA 704 is a supplemental labeling system specifically intended for emergency responders, though other people can read and benefit from these labels in normal working conditions.
2. Safety Data Sheets (formerly called Material Safety Data Sheets) communicate hazard information about chemical products.
3. A placard: is a notice installed in a public place, like a small card, sign, or plaque. It can be attached to or hung from a vehicle or building to indicate information about the vehicle operator or contents of a vehicle or building. It can also refer to paperboard signs or notice carried by picketers or demonstrators.

3.8 QUESTIONS AND EXERCISES

SHORT ANSWER QUESTIONS

1. How many parts of SDS?

LONG ANSWER QUESTIONS

1. Mention 10 parts of SDS?

PERSONAL PROTECTIVE EQUIPMENT

4

Structure

- 4.0 introduction**
- 4.1 learning objectives**
- 4.2 purpose**
 - what is personal protective equipment
 - identifying potential hazards in the workplace: (hazard assessment)
 - training
- 4.3 selection, use and maintenance of ppe**
 - types of eye and face protection
 - kinds of protective gloves
- 4.4 summary**
- 4.5 key terms**
- 4.6 answers to check your progress**
- 4.7 questions and exercises**

4.0 INTRODUCTION

The Occupational Safety and Health Administration (OSHA) requires employers to protect their employees from workplace hazards such as machines, work procedures, and hazardous substances that can cause injury. The preferred way to do this is through engineering controls or work practice and administration controls, but when these controls are not feasible or do not provide sufficient protection, an alternative or supplementary method of protection is to provide workers with personal protection equipment (PPE) and the know-how to use it properly.

4.1 LEARNING OBJECTIVES

After going through this unit, the trainee should be able to:

- ▶ Knowing personal protective equipment.
- ▶ Knowing the difference between Air-Purifying Respirators and an air-line respirator.
- ▶ Knowing the chemical suits approved by NFPA.

4.2 PURPOSE

The Personal Protective Equipment (PPE) program has been developed to provide employees and workers with the necessary information to identify work situations that require the use of PPE, the proper selection and use of PPE, and documentation of this information.

WHAT IS PERSONAL PROTECTIVE EQUIPMENT (HAZMAT)

Personal protective equipment, or PPE, includes a variety of devices and garments to protect workers from injuries. PPE includes:

- Goggles.
- Face Shields.
- Safety Glasses.
- Hard Hat.
- Safety Shoes.
- Gloves.
- Safety Belt, Harness.
- Respirators.
- Chemical suits.

PPE should be used in conjunction with permanent protective measures, such as engineered guards, substitution of less hazardous chemicals, and prudent work practices.

IDENTIFYING POTENTIAL HAZARDS IN THE WORKPLACE: (HAZARD ASSESSMENT)

OSHA requires that employers should identify and assess the risks to health and safety present in the workplace, so enabling the most appropriate means of reducing those risks to an acceptable level to be determined

TRAINING

Prior to conducting work requiring the use of personal protective equipment, employees must be trained to know:

- When PPE is necessary;
- What type is necessary;
- How it is to be worn;
- What its limitations are; and,
- Proper care, maintenance, useful life, and disposal.

Employers should provide appropriate PPE and training in its use to its employees.

No charge can be made to employee for the provision of PPE which is used only at work.

4.3 SELECTION, USE AND MAINTENANCE OF PPE:

A- HEAD PROTECTION:

Prevention of head injuries is an important factor in every safety program. Head injuries are caused by falling or flying objects, or by bumping the head against a fixed object.

Head protection, in the form of protective hats, must do two things:

Resist penetration;

Absorb the shock of the blow.

This is accomplished by making the shell of the hat of a material hard enough to resist the blow, and by utilizing a shock-absorbing lining composed of headband and crown straps to keep the shell away from the wearer's skull.

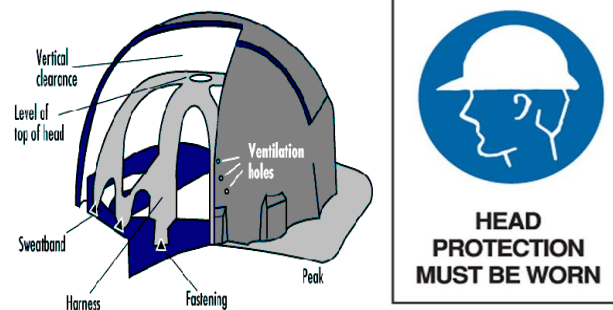


Figure5.1:

Selection:

Each type and class of head protector is intended to provide protection against specific hazardous conditions. An understanding of these conditions will help in selecting the right hat for the particular situation.

Protective hats are made in the following types and classes:

Type 1:

Helmets with full brim, not less than 1 and ¼ inches wide.

Type 2:

Brimless helmets with a peak extending forward from the crown.

For industrial purposes, three classes of helmets are recognized:

Class A:

These helmets are for general service. They provide good impact protection but limited voltage protection. They are used mainly in mining, building construction, shipbuilding, and manufacturing.

Class B:

Choose Class B helmets if your employees are engaged in electrical works they protect against falling objects and high-voltage shock and burns. (They are used extensively by electrical workers.

Class C:

Designed for comfort, these light weight helmets offer limited protection. They protect workers from bumping against fixed objects but do not protect against falling objects or electric shock. (This class is usually manufactured from aluminum and offers no dielectric protection).

B: EYE AND FACE PROTECTION:

Suitable eye protectors must be provided where there is a potential for injury to the eyes for face from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, potentially injurious light radiation or a combination of these.

Protectors must meet the following minimum requirements:

- Provide adequate protection against the particular hazards for which they are designed.
- Be reasonably comfortable when worn under the designated conditions.
- Fit snugly without interfering with the movements or vision of the wearer.
- Be durable.
- Be capable of being disinfected.
- Be easily cleanable and kept clean and in good repair.

TYPE OF CHEMICAL SUITS

LEVEL A

Hazmat-Suit-Level-A

The highest level of protection for the skin, eyes and respiratory system that are all at risk when exposed to the dangerous chemicals in any state.



Figure5.2:

Level A suits require:

- Full face Self Contained Breathing Apparatus (SCBA)
- Two-Way radio
- Proper footwear including Safety steel-toe boots with shanks on the outside
- Chemical-resistant gloves

These suits are used for the most extreme cases of chemical damage that could harm the eyes, skin or respiratory system with exposure. Example being an area that requires a permit to enter.

LEVEL B

Hazmat-Suit-Level-B

Very similar to Level A, the Level B suit is extremely protective and the difference is that these suits contain less skin and outer body protection compared the aforementioned level.

These are utilized when the wearer may require less skin protection but still a very high level of respiratory protection.



Figure5.3:

Level B suits require:

- Full face Self Contained Breathing Apparatus (SCBA)
- Two-Way radio attached either inside or outside the suit to avoid contamination
- Chemical-resistant gloves
- Proper footwear including Safety steel-toe boots with shanks on the outside
- Secured wrist, ankles, facepiece and waist areas for splash protection

An example of a situation that would call for a Level B protection suit would be an initial site survey.

LEVEL C

Hazmat-Suit-Level-C

The most commonly used suit, the Level C, possess similar characteristics as Level B but does not have the same level of respiratory protection.

The suit, predominately used when the hazardous material is identified, measurable and contained, is utilized when contact with the substance will not cause harm to the skin.



Figure5.4:

Level C suits require:

- full-face air purifying respirators
- Chemical-resistant gloves
- Proper footwear including Safety steel-toe boots with shanks on the outside

- Two-way radio as well as a hard hat

These suits are not permitted to be used in the event of a Chemical Emergency Response.

LEVEL D

Hazmat-Suit-Level-D

The least protective of the four suits, the Level D protection suit is mostly used in areas such as a construction site and provides zero protection from chemical exposure.



Figure5.5:

Level D suits require:

- Pair of coveralls
- Proper footwear including Safety steel-toe boots with shanks on the outside
- Goggles/glasses
- Gloves

Level D suits don't require much protection and can be found as firefighter turnout gear, for example.

These suits save lives each and every day by providing safety from chemical exposure that cause harm and illnesses to those who are vulnerable.

TYPES OF EYE AND FACE PROTECTION ...

Safety Glasses

Safety Goggles

Face Shields

Welding Goggles

Laser Safety Glasses

Selection:

Each eye, face, or face-and-eye protector is designed for a particular hazard. In selecting the protector, consideration should be given to the kind and degree of hazard, and protector should be selected on that basis.

C:

Statistics showed that most of the workers in selected occupations who suffered foot injuries were not wearing protective foot-ware.

For protection of feet and legs from falling or rolling objects, sharp objects, molten metal, hot surfaces, and wet slippery surfaces, workers should use appropriate foot guards, safety shoes, or boots.

Safety shoes should be sturdy and have an anti-resistant toe. In some shoes, metal insoles protect against puncture wounds.



Figure5.6:

D- HAND PROTECTION:

Employees are required to use appropriate hand protection when their hands are exposed to hazards such as:

- Absorption of harmful substances.
- Severe cuts or lacerations.
- Severe abrasions.
- Punctures.
- Chemical burns.
- Thermal burns.

Harmful temperature extremes (cold/heat).

4.4 KINDS OF PROTECTIVE GLOVES

Gloves made from a wide variety of materials are designed for virtually every workplace hazard. They may be divided into four groups:

Durable work gloves made of metal mesh, leather, or canvas.

Fabric and coated fabric gloves.

Chemical and liquid resistant gloves.

Insulating rubber gloves.

1- METAL MESH, LEATHER, OR CANVAS GLOVES:

Sturdy gloves made from metal mesh, leather, or canvas provide protection against cuts, burns, and sustained heat.

Leather gloves. Leather gloves protect against sparks, moderate heat, blows, chips, and rough objects. Welders in particular need the durability of higher-quality leather gloves.

Aluminized gloves. These gloves usually are used for welding, furnace, and foundry work because they provide reflective and insulating protection against heat. Aluminized gloves require an insert made of synthetic materials that protect against heat and cold.

Aramid fiber gloves. Aramid is a synthetic material that protects against heat and cold. Many glove manufacturers use aramid fiber to make gloves that are cut-and-abrasive-resistant and wear well.

Other synthetic materials. Several manufacturers make gloves with other synthetic fabrics that offer protection against heat and cold.

2- FABRIC AND COATED FABRIC GLOVES:

These gloves are made of cotton or other fabric to provide varying degrees of protection.

Fabric gloves. These gloves can protect against dirt, slivers, chafing, and abrasion. These gloves do not provide sufficient protection, however, to be used with rough, sharp, or heavy materials.

Coated fabric gloves. Manufacturers normally make these gloves from cotton flannel with napping on one side. By coating the unnapped side with plastic, fabric gloves are transformed into general-purpose hand

protection offering slip-resistant qualities. These gloves are used for tasks ranging from handling bricks and wire rope to handling chemical containers in laboratory operations.

3- CHEMICAL-AND LIQUID-RESISTANCE GLOVES:

Gloves made of rubber (latex, nitrile, or butyl), plastic, or synthetic rubber-like material such as neoprene protect workers from burns, irritation, and dermatitis caused by contact with oils, greases, solvents, and other chemicals. The use of rubber gloves also reduces the risk of exposure to blood and other potentially infectious substances. Some common gloves used for chemical protection are described below. (In addition table 4 rates various gloves as protectors against specific chemicals.)

Butyl rubber gloves. These gloves protect against nitric acid, sulfuric acid, hydrofluoric acid, red fuming nitric acid, and peroxides. Highly impermeable to gases, chemicals, and water vapor, butyl rubber gloves also resist oxidation and ozone corrosion. In addition they resist abrasion and remain flexible at low temperature.

Natural latex or rubber gloves. In addition to resisting abrasions caused by sandblasting, grinding, and polishing, these gloves protect workers hands from most water solutions of acids, alkalis, salts, and ketones. **Neoprene Gloves.** These glove have good pliability, finger dexterity, high density, and tear resistance which protect against hydraulic fluids, gasoline, alcohols, organic acids, and alkalis.

Nitrile rubber gloves. These sturdy gloves provide protection from chlorinated solvents such as trichloroethylene and perchloroethylene. In addition nitrile gloves resist abrasions, punctures, snags, and tears.

4- INSULATED RUBBER GLOVES:

These gloves provide protection against electricity.



Figure5.7:

E- RESPIRATORY PROTECTION:

Respiratory protective devices fall into three classes:

- Air Purifying Devices
- Air Supplying Devices
- Combination air-purifying and air-supplying devices.

1- AIR PURIFYING DEVICES:

The air-purifying devices cleans the contaminated atmosphere. Chemicals can be used to remove specific gases and vapors and mechanical filters can remove particulate matters. This type of respirator is limited in its use to those environments where the air contaminant level is within the specified concentration limitation of the device. These devices do not protect against oxygen deficiency (percentage of oxygen by volume is less than 19.5 percent oxygen).



Figure 5.8:

The various types of air-purifying devices include:

1. Mechanical-filter cartridge
2. Chemical-cartridge
3. Combination mechanical-filter/chemical-cartridge
4. Gas Masks
5. Powered Air-Purifying Respirators (PAPR)

MECHANICAL-FILTER RESPIRATORS:

Offer protection against airborne particulate matter, including dusts, mists, metal fumes, and smoke, but do not provide protection against gases or vapors.

CHEMICAL-CARTRIDGE RESPIRATORS:

Afford protection against low concentrations of certain gases and vapors by using various chemical filters to purify the inhaled air. They differ from mechanical-filter respirators in that they use cartridge chemicals to remove harmful gases and vapors.

COMBINATION MECHANICAL-FILTER/CHEMICAL-CARTRIDGE:

Use dust, mist, or fume filters with a chemical cartridge for dual multiple exposures.

GAS MASKS:

Afford respiratory protection against certain gases, vapors, and particulate matters. Gas masks are designed solely to remove specific contaminants from the air, therefore, it is essential that their use be restricted to atmospheres which contain sufficient oxygen to support life. Gas masks may be used for escape only from atmospheres that are immediately dangerous to life or health (IDLH), but never for entry into such environments.

Canisters for gas masks are color-coded according to the contaminant against which they provide protection.

POWERED AIR-PURIFYING RESPIRATORS (PAPR):

Protect against particulates, gases and vapors, or particulates and gases and vapors. The air-purifying element may be a filter, chemical cartridge, combination filter and chemical cartridge, or canister. The powered air-purifying respirator uses a

power source (usually a battery pack) to operate a blower that passes air across the air-cleaning elements to supply purified air to the respirator. The great advantage of the powered air-purifying respirator is that it usually supplies air at positive pressure (relative to atmospheric).

2- AIR-SUPPLYING DEVICES:

Air-supplying devices are the class of respirators that provide a respirable atmosphere to the wearer, independent of the ambient air. Air-supplying respirators fall into three groups:

- Supplied-air respirators
- Self-contained breathing apparatus (SCBA)

- Combination-SCBA and supplied-air respirators

Supplied-air respirators:

Deliver breathing air through a supply hose connected to the wearer's facepiece or enclosure. The air delivered must be free of contaminants and must be from source located in clean air. Supplied-air respirators should only be used in non-IDLH atmospheres.

Self-contained breathing apparatus (SCBA):

Provide complete respiratory protection against toxic gases and an oxygen deficiency. The wearer is independent of the surrounding atmosphere because he or she is breathing with a system that is portable and admits no outside air.

3- COMBINATION AIR-PURIFYING AND AIR-SUPPLYING DEVICES:

It is a device that is a combination of an air-line respirator with an auxiliary air-purifying attachment, which protection in the event the air supply fails.



Figure5.9:

Proper Selection:

Respirators shall be selected on the basis of hazards to which the worker is exposed. In selecting the correct respirator for a given circumstance, many factors must be taken into consideration:

- The nature of the hazard
- Location of the hazardous area
- Employee's health
- Work activity
- Respirator characteristics, capabilities, and limitations.

In order to make subsequent decisions, the nature of the hazard must be identified to ensure that an overexposure does not occur.

One very important factor to consider is oxygen deficiency. Air-purifying respirators can be used only at atmospheres containing greater than 19.5 percent oxygen.

Training and Fitting:

The user must be instructed and trained in the selection, use and maintenance of respirators. Every respirator user shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly.

Fit Testing:

Fit testing is done to find both a style and a size of respirator that fits the individual best and is most comfortable. There are two types of fit testing: Quantitative fit testing and qualitative fit testing.

Field Testing:

Once the fit test has been performed and a respirator selected, the user should perform "field tests" on his respirator each time before entering the toxic atmosphere. These consist of both a negative-pressure test and a positive-pressure test.

These tests apply to respirators with either a cartridge, canister, or filter.

Negative-Pressure Test:

In this test, the user closes off the inlet of the canister, cartridge(s), or filter(s) by covering with palm(s) or squeezing the breathing tube; inhales gently so that the facepiece collapses slightly; and holds the breath for about 10 seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough.

Positive-Pressure Test:

The positive-pressure test is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage.



Figure 5.10:



Check Your Progress

- 1 What types of hat?
- 2 WHAT TYPES OF hazmat Chemical suits?
- 3 How does air Air-Purifying Respirators work?

4.5 SUMMARY...

- ▶ LEVEL A , Hazmat-Suit-Level-A, The highest level of protection for the skin, eyes and respiratory system that are all at risk when exposed to the dangerous chemicals in any state
- ▶ COMBINATION AIR-PURIFYING AND AIR-SUPPLYING DEVICES: It is a device that is a combination of an air-line respirator with an auxiliary air-purifying attachment, which protection in the event the air supply fails.

4.6 KEY TERMS

- ▶ **PPE:** is equipment that will protect the user against health or safety risks at work. It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE).
- ▶ **A hazmat suit:** (hazardous materials suit), also known as decontamination suit, is a piece of personal protective equipment that consists of an impermeable whole-body garment worn as protection against hazardous materials.

4.7 ANSWERS TO CHECK YOUR PROGRESS

1. There are 3 types of hat: A, B and C.
2. There are 4 types of hazmat suits.
3. These are known as air-purifying respirators. They have filters, cartridges, canisters or a combination of filters and cartridges/canisters that remove contaminants from the air by passing the ambient air through the air-purifying element before it reaches the user.

4.8 QUESTIONS AND EXERCISES

SHORT ANSWER QUESTIONS

1. What does PPE mean?

LONG ANSWER QUESTIONS

1. Name the parts of suit class A?



Further Reading

- 1 OSHA (<https://www.osha.gov/>)
- 2 NFPA (<https://www.nfpa.org/>)



References

- 1 OSHA (<https://www.osha.gov/>)
- 2 NFPA (<https://www.nfpa.org/>)

HAZMAT

