

Before you begin . . .



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Go to exercise,
Part Two

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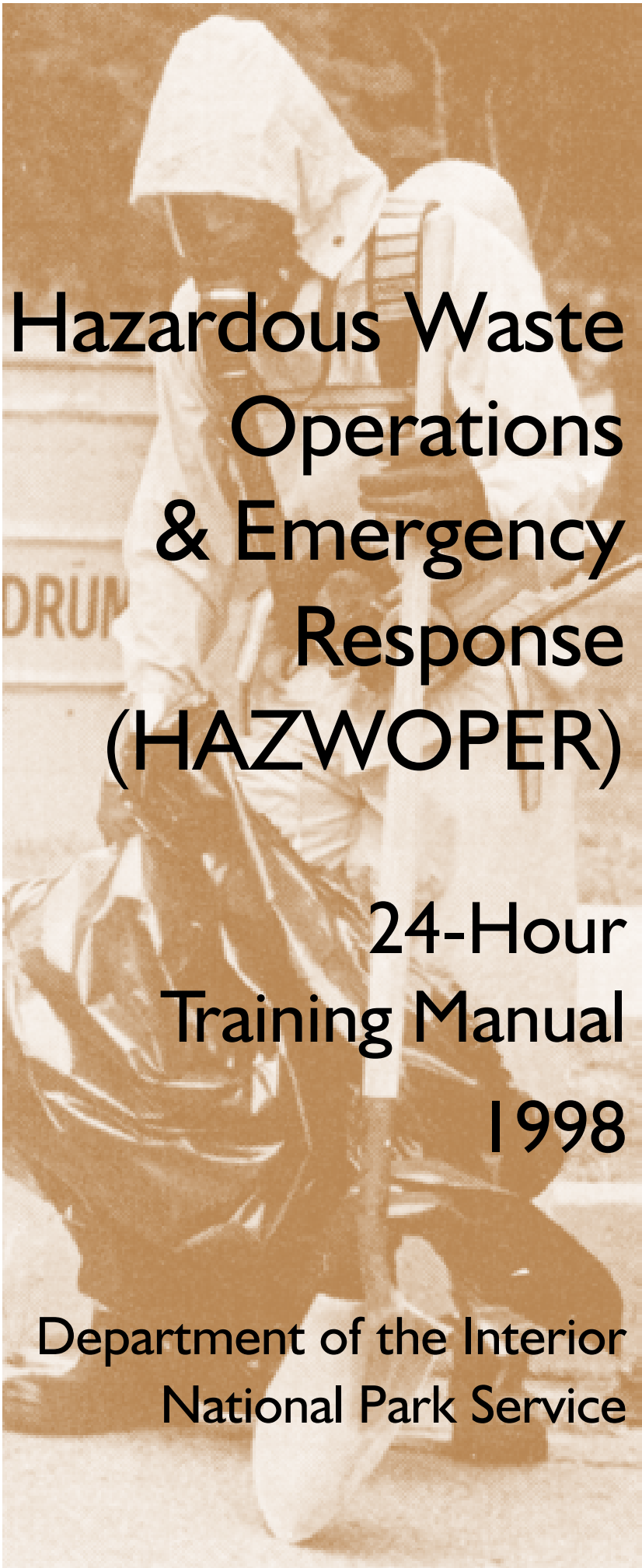
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As you go through the manual, keep an eye out for this chalkboard. Clicking on it will take you to an on-going class exercise that complements the manual.



Once you have finished the exercise, you can return to the manual by clicking on the "Return to Module . . ." button.

Click here to begin

A sepia-toned photograph of a person in a full-body white hazmat suit, including a hood and gloves, kneeling and working with a large black plastic bag. The person is in an industrial or outdoor setting with a wooden structure and a sign that says "DRUM" visible in the background.

Hazardous Waste Operations & Emergency Response (HAZWOPER)

24-Hour
Training Manual
1998

Department of the Interior
National Park Service

This HAZWOPER Training Manual meets the criteria for First Responder Operations Level as set forth in 29 CFR § 1910.120 (q)(6)(ii).

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ACKNOWLEDGEMENTS

This training manual is an updated version of the 1997 National Park Service (NPS) Hazardous Waste Operations and Emergency Response, 24-Hour Training Course. Contributors to its development include: NPS Risk Management Division; NPS Facilities Management; Alan Schroeder, U.S. Public Health Service; and Tanya Asman, HAZMED.



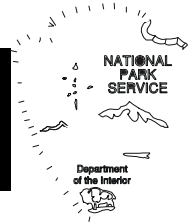
Module I Course Overview

HAZWOPER

**24-Hour
Training Manual**

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MODULE ONE - COURSE OVERVIEW

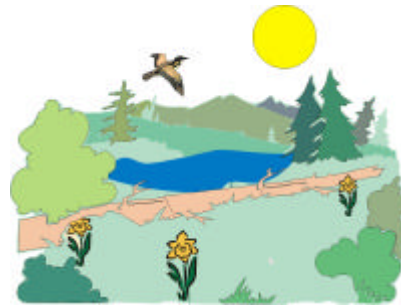
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WHY IS THIS COURSE IMPORTANT TO YOU?

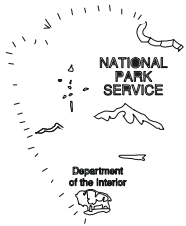
Although national parks seem an unlikely location for hazardous substances, they are present. Various park operations such as automotive and facility maintenance, pest management, historical preservation, and building renovation require that parks store or handle hazardous substances and/or wastes. Additionally, concessionaires may store hazardous materials; for example, underground storage tanks at gasoline stations may contain hazardous materials.

Protection of Human Health, Welfare, and Safety, and the Environment

Mismanagement of hazardous materials or substances, whether during daily operations or at the time of an accidental release into the environment, can lead to adverse health effects and even death of employees, and adverse effects on the environment. In order to prevent hazardous materials incidents (i.e., a situation in which a hazardous material is or may be released into the environment), it is important for park personnel most likely to work with hazardous materials or substances to learn proper management and handling techniques.



Additionally, park personnel should be able to recognize releases or threatened releases of hazardous substances and respond to such releases in a way that is protective of human health, welfare, and safety, and the environment. This course will instruct you in avoiding hazardous materials incidents through pollution prevention and waste minimization techniques. Should a hazardous materials incident occur, however, this course provides you with the training needed to respond efficiently and safely.



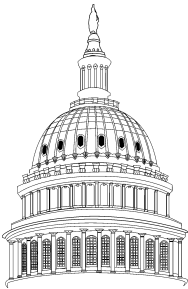
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HAZWOPER Training

Notes:

It's the Law

The Occupational Safety and Health Administration (OSHA) developed hazardous waste operations and emergency response (HAZWOPER) regulations and published them at 29 Code of Federal Regulations (CFR) § 1910.120. The regulations require that individuals in a workplace assigned to emergency response operations for releases of, or substantial threats of release of, hazardous substances, without regard to the location of the release, be properly trained in emergency response procedures (29 CFR § 1910.120 (a)(1)(v)).



OSHA also promulgated the Hazard Communication (HazCom) Standard (29 CFR § 1910.1200). This standard ensures that the hazards of all chemicals produced or imported are evaluated, and that information concerning the hazards associated with the chemicals is transmitted to employers and employees.

You are here because you may be required to respond to releases of hazardous materials or substances for either a park, Support Office, or at the Washington Office (WASO). This 24-hour course meets the training requirements for the First Responder at the Operational Level (29 CFR § 1910.120 (q)(6)(ii)).

COURSE OBJECTIVES AND MANUAL ORGANIZATION

The NPS developed this 24-hour course to fulfill three objectives; at the end of this course, you should be able to:

- (1) Recognize and safely handle the chemical hazards in your workplace (HazCom);
- (2) Respond to emergency releases of hazardous substances into the environment (HAZWOPER); and
- (3) Prevent hazardous materials incidents through pollution prevention and waste minimization techniques.

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HAZWOPER Training



This manual is organized into training modules designed to present topics under the OSHA standards as well as other NPS internal hazardous substance management objectives. The course also presents videos to enhance learning for subjects that benefit from visual interpretation (See [Appendix One](#) for a list of videos by topic area). The modules are as follows:

Notes:

Module One - Course Overview

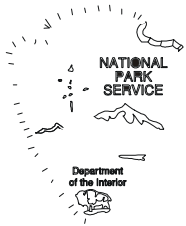
Module One introduces you to HAZWOPER and describes why the course is necessary, the basic learning objectives for the course, the course organization, and general administrative information (e.g., agenda, location of the bathroom). You will also have a pre-test exercise to assess your current knowledge and identify areas in which your understanding might be weak.

Module Two – Introduction to Hazards

Emergency response incidents may involve a variety of materials, many that pose health and safety concerns to site workers and visitors. These materials may be classified as either hazardous materials, hazardous substances, or hazardous wastes. The type of hazard these materials present may be categorized as either physical or health hazards. Module Two will introduce the basic concepts and terminology needed to determine the hazards presented by materials involved in an emergency response.

Module Three – Hazard Communication

OSHA's HazCom standard establishes requirements for chemical manufacturers, importers, and distributors, as well as for employers that use hazardous chemicals. The standard specifies requirements for ensuring that the hazards of all chemicals are evaluated and that the information is made available to affected employers and their employees through a hazard communication program, labeling, material safety data sheets (MSDSs), and employee training. Module Three will train students in the requirements of, and NPS's responsibilities in implementing, the HazCom standard.



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HAZWOPER Training

Notes:

Module Four – Toxicology

Emergency response incidents may trigger a number of health and safety concerns, among which contact with chemicals is foremost. This module introduces basic concepts in the field of toxicology that will aid site workers in recognizing toxic chemicals and their effects on the human body, as well as enable correct selection of personal protective equipment (PPE).

Module Five – Personal Protective Equipment

This module presents PPE, which is the last line of defense against toxic effects of hazardous substances. Used properly, PPE greatly decreases the risk of exposure to harmful substances as well as provides protection against biological and physical hazards. Choosing the appropriate PPE is just as important as wearing it, so this module also introduces the basic elements of the four levels of protection outlined by the Environmental Protection Agency (EPA).

Module Six – Responding to Emergency Releases of Hazardous Substances

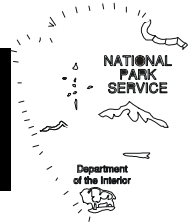
The training criteria for the First Responder (Operational Level) as defined under OSHA's HAZWOPER standard is presented in Module Six. Topics covered include: identifying hazards; developing an action plan, including safety and health and emergency response plans; zoning and securing the scene; managing the incident using the Incident Command System; obtaining assistance and reporting the spill; and terminating the response.

Module Seven – Confined Space Entry

Confined spaces present unique dangers to site workers. It is important that First Responders be able to recognize whether an emergency incident involves a confined space, and know that special precautions must be taken by those site workers with Confined Space Entry training. This module introduces the basic concepts associated with confined space entry hazards. In addition, this module addresses the safety concerns asso-

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ciated with energized equipment and machines. Specifically, Module Seven present lockout/tagout procedures that must be implemented prior to responding to an emergency involving energized equipment.

Notes:

Module Eight – Pollution Prevention/Waste Minimization

Pollution prevention (P2) and waste minimization are two of the most effective means by which NPS employees can reduce the risk of a hazardous materials incident. This module describes methods for reducing or eliminating waste volume and/or toxicity at the source (i.e., P2), how to minimize any waste that is created (i.e., waste minimization), and the types of programs available to NPS employees.

Module Nine – Review/8-Hour Refresher

Module Nine reviews the course material to reinforce the training objectives for new students and returning students. Key concepts are reviewed, including the "HAZMAT" acronym as a means for responding to and managing an emergency release of a hazardous substance, and PPE. An exercise requires students to use the knowledge gained throughout the course. At the end of Module Nine, students will participate in a field exercise intended to provide hands-on experience responding to an emergency. Students will don and doff PPE, set up zones around the release, assume roles within the Incident Command System, and identify defensive techniques for controlling the release.

Module Ten – Exam

Module Ten contains the Exam portion of the course.

Module Eleven – Class Exercise

Module Eleven presents a class exercise that is intended to be used throughout the course at referenced spots in the manual margin. The exercise presents a potential emergency incident that NPS personnel could face and asks students questions related to the scenario.



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Notes:

ADMINISTRATIVE INFORMATION

(Instructors – Discuss information regarding the location of bathrooms, water, telephones, and nearby food facilities.)

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EXERCISE

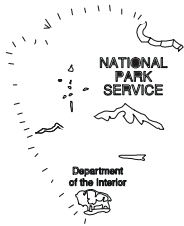
24-HOUR HAZWOPER TRAINING PRE-TEST

The following pre-test presents questions regarding the topics covered in this course. The purpose of the test is to introduce you to the topics, and to assess your current knowledge and reveal your strengths and weaknesses to allow you to focus your learning.

1. According to OSHA Standard 29 CFR § 1910.120, a Hazardous Waste Emergency First Responder (Operational Level) must have a minimum of how many hours of training?
 - A. 8 hours
 - B. 40 hours
 - C. 24 hours
 - D. 16 hours
 - E. None of the above

2. Chemicals enter into the bloodstream through which of the following pathways?
 - A. Ingestion
 - B. Inhalation
 - C. Skin absorption
 - D. A & B only
 - E. All of the above

3. According to the Hazard Communication Standard, supervisors must provide employees with an MSDS in:
 - A. English
 - B. Spanish
 - C. Employee's language
 - D. English and Spanish
 - E. None of the above



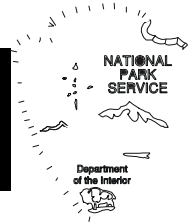
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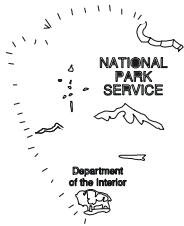
4. Match the description with the type of health hazard.
- | | |
|----------------------------------|-----------------|
| _____ Burns skin | A. Irritant |
| _____ Causes cancer | B. Corrosive |
| _____ Skin itch | C. Target organ |
| _____ Gene damage (sperm or egg) | D. Sensitizer |
| _____ Allergic response | E. Carcinogen |
| _____ Liver damage | F. Teratogen |
| _____ Fetus damage | G. Mutagen |
| _____ Freezes skin | H. Potentiation |
| | I. Cryogenic |
5. Will you know if you have been sensitized to a chemical at the time of your first exposure?
- A. Yes
 - B. No
6. Which of the following lists contain only major elements of a HazCom program Plan:
- A. Labeling, MSDSs, PPE, training, chemical inventory listing
 - B. Manifests, PPE, training, labeling, respirator management
 - C. MSDS, PPE, labeling, hazardous waste storage, training
 - D. Emergency spill response planning, PPE, hazardous materials inventory, labeling, respirator management
 - E. None of the above

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7. Label each statement either TRUE or FALSE.
- _____ I'll always be able to see, smell, or taste an exposure hazard.
 - _____ Most airborne hazards cannot be seen.
 - _____ If a smell disappears, I am no longer breathing the substance.
 - _____ Monitoring may be required to detect hazardous chemical exposures.
 - _____ Any chemical I can smell or taste is entering my body.
8. Workers need to know about the _____ in their workplace.
9. _____ are on chemical containers and provide information about the chemical contents.
10. _____ are chemicals that produce heat, gas, fire, or explode when mixed together.
11. As required by Subtitle C of the Resource Conservation and Recovery Act (RCRA), the mechanism for tracking the ultimate fate of a hazardous waste is known as a:
- A. UN/NA Label
 - B. HMIS Label
 - C. Uniform Hazardous Waste Manifest
 - D. Hazard Communication Inventory
 - E. None of the above
12. The process of removing hazardous chemicals from PPE is called _____.
13. As a First Responder on a spill site you should rush to the aid of a fallen co-worker.
- A. True
 - B. False



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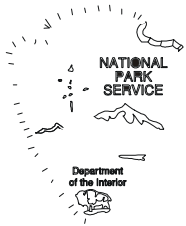
14. First Responders should approach a spill site upwind and upgrade.
- A. True
 - B. False
15. The first reference you should utilize at a hazardous chemical spill site involving a tractor-trailer rig would be which one of the following:
- A. *NIOSH Pocket Guide*
 - B. *ACGIH Threshold Limit Value Guide*
 - C. *DOT Spill Response Guidebook*
 - D. NFPA Hazardous Chemicals Guidebook
16. According to the National Contingency Plan (NCP), spills or other non-permitted releases of petroleum and hazardous substances must be reported to:
- A. OSHA
 - B. The National Response Center (NRC)
 - C. FEMA
 - D. CHEMTREC
 - E. The State
17. An open-head drum is used to contain solid materials.
- A. True
 - B. False
18. An overpack is used to contain a leaking 55-gallon drum.
- A. True
 - B. False

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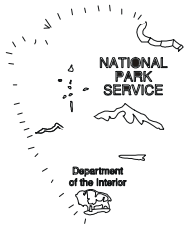
19. A high-efficiency particulate air (HEPA) filter removes what percentage of 0.3 micron smoke particles from the air?
- A. 100 percent
 - B. 99.97 percent
 - C. 94.97 percent
 - D. 88.88 percent
20. Organic vapor respirator cartridges are color-coded:
- A. Yellow
 - B. Green
 - C. Black
 - D. Purple
21. EPA mandates different levels of PPE. The level of PPE that consists of work clothes and no respirator is:
- A. Level A
 - B. Level B
 - C. Level C
 - D. Level D
22. Which one of the following materials or products listed below is not listed in the EPA's initial procurement guidelines for recovered-content purchases?
- A. Cement and concrete containing fly ash
 - B. Retreaded tires
 - C. Re-refined oil
 - D. Automotive batteries
 - E. Building insulation



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23. OSHA's permissible exposure limits (PELs) are outlined in which section of the Code of Federal Regulations (CFR)?
- A. 29 CFR 1910.134
 - B. 29 CFR 1910.1200
 - C. 29 CFR 1910.120
 - D. 29 CFR 1910.1000
24. 24-hour technical assistance (regarding hazardous chemicals) can be obtained by contacting:
- A. The US Department of Interior
 - B. CHEMTREC
 - C. NIOSH
 - D. ACGIH
 - E. All of the above
25. According to 29 CFR § 1910.1030, employees who are in contact with _____ would be eligible to receive Hepatitis B Vaccinations and related awareness training:
- A. Hazardous waste
 - B. Radioactive waste
 - C. Blood products or other body fluids
 - D. Hostile bosses
 - E. None of the above
26. What is the target organ for the following chemicals: alcohol, carbon tetrachloride, kepone, and vinyl chloride?
- A. Brain
 - B. Liver
 - C. Kidneys
 - D. Heart



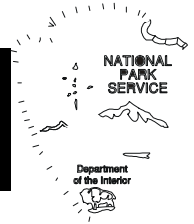
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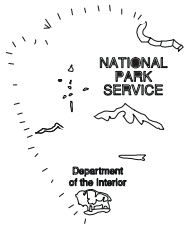
27. A medical surveillance program is required under OSHA 29 CFR 1910.120 for employees who are exposed to hazardous substances at or above exposure limits for 30 days or more per year.
- A. True
 - B. False
28. OSHA's confined space regulations are found in which set of regulations:
- A. 29 CFR 1910.134
 - B. 29 CFR 1910.119
 - C. 29 CFR 1910.146
 - D. 29 CFR 1910.120
29. Which of the following would not be considered a confined space under the definition provided in 29 CFR 1910.146?
- A. A sewage lift station
 - B. A trench
 - C. A utility vault
 - D. NPS Seasonal Employee Housing
 - E. All of the above
 - F. None of the above

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30. The first piece of analytical equipment that you should use on a spill site to identify potential hazards is the:
- A. Oxygen meter
 - B. Combustible gas indicator
 - C. Dragger sampling tubes
 - D. Radiation meter
31. Detector tubes have a minimum shelf life of:
- A. 4 years
 - B. 2 years
 - C. Indefinite
 - D. 10 years
32. According to RCRA, the characteristics for determining if a substance is a hazardous waste are:
- a) Reactive, stable, ignitable, corrosive
 - b) Reactive, ignitable, corrosive, toxic
 - c) Explosive, reactive, corrosive, unstable
 - d) Flammable, reactive, radioactive, synergistic
 - e) None of the above
33. Which Federal agency promulgated the HM-181 regulations?
- A. Department of Transportation
 - B. Department of Commerce
 - C. EPA
 - D. OSHA
34. Hazardous waste treatment, storage, transport, and disposal regulations are found in?
- A. 29 CFR
 - B. 49 CFR
 - C. 10 USC
 - D. 40 CFR



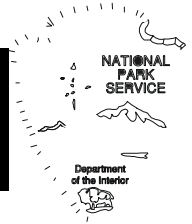
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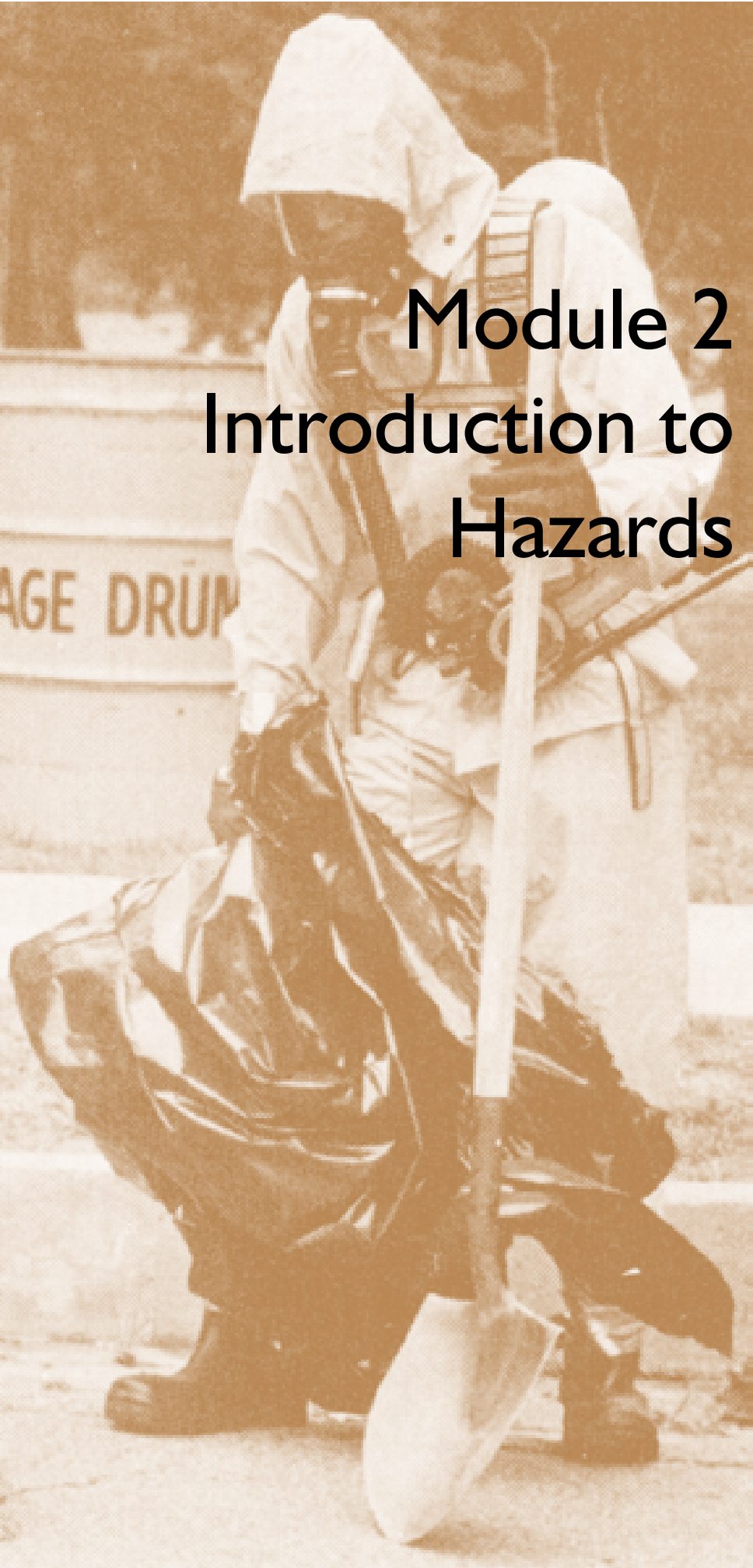
35. If you were entering a spill site and your combustible gas indicator read 25% of the L.E.L. you should:
- A. Proceed with caution
 - B. Leave the site immediately
 - C. Continue with the survey
 - D. None of the above
36. According to Subtitle C of RCRA, NPS is responsible for hazardous waste from the day it is generated until:
- a) It is lawfully disposed of
 - b) It is transported off-site
 - c) Forever
 - d) A signed manifest is received from the TSDF
 - e) All of the above
37. The key focus of a pollution prevention (P2) program should be:
- a) Using "upstream" technologies to remove the product from the waste stream at the source (e.g., product substitution)
 - b) Recycling generated wastes (e.g., used oil, etc.)
 - c) Developing emergency spill response procedures
 - d) Labeling all hazardous materials in use at the facility
38. Who is responsible for your health and safety when working with hazardous materials?
- a) NPS
 - b) Your supervisor
 - c) You
 - d) All of the above
 - e) None of the above

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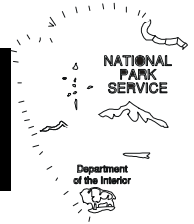
39. Compliance with the Hazard Communication Standard (a.k.a. "Right-to-Know) is required by:
- A. Federal Regulation (29 CFR § 1910.1200)
 - B. Executive Order (E.O. 12196)
 - C. Departmental policy (485 DM)
 - D. Agency guideline (NPS 50)
 - E. All of the above



Module 2 Introduction to Hazards

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE TWO – INTRODUCTION TO HAZARDS

At the end of this module, you should be able to:

- ◆ Determine whether a substance is a hazardous substance, hazardous waste, hazardous material, or a hazardous chemical
- ◆ Recognize typical hazardous substances found at National Parks
- ◆ Identify pertinent statutes, regulations and standards
- ◆ Identify the Federal agencies responsible for regulating hazardous substances

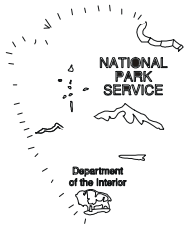
There are many definitions and descriptive names used for hazardous materials, each of which depends on the nature of the problem being addressed. The definitions are agency dependent and can be somewhat confusing. It is important to realize that Federal agencies, and State and local governments have different purposes for regulating the hazardous materials that can pose risks to the public or the environment.

WHAT IS A HAZARDOUS SUBSTANCE?

EPA uses the term “hazardous substances” for chemicals that, if released into the environment above a certain amount, must be reported, and depending on the threat to the environment, Federal involvement in handling the incident can be authorized. A list of the EPA hazardous substances is published in Title 40, Code of Federal Regulations, Part 302, Table 302.4.

OSHA uses the term “hazardous substance” in [Title 29, CFR Part 1910.120](#), which covers emergency response. The term hazardous substance as defined by OSHA is:

“...any substance...which [through exposure] results or may result in adverse affects on the health or safety of employees.” (29 CFR 1910.120(a)(3)).



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Notes:

Put simply, a hazardous substance is anything that through either short-term contact or prolonged exposure, is capable of causing infection or other health-related problems, including serious injury or death. For the purpose of the OSHA definition, petroleum products *are* considered hazardous substances. (CERCLA excludes petroleum products from its definition of hazardous substance.)

OSHA and EPA use the term differently. As used by OSHA, hazardous substance means every chemical regulated by both DOT and EPA.

WHAT IS A HAZARDOUS WASTE?

EPA uses the term “hazardous waste” for chemicals that are regulated under the Resource, Conservation, and Recovery Act (RCRA). EPA has specified at 40 CFR Part 261 that a solid waste is hazardous if is not excluded from regulation as a hazardous waste and meets any of the following conditions:

1. Exhibits any of the characteristics of a hazardous waste.
2. Has been named as a hazardous waste and listed as such in the regulation.
3. Is a mixture containing a listed hazardous waste and a nonhazardous solid waste.
4. Is a waste derived from the treatment, storage, or disposal of listed hazardous waste.

EPA has identified four characteristics for hazardous waste. Any solid waste that exhibits one or more of these characteristics is classified as hazardous under RCRA:

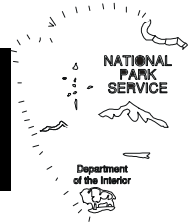
- ◆ Ignitability;
- ◆ Corrosivity;
- ◆ Reactivity; or
- ◆ Extraction Procedure (EP) Toxicity.

40 CFR 261.20 through 261.24 defines the properties of wastes exhibiting any or all of the existing characteristics listed above.

When hazardous wastes being transported, they are regulated by DOT.

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WHAT IS A HAZARDOUS MATERIAL?

Notes:

DOT uses the term “hazardous materials” to cover 11 hazard classes, some of which have subcategories called “divisions.” DOT includes in its regulations hazardous substances and hazardous wastes as class 9 (Miscellaneous Hazardous Materials), both of which are regulated by the EPA.

WHAT IS A HAZARDOUS CHEMICAL?

OSHA uses the term “hazardous chemicals” to denote any chemical that would be a risk to employees if exposed in the workplace. The term “hazardous chemicals” covers a broader group of chemicals than hazardous substances, hazardous wastes, and hazardous materials.

WHAT IS THE DIFFERENCE?

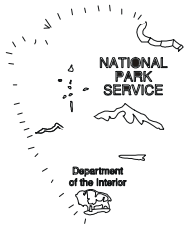
For all practical purposes, when **INITIALLY** responding to an emergency release, it is critical to identify that the substance released is in fact **HAZARDOUS**. Whether the released matter is classified as a substance, chemical, material, or waste can be determined as the response continues.

Hazards come in many shapes and sizes. Many are easy to recognize, such as a burning building, while others can go unnoticed until it is too late, such as a release of clear, odorless gases. The first step to controlling such hazards is understanding the circumstances at National Parks under which you may be exposed and the types of hazard associated with such circumstances.

TYPICAL HAZARDOUS CHEMICALS USED AT PARKS

There are hazardous chemicals that are commonly found at National Parks. These include:

- ◆ Automotive: motor oil, fuel, lubricants, and fluids
- ◆ Facility maintenance: ammonia, chlorine (bleach), sodium hydroxide (drain cleaner), turpentine, paint and related materials



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Notes:

- ◆ Preservation/renovation: lead-based paint, acetone, asbestos, glues, paints, cleaners
- ◆ Pest management: pesticides, insecticides, fungicides, and herbicides
- ◆ Security: chemical mace, CN/CS gas, OC, biohazardous substances

PHYSICAL PROPERTIES OF HAZARDOUS SUBSTANCES

Chemical compounds possess inherent properties that determine the type and degree of hazard they represent.

Boiling Point

The boiling point is the temperature at which a liquid changes to a vapor, that is, it is the temperature where the pressure of the liquid equals the atmospheric pressure.

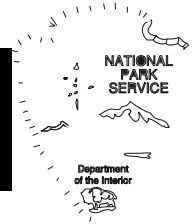
Boiling point is important because it can dictate the route of entry. For liquids with a high boiling point the most common route of entry is by body contact, while for liquids with a low-boiling point the most common route of entry is inhalation.

Vapor Pressure

The pressure exerted by a vapor against the sides of a closed container is called “vapor pressure.” Vapor pressure is temperature dependent; as the temperature increases, so does the vapor pressure.

Vapor pressure is important for two reasons.

1. If a chemical has a high vapor pressure, more of it will be in the air than a chemical with low vapor pressure. If the material is toxic or flammable, the vapors are extremely dangerous.



2. The higher the vapor pressure of a chemical in a sealed container the more likely it is to burst as the temperature rises.

Notes:

Vapor Density

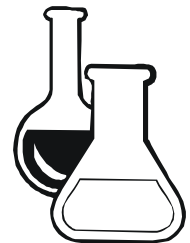
The density of a gas or vapor can be compared to the density of the ambient atmosphere. If the density of a vapor or gas is greater than that of the ambient air, then it will settle to the lowest point; and if the vapor density is close to air density or lower, the vapor will tend to disperse in the atmosphere. It is, therefore, important to know the vapor density of gases or vapors, since it can determine the proper response action at an emergency release.

Density/Specific Gravity

The density of a substance is its mass per unit volume, commonly expressed in grams per cubic centimeter (g/cc). If the specific gravity of a substance is greater than 1 it will sink in water. The substance will float if its specific gravity is less than 1. This is an important factor to consider when evaluating mitigation and treatment methods.

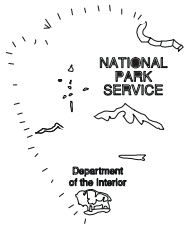
Solubility

The ability or tendency of a substance (solid, liquid, gas, or vapor) to blend with another to produce a uniformly dispersed mixture is its solubility. An insoluble substance can be physically mixed or blended in a solvent for a short time, but is unchanged when it finally separates. The solubility of a substance is independent of its density or specific gravity.



Melting Point

The temperature at which a solid changes phase to a liquid is its melting point. This temperature is also the freezing point, since a liquid can change phase to a solid. If a substance has been transported at a temperature that maintains a solid phase, then a change in temperature may cause the solid to melt. The particular substance may exhibit totally different properties in each of its phases. One phase could be inert while the other phase is highly reactive. Therefore, it is imperative to recognize the possibility of a substance changing phase due to changes in ambient temperature.



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Flashpoint

If the ambient temperature in relation to the material of concern is right, then it may give off enough vapor at its surface to allow ignition by an open flame or spark. The minimum temperature at which a liquid or volatile solid produces sufficient flammable vapors to ignite is its flashpoint. If the vapor does ignite, combustion can continue as long as the temperature remains at or above the flashpoint. The lower the flashpoint, the greater the fire hazard of a material.

TYPES OF HAZARDS

Flammables and Combustibles

Flammables are any solid, liquid, vapor, or gas that will ignite easily and burn rapidly. Solid flammables include dusts, and powders such as charcoal and aluminum, and also include low ignition point materials such as films and fibers. DOT defines flammable liquid as a liquid having a flash point of not more than 60.5°C (141°F), or any material in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and transported at or above its flash point (See 49 CFR 173.120 (a) for exceptions). EPA states that a material exhibits the characteristics of ignitability if it is a liquid that has a flash point less than 60°C (140°F). Flammable gases ignite easily and may be explosive if confined in a canister or cylinder.



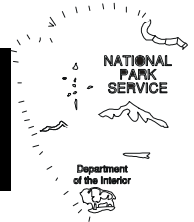
Combustibles ignite only after being heated to their flashpoint temperature. Any solid that is capable of burning is considered a combustible. DOT defines a combustible liquid as any liquid that does not meet the definition of any other hazard class and has a flash point *above* 60.5°C (141°F). A flammable liquid with a flash point at or above 38°C (100°F) may be reclassified as a combustible.

Oxidizers

Oxidizers are substances that are able to supply oxygen chemically or supplement oxygen with other oxidizing gases enabling the support of fire.

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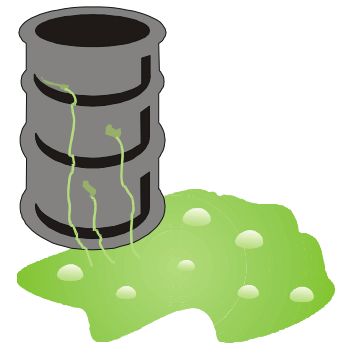


Oxidizers can exist in the form of a solid, liquid, or gas. Some common oxidizers include chlorine, peroxides and nitrates.

Notes:

Corrosives

Corrosive hazards are substances that cause the deterioration of other materials. A corrosive may eat through and destroy metal, body tissue, plastics, and other materials. Corrosives can be in the form of solids, liquids, or gases. Corrosives may burn on contact and may cause permanent damage. Danger also exists if corrosives are dispersed into the air. Corrosivity can be characterized by a substance's pH value. The pH of a chemical is a measure of acidity (corrosive) to alkalinity (base). Chemicals are measured on a scale of 0 to 14 with 7 being neutral (pure water), 0 being highly acidic (hydrochloric acid), and 14 being highly alkaline (caustic soda).



Reactives

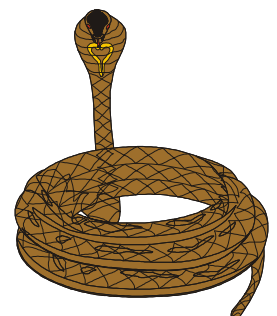
A reactive hazard is a substance that will vigorously decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.

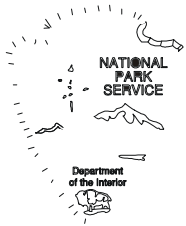
Explosives

Explosives are substances that undergo a very rapid chemical transformation with a violent release of pressure and heat. Some explosives can be detonated by shock, heat, or friction, while others are less volatile and need a booster to detonate.

Natural Hazards

Although not a hazardous substance release, natural hazards can present the need for emergency response. Because at national parks, especially those in the western United States, workers and visitors may be subject to these natural hazards, a discussion of recommended response actions is warranted. Table 2-1 describes potential natural hazards.





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Protection against most natural hazards can be achieved by wearing protective clothing such as boots, gloves, and long sleeved shirts and pants of sturdy material. General safety precautions include the following:

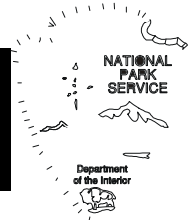
- ◆ Avoid plants and animals suspected of being poisonous;
- ◆ Wear high boots or chaps and heavy gloves if entry into a suspected snake habitat;
- ◆ Wear a gauze mask if gnats or similar annoying insects are present;
- ◆ Wear heavy pants, long-sleeved shirt, boots, and gloves if poisonous spiders are expected;
- ◆ Wear heavy pants, long-sleeved shirt, boots, and gloves if poisonous spiders are expected;
- ◆ Wear gloves, a long-sleeved shirt, and pants of heavy material if traversing outlying areas with thorny plants; and
- ◆ Identify site workers who are allergic to wasp or bee stings to be alert to the possibility that these people may go into anaphylactic shock if bitten or stung. Instruct these workers to carry appropriate medication with them on the job.

Potential exposure to biological hazards can be ascertained prior to approaching a hazardous material incident by reviewing the following information:

- ◆ Location of the facility (to determine which indigenous plants or animals may be present);
- ◆ Age of buildings and equipment (older facilities may house rodents);
- ◆ Layout (or floor plan) of building(s) (open buildings may allow animal and insect access); and
- ◆ Inspection task (whether the incident has occurred inside or outside of a building).

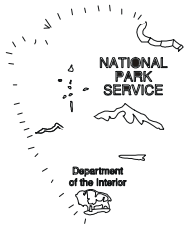
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Hazard Description	Considerations/Precautions	Possible Needs
Poisonous Insects (Bees, Spiders, Scorpions, etc.)	<ul style="list-style-type: none"> - Medical attention in close proximity. - Allergic reactions (anaphylactic shock) can be deadly. - All persons allergic to insects should be identified and required to carry the appropriate medication. 	Nearby medical facility Ice packs Bee sting kit if workers are allergic Long-sleeved shirt (heavy) Long pants (heavy) Gloves and boots
Snake Bites	<ul style="list-style-type: none"> - Can cause severe reactions, including death. - Ask person to lie down and keep him/her calm; elevated heart rates speed the distribution of venom. - Avoid all contact with snakes. - Wear heavy-duty PPE. 	Nearby medical facility Heavy duty gloves Calf-high boots Chaps
Animal Bites (Foxes, Dogs, Raccoons, Bats, etc.)	<ul style="list-style-type: none"> - Rabies may infect any warm blooded animal. - Rabies is a deadly condition with a mortality rate of almost 100% if medical attention is not administered. 	Immediate medical attention for a bite by a wild animal
Poisonous Plants	<ul style="list-style-type: none"> - Never ingest plants at a work site. - Eliminate contact with the skin by wearing long-sleeved shirt, long pants, and gloves. - Never burn plants. - Wash with mild soapy water to remove oily plant residue. - Cover all abrasions and scratches to eliminate entranceways for infection. 	Long-sleeved shirt Long pants Gloves Soap and water solution
Pathogenic Agents	<ul style="list-style-type: none"> - Avoid contact with local surface waters, especially if there is a potential that the water receives untreated sewage. - Wear protective clothing and equipment if exposure is expected. - Wash thoroughly if contact is made with skin. 	Protective clothing (e.g., tyvek suit) Rubber boots Rubber gloves Dust/mist respirator Soap and water solution
Heat Stress	<ul style="list-style-type: none"> - Work during cooler hours if possible. - Provide shading of the work area. - Take more frequent breaks. 	Nearby medical facility Change of clothing Water hose Ice vests (optional)
Cold Stress	<ul style="list-style-type: none"> - Wear heavy clothing: a hat, gloves, and boots. - Eliminate contact with water. - Do not take drugs that restrict blood flow. - Work in a sheltered area if possible. - Maintain a high-calorie intake. 	Nearby medical facility Warm clothing





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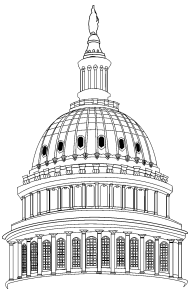
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APPLICABLE LAWS, REGULATIONS, AND STANDARDS

Overview

This section presents the various laws and regulations that govern hazardous waste operations. OSHA and EPA have established many standards by which hazardous waste and hazardous materials are controlled, including regulation 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, which mandated this training course. The rights and responsibilities that go hand-in-hand with these ordinances are also presented.

EPA regulates hazardous materials and wastes according to four major Acts: the Occupational Safety and Health (OSH) Act; the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Superfund Amendments and Reauthorization Act (SARA). Other EPA regulations include: the National Environmental Policy Act (NEPA); the Clean Water Act (CWA); the Clean Air Act (CAA); the Toxic Substances Control Act (TSCA); the Safe Drinking Water Act (SDWA); and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).



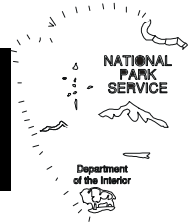
DOT monitors the transportation of hazardous materials from production to final disposition at a treatment, storage, or disposal facility. DOT regulations provide for material manifests, container labels, and truck placards. The transportation of hazardous wastes, however, is regulated under RCRA.

OSHA is contained within the Department of Labor (DOL) and is its primary vehicle for worker health and safety regulation. The National Institute of Occupational Safety and Health (NIOSH) conducts research on health and safety issues and aids and influences OSHA in forming regulations. OSHA was the first regulator to deal comprehensively with health and safety issues for hazardous waste operations.

NPS is concerned with these various laws due to several Executive Orders mandating that all Federal agencies come into compliance with all laws with which private industry must comply. One of these mandates is Executive

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Order 12196, signed by President Carter in 1979, which requires all Federal agencies to establish safety programs and to comply with all OSHA standards.

Notes:

Occupational Safety and Health (OSH) Act

The OSH Act was passed by Congress in 1970. It consolidated many of the previous safety and health laws into one comprehensive law. The OSH Act created three agencies: OSHA, NIOSH, and the Occupational Safety and Health Review Commission.

Employee Rights and Responsibilities

The OSH Act was written to ensure a safe and healthful work environment for all workers in the nation. The standards implemented by this Act were mandated by Executive Order 12196 and entitle all NPS employees to certain rights and obligate them to certain responsibilities concerning occupational health and safety.

Employee Rights:

- ◆ Work under safe and healthful conditions, free of recognized hazards.
- ◆ Have basic and, when necessary, specific health and safety training.
- ◆ Be provided with personal protective equipment, at no cost, if it is required to perform the job.
- ◆ Request postponement of an unsafe investigation or inspection until conditions are safe.
- ◆ Report hazardous working conditions without penalty.
- ◆ Participate in the occupational medical monitoring program if their lab work exposes them to hazards.



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Employee Obligations:

- ◆ Comply with OSHA health and safety standards and regulations.
- ◆ Report to work able to perform assigned duties.
- ◆ Use the personal protective clothing and equipment provided.
- ◆ Observe all rules, signs, and instructions relating to personal safety.
- ◆ Obtain a baseline medical examination that includes confirmation of fitness for duty (if the job requires it).
- ◆ Report unsafe and unhealthful working conditions.
- ◆ Report accidents, injuries, and property damage.

OSHA 29 CFR 1910.120

All NPS employees are also entitled and required to have basic safety and health training for field activities, and training that is specific to the hazards encountered in assigned activities. This training is mandated by regulation 29 CFR § 1910.120 (for additional information see Module 3).

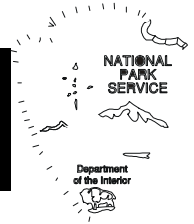
The Hazardous Waste Operations and Emergency Response Standard (HAZWOPER)

Until 1986, hazardous waste operations were regulated by a multitude of health and safety regulations administered by various organizations. The first regulation to deal comprehensively with health and safety for hazardous waste operations was the OSHA Hazardous Waste Operations and Emergency Response Standard. This standard applies to workers involved in hazardous emergency response, waste management, and cleanup operations.

In addition, general industry standards, standards for construction, and others covering areas such as fire protection, hand and portable powered tools, and walking/working surfaces have been promulgated by OSHA and apply

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at sites where hazardous waste activities are ongoing.

Notes:

The National Oil and Hazardous Substances Pollution Contingency Plan, also known as the National Contingency Plan (NCP), outlines the official U.S. environmental policy on the emergency response and remedial action section of CERCLA. All response activities performed under the NCP must meet OSHA health and safety regulations.

OSHA's hazardous waste standards apply to employers and employees engaged in four activities:

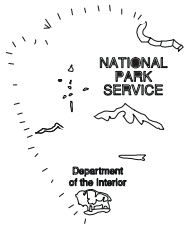
1. Hazardous substance response operations under CERCLA.
2. Major corrective actions under RCRA.
3. RCRA-regulated waste operations.
4. Other hazardous waste and emergency response operations.

OSHA also requires that industrial or generator facilities must inaugurate an emergency response plan to handle anticipated onsite emergencies prior to beginning hazardous waste operations. This plan must address the following:

- ◆ Pre-emergency planning;
- ◆ Emergency recognition and prevention;
- ◆ Personnel roles, site security, and control;
- ◆ Decontamination;
- ◆ Personal protective and emergency equipment;
- ◆ Emergency medical equipment;
- ◆ Evacuation routes and procedures;
- ◆ Emergency alerting and response procedures; and
- ◆ Post-emergency critique of response and follow-up.

OSHA's Hazard Communication Standard

The Hazard Communications Standard (HazCom), issued by OSHA, is designed to ensure that workers are informed about chemical hazards in the



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workplace. HazCom originally applied only to specific manufacturers, but the August 24, 1987, amendment expanded its scope to all employers. This amendment became effective June 24, 1988.

HazCom applies to all hazardous chemicals determined to be either a physical or health hazard. Due to the broad definition of a hazardous chemical, no comprehensive list has ever been compiled. Employers are thus charged with the responsibility of determining whether any particular substance is subject to the HazCom requirements. There are certain substances that HazCom always deems as hazardous, however, and these substances are those that other organizations or statutes (OSHA, the American Conference of Governmental Industrial Hygienists, the National Toxicology Program, the International Agency for Research on Cancer, and 29 CFR Part 1910 Subpart Z) have already defined as hazardous.

Exempted from HazCom regulation are the following:

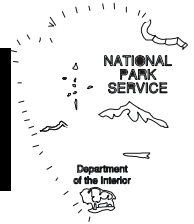
- ◆ RCRA Subtitle C wastes;
- ◆ Tobacco products;
- ◆ Wood products;
- ◆ Food, drugs, cosmetics, and alcohol;
- ◆ Consumer products;
- ◆ Certain pharmaceuticals; and
- ◆ Manufactured articles that do not release hazardous chemicals under normal conditions of use.

The HazCom Standard has five principal elements:

- ◆ **Hazard Determination:** Determining whether a particular substance meets the definition of either a health or physical hazard is the first in the HazCom program.
- ◆ **Labeling:** Manufacturers, importers, and distributors must ensure that all containers of hazardous chemicals are labeled properly.
- ◆ **Material Safety Data Sheets (MSDSs):** Preparation of MSDSs are the responsibility of the chemical manufacturer or importer.

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- ◆ **Hazard Communication Program:** Employers must have a written program describing how the requirements for labeling MSDSs and training will be met; how employees will be informed of the risks of nonroutine tasks; how the employees of the contractors will be informed of potential hazards; and suggestions for protective measures. The written program must also include a list of all hazardous chemicals present in the workplace.
- ◆ **Information and Employee Training:** Employees must be informed of all instances of hazardous chemicals in their work areas and must be trained accordingly. Employees must also be informed of the location and availability of the employer's written Hazard Communication Program.

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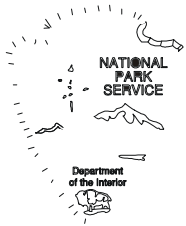
The Resource Conservation and Recovery Act (RCRA)

RCRA was enacted in 1976 as an amendment to the Solid Waste Disposal Act. RCRA regulates treatment, storage, and disposal facilities and the transportation of hazardous wastes. RCRA has three main goals:

1. To protect human health and the environment;
2. To reduce waste and conserve natural resources; and
3. To reduce or eliminate generation of hazardous waste.

The areas it addresses include solid hazardous and medical waste management, as well as underground storage tanks.

RCRA sets minimum standards and guidelines that are implemented at State and local levels. It promotes environmentally sound disposal methods and fosters resource conservation for waste identification, waste generator and transportation facility operation, permit issuance, corrective action, and enforcement. RCRA regulates petroleum products and hazardous substances stored in underground tanks, assigning primary enforcement responsibility to the States. RCRA also addresses medical waste disposal and has a public participation program including comment on decisions, information reports and meetings, and an outreach effort with a hotline and an Office of Ombudsman.



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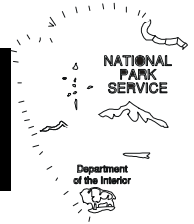
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RCRA is implemented by EPA in 40 CFR. The following parts of the regulation are of interest to NPS with regard to this training:

- ◆ **40 CFR Part 260, Hazardous Waste Management System (General).** Includes definitions and general provisions applicable to all of RCRA Subtitle C. This part also includes flow charts to assist in the interpretation of definitions and the regulatory provisions.
- ◆ **40 CFR Part 261, Identification and Listing of Hazardous Waste.** Defines solid and hazardous wastes, allows for exclusions of certain waste and provides special considerations for small quantity generators and for hazardous wastes that are used, reused, recycled, or reclaimed. The characteristics of hazardous waste (ignitability, corrosivity, reactivity, and toxicity) are defined. Finally, lists of hazardous wastes are presented.
- ◆ **40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste.** Establishes the responsibilities of hazardous waste generators; primarily, obtaining an ID number, preparing a manifest, ensuring proper packaging and labeling, and recordkeeping and reporting.
- ◆ **40 CFR Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.** Establishes the requirements and technical standards that owners and operators of hazardous waste treatment, storage, and disposal facilities must meet.
- ◆ **40 CFR Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.** Establishes the requirements and technical standards that owners and operators of hazardous waste treatment, storage, and disposal facilities must meet in order to continue operating until a final permit can be issued for their facility.
- ◆ **40 CFR Part 268, Land Disposal Restrictions.** Identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.

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- ◆ **40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks.** Prohibits the installation of any new underground storage tank for regulated substances unless the tank is protected against corrosion and structural failure and is compatible with the substance to be stored. This part also establishes the upgrade requirements for existing tanks regarding corrosion protection and leak detection.

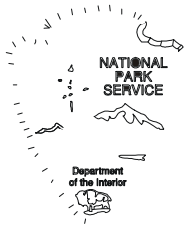
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The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA, commonly known as “Superfund,” was enacted in 1980. It provides broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA also sets aside funds for a safety training program for employees who respond to hazardous waste releases. One source of CERCLA funds is a special tax on the chemical and petroleum industries. In the first five years, \$1.6 billion were collected and placed in a trust fund.

In 1986, the Superfund Amendments and Reauthorization Act (SARA) increased CERCLA’s trust fund to \$8.5 billion over five years. Under the Superfund program, EPA can pay for cleanup, take legal action, make short-term removals, and/or take longer term remedial responses to any site on the National Priorities List (NPL). The NPL is EPA’s list of uncontrolled or abandoned hazardous waste sites. Remedial response paid for by CERCLA may include any of the following:

- ◆ Destroying, detoxifying, or immobilizing hazardous substances through incineration or treatment;
- ◆ Containing substances onsite;
- ◆ Removing substances to a waste facility for treatment, containment, or destruction; and/or
- ◆ Identifying and restoring contaminated groundwater.



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Notes:

CERCLA legislation differs from other environmental statutes in that its principal intent is to remediate contamination that has already occurred, while other statutes impose standards on current activities in order to prevent the release of contaminants. An important concept behind this legislation is to establish the “no fault” liability of facility owners and operators, generators, and certain transporters of hazardous substances for releases of those materials. However, this legislation does allow for the imposition of financial responsibility on these same parties.

A multi-step method is followed to determine the best solution to an environmental cleanup problem under Superfund. The steps are:

- ◆ Remedial investigation (RI) to assess the extent and nature of contamination;
- ◆ Feasibility study (FS) to provide quantitative evaluation;
- ◆ Remedial design (RD) to develop the remedial action; and
- ◆ Remedial action (RA) to correct the deficiency.

CERCLA is enforced by the EPA and is not intended for delegation to individual States. However, States may become involved through a “lead agency” position for a specific site or if acting as a “citizen” when pursuing remedial action through a citizen’s suit.

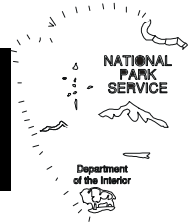
A community relations program linking EPA to the public is also an important element of the Superfund program. Community relations programs involve public hearings, formal and informal public meetings, and workshops and newsletters and other mailings.

Superfund Amendments and Reauthorization Act (SARA) Title III, Emergency Planning and Community Right-to-Know Act (EPCRA)

EPCRA, enacted October 17, 1986, ensures that the general public has access to information about any chemicals present in their communities. It is a separate, free-standing law included as Title III to the SARA of 1986. EPCRA has two main subtitles. Subtitle A requires the development of com-

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prehensive local emergency response plans for chemical release situations. New reporting requirements for chemical releases are also included under Subtitle A. Subtitle B imposes new “community right-to-know” reporting requirements that now make virtually all information available to the public.

Notes:

Subtitle A of EPCRA mandates the establishment of State Emergency Response Commissions (SERCs) by the governor of each State. Each SERC then designates “emergency planning districts” and appoints Local Emergency Planning Committees (LEPCs) for each district. SERCs are responsible for overseeing State implementation of EPCRA. Each LEPC must write an emergency plan for its district; the SERC makes recommendations for and reviews each plan under its jurisdiction. Each plan must include:

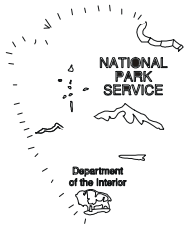
- ◆ Covered facilities and transportation routes;
- ◆ Responsible personnel;
- ◆ Notification procedures;
- ◆ Methods for estimating releases and areas likely to be affected;
- ◆ Emergency equipment and facilities;
- ◆ Evacuation plans;
- ◆ Training; and
- ◆ Exercises.

All companies are required to report to the SERC the identity of each facility that contains any substance on EPA’s list of “extremely hazardous substances” that exceed the “threshold planning quantity” established by EPA. Each notifying facility must also designate a facility emergency coordinator to assist the LEPC in plan development.

The release of a “reportable quantity” of any “extremely hazardous substance” or CERCLA “hazardous substance” from any facility must be reported to LEPCs and SERCs by both an immediate oral notification and a follow-up written report.

The National Environmental Policy Act (NEPA)

NEPA was enacted in 1970 to establish means for environmental protection. NEPA’s basic policy states that the Federal government shall “use all practical means and measures.... To create and maintain conditions under which



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man and nature can exist in productive harmony, and fulfil the social economic, and other requirements of present and future generations of Americans.” All Federal agencies are subject to NEPA regulations.

NEPA requires Federal agencies to incorporate environmental considerations in their planning and decision making, and established the Council of Environmental Quality (CEQ) to advise the President on Federal programs and policies and to issue and enforce regulations.

The CEQ conducts studies, surveys, research, and analyses related to environmental quality and evaluates Federal programs. The program requires Federal agencies to conduct Environmental Assessments (EAs) or Environmental Impact Statements (EISs) before Federal actions. EAs are written environmental analyses prepared to determine whether a Federal action would significantly affect the environment and thus require a more detailed EIS. EISs are prepared by the lead agency and reviewed by EPA. EISs describe the positive and negative effects of the undertaking and list alternative actions.

The Clean Water Act (CWA)

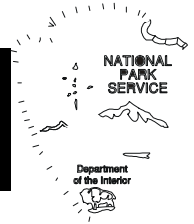
The CWA, also known as the Federal Water Pollution Control Act, was first enacted in 1977 and provided the basic authority for water pollution control programs. The CWA is probably most well-known for establishing the National Pollution Discharge Elimination System (NPDES) permitting program, which translates water quality standards contained in the law into allowable effluent limits for individually permitted sources of discharge into surface waters. The CWA also established requirements for the pretreatment of discharges into municipal sewer systems, and for local planning of nonpoint source pollution. The CWA protects wetlands by requiring that a party seeing to discharge into, dredge, or fill a wetland, first obtain a permit.

Oil Pollution of 1990 (OPA)

The OPA provides liability measures for the discharge or substantial threat of discharge into or on navigable waters or adjoining shorelines of the U.S. Responsible parties include owners and operators of an onshore or offshore facility or vessel. Note that in the case of an onshore facility, a Federal agency owning such a facility shall not be considered a responsible party

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where the agency transfers possession and right to use the property to another person by lease, assignment, or permit.

Notes:

Clean Air Act (CAA)

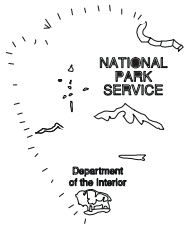
The CAA was enacted in 1964 and has been the basic legal statute designed to enhance the quality of the air. The CAA is the statute that provides the authority for the nation's air pollution regulations. The CAA was reauthorized in 1990, and this reauthorization contains many major amendments to air pollution control. Under the amendments, almost every significant source of air pollution will be subject to a new permitting process. The number of Hazardous Air Pollutants (HAPs) increased from 8 to 189 by the amendments; this means that greater control of these sources is required to prevent air pollution. The standards for HAPs were also changed from a health-based method to a technology-based method.

The Toxic Substances Control Act (TSCA)

TSCA was enacted in 1976 to regulate commerce and protect human health and the environment by requiring testing and use restrictions on certain chemical substances. Unlike most environmental statutes, which focus only on waste disposal, TSCA grants EPA authority to regulate the entire lifecycle of a chemical, from its manufacture to its disposal.

Under Title I of TSCA, EPA banned the manufacture and use of polychlorinated biphenyls (PCBs) and promulgated rules on PCB disposal and marking. Additional rules were developed on inspections, storage, and use of transformers. Under Title 2, EPA has initiated a phase-out of the manufacture and use of asbestos.

The regulatory authority of TSCA rests entirely with the Federal government; it can not be delegated to individual States.



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Notes:

The Safe Drinking Water Act (SDWA)

SDWA was enacted in 1974 with the purpose of protecting the quality of drinking water in the United States. SDWA is composed of two major parts: public water systems, and protection of underground sources of drinking water. The first part includes the setting of standards concerning water contaminants to provide for the safety of piped water intended for human consumption. The protection of underground sources of drinking water is accomplished through regulation of the disposal of hazardous wastes through wells.



Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Under FIFRA, EPA is responsible for the registration of new pesticides to ensure that, when used according to label directions, they will not present any unreasonable risks to human health or the environment. FIFRA regulations apply to persons who manufacture, market, formulate, distribute, use, or dispose of pesticides and pesticide containers.



Module 3 Hazard Communication

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE THREE – HAZARD COMMUNICATION

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

- ◆ Understand the purpose of the Hazard Communication Program
- ◆ Read and interpret a material safety data sheet
- ◆ Read and interpret warning labels

OVERVIEW

The purpose of OSHA's HazCom standard (from SARA Title III – the "Right to Know" law) is to ensure that hazards of all chemicals produced in, or imported into, the United States are evaluated, and that the information concerning such hazards is transmitted to employers and their employees. The standard creates a "downstream flow of information," which means that producers of chemicals have the primary responsibility for generating and disseminating information, whereas employers using chemicals must obtain the information and transmit it to their own employees.

Generally speaking, the standard creates requirements for:

- ◆ Chemical manufacturers, importers, and distributors; and
- ◆ Employers who use hazardous chemicals in the workplace.

Chemical Manufacturer, Importer, and Distributor Responsibilities

- ◆ Determine the hazards of each product (chemical manufacturers and importers only); and
- ◆ Communicate the hazard information and associated protective measures to customers through labels and material safety data sheets (MSDSs).



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Notes:

Employer's Responsibilities

- ◆ Develop and implement a written hazard communication program that addresses labeling, MSDSs, and employee training;
- ◆ Identify and list hazardous chemicals in the workplace;
- ◆ Obtain MSDSs and labels for each hazardous chemical; and
- ◆ Communicate hazard information to employees through labels, MSDSs, and formal training programs.

THE WRITTEN HAZCOM PROGRAM

OSHA 1910.1200 requires employers to develop and update a written hazard communication (HazCom) program and make that program available to all affected employees. The written document must address the employer's labeling, material safety data sheets (MSDSs), and training program. The document must also contain a current inventory of all the hazardous chemicals used or stored in the workplace. (See [Appendix Two](#) for a sample Written HazCom Program.)

The Chemical Inventory List

Each park is responsible for creating and updating a chemical inventory list of all chemicals used or stored in the work place and incorporating that list into the written program. (See [Appendix Three](#) for a sample Chemical Inventory List.) The inventory must:

- ◆ Be performed annually;
- ◆ Specify whether there is an MSDS for the chemical;
- ◆ Name the chemical as identified on the MSDS; and
- ◆ Give the location in the workplace where the chemical is used/stored.



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Labeling

Notes:

The written HazCom program must describe the park's program for labeling hazardous substances. The labeling program must:

- ◆ Clearly identify the hazardous substance;
- ◆ Provide appropriate hazard warnings to ensure employee protection;
- ◆ Provide the name and address of the chemical manufacturer, importer, or other responsible party; and
- ◆ Identify alternate or additional labels or warnings used for hazardous substances in the work place such as those created by the National Fire Protection Association (NFPA), the Hazardous Management Information System (HMIS), or EPA hazardous waste labels.



Information and Training Program

The written document must describe the park's hazardous materials/hazardous waste safety information and training program. This training program must be presented to all employees whose work involves or may involve the use or exposure to hazardous materials.

Specifically, the training program must instruct employees in:

- ◆ Presenting a clear definition of a hazardous material;
- ◆ Identifying hazardous materials commonly encountered in their daily work;
- ◆ Indicating where to locate, access, read, and interpret MSDSs and labels;
- ◆ Obtaining and using the available hazard information;



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Notes:

- ◆ Contacting Federal, State, local, and private hazardous materials and waste management agencies for information regarding hazardous materials used in the work place;
- ◆ Identifying the specific PPE or engineering controls for each chemical(s) used in the work place, such as eye/face, hand, foot, head, torso, and respiratory protection; and
- ◆ Understanding emergency notification procedures.

Employees from Other Parks, Agencies, or Outside Contractors

The written program must be provided to employees of other parks, agencies, or outside contractors. The requirements of the plan must be clearly spelled out in contract, pre-job assessments, or pre-construction conferences, and present any chemical or non-chemical hazards (such as lead-based paint and asbestos) that exists in the area(s) they are working.

Park Personnel Responsibilities

HAZARD INFORMATION RESOURCES

The main purpose of the HazCom program is for an employer to communicate safety and health hazards to its employees. Informational resources such as MSDSs, labels, and other forms of warnings are the foundational elements to achieving that goal. Listed below is a description of tools used to inform employees and emergency responders of the hazards in a work place.

Material Safety Data Sheets (MSDSs)

MSDSs are informational documents, usually two to four pages long, that contain information about a hazardous substance. The primary purpose of

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the MSDS is to communicate information about the hazards of the hazardous chemicals in a work place. OSHA 1910.1200 sets forth requirements for manufacturers, distributors, and employers regarding the preparation and distribution of these forms. Generally speaking, the requirements are as follows:

Notes:

- ◆ **Manufacturers and distributors.** Manufacturers and distributors of hazardous chemicals must complete a MSDS for each hazardous chemical. Manufacturers and distributors must provide MSDSs to employers at the time of the first shipment of the hazardous chemical to the employer and upon request by the employer.
- ◆ **Employers.** Copies of MSDSs must be readily accessible to employees at the work site and must also be provided to an employee upon request. If missing or lost, employers should request a copy of an MSDS from the manufacturer or distributor.

OSHA 1910.1200 requires that certain information be included in an MSDS; however, there is no prescribed format for presenting the information. Generally, manufacturers or distributors use OSHA's non-mandatory form OSHA 174. (See [Appendix Four](#) for a sample MSDS). Below is a description of the information in an MSDS as presented in form OSHA 174.

Section One – Product Identification

Provides basic information about the chemical including the:

- ◆ Product name/synonyms;
- ◆ Manufacturer name and address;
- ◆ Telephone number for use in a chemical emergency;
- ◆ Telephone number for non-emergency informational use;
- ◆ The date prepared; and
- ◆ Signature of the person who prepared the MSDS.



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Notes:

Section Two – Principal Ingredients

Describes the composition of the chemical and any technical information that may be necessary such as the:

- ◆ Specific chemical identity;
- ◆ Common names of the chemical;
- ◆ Chemical abstract service (CAS) registry number; and
- ◆ Threshold Limit Values (TLVs).

Section Three – Physical/Chemical Data

This section lists a variety of data relating to the physical properties of the substance, including the following:

- ◆ Boiling point;
- ◆ Vapor pressure;
- ◆ Vapor density;
- ◆ Solubility in water;
- ◆ Evaporation rate;
- ◆ Percent volatile by volume;
- ◆ pH factor; and
- ◆ Appearance and odor.

Section Four – Fire and Explosion Hazard Data

Provides information on the hazardous material's flammability, including its flash point and flammable limits. This section also provides details regarding extinguishing media, special fire-fighting procedures, and unusual fire and explosive hazards.

Section Five – Reactivity

This section provides data on the stability of the substance, as well as specialized information on incompatibility, conditions to avoid, hazardous decomposition or byproducts, and polymerization.



Section Six – First Aid and Health Hazard Data

Notes:

Without question, this is the most important section of the MSDS with which you should become familiar. Section Six contains all pertinent information regarding:

- ◆ Emergency first aid;
- ◆ Primary routes of entry;
- ◆ Symptoms of exposure;
- ◆ Carcinogenic effects; and
- ◆ Medical conditions aggravated by exposure.

Section Seven – Precautions for Safe Handling and Use

Also a very important section, Section Seven instructs readers in how to safely handle and use the hazardous chemical. Specifically, Section Seven describes:

- ◆ Steps to be taken in case material is released or spilled;
- ◆ Waste disposal method;
- ◆ Precautions to be taken in handling and storing; and
- ◆ Other general precautions.

Section Eight – Control Measures

Section Eight describes the required eye, skin, and respiratory PPE that should be used to protect against exposure to the hazardous chemical as well as ventilation requirements.

Warning Labels and Placards

Warning or hazard labels and placards are used to warn of the dangers associated with a hazardous chemical, material, substance, or waste. The type of label or placard on an item depends on the Federal law under which the item is regulated. NPS emergency responders will most likely encounter labels required by OSHA, DOT, or EPA regulations. As noted in Module Two, each agency classifies hazards in a different way, and some definitions overlap with each other.





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Notes:

OSHA Warning Labels

OSHA is concerned with occupational safety and health and thus has labeling requirements related to the use of hazardous chemicals in the work place. OSHA's HazCom standard requires that at a minimum, chemical manufacturers, importers, or distributors ensure that each container of hazardous chemical is labeled, tagged, or marked with information that warns the users of the hazards associated with the chemical. At a minimum all hazardous chemicals must be clearly marked with the following information:

- ◆ Identity of the hazardous chemical(s) contained therein;
- ◆ Appropriate hazard warnings; and
- ◆ Name and address of the chemical manufacturer, importer, distributor, or other responsible party.

Many manufacturers have gone a step further with their labeling and now provide some, if not all, of the following information on their labels:

- ◆ Emergency response telephone numbers (the telephone number that appears in section one of the label will connect you with **CHEMTREC: 1-800-424-9300**, a database provided by the Chemical Manufacturers Association);
- ◆ Health risks;
- ◆ Flammability risks;
- ◆ Reactivity risks;
- ◆ Personal protection; and
- ◆ Disposal procedures.



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Important Note: If you transfer the material from the manufacturer's container into another container you must label the new container with the same information that is on the manufacturer's label.

Notes:

DOT Labels and UN/NA Identification Numbers

DOT regulates the transport of hazardous materials within the United States and requires labels (for containers and packages) and placards (for vehicles). DOT utilizes portions of the International Maritime Organization's (IMO) hazard classification system, also known as the United Nations (UN) coding system. IMO regulates the transport of hazardous materials between countries when any portion of the transportation involves carriers on water. DOT classification, labeling, and placarding regulations are summarized in the Hazardous Materials Table found at 49 CFR § 172.101.

DOT classifies hazardous materials into one of nine hazard classes. The classes are further broken down into divisions. Tables 3-1 and 3-2 below describe the DOT classes and divisions.

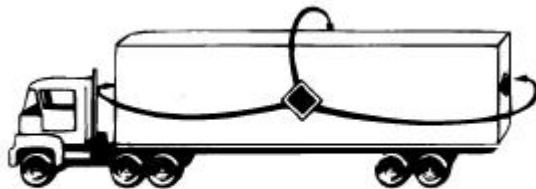
TABLE 1 (PLACARD ANY QUANTITY)		TABLE 2 (PLACARD 1,001 LBS OR MORE)	
Hazard Class or Division	Placard Name	Hazard Class or Division	Placard Name
1.1	EXPLOSIVES 1.1	1.4	EXPLOSIVES 1.4
1.2	EXPLOSIVES 1.2	1.5	EXPLOSIVES 1.5
1.3	EXPLOSIVES 1.3	1.6	EXPLOSIVES 1.6
2.3	POISON GAS	2.1	FLAMMABLE GAS
4.3	DANGEROUS WHEN WET	2.2	NON-FLAMMABLE GAS
6.1 (PGI, PIH only)	POISON	3	FLAMMABLE
7 (Radioactive Yellow III)	RADIOACTIVE	Combustible	
		Liquid	COMBUSTIBLE
		4.1	FLAMMABLE SOLID
		4.2	SPONTANEOUSLY COMBUSTIBLE
		5.1	OXIDIZER
		5.2	ORGANIC PEROXIDE
		6.1 (PGI or II, other than PGI, PIH)	POISON
		6.1 (PGIII)	KEEP AWAY FROM FOOD
		6.2	NONE
		8	CORROSIVE
		9	CLASS 9
		ORM-D	NONE



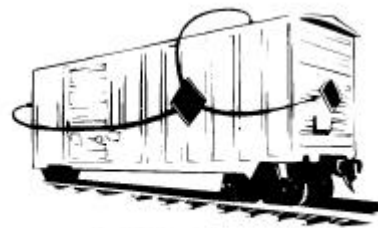
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Notes:



Semi-Trailer Placarding



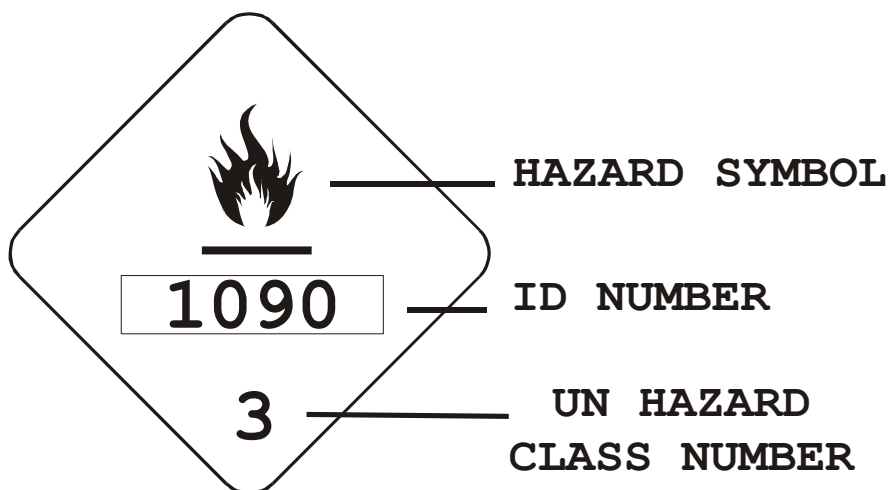
Rail Car Placarding

DOT uses hazard class labels and placards to identify hazards on containers and transportation vehicles. (See [Appendix Five](#) for a copy of DOT Chart 10 – Hazardous Materials Marking, Labeling, and Placarding Guide.) Labels are diamond-shaped symbols, four-inches square, required for all packages being shipped.

Placards are diamond-shaped symbols, 10¾ inches square that are applied to each side and end of a motor vehicle, rail car, freight container, or portable tank container carrying hazardous materials.

Both labels and placards symbols use three mechanisms to convey the contents and type of hazard found in either the package or vehicle:

- ◆ Hazard symbols;
- ◆ Color; and
- ◆ The UN/NA number.



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Symbols

Bursting ball = explosive

Flame = flammable

Slashed W = dangerous when wet

Skull and crossbones = poisonous material

Circle with flame = oxidizing material

Cylinder = non-flammable gas

Propeller = radioactive

Test tubes/hand/metal = corrosive

“Residue” = product has been removed,
but a harmful residue may
still be present

Notes:

Color

- ◆ Orange = explosive
- ◆ Green = non-flammable
- ◆ Red = flammable
- ◆ Yellow = oxidizing material
- ◆ White = poisonous material
- ◆ White with vertical strips = flammable solid
- ◆ Blue = dangerous when wet
- ◆ Yellow over white = radioactive material

EPA Hazardous Waste Labels

EPA requires that containers of hazardous waste be labeled. The label provides the following information:

- ◆ Generator name and address;
- ◆ EPA generator identification number;
- ◆ Manifest documents number;
- ◆ Accumulation start date;
- ◆ EPA waste number; and
- ◆ DOT proper shipping name.



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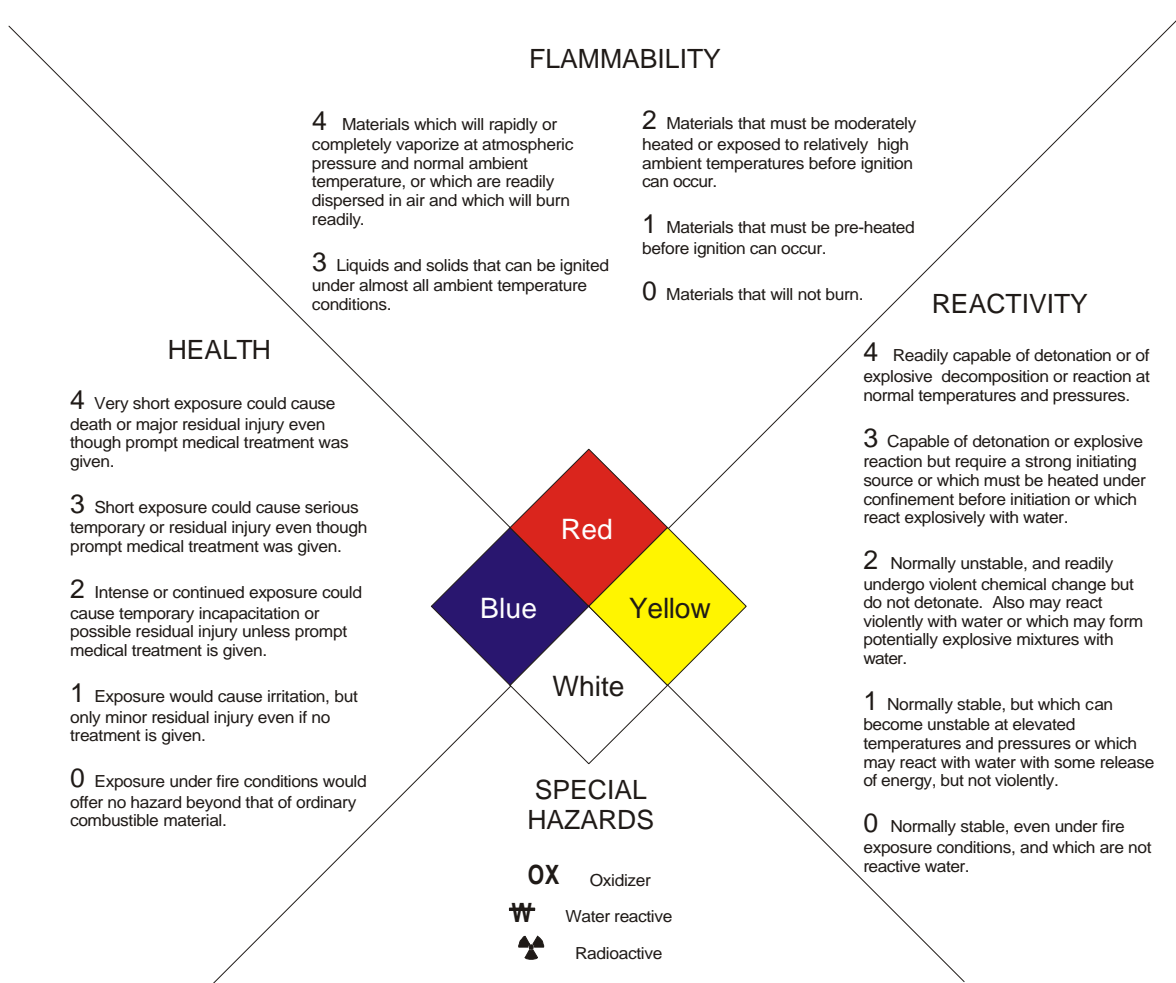
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Notes:

The National Fire Protection Association (NFPA) 704 System

NFPA is an organization that develops many widely recognized and accepted standards. One such standard is Standard Number 704, Hazard Identification, or NFPA 704 Hazard Identification System. NFPA 704 is used at fixed installations to indicate the presence of hazards.

NFPA 704 is similar to the DOT labeling system in that it uses a combination of color-coding and numbering in a picture of a diamond that is easy to interpret for quick hazard identification. The diamond is divided into four smaller diamonds, each containing a color and number. The number between zero and four, describes the hazard's rating, with zero being the lowest hazard and four being the highest hazard.



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Notes:

Pesticide Labels

Pesticides are regulated under FIFRA and are labeled in accordance with EPA requirements. Signal words on pesticide labels are the most important piece of information. They are located in the center of the front panel and indicate three toxicity categories:

- ◆ **Danger** refers to a highly toxic pesticide and is indicated by a skull and crossbones symbol and the word "Poison" printed in red.
- ◆ **Warning** refers to a moderately toxic pesticide.
- ◆ **Caution** refers to a relatively low toxicity pesticide.

Other information on a pesticide label includes:

- ◆ Statement of practical treatment (antidote treatment, treatment information);
- ◆ Chemical and physical hazards (located on the side of the panel);
- ◆ Product name (shown clearly on front label);
- ◆ Ingredients statement;
 - Required on all labels;
 - Active ingredients list the chemical name; and
 - Inert ingredients are not named, they are listed in percentages only.
- ◆ EPA registration number (CAS number); and
- ◆ EPA establishment number (indicates the facility location where the product was manufactured).



**FLAMMABLE
LIQUIDS ARE
LISTED AS
INERT!**



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Notes:

Hazardous Materials Identification System (HMIS)

The National Paint and Coatings Association also developed a labeling system called the HMIS. The HMIS is similar to the NFPA 704 system. The HMIS uses color-coded hazard warnings, with numbers and symbols to present acute and chronic health, flammability, and reactivity hazard warnings, as well as to designate appropriate personal protective.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

I HEALTH HAZARD RATING

0. MINIMAL HAZARD: NO SIGNIFICANT RISK TO HEALTH.
 1. SLIGHT HAZARD: IRRITATION OF MINOR RECEPTORS INADVERTENTLY POSSIBLE.
 2. MODERATE HAZARD: TEMPORARY OR MINOR INJURY MAY OCCUR.
 3. SERIOUS HAZARD: MAJOR INJURY UNLESS PROMPT ACTION IS TAKEN AND MEDICAL TREATMENT GIVEN.
 4. SEVERE HAZARD: LIFE THREATENING; MAJOR PERMANENT DAMAGE. MAY RESULT FROM A SINGLE OR REPEATED EXPOSURE.

II FLAMMABILITY HAZARD RATING

0. MINIMAL HAZARD: MATERIALS THAT ARE NORMALLY STABLE AND DO NOT BURN.
 1. SLIGHT HAZARD: MATERIALS THAT MUST BE PREHEATED BEFORE IGNITION WILL OCCUR FLAMMABLE IN THIS CATEGORY WILL HAVE A FLASH POINT AT OR BELOW 100°F.
 2. MODERATE HAZARD: MATERIALS THAT MUST BE MODERATELY HEATED BEFORE IGNITION WILL OCCUR INCLUDING FLAMMABLE LIQUIDS WITH FLASHPOINTS AT OR ABOVE 100°F AND BELOW 200°F.
 3. SERIOUS HAZARD: MATERIALS CAPABLE OF IGNITION AT ALMOST ALL N.T.P. INCLUDING FLAMMABLE LIQUIDS WITH A F.P. BELOW 100°F AND ABOVE 200°F INCLUDING GASES WITH FLASHPOINTS BELOW 100°F.
 4. SEVERE HAZARD: VERY FLAMMABLE GASES OR VERY FLAMMABLE LIQUIDS VOLATILE WITH FLASHPOINTS BELOW 100°F AND BOILING POINT BELOW 100°F.

III REACTIVITY HAZARD RATING

0. MINIMAL HAZARD: MATERIALS THAT ARE NORMALLY STABLE UNDER FIRE CONDITIONS AND WILL NOT REACT WITH WATER.
 1. SLIGHT HAZARD: MATERIALS THAT ARE NORMALLY STABLE BUT CAN BECOME UNSTABLE AT HIGH TEMPERATURES AND PRESSURES. MATERIALS MAY REACT WITH WATER BUT WILL NOT RELEASE ENERGY VIOLENTLY.
 2. MODERATE HAZARD: MATERIALS THAT ARE IN THEMSELVES NORMALLY STABLE WILL REACT UNDER VIOLENT CHEMICAL CHANGE BUT WILL NOT DETONATE. THESE MATERIALS MAY ALSO REACT VIOLENTLY WITH WATER.
 3. SERIOUS HAZARD: MATERIALS THAT ARE CAPABLE OF DETONATION OR EXPLOSIVE REACTION BUT REQUIRE A STRONG IGNITION SOURCE OR WHICH MUST BE HEATED UNDER CONFINEMENT BEFORE IGNITION, OR MATERIALS THAT REACT EXPLOSIVELY WITH WATER.
 4. SEVERE HAZARD: MATERIALS THAT ARE READILY CAPABLE OF DETONATION OR EXPLOSIVE DECOMPOSITION AT NORMAL TEMPERATURES AND PRESSURES.

IV CHRONIC EFFECTS INFORMATION

CHRONIC EFFECTS MAY BE INDICATED BY (1) OR OTHER DESIGNATION IN THE HEALTH HAZARD RATING SECTION.
 (2) A WRITTEN WARNING IN THE WHITE SECTION OF THE LABEL.

V PERSONAL PROTECTIVE EQUIPMENT

PERSONAL PROTECTIVE EQUIPMENT TYPE WILL BE DESCRIBED BY INFORMATION PROVIDED BY THE PAINT MANUFACTURER.

SEARCH & RESCUE STATUS MARKER

	SINGLE SLASH DRAWN UPON ENTRY TO A STRUCTURE OR AREA INDICATES THAT SEARCH OPERATIONS ARE CURRENTLY IN PROGRESS.		2 - LIVE 3 - DEAD	BOTTOM QUADRANT: NUMBER OF LIVE AND DEAD VICTIMS INSIDE THE STRUCTURE.
	CROSSING SLASH DRAWN UPON SEARCH PERSONNEL EXIT FROM THE STRUCTURE OR AREA.			NO VICTIMS.
	LEFT QUADRANT: RESCUE TEAM IDENTIFIER.			EXACT LOCATION OF VICTIM.
	TOP QUADRANT: TIME AND DATE THAT THE TASK FORCE PERSONNEL LEFT THE STRUCTURE.			SURVEYING TAPE.
	RIGHT QUADRANT: PERSONAL HAZARDS.			INFORMATION IN EACH QUADRANT WILL BE PLACED ON THE "X" UTILIZING CARPENTER'S CHALK OR LIMBER CRAYON.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HEALTH		1	HAZARD INDEX	
FLAMMABILITY		3	4	1
REACTIVITY		0	3	0
PERSONAL PROTECTION CODE LETTER	OR WRITTEN WARNING	G	2	*
PERSONAL PROTECTION INDEX				
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				
X	ASK YOUR SUPERVISOR FOR SPECIALIZED HANDLING DIRECTIONS			
		NATIONAL PAINT AND COATINGS ASSOCIATION U.S.A.		

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Other Hazard Identification Systems

Notes:

Shipping Papers

Shipping papers required for transportation of hazardous materials contain pertinent information regarding the hazards of the materials. See Table 3-3 below for additional information regarding shipping papers. (See [Appendix Six](#) for sample shipping papers.) Shipping papers include:

- ◆ Bill of lading (for highway transportation);
- ◆ Waybill consist or wheel report (for rail movement);
- ◆ Dangerous cargo manifest (for water transport);
- ◆ Air bill with shipper's certification for restricted articles (for air shipment); and
- ◆ Uniform hazardous waste manifest (required by EPA for the transport of all hazardous waste).

Mode of Transportation	Title of Shipping Paper	Location of Shipping Papers	Responsible Person
Highway	Bill of Lading	Cab of vehicles	Driver
Rail	Waybill	With conductor or engineer	Conductor or engineer
Water	Dangerous cargo manifest on barge	Wheelhouse or pipe-like container	Captain or master
Air	Air bill with shipper's certification for restricted articles	Cockpit	Pilot



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Notes:

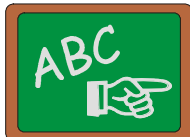
Pipeline Markings

Ruptured underground pipelines present a hazardous materials incident that often goes overlooked by emergency response personnel. Some of the most common uses of pipelines are the transport of natural gas, gasoline, or diesel fuels. One of the most common hazardous materials incidents involving pipelines is rupturing due to digging for construction. NPS personnel should take note of pipeline markings and contact local utilities, county planning departments, and local industry prior to performing digging.



Military Hazardous Materials Markings

The U.S. military also established a system for marking and identifying hazardous materials. The military system consists of seven markings used to identify military structures that store hazardous materials. The four military classes correspond to DOT divisions 1.1 (explosives), 1.2 (explosives), 1.3 (flammable), and 1.4 (flammable).



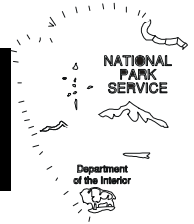
[Go to exercise, Part One](#)



Module 4 Toxicology

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE FOUR – TOXICOLOGY

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

- ◆ List the seven different mechanisms of toxicity
- ◆ List the four routes of entry by which a chemical can enter the body
- ◆ Describe the basic symptoms of exposure
- ◆ List the factors that make an organism more susceptible to the adverse effects of chemical exposure
- ◆ Understand the requirements of medical monitoring

This module presents the factors that influence toxicity, routes of entry for toxic chemicals, exposure symptoms, and the types of toxic hazards most likely to be encountered by NPS personnel. The main objective of this section is to instruct students in how chemical exposure can adversely affect the human body.

MECHANISMS OF TOXICITY

Toxicology is the scientific study of poisons, its subsequent limits of safety, and its adverse effects on living organisms. A poison is any substance (including radiation, sound, and chemicals) that has an adverse effect on human health. Toxic agents can be divided into seven categories:

Asphyxiants

Physical asphyxiants (CO₂, methane) deprive the lungs of oxygen, while chemical asphyxiants (CO, HCN) deprive specific cells within body tissue of oxygen.

Irritants

Inflammation of membranes results from exposure to irritants. Other effects include redness, swelling, blistering, burning, and itching. Irritants usually act locally or topically.

Sensitizers



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Notes:

Sensitizers are systemic irritants. Allergic sensitizers affect an entire system instead of producing local irritation. Often it is difficult to determine whether a reaction is merely from an irritant or the result of an allergy.

Corrosives

Corrosives cause chemical deterioration of living tissue (i.e., acid burns).

Carcinogens

Carcinogens are agents that cause cancer. Other non-carcinogenic chemicals may increase the number and severity of cancer tumors. When applied before or with the carcinogen, these chemicals are termed “co-carcinogens” (asbestos is a co-carcinogen). When applied after the carcinogen, they are referred to as “promoters” (sunlight is a promoter of skin cancer when combined with exposure to tar). Substances that are carcinogenic to laboratory animals but have not been shown conclusively to cause cancer in humans are suspect carcinogens.

Mutagens

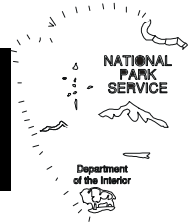
Mutagens are generally a chemical or form of radiation that causes changes in the genetic structure of cells. In humans, the two types of cells that should be affected are body cells (resulting in a cancer) or reproductive cells (either egg or sperm cells possibly affecting the offspring). Carcinogens are a type of mutagen, but not all mutagens are carcinogens.

Teratogens

These hazardous substances affect the developing fetus without harming the mother.

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ROUTES OF ENTRY

Notes:

There are four routes of entry for toxicants.

Inhalation

Inhalation is the most common means by which toxic substances enter the body. Fumes, mists, gases, and vapors often pass easily from the lungs into the bloodstream and then move on to target organs.

Absorption

Absorption through the skin or eye is a typical route of exposure. Many toxic substances can readily permeate healthy skin and enter the bloodstream.

Ingestion (Oral)

Eating, drinking, or smoking is a common way for substances to enter the body. Once in the digestive tract lining, they may be absorbed through the lining into the bloodstream.

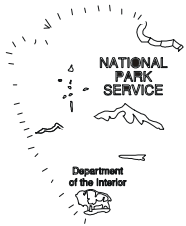
Injection

Injection is one of the fastest ways to administer a toxicant. This usually occurs by exposure to open wounds.

SYMPTOMS OF EXPOSURE

The effects of exposure to different chemicals can vary widely; however, the following symptoms are common signs of exposure:

- ◆ Skin discoloration (red or white);
- ◆ Pale complexion;
- ◆ Choking;
- ◆ Headache;
- ◆ Disorientation;
- ◆ Irritation of eyes or skin;



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Notes:

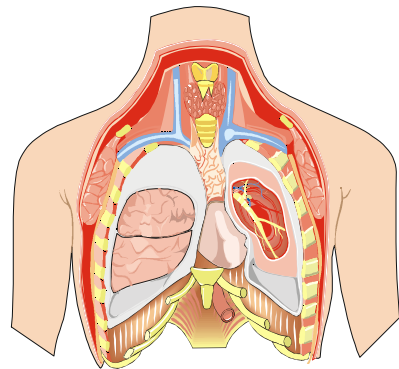
- ◆ Nausea;
- ◆ Sleepiness;
- ◆ Itching, swelling, or rash;
- ◆ Shortness of breath or noticeable change in respiration; or
- ◆ Lung or nasal irritation.

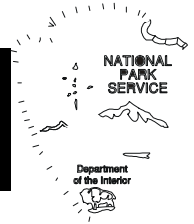
Anyone experiencing symptoms of chemical exposure during a site activity should be moved from the area, and help should be summoned.

Chemical Effects on Organs

Organs commonly affected by specific chemicals include:

- ◆ Blood – Hemoglobin can be altered, making it incapable of carrying oxygen (Nitrobenzene).
- ◆ Lungs – Lung cancer can begin (Asbestos).
- ◆ Bone marrow – White cell count can be decreased, which can lead to leukemia (Benzene).
- ◆ Kidneys – Interruption of hemoglobin synthesis can promote fibrosis (Lead).
- ◆ Skin – Necrosis (Creosote).
- ◆ Nervous system – Eventual blocking of the nerve connection can result in initial hyperactivity and subsequent convulsions followed by tetanic paralysis (Organophosphate).
- ◆ Liver – Liver ceases functioning due to filling with fat (Carbon tetrachloride).





FACTORS THAT INFLUENCE TOXIC EFFECTS

Notes:

A number of factors make an organism more susceptible to the adverse effects of chemical exposure.

Concentration, Duration, and Dose

The concentration-duration-dose relationship is the most significant factor in determining a chemical's physical effect on a person.

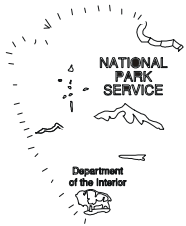
Frequency/Concentration. Frequency of exposure is critical to the concentration levels of the agent in the organism. The organism does not have time to dispose of the toxicant if the exposures are frequent, and hence the overall effect is cumulative. In general, the greater the frequency of exposure, the more severe the effect.

Duration. Exposure duration is critical to the effects of the toxicant in the system. Acute, subchronic, and chronic exposures can have varying toxic effects; however, in general, the longer the exposure duration, the more severe the effect.

Dose (concentration x exposure = dose). The quantity of toxicant that enters the body is referred to as a "dose." Dosage is used to describe the effects of toxic substance at various concentrations. A dose that is absorbed into the bloodstream and is circulated throughout the body is called a systemic dose. The affect a dose has is dependant upon the body weight of the recipient.

Depending upon the duration and frequency/concentration (dosage), one of three levels of exposure can occur:

1. *Acute Exposure.* The result of a single, high level exposure for a short period (e.g., less than a day). This type of exposure has relatively immediate effects with the possibility of a significant delay before onset of exposure symptoms.
2. *Subchronic Exposure.* The result of multiple or continuous low-level exposure over a long period of time (totaling up to 10 percent of a life



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Notes:

span). This type of exposure usually accumulates into a significant absorbed dose over time. Sometimes a significant period of time lapses between exposure to an agent and the onset of symptoms.

3. *Chronic Exposure.* Similar to subchronic exposure, chronic exposure is a result of multiple or continuous low-level exposure over a long period of time. The differing factor between the two is that chronic exposure encompasses up to 80 percent of a life span.

Species

The science of toxicology depends heavily upon the data obtained from animal experimentation. Therefore, it is important to recognize that species differ in their responses to the toxic properties of chemicals. Further, humans do not rank consistently among animal species with regard to sensitivity to chemicals.

Sex/Gender

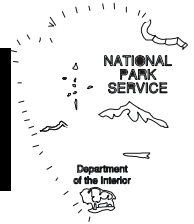
Toxicants affecting the sex organs show an obvious gender effect. Although scientific evidence supporting sex differences is indirect, chemicals that do show a sex difference in adult animals often show no such difference in immature animals. Additionally, it has been proven that women accumulate and absorb fat soluble toxic substances more readily than men due to the fact that women possess a greater percentage of body fat.

Age

Newborn and elderly animals have weaker immune systems than young adults. Therefore it is likely that children or senior citizens may be particularly sensitive to toxic chemicals.

Nutrition

Diet affects an individual's susceptibility to harm for hazardous substances. Generally, healthful diets substantial in proteins and vitamins protect against the toxic effects of chemicals.



Overall Health

Notes:

Individuals in good health are better able to respond to toxicants. Existing diseases generally increase susceptibility to the effects of chemical exposure. For example, liver disease enhances the toxic effects of chemicals that cause liver damage. Genetic factors may also come into play. People in whom the abundance of important enzymes differs from the norm may be more or less sensitive to diseases that actively involve those enzymes.

Adaptation

Exposure to subtoxic doses of a chemical can render a person tolerant to subsequent toxic doses of the chemical. However, this adaptation process is not true for all foreign chemicals, and it cannot protect an individual against ever increasing amount of the toxicant.

Previous Exposure

Positive Effect: Previous exposure may improve the condition if the source is an acute-acting agent.

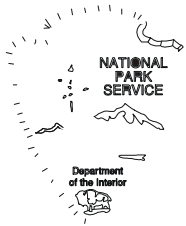
Negative Effect: Previous exposure exacerbates the condition if the source is a chronic toxicant.

Interaction of Chemicals

The effects of two chemicals given simultaneously will produce a response that may be simply additive or may be less than or greater than the expected effects of adding their individual responses.

Additive Effect: The combined effect of two chemicals given simultaneously equals the sum of their individual effects (e.g., $3+4=7$).

Antagonistic Effect: The combined effect of two chemicals given simultaneously produces a lesser effect than the sum of the effects if the agents were given alone (e.g., $3+4=5$).



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Notes:

Synergistic Effect: The combined effect of two chemicals given simultaneously produces a greater effect than the sum of the effects if the agents were given alone (e.g., $3+4=24$).

Size

Larger animals experience greater levels of exposure; they show effects over longer periods of time, and have greater intakes of toxicants.

Internet Resources

The Internet often produces a wealth of information regarding hazardous chemicals, such as toxic profiles. The following web sites contain information regarding toxic chemicals or point to other Web sites that do.:

- ◆ <http://mail.odsnet.com/TRIFacts/>
- ◆ <http://atsdr1.atsdr.cdc.gov:8080/atsdrhome.html>
- ◆ <http://www.clay.net/health.html>
- ◆ <http://www.cdc.gov>
- ◆ <http://www.cdc.gov/niosh/homepage.html>

EXPOSURE LIMITS

Permissible Exposure Limits (PELs)

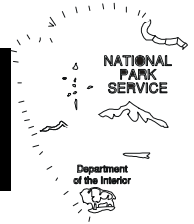
These limits are established by OSHA. Employers shall achieve airborne contamination levels below the PELs by any reasonable combination of engineering controls, work practices, and PPE.

Threshold Limit Values (TLVs)

These limits are established by the American Conference of Governmental Industrial Hygienists (ACGIH). These limits are recommendations and should be used as guidelines for good practices. Unless noted otherwise, PELs and TLVs are time-weighted average (TWA) concentrations that must not be exceeded during any 8-hour work shift of a 40-hour work week.

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There are three categories of PELs and TLVs.

Notes:

1. **Time-Weighted Average (TWA):** The time-weighted average concentration for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse affect.
2. **Short-Term Exposure Limit (STEL or ST):** A STEL is defined as a 15-minute TWA exposure that can not be exceeded at any time during a work day unless otherwise specified.
3. **Ceiling (C):** The concentration that should not be exceeded during any part of the working exposure without appropriate respiratory protection.

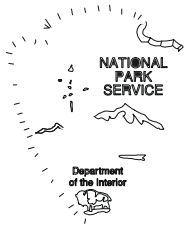
Immediately Dangerous to Life and Health (IDLH)

Immediately dangerous to life and health (IDLH) concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects.

Lethal Dose-50 (LD₅₀)

Paracelsus (1493-1541) said, “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.” Among chemicals there is a wide spectrum of doses that are needed to produce harmful effects, serious injury or death. Relative lethality is one way that we evaluate the toxicity of chemicals. Lethal Dose-50 (LD₅₀) is the dosage of a chemical needed to produce death in 50 percent of the test population (animals). Table 4-1 above illustrates relative indices of toxicity using LD₅₀ criteria.





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Notes:

Class	LD50	Probable Lethal Dose for 70 kg (150 lbs.) Person	Example
Super Toxic	Less than 5mg/kg	A taste (7 drops or less)	Dioxin, botulinum toxin
Extremely Toxic	5-50 mg/kg	1 teaspoonful	Arsenic trioxide, strychnine
Very Toxic	50-500 mg/kg	1 ounce	Phenol, caffeine
Moderately Toxic	0.5-5 g/kg	1 pint	Aspirin, sodium chloride
Slightly Toxic	5-15 g/kg	1 quart	Ethyl alcohol, acetone

BLOODBORNE PATHOGENS

OSHA requires under 29 CFR 1910.1030 that an Infectious Disease Exposure Control Plan be implemented when there is a possibility of exposure to body fluids. Transmission of bloodborne diseases in the workplace is rare, but because of their deadly potential, everyone must be aware of how these diseases are transmitted and the safe work practices that can minimize the potential of transmission.

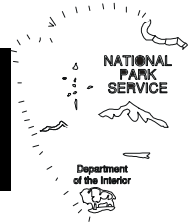
What are Bloodborne Pathogens?

Bloodborne pathogens are microorganisms (e.g., microscopic bacteria) in the blood stream that can cause disease. Although they are very small, they can carry many diseases, including the HIV virus that causes AIDS.

Many other diseases, such as malaria and syphilis, can be attributed to bloodborne pathogens but the two diseases that are a concern in the work environment are Hepatitis B and HIV.

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Where are Bloodborne Pathogens Found?

Notes:

Bloodborne pathogens are found in blood and blood products including:

- ◆ Blood;
- ◆ Semen;
- ◆ Vaginal secretions;
- ◆ Breast milk;
- ◆ Saliva;
- ◆ Urine;
- ◆ Tears; and
- ◆ Other body fluids.

Only blood, semen, vaginal secretions, and breast milk have been proven to transmit HIV and Hepatitis B.

Bloodborne pathogens can also be found in tissue cultures, organ cultures, and experimental animals that have been infected. Although bloodborne pathogens are found in the body fluids listed above, in many cases they are not strong enough to be transmitted.

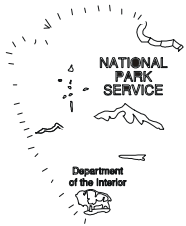
Routes of Entry

Blood or infectious material could enter into your blood system through these routes of entry:

- ◆ **Unprotected openings** in the skin such as cuts, scrapes, and dermatitis.
- ◆ **Unprotected mucus membrane openings** such as eyes, nose, and mouth.
- ◆ **Penetration into the skin by a sharp object** such as broken glass, a needle, or knife blade.

It is important to remember that in order for an infection to take place, the source blood must be infected and that blood must have entered your blood system through any of the routes of entry listed above.





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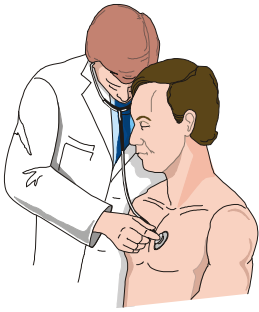
Notes:

MEDICAL SURVEILLANCE

Medical surveillance is used both to determine the ability of a worker to wear PPE and perform site tasks, and to establish a health baseline for the worker to aid in determining if exposure to a toxicant has occurred.

OSHA 29 CFR 1910.120(f) requires that employers implement a medical surveillance program for hazardous waste workers (at fixed hazardous waste sites) and emergency responders. The purpose of a medical surveillance program is to monitor the health of those responding to hazardous incidents by performing periodic medical examinations. Medical surveillance is the collection and interpretation of data from monitoring programs and from other available sources for the purpose of detecting changes in the health status of individuals and groups. The components of the medical surveillance program are described below.

The employees who are covered by the medical surveillance requirement include:



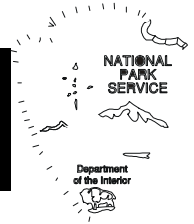
- ◆ All employees who are or may be exposed to hazardous substances or health hazards at or above PELs, without regard to use of respirators, for 30 or more days per year.
- ◆ All employees who wear a respirator for 30 or more days per year.
- ◆ Employees who serve as Hazardous Materials team members and are engaged in hazardous waste operations.
- ◆ All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards.

Medical Consultation

Employees should complete a questionnaire that gathers information regarding the medical, occupational, and family background, any current symptoms, risk factors, emergency contacts, and current job duties.

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The frequency of the medical consultation should incorporate the following considerations:

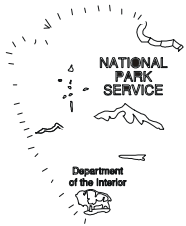
Notes:

- ◆ Prior to assignment.
- ◆ At least once every 12 months.
- ◆ At termination of employment or at reassignment if employee has not had an examination in 6 months.
- ◆ As soon as possible upon notification by employee of symptoms or signs indicating possible overexposure.
- ◆ At more frequent times if the examining physician determines that an increased frequency of examination is medically necessary.

The medical examination and consultation should include the medical and work history, and the fitness for duty, including the ability to wear PPE under the expected work conditions.

A copy of the written opinion of the physician should be furnished to the worker and contain the following information:

- ◆ Results of the medical exam and tests.
- ◆ The physician's opinion as to whether the worker has any detected medical conditions that would place the worker at increased risk.
- ◆ The physician's recommended limitations upon the worker's assignments.
- ◆ A statement that the worker has been informed by the physician of the results of the medical exam.
- ◆ A list of medical conditions that require further examination or treatment.



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Notes:

Physical Examination

A medical professional should complete a physical subsequent to exposure that examines all of the body systems, especially vision, hearing, cardiovascular, pulmonary, and musculoskeletal. Further emphasis should be placed on organs exposed to the hazards.

Diagnostic Medical Testing

Blood tests, urinalysis, pulmonary function testing, and electrocardiograms may also be performed if necessary.

Biological Monitoring

Biologic monitoring measures the amount of an agent in an individual's body fluid.

Emergency Medical Procedures

Emergency medical procedures should be established to minimize the health and safety risk to employees at each incident. The range of actual and potential hazards at each site should be considered, including chemical, physical, and biologic hazards. Emergency medical treatment should be integrated with the overall emergency response program. First-aid procedures should be made known to all employees before commencing work.

UPDATES

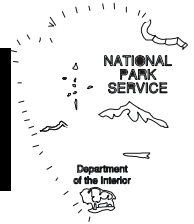
In 1993, the Centers for Disease Control (CDC) revised its guidelines concerning Mycobacterium TB and OSHA has issued national enforcement measures based upon those guidelines. CDC now recommends an annual purified protein derivative (PPD) skin test and HEPA respirator.

Hazard Communication

Training occurs under HazCom “whenever a new physical or health hazard (the employees have not previously been trained about) is introduced into their work area.” OSHA specified that the hazard be related to physical

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safety or health and requires training to occur when employees have not received previous training in that specific hazard category.

Notes:

The regulation included the training required for MSDSs, labels, protective measures and the employer's hazard communication program at multi-employer worksites.

Personal Protective Equipment

Implementation of the revised PPE regulations requires that employees be trained in the use of PPE. PPE includes hard hats, face shields, safety glasses, gloves, and safety shoes. Each employer will also have to certify in writing that each employee has received and understands the training. Employees need to know:

- ◆ When equipment is necessary;
- ◆ What equipment is necessary;
- ◆ How to wear PPE;
- ◆ Limitations of PPE;
- ◆ Proper care, use, and maintenance of PPE; and
- ◆ The useful life of PPE.

The final rule provides guidance for the selection and use of PPE as well as performance-oriented requirements. A new section on hand protection was added.

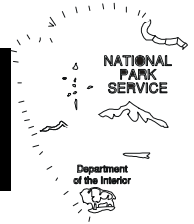
[**Instructors should discuss any updates to regulations.****]**

A sepia-toned photograph of a person wearing full personal protective equipment (PPE), including a hooded suit, gloves, and boots. The person is kneeling on the ground, holding a shovel. In the background, a sign with the words "AGE DRUM" is partially visible.

Module 5 Personal Protective Equipment (PPE)

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE FIVE – PERSONAL PROTECTIVE EQUIPMENT

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

- ◆ Define and describe Level A, B, C, and D protection
- ◆ Name the three chemical breakthroughs in protective clothing
- ◆ Describe the limitations that PPE places on the worker's performance

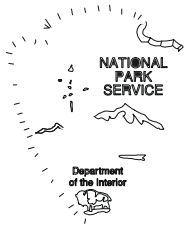
Personal protective equipment (PPE) is the last line of defense against the toxic effects of hazardous substances. Used properly, it can greatly decrease the risk of exposure to harmful substances as well as provide protection against biological and physical hazards. Choosing the appropriate PPE is as important as wearing it.

EPA LEVELS OF PROTECTION

The choice of protection level is based upon the potential exposure to the substances in the air, splashes of liquid, or other direct contact with materials due to the task being performed. It is critical that the equipment to be worn is compatible with the hazards to which it will be exposed.

(At the conclusion of this section, students should perform an exercise matching hazards with appropriate protection level and appropriate clothing).

A number of factors must be considered in selecting the proper PPE for a task. Only after the proper equipment has been determined can a task be completed safely and effectively. The first consideration in selecting the proper PPE to be worn is the type of work to be performed. The EPA has set out guidelines for the type of clothing that is best suited for listed types of hazardous materials handling.



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Notes:

Level A

This is the highest available level of respiratory, skin, and eye protection. It should be used when the chemical substance has been identified and requires the highest level of protection based on measured concentrations or site operations involving a high potential for splash, immersion, or exposure to harmful materials. If operations are conducted in confined, poorly ventilated areas, Level A protection is required until site conditions are properly ascertained.

Level B

This level should be worn when the highest level of respiratory protection is needed but a lesser level of skin protection than Level A is required. This involves atmospheres with immediately dangerous to life and health (IDLH) concentrations of specific substances that do not represent a severe skin hazard or atmospheres that do not meet the criteria for use of air-purifying respirators. Atmospheres that contain less than 19.5 percent oxygen necessitate Level B protection, as does the presence of incompletely identified vapors or gases that are not hazardous to the skin.

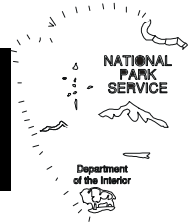
Level C

This is the same level of skin protection but less respiratory protection than Level B. This level should be worn when the criteria for using air-purifying respirators are met. Additionally, the atmospheric contaminants, liquid splashes, or other direct contact must not adversely affect any exposed skin.

Level D

This level offers no respiratory protection and minimal skin protection. It should only be worn as a basic work uniform and not on any site with respiratory or skin hazards. The atmosphere must contain no known hazards and work functions must preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.





CONSIDERATIONS FOR SELECTING PPE

Notes:

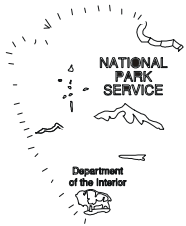
Chemical Resistance

The most important consideration in the selection of PPE is its resistance to chemical and toxic substances. When subjected to hazardous materials, PPE must maintain its integrity and protective qualities. It must be strong enough to resist tears, punctures, and abrasions. Clothing materials must resist permeation by the chemical compound they were designed to resist. A complete inspection process of the proper clothing must be made prior to dressing for any toxic cleanup operation.

There are several types of chemical breakthroughs in clothing:

- ◆ **Degradation** is the actual destruction of the clothing material by either physical or chemical means. Degradation can vary in complexity from slight to severe. Physical degradation can be by punctures, rips, or tears from protruding sharp or rough physical surfaces. Chemical degradation is a reaction to the clothing material that causes it to shrink, swell, or change its molecular structure.
- ◆ **Penetration** is the state that allows the transfer of solids, gases, or liquids through the clothing material. This penetration usually happens by design flaws in the construction of the garment such as stretched seams, zippers, and defective fabric.
- ◆ **Permeation** is the transfer of chemicals by molecular diffusion from one side to the other. When a chemical comes in contact with a material, the chemical's natural tendency is to transfer itself from a high concentration to a less concentrated side, much like a spilled bottle of ink on an ink blotter. When the contamination material passes through the garment material it may remain in its natural state or change to another state: gas, liquid, or solid.

Permeation of materials is directly proportional to the amount of contact time a chemical has with the garment material. No material can withstand permeation by all substances, so a conscious effort must be made to avoid prolonged exposure to any hazardous contaminant.



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Notes:

Data on garment permeability are available from manufacturers and independent testing labs. The American Conference of Governmental Industrial Hygienists' (ACGIH) Guidelines for the Selection of Chemical Protective Clothing presents a summary on the effectiveness of clothing protection from hazardous materials. In addition NIOSH has a catalog of chemical resistant clothes, and respirators that have been tested.

Thermal Resistance and Protection

Clothing must maintain its protective qualities with various temperature extremes. Clothing that is not certified for certain temperatures may not be effective in providing the proper resistance for the toxic material it was designed to withstand. Clothing must be comfortable while at the same time capable of protecting the user under temperature variables. Clothing that doesn't fit the wearer properly can make a cleanup job unproductive and cause the worker to suffer needlessly while working with toxic chemicals.

Flexibility and Size of Materials

PPE must be flexible while affording the wearer protection. Suits and gloves fall into this category. Containers and drums at best are cumbersome, and having an ill-fitting suit can make response intolerable and almost impossible to finish if movement is restricted. Gloves must be flexible to allow the worker manual dexterity to handle small tools and fittings.

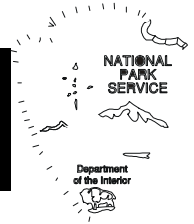
Environmental Hazards

Under some conditions environmental hazards will be evident, and some protection will be necessary to prevent injury to the worker. Examples of environmental hazards are weather, biologicals, and physical considerations.

- ◆ Weather is a concern when working outdoors. Extreme temperature conditions can result in frostbite, hypothermia, or sun or heatstroke. Rain mixed with chemical hazards may result in slippery surfaces and make footing treacherous.

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- ◆ Biologicals are hazards that exist from plants or animals. Snakebites and poisonous insects and plants are categorized here.
- ◆ Boots, pants, gloves, safety glasses, and hardhats will provide protection against most physical hazards. Sometimes additional protection such as chaps, heavy work boots, and face netting will be necessary.

Notes:

Cleanability

PPE should be designed to be easily cleaned and decontaminated to reduce maintenance costs. Butyl rubber and Viton (c) can be cleaned and decontaminated effectively but are initially expensive. Many other materials are impossible to completely decontaminate, and it may be advantageous to use disposable suits and garments instead.

Limitations of Clothing

PPE can impose limitations on the wearer. Gloves can decrease manual dexterity, while masks can cause a narrower field of vision and make communication difficult. Breathing through a filter mask is difficult, and fogging can occur in full masks.

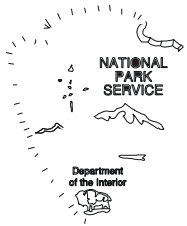
Protective equipment decreases worker performance. There are several human characteristics that play a role in determining the magnitude of this phenomenon including:

- Physical condition;
- Level of acclimatization;
- Age; and
- Gender.

A full protective suit, unless ventilated, can be hot, thereby causing heat stress and reduction in reaction time in an emergency.

Risks

Wearing protective equipment puts hazardous waste workers at considerable risk of developing heat stress. This can result in health effects ranging from



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Notes:

transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably the most common (and potentially serious) illness at hazardous waste sites, regular monitoring and other preventive precautions are vital.



TYPES OF PPE

Head Protection

The use of hardhats protects heads from impact as well as from flying debris, liquids, and electrical shock. Hardhats are rated by American National Standard Institute (ANSI) Z89.1 for head protection in industry. Hardhats that meet ANSI specification are marked inside with one of the following classifications:

- ◆ Limited voltage;
- ◆ High voltage;
- ◆ No voltage; and
- ◆ Firefighting.

Eye and Face Protection

Eye protection is primarily for protection from flying debris and liquid splashes. Basically divided into three categories, eye protection includes spectacles, goggles, and full face shields.



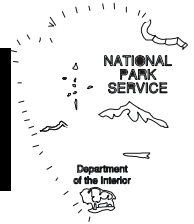
- ◆ Spectacles are, simply put, conventional eyeglass frames. Usually the lenses are impact-resistant and may be constructed of plastic or glass. Some glasses have top or side protection. Those glasses that do not have side protection can be modified for persons needing prescription eyewear.



- ◆ Goggles are eye protectors that have a flexible or rigid form fitting closely around the contours of the face. These provide more protection than spectacles from fine dust, fumes, liquids, and sprays. Ventilation is provided in most cases to eliminate fogging.

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- ◆ Full shields protect the face and eyes from flying particles and liquid sprays. Full face shields are not protection against large, heavy particles, welding, cutting, or intense radiant energy. In these instances, goggles should be used in conjunction with a face shield.

Notes:

Face shields are available as attachments for hardhats. Check for a fit that leaves no gap between the brim of the hat and the top of the face shield. This will prevent splashes from running inside the shield.

The use of safety glasses, goggles, and face shields must meet ANSI Z87.1 and OSHA 29 CFR 1910.133 requirements.

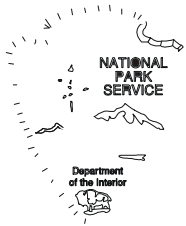
Foot and Hand Protection

In selecting proper footwear for hazardous work sites, the specific need will determine how much protection is necessary. Disposable pullover boots are on the low end of the scale; heavy toe protected boots are on the upper end of the scale. If a non-disposable boot is used, it must be decontaminated thoroughly after use. If decontamination is not possible then the boots must be disposed. Most heavy boots are available in a variety of styles with many features. Antistatic, quick removal, reinforced soles, butyl rubber, PVC, and wood soles are available features for boots that can be used for a variety of work environments.



Gloves provide protection to the hand. When working in hazardous waste areas, the glove must be strong enough to resist tearing and puncturing. Because leather gloves are not easily decontaminated and do not afford good chemical resistance, other materials should be considered when handling toxic wastes. Gloves are available in a variety of materials and should be selected according to the requirements and resistive qualities of the garments. If working on overhead structures, the cuff of the glove should be taped to the sleeve of the protective body suit to prevent chemicals from entering the sleeve.





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Notes:

Care and Maintenance

Before using PPE under hazardous environments, the suit and equipment must be inspected for damage. Visually inspect the equipment, checking for cuts, holes, or tears in the fabric and seams. Check the zippers and other fastening devices for sealing and operation. Look for signs of corrosion or improper decontamination. Check respirators for soil and proper fit. Replace filters when clogged or damaged. Be sure that exhaust valves and fittings are sealed per manufacturers' instructions. Inspect straps and quick release mechanisms for proper action. Replace all defective, worn, or contaminated parts.

When cleanup tasks are complete, each piece of equipment must be decontaminated, cleaned, properly discarded, and sanitized. Sanitizing removes body oils and perspiration and maintains functionality of the equipment for future use.



Packing equipment in its original container will ensure that the gear will maintain a longer life span. Proper storage will also prevent cross-contamination and punctures and tears from other equipment stored in the vicinity.

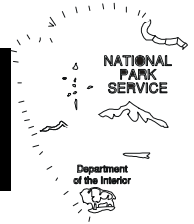
RESPIRATORY PROTECTION

Inhalation is a common route for toxic chemicals to enter the body. Because the respiratory system is only able to tolerate toxic gases to a limited degree, respiratory protection is critical at hazardous materials response incidents. Any device that protects the wearer from breathing contaminated air is termed a “respirator.”

NIOSH recommends that respirators only be used when engineering controls are not feasible or effective, while controls are being installed or repaired, or for emergency and other temporary (intermittent) situations. Respirator selection is very complex and should only be performed by an industrial hygienist or other professional knowledgeable in respiratory protective devices.

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The basic purpose of any respirator is to protect the respiratory system from inhalation of hazardous atmospheres. Respirators provide protection either by removing contaminants from the air before it is inhaled or by supplying an independent source of respirable air.

Notes:

A respirator that removes contaminants from the ambient air is called an air-purifying respirator. A respirator that provides air from a source other than the surrounding atmosphere is an atmosphere-supplying respirator.

The minimum requirements for the establishment and maintenance of a respiratory protection program are set forth at 29 CFR 1910.134(b).

The major elements of the respiratory protection program standard are:

- ◆ Written plan covering selection and use;
- ◆ Respirator selection based upon workplace hazards;
- ◆ Respirator user training on types, use, and limitations;
- ◆ Respirator cleaning and disinfecting;
- ◆ Respiratory storage;
- ◆ Respirator inspection;
- ◆ Workplace surveillance;
- ◆ Medical evaluation of respirator users; and
- ◆ Respirator fit-testing.

Types of Respirators

Disposable Respirators

In order to be approved for NPS use, the disposable respirators must have two straps, an exhalation valve, and a NIOSH/MSHA approval number. Medical or dental surgical style disposable respirators are NOT approved for any use.

Air Purifying Respirators

Particulate Filtering Respirators. Particulate filtering respirators are used for protection against dusts, fumes, and/or mists. A dust is a solid, mechanically produced particle. A fume is a solid condensation particulate, usually





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Notes:

of a vaporized metal. A mist is a liquid condensation particle. Currently, all particulate filtering respirators use fibrous material (a filter) to remove the contaminant. As a particle is drawn onto or into the filter, it is trapped by the fibers.

Gas and Vapor Removing Respirators. Vapor and gas removing respirators normally remove the contaminant by interaction of its molecules with a granular, porous material known as the sorbent. Cartridges and canisters are available to protect against both particulates and vapors and gases. These devices look similar.

A gas mask is certified for single or specific classes of gases and vapors.

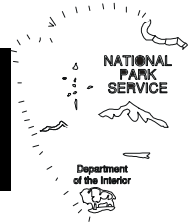
- ◆ **Sorbent Volume.** The basic difference between cartridges and canisters is the volume of sorbent contained, not their function. Cartridges are vapor- and gas-removing elements that may be used singly or in pairs on quarter and half masks and on full-face-pieces. The sorbent volume of a cartridge is small, about 50-200 cm³, so the useful lifetime is usually short, particularly in high gas or vapor concentrations. Therefore, the use of respirators with cartridges generally is restricted to low concentrations of vapors and gases.
- ◆ **Canisters.** Have a larger sorbent volume and may be chin-, front-, or back-mounted. Respirators with canisters can be used in higher vapor and gas concentrations (up to the immediately dangerous to life and health (IDLH) level) than those with cartridges.
- ◆ **Labeling.** Vapor and gas removing cartridges and canisters are designed for protection against specific contaminants, or classes of contaminants. Printed certification labels on the cartridges and canisters identify the contaminant they are designed to protect against. **READ THE LABEL.** DO NOT rely on color coding when determining the proper canister or cartridge to use.

Inspection Frequency. Under routine use, air-purifying respirators should be inspected before and after each use. Under emergency use, air-purifying respirators should be inspected after each use and every 30 days.

Maintenance and Cleaning. Respirators must be cleaned, disinfected, and

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stored to protect against damage and contamination. OSHA requires respirators to be stored from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage.

Notes:

Atmosphere-Supplying Respirators

Self-Contained Breathing Apparatus. The distinguishing feature of any self-contained breathing apparatus (SCBA) is that the wearer need not be connected to a stationary breathing gas source, such as an air compressor. Instead, enough air or oxygen for up to 4 hours, depending on the design, is carried by the wearer.

- ◆ **Closed Circuit.** A closed circuit SCBA is a “rebreather” device. The breathing gas is rebreathed after exhaled carbon dioxide has been removed and the oxygen content restored by a compressed or liquid oxygen source or an oxygen generating solid. These devices are designed primarily for 1 to 4 hour use in oxygen deficient or IDLH atmospheres
- ◆ **Open Circuit.** An open circuit SCBA exhausts the exhaled air to the atmosphere instead of recirculating it. The service life of an open-circuit SCBA is usually shorter than the closed circuit SCBA. Most open-circuit SCBA have a service life of 30 minutes to 60 minutes based on NIOSH breathing machine tests.



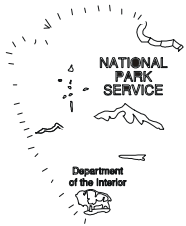
Supplied-Air Respirators

Airline respirators. Use compressed air from a stationary source delivered through a hose under pressure.

Hose masks. Supply air from a contaminated source through a strong large diameter hose to a respiratory inlet covering.

Fit Testing

The face-to-facepiece fit of a respirator is of the utmost importance if the wearer is to be adequately protected. A poor fit will allow dangerously high volumes of contaminated air to enter the facepiece. Therefore, fit tests must always be conducted as part of the respirator assignment procedure. There



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Notes:

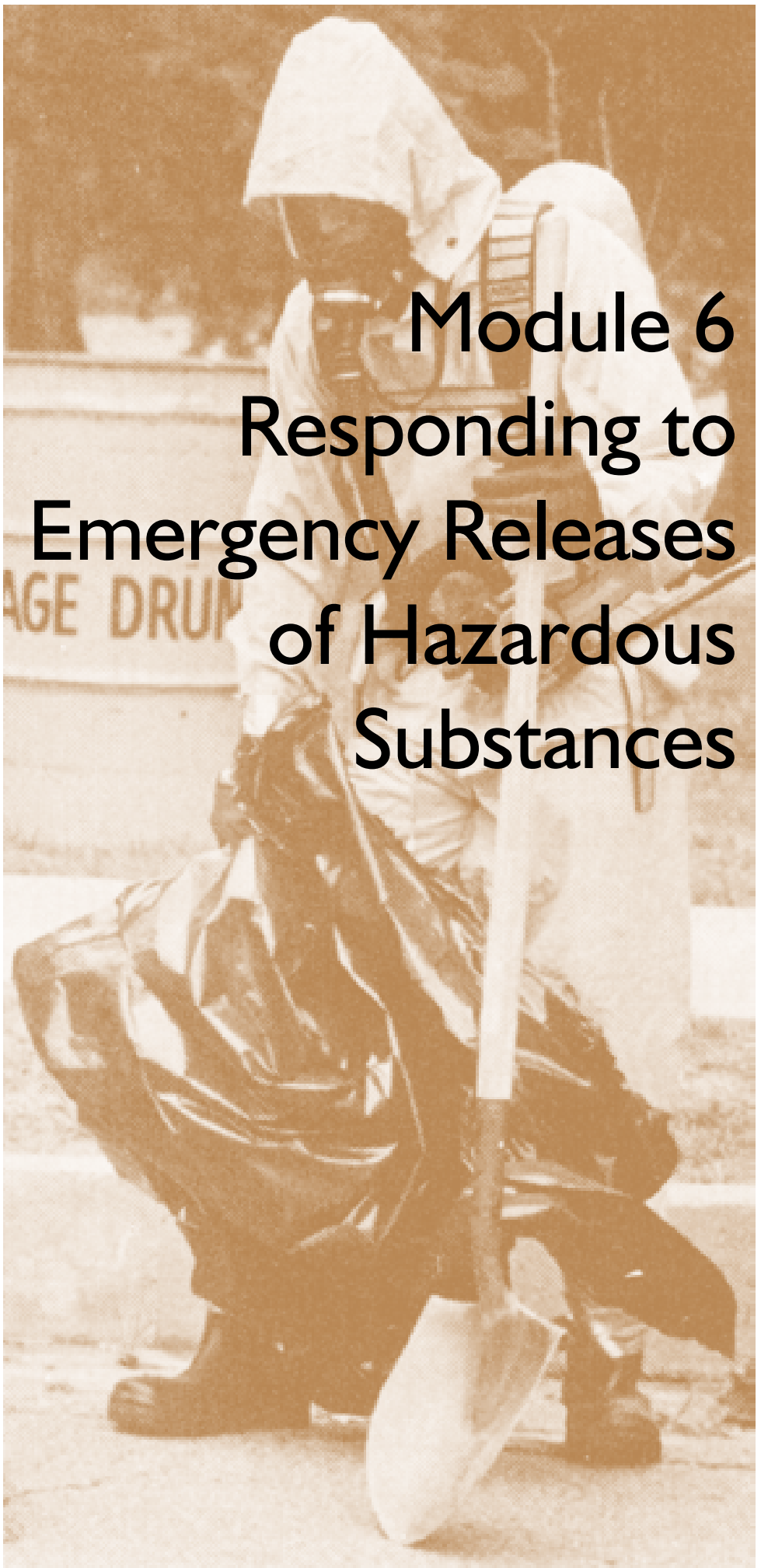
are two methods of fit testing.

Quantitative. Quantitative fit tests are complicated tests designed to produce a numerical value (or fit factor) indicating the degree of fit. Quantitative testing is typically performed by placing the wearer in an enclosure containing a known concentration of contaminant. A sample is drawn from within the facepiece and analyzed to determine the concentration of contaminant it contains.

Qualitative. Qualitative fit tests are simple tests designed to determine whether an acceptable fit has been achieved. This fit test should be performed every time a worker dons his or her respirator.

- ◆ Negative-pressure tests are conducted by blocking the inhalation pathway of the facepiece, inhaling gently, and holding the breath for 10 seconds while checking for leakage. If the fit is acceptable, the respirator should be pulled back toward the face by the vacuum generated through inhalation and remain there as the wearer holds his or her breath.
- ◆ Positive-pressure tests can be performed by blocking the facepiece exhalation valve and gently exhaling. Failure to generate a positive pressure inside the facepiece indicates a poor fit.
- ◆ Irritant smoke, odorous vapor, and sweetener tests are performed by exposing the wearer to irritants or substances with distinctive odors or tastes. If the facepiece is a good fit, the wearer should experience no reactions or sensations related to the substance used.





Module 6 Responding to Emergency Releases of Hazardous Substances

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE SIX – RESPONDING TO EMERGENCY RELEASES OF HAZARDOUS SUBSTANCES

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

- ◆ Understand the First Responder Operational Level responsibilities
- ◆ Describe the components of responding to emergencies
- ◆ Activate the incident command system
- ◆ Understand specialized safety procedures

OVERVIEW OF EMERGENCY RESPONSE

In general, OSHA's HAZWOPER training requirements can be separated into two categories:

- ◆ Individuals performing clean-up operations at uncontrolled hazardous waste sites, sites subject to clean-up requirements of a RCRA corrective action, and RCRA-permitted hazardous waste treatment, storage, and disposal (TSD) facilities; or
- ◆ Staff responding to emergency releases of hazardous substances, regardless of the location of the release.

The *first category* applies to workers employed for the primary purpose of cleaning up hazardous waste sites (e.g., professional hazardous waste site technicians, on-site equipment operators, etc.), or individuals working at treatment, storage, or disposal facilities handling hazardous wastes on a routine basis. Generally, NPS employees do not fall into this first category.

The *second category* applies to employees assigned to respond to emergency releases (e.g., spills, explosions) of a hazardous substance regardless of the location. As described above in Module Two, there are many situations at National Parks that provide an opportunity for accidental spills; therefore, this training is necessary for you. Table 6-1 presents the



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Notes:

different levels of emergency response training for hazardous substances and describes in general terms the activities required by each level. This course was developed to meeting the training criteria of the ***First Responder Operational Level***. The First Responder Operational Level participates only in defensive controls of the release and should never attempt to physically come in contact with any hazardous substance in an effort to control the release.

MANAGING AND RESPONDING TO THE INCIDENT

Table 6-1 Hazardous Materials Responders Categories*		
TITLE	ACTION	PERSONNEL
First Responder Awareness	<ul style="list-style-type: none"> Recognize problem Identify (if possible) Notify more qualified responders 	<ul style="list-style-type: none"> Police Some firefighters Public works officials Other field units
<i>First Responder Operations</i>	<ul style="list-style-type: none"> <i>Defensive</i> skills Contain spill (diking) Minimize harm (evacuation, water fog, protecting in place) 	<ul style="list-style-type: none"> Some police Firefighters NPS designated personnel (facility maintenance supervisors)
Hazardous Materials Technician	<ul style="list-style-type: none"> <i>Offensive</i> operations Plugging and patching Controlling the spill and stopping the release 	<ul style="list-style-type: none"> Hazardous Materials Response Teams Industrial brigades Emergency Response
Hazardous Materials Specialist	<ul style="list-style-type: none"> Respond and provide support to technicians 	<ul style="list-style-type: none"> Skilled oriented basis “Super Teams” State and/or Federal Industrial
On-Scene Incident Commander (OSHA)	<ul style="list-style-type: none"> Any incident commander above the awareness level 	<ul style="list-style-type: none"> Fire chiefs NPS designated personnel (facility maintenance supervisors) Sheriffs and deputies State and/or Federal On-Scene Coordinators
* As defined by OSHA 29 CFR § 1910.120(q).		

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Notes:

Protecting employees, visitors, and the environment are key concerns for NPS. Even a small amount of a hazardous substance or petroleum product, such as a quart of motor oil, can contaminate a drinking water supply or threaten an environmentally sensitive area. Every incident should be considered a hazardous materials response until proven otherwise.

Emergency responders can effectively respond to and manage an incident by completing six activities that can be remembered as the acronym "HAZMAT."

Hazard Identification:	Preliminary evaluation of the situation prior to entry.
Action Plan:	Steps to respond to or control the release.
Zoning:	Controlling the risk and securing the scene appropriately.
Managing the Incident:	Implementing the Incident Command System.
Assistance:	Reporting the spill and determining additional resources needed.
Termination:	Decontamination, conclusion of the incident, post-incident analysis, medical surveillance..

Hazard Identification

Prior to rushing into the area where the spill has occurred, take a few minutes to *assess the overall situation and identify the hazards*. NPS prohibits employees from entering areas where unknown hazardous substances may have been discharged. Under no circumstances should NPS employees enter the spill area unless trained as a hazardous waste emergency responder.

NPS employees should **NEVER** enter areas where the hazardous substance is "**Immediately Dangerous to Life and Health (IDLH)**." Unidentified hazardous substances must be treated as IDLH until proven otherwise.



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Notes:

Identify the hazards presented by the spilled substance as well as additional hazards created as a result of the spill such as heat stress; excessive noise; radiation; slip, trip, and fall hazards; and downed electrical wires.

To avoid entering the area of the spill, use the following tools or clues for identifying the hazards from a distance:

Binoculars or Spotting Scopes

Binoculars or spotting scopes can be an effective means to view the release from a distance. Look for labels, placards, or other visual clues that may help you define the situation.



Odors and Appearance

Odors and appearance will be among your first clues to use for determining the appropriate action. Hazardous chemicals, such as gasoline, often have distinctive odors that can quickly be identified. Remember however, that not all hazardous chemicals have odors, for example, carbon monoxide is odorless, colorless, and tasteless.

Notice also the appearance of the area. Look for stressed vegetation or fallen animals, oily stains, or more obviously, smoke.

Container Shapes

Types of hazardous materials can sometimes be identified by the shapes of the container in which they are stored and transported or the container material. Hazardous liquids, solids, and gases are stored in different manners due to their chemical and physical disposition. For example, cylinders usually contain liquids or gases under pressure, drums with bung tops are designed to hold liquids, and drums with removable tops contain solid materials. Table 6-2 describes types of containers and their possible hazardous contents.

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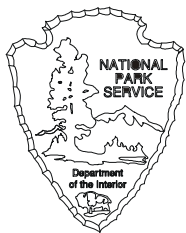
Containers	Description	Possible contents
Bags	Multi-wallpaper, plastic, paper lined with plastic	Solids (corrosive, flammable, poison, blasting agents, explosives)
Bottles (jars)	Glass or plastic with stopper or lid; hold up to several gallons	Any types of hazardous materials; solids or liquids
Carboys	Glass, plastic; usually inside cushioned boxes	Liquids; primarily used for corrosive materials
Cylinders	Metal; maybe color-coded, but this is not required by law and therefore is not a reliable indicator	Pressurized gases
Pails	Metal, plastic; hold one to five gallons	Any types of hazardous materials; solids or liquids
Drums	Metal, fiber board, plastic; hold 5 to 85 gallons	Any types of hazardous materials; solids or liquids

Notes:

Sampling and Monitoring Equipment

Sampling and monitoring equipment are useful in determining radiation levels, combustible or explosive atmospheres, oxygen deficiency, and organic vapors and gas. Examples of equipment include:

- ◆ Oxygen meters;
- ◆ Combustible gas indicators (CGI) for explosivity;
- ◆ pH meters;
- ◆ Radiation detection equipment;
- ◆ Colorimetric detector tubes;
- ◆ Organic vapor analyzers;
- ◆ Photoionization detectors;
- ◆ Air sampling devices;
- ◆ pH paper or strips;
- ◆ Organic vapor badge or film strips;
- ◆ Mercury badges; and
- ◆ Formaldehyde badges or strips.



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Notes:

Material Safety Data Sheets, Manifests, and Shipping Papers

MSDSs must be located at or near the workplace in which the hazardous chemical is used. Manifests and shipping papers are useful when responding to an emergency release involving transportation of hazardous waste or materials. (See Module Three for a detailed description of how to read these documents.)

Emergency Response Organizations

There are several emergency response organizations in or outside the United States that responders may call for information on hazardous chemicals or materials. The following numbers should be contacted only in emergency situations.

- ◆ **CHEMTREC** toll free at **1-800-424-9300**, is a service of the Chemical Manufacturers Association.
- ◆ **CHEM-TEL, INC.** toll free at **1-800-255-3924**.
- ◆ **National Response Center (NRC)** toll free at **1-800-424-8802**.
- ◆ **Department of Defense for Military Shipments** at **703-697-0218** for incidents involving explosives and ammunition or toll free at **1-800-851-8061** for incidents involving dangerous goods other than explosives and ammunition.
- ◆ **CANUTEC** (Canadian Transport Emergency Centre) at **613-996-6666**.
- ◆ **SETIQ** (Emergency Transportation System for the Chemical Industry) at **91-800-00-214** in Mexico or **0-11-52-5-575-0839** or **0-11-52-5-575-0842** outside of Mexico.
- ◆ **CECOM** (National Center for Communications of the Civil Protection Agency) at **91-800-00-413** in Mexico, or **0-11-52-2-550-1496** outside of Mexico.

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Published Reference Documents

Notes:

Published reference documents, pamphlets, and guides are very useful tools in responding to incidents. Every park dispatch vehicle should have in its glove box a copy of *The DOT North American Emergency Response Guidebook*. Also, the *National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards* and the *American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs)* booklets should be within easy reach of the first responder during an emergency.

The DOT North American Emergency Response Guidebook

One of the best ways to identify a hazardous substance is through its four-digit UN/NA identification number and the use of *The DOT North American Emergency Response Guidebook*. (See Module Three for a discussion of DOT's hazard coding system.) This number is generally found on or directly below a diamond shaped label on the container or placard on the vehicle. To identify the product by the UN/NA number, follow the procedure listed below:



1. Refer to the **YELLOW** pages of the Emergency Response Guidebook (a copy should be located in each patrol vehicle and/or at Dispatch at all times).
2. Locate the UN/NA number. The HAZMAT name appears next to the UN/NA code (e.g., 1203 = gasoline).
3. Note the number indicated under the "Guide" column and turn to the appropriate guide number in the **ORANGE** section of the book (e.g., gasoline = guide 27). This section provides you with **basic spill response information**.
4. If an entry in the Emergency Response Guidebook is highlighted, this indicates that **additional spill response information** is available in the **GREEN** section of the book.



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Notes:

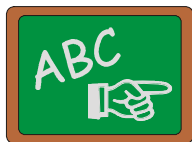
5. If you **don't know the UN/NA number** for the substance, but you know the name, turn to the **BLUE** section of the book. This section will also refer you to the **ORANGE** section for the appropriate response guide.

NIOSH Pocket Guide to Chemical Hazards

The *NIOSH Pocket Guide to Chemical Hazards* contains information on 397 hazardous chemicals. Information includes: chemical names, formulas, synonyms, permissible exposure limits (PELs), chemical and physical properties, respiratory and personal protective equipment use recommendations, symptoms of overexposure, monitoring procedures, and procedures for emergency treatment.

ACGIH TLVs and BEIs

The American Conference of Governmental Industrial Hygienists (ACGIH) developed threshold limit values (TLVs) and biological exposure indices (BEIs) for hazardous chemicals and agents. TLVs refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects; BEIs provide a tool for assessing a worker's exposure to chemicals.



Go to exercise,
Part Two

Action Plan

Emergency responders should always assume an incident involves hazardous materials unless positive identification proves otherwise. As previously mentioned, NPS employees should never enter areas where the hazardous substance is IDLH. First Responders to an incident must assess the situation by using the means mentioned above and immediately implement the health and safety and emergency response plans. The first responder should call for help immediately should the situation warrant it.

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Spill Prevention and Containment

Notes:

For the first responder at the operational level, taking action at an emergency response means *defensive action*, through physical controls or chemical neutralization. The best defensive action is spill prevention through proper storage and handling. This includes not moving containers such as bulging drums until they are carefully overpacked. (Overpacking involves the placement of the leaking or damaged container into another larger container. Overpacking should not be performed by the First Responder at the Operational Level.)

Should a spill occur however, First Responders can take low-risk, defensive measures to contain the spill and prevent further release. There are three basic types of media into which a spill may occur: land, water, and air. The type of action taken will depend upon the media into which the spill occurs. In all cases, the area should be isolated to avoid contact by untrained personnel with the hazardous material. Isolation may include installing fences or warning signs or implementing institutional controls such as closing an area to park visitors.

Controlling Land Releases

A primary goal of controlling land releases is to prevent migration of the spill to other media. Topography and the surface onto which the spill occurred affect the migration of a spill, and therefore the first responder should quickly survey the spill area to determine the route of migration.

Isolating Leaking Containers

Without coming in contact with hazardous chemicals, the First Responder should attempt to isolate any leaking containers to prevent contamination of sound containers and to keep untrained personnel away from the incident.

Damming/Diking

Damming or diking contains the flow of liquid substances within a barrier such as a stream or creek. Basic construction design considerations for barriers are:



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Notes:

- (1) They must be massive enough to withstand the pressure exerted by flowing or contained liquids, and
- (2) They must be constructed out of materials that are compatible with the spilled material.

Diversion

Diversion means placing a control device in the pathway of a substance to divert it into safe, controlled area such as a “catch basin.” First Responders can dig ditches or trenches or use dikes and booms to divert substances.

Sorbents

Sorbents stop the flow of spilled liquids by absorbing or adsorbing the spill. To be totally effective, the sorption rate must exceed the flow rate of the spill. Additionally, sorbents can decrease evaporation of the spilled substance.

A wide variety of sorbents are available, from ordinary straw to complex synthetic products. Sorbents are applied on or in the path of the spill. Once the sorbent is saturated, it is removed and placed in a suitable container for disposal. If any spill remains, more sorbent is applied. Depending on the material spilled and the type of sorbent used, the resulting saturated sorbent may be subject to RCRA regulations. Table 6-3 identifies typical natural and synthetic sorbents.

Controlling Water Releases

Materials released into water are usually characterized as either heavy insoluble, light insoluble, or water-soluble. The type of control measure will depend on which type of characteristic is present.

Heavy Insoluble Materials. Overflow dams and catch basins are useful for heavy, insoluble substances (e.g., Asbestos, trichloroethane) spilled into slow-moving streams. In both cases, the material, as it passes over a pit area in the stream, accumulates in the depression and can be collected for proper disposal.

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Table 6-3
Characteristics of Sorbents

Notes:

Product	Advantages	Disadvantages
Corn cobs or other vegetable by-products	<ul style="list-style-type: none"> • Can be incinerated • Inexpensive 	<ul style="list-style-type: none"> • Slow sorbency • Short shelf life • Nest for bugs and mice
Minerals (vermiculite, crushed limestone or diatomaceous earth)	<ul style="list-style-type: none"> • Inexpensive 	<ul style="list-style-type: none"> • Slow sorbency • Limited capacity • Heavy • Creates dust
Synthetics (Tyvek, Polyolefin, Polypropylene)	<ul style="list-style-type: none"> • High rate and capacity of sorption • Sorbed materials tend not to leach out • Can be incinerated 	<ul style="list-style-type: none"> • Expensive

Light Insoluble Materials. Booms, underflow dams, and filter fences can be used to contain a light insoluble materials (e.g., waste oil, gasoline) in a stream or lake. Booms are elongated tubular devices that float on the surface of a water body and confine a product. Underflow dams are the opposite of overflow. They allow a material to accumulate at the surface of the water and use pipes or tubing to allow clean water to flow from the bottom up and through the top of the dam. Filter fences use posts, fencing, and suitable sorbent materials to confine a release. The fencing holds the sorbent material in place, which soaks up the contaminant as the stream flows through the filter fence.

Water-Soluble Releases. Water soluble products (e.g., chlorine, ammonia) are very hard to control because they mix with the water. Confinement techniques usually involve capturing an entire volume of contaminated water for treatment. These actions will usually involve expertise and equipment not available to the First Responder at the Operational Level.

While EPA favors the development and utilization of sorbents, booms, dams, and other physical controls, chemical treatment such as neutralization may be the only viable option for controlling water-soluble releases. Neu-



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Notes:

tralization is generally considered a more offensive approach, uncharacteristic of the First Responder at the Operational Level; however, it bears mentioning. Neutralization is a process of counteracting a chemical spill and restoring the neutral condition of the water rapidly by application of neutralization chemicals. Neutralizing a chemical spill in a body of water is difficult. The neutralizing chemical should be very weak, non-injurious to the environment, and should not form toxic compounds.

Before neutralizing a chemical spill, the nature of the body of water should be taken into consideration. Some things to consider are:

- ◆ Natural pH levels (acidic or alkaline);
- ◆ Fresh vs. marine water;
- ◆ Water movement; and
- ◆ Rate of mixing.

Other Control Techniques

Although the following techniques are generally considered more offensive activities, and thus, ones that the First Responder at the Operational Level should not perform, they are mentioned below for informational purposes.

Vapor Dispersion/Vapor Suppression

Vapor dispersion refers to directing fog patterns from fire hoses through a vapor cloud of hazardous substances. Most effective with water-soluble materials, this activity creates a large amount of contaminated water which should be confined in order to minimize environmental impact.

Vapor suppression refers to the application of a product, such as a foam blanket, over a volatile material that is emitting vapors from its surface. Types of foam suppressors differ depending on the hazardous materials involved in the spill and therefore, specialized training is necessary to ensure safe and effective use.

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Dispersion

Notes:

Dispersants are emulsifiers that break up oil contaminants. They are generally applied after an insoluble, oily substance has been removed from the land or water surface by vacuuming and/or sorption techniques. Of consideration when using dispersants to control spills is that the contaminant is not removed from the environment, merely dispersed.

Dilution

Responders can reduce the hazards posed by a contaminant by diluting it with large amounts of water. Only effective with water-soluble materials, dilution can render the material nonhazardous if its hazard was due only to its concentration level. Responders should remember, however, that water should never be applied to certain hazardous materials. Therefore never use dilution when: (1) the material is unknown; (2) the material is a strong acid; and (3) the material is water-reactive.

Health and Safety Plans

OSHA's HAZWOPER standard establishes criteria related to the protection of workers' health and safety in the workplace. Primary among those criteria is the development and implementation of a written health and safety program that identifies, evaluates, and controls health and safety hazards, and provides emergency response procedures for hazardous waste sites or treatment, storage, and disposal facilities.

Each park should have a Health and Safety Plan. Your park may also have a Site Specific Health and Safety Plan depending on the hazardous waste management or cleanup activities at the park. Generally speaking, a Site Specific Health and Safety Plan is developed any time a facility is handling hazardous waste on a regular basis either as part of daily operations at the facility or when performing RCRA/CERCLA regulated clean-up action to a release of a hazardous waste or substance.

Emergency responders should be aware of the location and contents of the Safety and Health Plan at the park. The elements of the Health and Safety Program include the following: (See [Appendix Seven](#) for a sample of a



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Notes:

Site Health and Safety Plan):

- ◆ An organizational workplan;
- ◆ Site evaluation and control;
- ◆ A site-specific health and safety plan (if necessary);
- ◆ Information and training program;
- ◆ Personal protective equipment program;
- ◆ Monitoring;
- ◆ Medical surveillance program;
- ◆ Decontamination procedures; and
- ◆ Emergency response program.

Emergency Response Plan

OSHA requires that an emergency response plan be included as part of the Site Health and Safety Plan. Like the Site Health and Safety Plan, the Emergency Response Plan must be written to include the specific hazardous conditions associated with the site. OSHA requires that, at a minimum, the Emergency Response Plan include the following elements:

- ◆ Pre-emergency planning;
- ◆ Personnel roles, lines of authority, and communication;
- ◆ Emergency recognition and prevention;
- ◆ Safe distances and places of refuge;
- ◆ Site security and control;
- ◆ Evacuation routes and procedures;
- ◆ Decontamination procedures that are not covered by the site health and safety plan;
- ◆ Emergency medical treatment and first-aid;
- ◆ Emergency altering and response procedures;
- ◆ Critiques of response and follow-up; and
- ◆ Personal protective equipment and emergency equipment.

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Appendix Eight includes a Hazardous Materials Response Equipment List. This list identifies items that should be stored at any spill response headquarters or dispatch location.

Notes:

Zoning

Generally speaking, emergency responders manage hazardous material spill sites by setting up zones: the Exclusion Zone is the contaminated area; the Contamination Reduction Zone is the area where decontamination is performed; and the Support Zone is the clean area where workers should not be exposed to hazardous substances (See Figure 6-1).

Setting up zones around the spill prevents spectators and other non-essential or untrained personnel from entering the area. Size of the zones depends on the incident conditions and the product involved. Initially, an elaborate control system is not necessary due to time constraints. The zones, however, should be staked and clearly marked with flags or signs.

The Exclusion Zone

The Exclusion Zone is the innermost zone where hazardous materials or wastes are located. Only trained personnel wearing the appropriate personal protective equipment may enter this zone. Table 6-4 identifies criteria that responders should evaluate to determine the Exclusion Zone border. To determine the safe distances from specific materials and the size of the Exclusion Zone, refer to the *DOT North American Emergency Response Guidebook*. Activities that occur in this zone include:

- ◆ Site characterization;
- ◆ Sampling and monitoring; and
- ◆ Release response (hazardous substance/material removal or remedial action).



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Notes:

Table 6-4 Establishing the Exclusion Zone Borderline
Visually survey the immediate site environs.
Determine the locations of: ⇒ Hazardous substances; ⇒ Drainage, leachate, and spilled material; and
Evaluate data from the initial site survey indicating the presence of: ⇒ Combustible gases; ⇒ Organic and inorganic gases, particulates, or vapors; and
Evaluate the results of soil and water sampling.
Consider the distances needed to prevent an explosion or fire from affecting personnel outside the Exclusion Zone.
Consider the distances that personnel must travel to and from the Exclusion Zone.
Consider the physical area necessary for site operations.
Consider meteorological conditions and the potential for contaminants to be blown from the area.
Secure or mark the Hotline.
Modify its location, if necessary, as more information becomes available.

Contamination Reduction Zone (Yellow Zone)

The Contamination Reduction Zone is the area between the Exclusion Zone (contaminated area) and the Support Zone (clean area). Activities that occur in this zone include:

- ◆ Decontamination of equipment, workers, and sample containers;
- ◆ Emergency response (e.g., first aid, fire equipment, etc.);
- ◆ Equipment re-supply; and
- ◆ Sample packing and preparation for on-site or off-site laboratories;
- ◆ Worker rest areas; and
- ◆ Decontamination fluids collection, sampling, and storage.

Remember:

- ◆ Keep flammable material and products away from the release area.
- ◆ Do not come in contact with substance(s).



Notes:

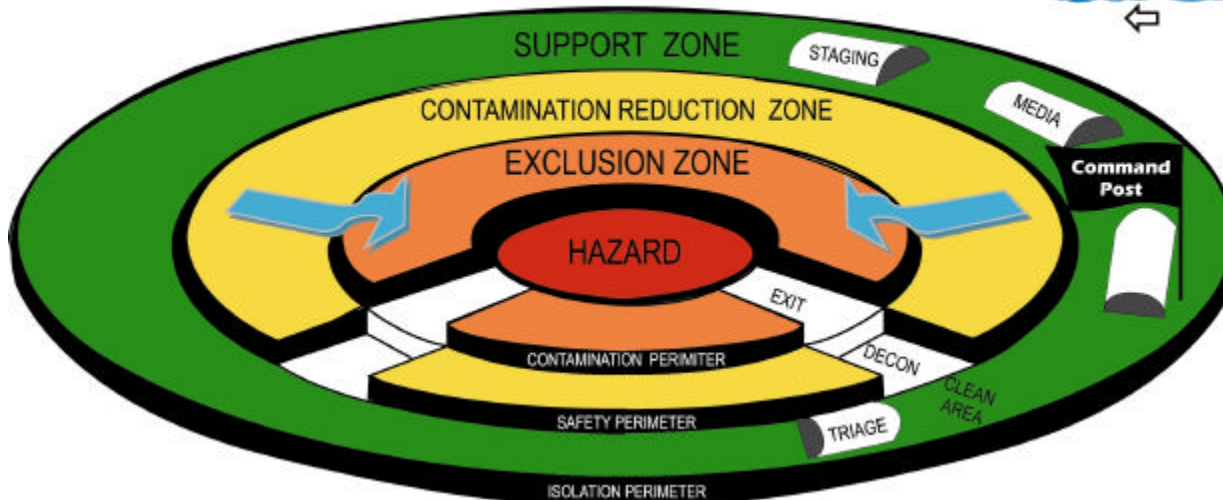
The Contamination Reduction Zone is designed to reduce the possibility of the clean area becoming contaminated by site hazards. Decontamination activities take place within the Contamination Reduction Zone in an area called the Contamination Reduction Corridor (CRC). One line of decontamination stations should be set up within the CRC for workers and one line of stations for heavy equipment. Exit from the Exclusion Zone, at the Hotline, is through a decontamination station in the CRC. For further information regarding decontamination refer to the end of this Module.

The Support Zone (Green Zone)

The Support Zone is a clean area used for site control directly outside the yellow zone. All support activity should be conducted up wind of the Exclusion and Contamination Reduction Zones. Activities or personnel in this area include:

- ◆ Incident command post;
- ◆ Administrative activities;
- ◆ Media; and
- ◆ Other support functions.

Figure 6-1





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Notes:

Managing the Incident

Upon arrival at the incident, First Responders at the Operational Level begin the management process. Not until the last piece of equipment leaves the scene and all necessary paperwork is completed is the incident over.

The Incident Command System

The Incident Command System (ICS) was developed by Federal fire protection agencies. It is a widely recognized method for managing an emergency response. OSHA requires that the ICS be utilized when responding to emergency releases of hazardous substances, wastes, or materials in the workplace.

The ICS is an organizational structure that uses interrelated components and assigns duties to personnel to maintain order when responding to an emergency, which is critical because the situation can otherwise quickly become chaotic. The structure identifies personnel roles and is designed so that each person receives orders from only one individual, promoting efficiency, teamwork, and safety. The system takes into consideration multi-disciplinary, multi-agency, and multi-jurisdictional response actions.

The ICS utilizes several components that work together interactively to provide the basis for an effective operation. They include:

- ◆ **Common Terminology.** The ICS uses the same terminology for organizational functions, resource elements, and facilities in order to promote consistency during multi-disciplinary, multi-agency, and multi-jurisdictional response actions.
- ◆ **Modular Organization.** The ICS organizational structure develops in a modular fashion based upon the kind and size of an incident. The organization's staff builds from the top down with responsibility and performance placed initially with the Incident Commander (See Figure 6-2 below). As the need develops, separate sections can be developed as can units within the sections. The structure size is based upon the management needs of the incident. If one individual can simultaneously manage all major functional areas, no further organization is required.

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Notes:

- ◆ **Integrated Communications.** Incident management and communications are managed through a common communications plan and an incident based communications center or incident command post. The incident command post is the center for all organizational activities and tactical operations.
- ◆ **Unified Command Structure.** A unified command structure refers to the requirement for multi-jurisdictional management of an incident. A unified command structure could consist of a key responsible official from each jurisdiction in a multi-jurisdictional situation or it could consist of several functional departments within a single jurisdiction.
- ◆ **Consolidated Action Plan.** Emergency responders should implement use of the health and safety and emergency response plans, which should contain standard operating procedures for responding to the incident.
- ◆ **Manageable Span-of-Control.** The ICS acknowledges that a person acting in a managerial role can efficiently direct and supervise the activities of three to seven subordinates. If a span of control is exceeded, the managerial skills of personnel can be overwhelmed leading to a breakdown in effective response.
- ◆ **Comprehensive Resource Management.** The ICS provides centralized control and coordination resources such as personnel, equipment, and supplies to mount an efficient response.

The ICS is generally divided into five hierarchical functional areas, each of which is managed by one individual and his or her subordinates, who may also manage individuals. Those areas include: command; operations; logistics; planning; and finance. The first responder may at first assume all of these roles, then be relieved of some or all of the duties as other emergency response personnel appear on the scene.

Command

The Incident Commander carries out the command functions. The Incident Commander is the official in charge of the command section responsible for managing the entire response action. The Incident Commander administers

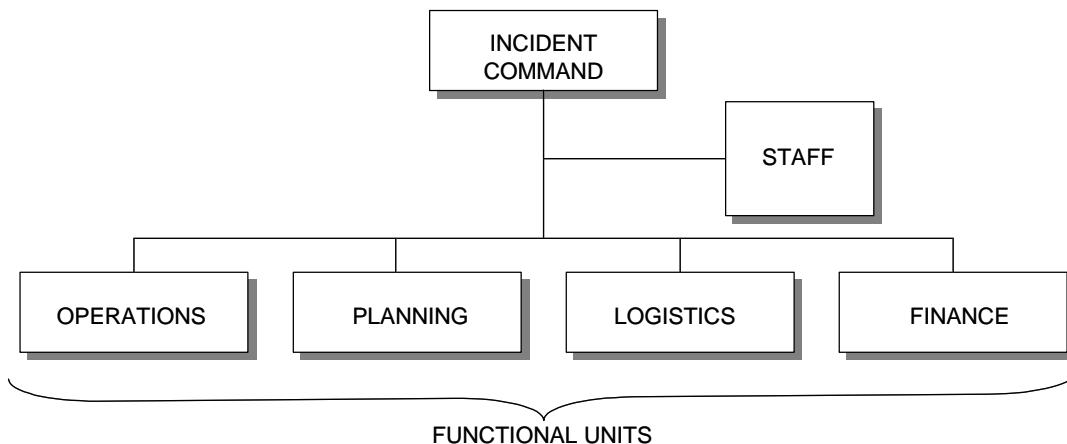


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Notes:

Figure 6-2



scene activities, develops work plans, and manages and directs all response activities. The First Responder assumes the role of Incident Commander until relieved of such duties by a higher-ranking emergency response individual on the scene. Other command staff may include the information officer, safety officer, and liaison officer.

Operations

As an incident grows in complexity, the Incident Commander will appoint an individual to be the Operations Officer. The Operations Officer directs all tactical operations used to control the incident. Responsibilities include directing the actual response activities such as taking measures to control, confine, and contain the emergency release.

Logistics

The Logistical Officer plans the use of and acquires equipment, supplies, and other support services needed to effectively respond to the emergency. Such items may include earth moving equipment, sampling and analysis equipment, food for responders, or personal protective equipment.

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Planning

Notes:

The Planning Officer is responsible for gathering and analyzing data regarding the incident operations and assigned resources, developing alternatives for tactical operations, conducting the planning meetings, and preparing the action plan for each operational period. The planning officer will normally originate from the jurisdiction with command responsibilities.

Finance

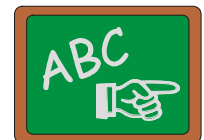
The finance section is established for incidents when there is a specific need for finance services, such as procurement and recordkeeping. NPS policy is to recover all costs expended responding to hazardous substance releases from responsible parties. It is critical that all costs are tracked and purchase orders, invoices, and time sheets are retained in a separate file for future analysis and potential cost recovery litigation.

Assistance

The First Responder should seek assistance immediately and throughout the response process as necessary. Federal law requires that individuals report spills to the appropriate authorities. Park policy requires that individuals report releases to park managers. The First Responder should immediately report incidents to dispatch or other centralized information sources. Reporting the incident immediately provides for mobilization of reinforcements should the situation warrant the need for assistance.

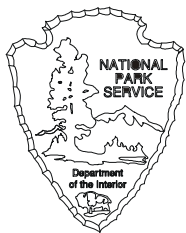
Reporting to the National Response Center (NRC)

Federal law requires that individuals report releases of hazardous substances to the National Response Center (NRC) as soon as that person has knowledge of any release of a hazardous substance in a quantity equal to or greater than the substance's reportable quantity (RQ). RQs vary with each substance. The NRC can also provide information on responding to the emergency.



[Go to exercise, Part Three](#)





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Notes:

The NRC can be reached at 1-800-424-8802. A Spill Report Form should be completed prior to contacting the NRC to assist in responding to the NRC's inquiries (See [Appendix Nine](#) for a Spill Report Form). The NRC will dispatch a Federal On-Scene Coordinator (usually EPA or United States Coast Guard personnel) to respond to the incident accordingly.

Other Assistance

Assistance can also be obtained from local emergency response organizations including:

- ◆ Fire departments;
- ◆ Police departments;
- ◆ Park health centers or clinics;
- ◆ Contractors;
- ◆ Technical specialists (e.g., universities);
- ◆ Pollution control organizations;
- ◆ Federal Regional Response Teams; and
- ◆ State emergency response organizations.

Termination

Decontamination

At all sites where there has been a response to a spill or release of hazardous substances the potential exists for anything that comes in contact with toxic materials to be contaminated. It is vital to the health and safety of hazardous materials site workers that all equipment and people be decontaminated properly.

Decontamination is the chemical or physical process of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

- Standard health and safety regulations require that the development of a decontamination plan (as part of the Site Health and Safety Plan) be in operation before any personnel or equipment may enter any areas where the potential for exposure for hazardous substances exists.

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Seven points to consider when developing a decontamination plan:

Notes:

- ◆ Determine the number and layout of decontamination stations;
- ◆ Determine the decontamination equipment needed (e.g., chemicals to neutralize, brushes);
- ◆ Determine the appropriate decontamination methods;
- ◆ Establish procedures to prevent contamination of clean areas;
- ◆ Establish methods and procedures to minimize responder contact with contaminants during removal of PPE;
- ◆ Establish methods for disposing of clothing and equipment which are not completely decontaminated; and
- ◆ Undergo revision whenever the type of personal protective clothing or equipment changes, the scene conditions change, or the scene hazards are reassessed based on new information.

Decontamination procedures should be tailored to the specific hazards of the site, and may vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending upon the specific substance, since one procedure or method may not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to ensure that employees are not exposed to hazards by re-using PPE.

People and objects can be contaminated in numerous ways, including being splashed, tracking through soil and liquids, inhaling airborne particulate, and using contaminated equipment. Therefore, all equipment and personnel must be decontaminated properly.



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Notes:

In any hazardous situation, before entering the work site, a thorough plan must be implemented to handle decontamination procedures. Prevention of contamination is the first step. The subsequent steps are:

- ◆ Assess the hazardous situation;
- ◆ Locate the hazardous material;
- ◆ Identify the hazardous materials and its physical state;
- ◆ Survey the extent of contamination;
- ◆ Identify the work to be done; and
- ◆ Choose the proper level of personal protection equipment.

Personal and equipment decontamination procedures vary according to the level and type of contaminant identified. Unless otherwise known, always assume a worst-case scenario. Testing at a later time may prove that a lesser degree of protection and decontamination procedures are warranted.

Decontamination of Personnel

Decontamination procedures must provide an organized process by which levels of contamination are reduced. The decontamination process should consist of a series of procedures performed in a specific sequence. Table 6-5 illustrates the basic stages of the personnel decontamination station. The level of protection will vary depending upon the type of decontamination equipment used. For example, workers using a steam jet may need a different type of respiratory protection than other decontamination personnel due to high moisture levels produced by the steam jets.

<u>Stage 1 (Solo)</u> → <ul style="list-style-type: none"> • Tool drop • Primary decon • Full outer wash 	<u>Stage 2</u> → <ul style="list-style-type: none"> • Wash • Rinse • Remove <ul style="list-style-type: none"> – Tape – Bands – Outer boots 	<u>Stage 3</u> → <ul style="list-style-type: none"> • Wash • Rinse • Remove <ul style="list-style-type: none"> – Suit – Inner gloves – SCBA 	<u>Stage 4</u> <ul style="list-style-type: none"> • Full body wash • Dry and dress • Medical exam <ul style="list-style-type: none"> – Exposure – Heat Stress – Hydration
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In some cases, decontamination personnel may be sufficiently protected by wearing protection that is one level lower than the workers they are decontaminating (e.g., wearing Level C protection while decontaminating workers who are dressed in Level B).

Notes:

All decontamination personnel work in a contaminated area and must be decontaminated themselves before entering the clean support zone.

General Methods for Decontamination

The time of day, temperature, wind direction and speed, and other environmental factors must be considered when determining the level of decontamination to perform and where to perform it.

All PPE must be decontaminated and sanitized before reuse. Regulators of respiration devices must be maintained by certified personnel according to manufacturers' recommendations. Leather strips may be heavily contaminated and must be disposed of.

Large, heavy equipment must be hydro-blasted, steam cleaned, scrubbed, or sandblasted to remove contamination. If necessary, a wipe test should be made. The sample wipe should be sent to laboratory for examination of persistent contamination.

Any equipment not decontaminated, as well as decontamination solutions, must be handled as hazardous waste and secured in drums, plastic bags, or other containers, and labeled and disposed of as contaminated waste.

Dilution and Washing. Dilution ranges from rinsing off with a booster line to an eight step system of decontamination. Water usually does not change the product's chemical make-up. However, using water to dilute has advantages over the other means of decontamination because water is readily available. Using soap or other cleansing agents with water can remove many hazardous products. It is difficult to contain dilution runoff, but it is essential to make every effort to control the runoff. Runoff will eventually flow to some other site, transferring the problem to someone else.



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Notes:

Chemical Neutralization or Degradation. A method of decontamination in which the chemical structure of the hazardous material is altered by mixing with another reactive chemical to lessen the danger of the hazardous materials.

Absorption or Adsorption. A process of picking up the hazardous substance with an absorbent material such as powdered lime, soil, or clay absorbent.

Isolation and Disposal. Methods used for any equipment that cannot be successfully decontaminated by other methods.

Physical Removal. Gross contamination can often be removed by physical means such as dislodging or displacing, rinsing, wiping off, and evaporation.

Chemical Removal. Physical removal of gross contamination should be followed by a wash/rinse process using cleaning solutions.

Dry Decontamination. First Responders trained at the Operational Level who have entered a potentially contaminated area and have conducted themselves so as to limit exposure and avoid contamination can perform dry decon by systemic removal of their PPE. This is done by turning the PPE inside-out as the individual undresses, being careful not to allow contaminants to contact the body. The PPE must be left in the Contamination Reduction Zone (Yellow Zone) and treated the same as other contaminated equipment. Some responders may wear multiple layers of PPE which are then removed at separate stations in the decontamination line. Dry decontamination can then be followed by a secondary wash and other decontamination activities or can be provided without the formal establishment of a contamination reduction corridor, as in the case of emergency decontamination.

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Hazards of Decontamination

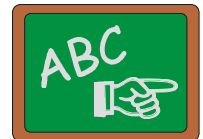
Notes:

Decontamination can pose hazards under certain circumstances. Specifically, decontamination methods may:


- ◆ Be incompatible with the hazardous substances being removed (e.g., a decontamination method may react with contaminants to produce an explosion heat, or toxic products).
- ◆ Be incompatible with the clothing or equipment being decontaminated (e.g., some organic solvents can permeate or degrade protective clothing).
- ◆ Pose a direct health hazard to responders (e.g., vapors from chemical decontamination solutions may be hazardous if inhaled, or they may be flammable).

Emergency Decontamination

In a life-threatening situation all decontamination procedures should be waived. If possible, remove all outer PPE and respiratory equipment – cut them away if necessary. If this cannot be safely done then the injured party should be wrapped in plastic or rubber sheets to prevent contamination to medical personnel. All hazardous materials information must be provided to the toxicologist working with the medical rescue team and local hospital. All rescue personnel must be decontaminated afterward according to the steps established in this Module.



[Go to exercise, Part Four](#)



Module 7 Confined Space Entry

HAZWOPER

**24-Hour
Training Manual**



MODULE SEVEN – CONFINED SPACES

Notes:

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

- ◆ Describe the characteristics of a confined space
- ◆ Describe the three types of atmospheres and three space classifications of a confined space
- ◆ List the three types of space classifications and describe the characteristics of each
- ◆ List safety measures to be taken for lockout/tagout of energized equipment

Workers often underestimate the danger involved with working in a confined space. Confined spaces present potential safety and health problems that require special precautions. This section describes the different types of confined spaces and alerts workers to the special hazards that they present, and examines the precautions that must be exercised when working in a confined space.

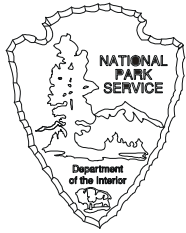
CHARACTERISTICS OF A CONFINED SPACE

A confined space is an area that:

- ◆ Exhibits poor ventilation or contains an atmosphere that could produce dangerous air contaminants;
- ◆ Is of a design not meant for continuous worker occupancy; and
- ◆ Has limited openings for entrance and exit.

Confined spaces include, but are not limited to, manholes, sewers, storage tanks, boilers, and ventilation ducts. In general, a confined space is an area that has (1) limited access/exit, (2) possesses the potential for toxic or flammable contaminants to accumulate, and/or (3) exhibits an oxygen-deficient atmosphere unable to support life.

NOTE: This module **DOES NOT** meet the training requirements for



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Notes: confined space entry as set forth in 29 CFR 1910.146.

CONFINED SPACE HAZARDS: ATMOSPHERES

Lack of air circulation inside confined spaces can produce extremely hazardous atmospheres. The hazardous atmospheres detailed below may be present within a confined space.

Oxygen-Deficient Atmosphere

An oxygen-deficient atmosphere is one whose oxygen content is less than 19.5 percent (21 percent is normal for sea level). This type of atmosphere should not be entered without an approved atmosphere-supplying respirator. Physiological effects (such as impaired attention, coordination, breathing, and judgment) appear in humans when their oxygen level is decreased to 16 percent. An environment with an oxygen content of less than 16 percent can lead to rapid fatigue, nausea and vomiting, brain and heart damage, unconsciousness, and death. Two factors can influence oxygen deficiency within a confined space:

1. **Type of Work:** The type of work being performed in a confined space may decrease the oxygen level. Work such as welding or brazing can displace oxygen.
2. **Chemical Reactions:** Some chemical reactions (such as rotting organic matter) can decrease oxygen levels.

Flammable/Combustible Atmosphere

Fire and explosion in a confined space are serious, and often fatal, hazards. Two factors that can cause an atmosphere to become flammable are (1) oxygen, and (2) flammable vapor, gas, or dust (in the proper mixture). Sources of ignition include the following:

- ◆ Sparks from welding, grinding, or cutting;
- ◆ Static electricity;
- ◆ Lit cigarettes;
- ◆ Unapproved electrical equipment; and



- ◆ Metal friction.

Notes:

Toxic Atmosphere

Most liquids, vapors, mists, gases, solid materials, and dusts should be considered hazardous when located in a confined space environment. Toxics that may be found in a confined space include carbon monoxide, sulfur dioxide, carbon dioxide, and hydrogen sulfide. Excessive amounts of toxic exposure can kill. Most toxics are not easily detected, as they have no smell or visual presence. Toxics present two different types of risk:

1. **Chemical Asphyxiation:** Certain chemicals can cause asphyxiation once they gain entrance to the lungs; others can terminate oxygen supplies after being absorbed into the body.
2. **Irritation:** Small amounts of some toxic substances can affect the respiratory or nervous systems.

Toxic atmospheres can arise as a result of one of three situations:

1. Storage of a product in a confined space (once a stored product is removed from a confined space, toxic gases can exude from the walls).
2. Work that takes place in a confined space (painting, sanding, welding, brazing, etc.).
3. Work occurring near a confined space (toxic substances produced by work taking place near a confined space may enter and accumulate in the confined space).



OSHA 29 CFR 1910.146 requires the following items when working with confined spaces:

- ◆ Identification;
- ◆ Posting;
- ◆ Permitting; and
- ◆ Mandatory attendants.

CONFINED SPACE TYPES



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Notes:

Class A Confined Spaces

Class A confined space is immediately dangerous and life threatening and is therefore considered the most hazardous type of confined space. Characteristics of a Class A confined space include an oxygen level of less than 19.5 percent (or greater than 23.5 percent), explosive or flammable atmospheres, or toxic substances of a high enough level of concentration to be considered “immediately dangerous to life and health” (IDLH).

Workers who need to enter a Class A confined space should strive to change the space’s rating to Class B before entering the space. This can be accomplished by ventilating, flushing, and/or draining the space to replace the hazardous atmosphere with clean air. If the hazardous atmosphere cannot be controlled, entrants must wear the appropriate PPE. The atmosphere inside the confined space should be monitored constantly once work begins.

Note: Class A confined spaces should never be entered except in the case of an emergency.

If a worker should inadvertently enter a Class A environment, and a subsequent rescue needs to be performed, site emergency procedures must be followed with no exceptions. Rescuers must don approved respiratory protection as well wear other required PPE.

Class B Confined Spaces

Class B confined space is considered dangerous but not immediately life threatening. If preventative measures are not taken, Class B space has the potential to cause illness to or injure the worker. Class B space is not immediately dangerous to the life or health of the worker. Rescue procedures for Class B space require the entry of at least two individuals who are fully equipped with life support equipment. These rescuers must maintain indirect visual or auditory communication with the worker(s) being rescued as well as the workers outside the confined space.

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Class C Confined Spaces

Notes:

Class C confined space is considered to be a potential hazard. This type of space does not require the worker to modify his or her work procedures.

Standard rescue procedures are to be utilized in the event of an injured or downed worker in a Class C confined space. Direct contact with workers outside the confined space must be maintained.

It should never be assumed that a confined space is Class C (even if the space was previously considered Class C).

ENTRY AND SAFETY MEASURES

What Kind of Work Environment Should I Expect?

Working in a confined space has its own set of potential work problems, such as:

- ◆ Minimum room in which to move/work;
- ◆ Excessive heat or cold;
- ◆ Excessive noise; and
- ◆ Poor lighting.

Each worker must be aware of the effects of his or her actions inside the confined space. It is the duty of each worker to realize and remember that one mistake could lead to a serious injury, either to the worker personally or to others working nearby.

Note: Every space shall be automatically treated as if it were Class A until it has been tested adequately and proven otherwise.



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Notes:

What Safety Measures Shall Be Taken?

Testing

It is vital to test the atmosphere before entering a confined space. Never trust your sight or sense of smell to determine if the air in a confined space is safe. Some toxic chemicals are not detectable by the human olfactory senses (e.g., carbon monoxide). Testing should always be performed before worker entry. Initial testing of the internal confined space atmosphere is always performed from outside the space. The tests should be performed by a person who is trained in (1) calibrating and operating test equipment, and (2) confined space procedures. The atmosphere is tested for oxygen content, and the presence of toxic gases and vapors, and explosive or flammable agents. Some gases or vapors are heavier than air and can settle to the ground, or bottom, of a confined space. Other gases are lighter than air and can be found near and around the top of a confined space. Therefore, it is imperative to make a habit of testing all areas (top, middle, and bottom) of a confined space. Properly calibrated testing instruments must be used to determine what types of gases are present. Test results that reveal the presence of toxic gases or vapors, or that inform the worker of an oxygen-deficient atmosphere, serve as an indicator that ventilation and retesting of the space should occur before worker entry takes place. If entry is necessary and ventilation is impossible (i.e., in an emergency rescue), workers must don appropriate respiratory protective gear before entering.

If, while performing your task, the likelihood of a change in atmosphere exists (possibly due to the work you're performing), continuous monitoring must take place during the operation.

Ventilation

Ventilating the confined space is another important safety measure. The methods and equipment used for confined space ventilation vary depending on the size of the space openings and the gases to be exhausted. A common ventilation method consists of lowering one end of a large hose (flexible duct) into the opening, attaching the opposite end to a fan, and letting the fan blow out all the harmful gases and vapors. Air intakes for all ventilation systems shall be placed in an area that will draw in fresh air only. Ventila-

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tion shall be continuous, as the gases and vapors produced in many of these spaces will reaccumulate once air flow is ceased.

Notes:

Personal Protective Equipment

Protective equipment appropriate for the confined space (see Module 5) must be worn. Equipment appropriate for confined spaces (i.e., grounded, explosion-proof) shall be used, and tag lockouts must be utilized to prevent accidental equipment start-up.

Before beginning a confined space work task, the site safety procedures must be thoroughly reviewed, the space must be cleaned, and worker roles (such as observers) and teams (utilizing the “buddy system”) must be established. Also, steam, heat, fume, water, or other agents such as gas or power lines must be extinguished or disengaged.

LOCKOUT/TAGOUT

Employers are required under 29 CFR 1910.147 to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start up, or release of stored energy in order to prevent injury to employees.

Lockout is the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

A **lockout device** is a device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. For example, blank flanges and bolted slip blinds are lockout devices.

An **energy source** is any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.



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Notes:

Tagout is the placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

A **tagout device** is a prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

General Requirements

An energy control program must be established if the servicing and maintenance of machines and equipment in which the “unexpected” energization or start up of the machines or equipment, or release of stored energy could cause injury to employees.

Lockout-tagout procedural training is required prior to employees engaging in lockout-tagout activities.

Note: This module **DOES NOT** meet the training requirements for lockout/tagout, but is instead included to introduce the concept and familiarize workers with the need for such training prior to working with machines and equipment that can be unexpectedly energized.

Application of Control

Lockout and tagout procedures must include the following elements:

- ◆ Preparation for shutdown;
- ◆ Machine or equipment shutdown;
- ◆ Machine or equipment isolation;
- ◆ Lockout or tagout device application;
- ◆ Stored energy; and
- ◆ Verification of isolation.

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Release from Lockout or Tagout

Notes:

Before lockout or tagout devices are removed and energy is restored to machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

- ◆ The work area has been inspected to ensure that nonessential items have been removed and to ensure the machinery or equipment components are operationally intact.
- ◆ The work area has been checked to ensure all employees have been safely positioned or removed.
- ◆ Each lockout or tagout device has been removed from each energy isolating device by the employee who applied the device.





Module 8 Pollution Prevention/ Waste Minimization

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE EIGHT – POLLUTION PREVENTION/ WASTE MINIMIZATION

At the end of this Module, you will be able to:

- ◆ Define "pollution prevention" and "waste minimization"
- ◆ Identify pollution prevention techniques
- ◆ Identify methods to reduce or minimize wastes at the source

OVERVIEW

Pollution prevention (P2) and waste minimization are two techniques used to reduce environmental costs, liabilities, and safety considerations. Although similar in intent, the two concepts have different meanings.

Pollution Prevention (P2) means reducing or eliminating waste volume and/or toxicity at the source and is also referred to as source reduction. Source reduction refers to in-plant changes that either reduce or eliminate the generation of hazardous waste.

Waste Minimization occurs after the waste has been generated but before treatment or disposal and is commonly referred to as recycling. Recycling means the reuse of a waste stream as an ingredient in a productive process or recovery of a reusable product.

NPS and EPA promote the use of P2 efforts before pursuit of waste minimization strategies. The transfer of pollutants from one medium to another does not constitute waste minimization.



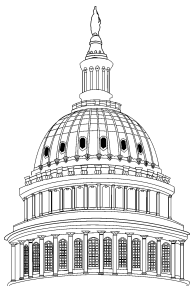
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Notes:

Together, P2 and waste minimization:

- ◆ Reduce costs associated with waste disposal;
- ◆ Reduce obligations and liabilities related to handling, use, storage, transportation, and disposal of materials and waste;
- ◆ Reduce risk of releases and discharge of hazardous substances;
- ◆ Increase safety of the working environment for NPS employees; and
- ◆ Promote the NPS mission to protect natural and cultural resources by creating more sustainable park management.



There are several Federal laws that require P2 and/or waste minimization whenever possible.

- ◆ RCRA states that it is the national policy of the U.S. to reduce the generation of hazardous waste or eliminate it as expeditiously as possible.
- ◆ The Pollution Prevention Act (PPA) of 1990, requires that pollution should be prevented or reduced at the source whenever feasible. Pollution that cannot be prevented at the source should be recycled in an environmentally safe manner. If the pollution cannot be prevented or recycled, it should be treated in an environmentally sound manner and disposal should be employed only as a last resort.
- ◆ Several executive orders require Federal agencies to comply with pollution prevention, waste minimization, and recycling. Specifically, Executive Order 12856 established Federal policy and requires Federal agencies to incorporate the activities required by the Emergency Planning and Community Right-to-Know Act (EPCRA) and the PPA of 1990. Executive Order 13101, “Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition,” requires Federal agencies to incorporate waste prevention and recycling in daily operations

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and directs Federal agencies to modify their purchasing practices to enhance markets for recovered content materials and achieve other environmental benefits.

Notes:

Concessionaires and contractors, however, are not required to comply with many of these P2 and waste minimization initiatives. The best way to ensure their participation is by including these requirements in the contract language.

TECHNIQUES FOR IMPLEMENTING P2 AND WASTE MINIMIZATION

P2 and waste minimization can be broken down into two major categories: source reduction and recycling. Source reduction includes inventory control, improved housekeeping, production/process modifications, product substitution or reformulation, waste segregation, and new uses. Recycling includes the use or reuse of the material as an effective substitute for a commercial product or as an ingredient or feedstock in a process. It includes the reclamation of useful constituents within a waste material or the removal of contaminants from a waste to allow it to be reused.

Techniques for implementing P2 and waste minimization can be broken down into three categories:

- ◆ Product substitution (P2) and affirmative procurement;
- ◆ Improved housekeeping and inventory control (P2); and
- ◆ Recycling and waste segregation waste minimization.

Product Substitution and Affirmative Procurement

Product substitution may include production and process modifications to reduce volume or substitute less hazardous substances used in the course of park operations. Affirmative procurement means using the purchasing process to achieve environmental benefits (or minimize environmental consequences). Affirmative procurement is a form of product substitution, specifically acquiring materials with a high level of recovered material content.





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Notes:

EPA purchasing guidelines published at 40 CFR Part 247 discuss minimum content standards of 24 products, including: paper, retread tires, re-refined motor oil, cement and concrete that contains fly ash, and building insulation products.

Effective May 1, 1996, Federal agencies spending more than \$10,000 per year on certain specified products should attempt to buy the item with the highest recovered material content possible. Each park unit must still determine whether a given product meets its own performance requirements. Parks failing to procure products consistent with the guidelines must provide written justification (DOI Guidance on Pollution Prevention and Right-to-Know, Recycling and Green Acquisition, September 1995). Table 8-1 presents product substitution and procurement tips.

Table 8-1
Product Substitution and Procurement Tips

- ◆ Require supervisor approval prior to purchasing hazardous chemicals.
- ◆ Consider using re-refined oil in vehicles (pilot study on-going in NCR, including park
- ◆ Consider using less toxic solvents (e.g., citrus-based cleaning solvents).
- ◆ Substitute with less toxic drain cleaners (e.g., baking soda and vinegar) and glass
- ◆ Use water-based paints (as technology improves, newer latex paints may be as effec-
- ◆ Discourage use of all chlorinated solvents (e.g., trichloroethylene).
- ◆ Encourage higher flash-point solvents (instead of Stoddard solvents).
- ◆ Inform non-GSA suppliers of the park's interest in hazardous waste reduction.
- ◆ Make sure purchasing specifications include environmentally "preferable" products.
- ◆ Build environmental standards into contracts and purchase orders (DSC: 303-969-2130
- ◆ Establish pilot programs to test the success of product alternatives.

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Sources of environmental products include:

Notes:

- ◆ The General Services Administration (GSA); relevant offices and phone numbers are provided below:
 - Environmental Products Guide (800-848-8928)
 - Environmental Executive (202-208-7929)
 - Environmental Engineering and Commodity Management Center (703-305-5149)
 - Office Supplies and Paper Products Commodity Center (212-264-3573)

- ◆ Defense Supply Center Richmond (DSCR); relevant offices and phone numbers are provided below:
 - Environmental Products (616-961-4958)
 - Energy Efficient Lighting (800-352-2858)
 - Re-refined Motor Oils (800-345-6333)

Improved Housekeeping and Inventory Control

This category of P2 techniques focuses on improving the storage, handling, and use of materials and wastes in a manner that will reduce or eliminate the risk of pollution, the amount of waste generated, or the potential for injuries to human health and safety. Table 8-2 presents housekeeping tips; Table 8-3 presents inventory tips.



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Notes:

Table 8-2
Housekeeping Tips

- ◆ Segregate and store products according to compatibility (e.g., acid/bases, flammables).
- ◆ Clean and organize storage areas.
- ◆ Properly label all products and wastes, including temporary containers.
- ◆ Conduct monthly inspections (minimum).
- ◆ Utilize drip pans and secondary containment.
- ◆ Improve hazardous liquid transfer techniques (e.g., from drum to pail, drum transfer

- ◆ Use spigots, pumps, and funnels.
- ◆ Include leak-patching equipment with spill response kits.
- ◆ Protect against extreme environmental conditions (e.g., freeze/thaw of containers, rain,

- ◆ Spot wash or dry wash floors and equipment to reduce wastewater generation.
- ◆ Reduce evaporation of volatiles (e.g., close tops on drums and cans).
- ◆ Check floor drains, identify where they lead, and label drains. Consider "trough

- ◆ Use rubber mats to control spills.

Table 8-3
Inventory Control Tips

- ◆ Maintain minimum inventories. Purchase only what can be used in a short time.
 - ◆ Reduce number of brands or products used for the same purpose.
- Note:** In the Intermountain Field Area survey, EPA found that 75-80 percent of products that become hazardous waste do so because the product is outdated or no longer wanted.
- ◆ Use simple labeling codes for hazardous chemicals (e.g., orange stickers – See Module

 - ◆ Ensure concession and other contracts reflect NPS inventory goals and requirements.
 - ◆ Employ a "First-In, First-Out" policy.
 - ◆ Designate one person responsible for an area or procedure.



Notes:

Recycling and Waste Segregation for Waste Minimization

Recycling, reuse, and waste segregation are waste minimization techniques that will reduce or eliminate the quantity of hazardous waste once generated in the course of park operations. There are many opportunities to recycle or reuse products used at parks. Usually, one thinks of aluminum cans or paper when recycling is mentioned, although these are not considered hazardous materials. As indicated in Tables 8-4 and 8-5, there is also significant opportunity to recycle or reuse hazardous materials at parks.

Table 8-4 Hazardous Materials Recycling or Reuse Tips
<ul style="list-style-type: none"> ◆ Use anti-freeze recycling units for medium to large fleets (\$2,000-\$10,000). ◆ Identify all markets in your area to recycle all batteries or purchase rechargeable batteries. ◆ Recycle used oil or burn waste oil in-house (Clor-D-Tect). ◆ Capture Freon from air conditioner units (certification required) and switch to non-CFC. ◆ Recycle used tires. ◆ Use fluorescent light tubes. ◆ Exchange materials rather than dispose as a waste.

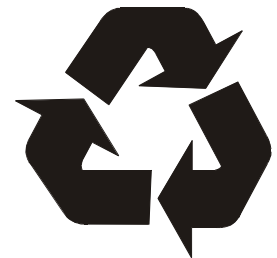


Table 8-5 Waste Segregation Tips
<ul style="list-style-type: none"> ◆ Segregate non-hazardous from hazardous waste streams. ◆ Do not mix used oil with antifreeze or solvents (especially chlorinated solvents). ◆ Do not mix water based and oil-based paints. ◆ Use oil/water separators for vehicle washing and vehicle maintenance wastewater. ◆ Do not mix unknowns, acids, bases, two-part (epoxy paints), or reactive chemicals.



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Notes:

Pollution Prevention (P2) Assessments

Pollution prevention assessments provide a detailed analysis of operations and waste streams at your park to identify how and where P2 can be implemented. The assessment consists of a careful review of facility operations records (purchase and disposal), waste stream characterization, and the selection of specific areas to assess. After a particular waste stream or area is established, a number of options with the potential to minimize waste are developed and screened. The technical and economic feasibility of the selected options is then evaluated. Finally, the most promising options are selected for implementation.

Assessments were conducted in 1995 at over 50 national parks in the Intermountain Field Area through a cooperative agreement between NPS, EPA, and local community colleges. Listed below are primary waste streams and functions at national park system units revealed by the assessments. NPS also developed fact sheets on these topics called ENVIROFACTS that describe in more detail NPS policy and procedures for managing these waste streams (See <http://165.83.218.50/HAZMAT/> for ENVIROFACTS Sheets).

Cleaning Solvents

Cleaning solvents, such as chlorinated chemicals, are one of the largest waste streams at parks. Releases produce an expensive cleanup and are a significant threat to the ozone layer. Empty aerosol cans and flammability hazards are a primary concern. Parks must purchase solvents with flash points above 140°F and use refillable/rechargeable pump or spray dispensers.

Used Oils and Lubricants

Used oil is the largest source of pollution in U.S. waterways, with 240,000,000 gallons/year released into sewers or soil – equivalent to an Exxon Valdez spill every two weeks. One pint of used oil produces a slick on one acre of water; one gallon can pollute one million gallons of drinking water; and one quart can foul the taste of 250,000 gallons of water.

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Notes:

Used oil is exempt from hazardous waste regulations if no hazardous components, such as solvents, are mixed into it and it is recycled. Parks must recycle oil, use chlorine detection kits, and not use oil additives (they may contain chlorine compounds). Parks should also consider approved used oil burners (recycling includes burning oil for energy recovery).

Landscaping and Maintenance

The main concerns surrounding landscaping and maintenance is water consumption and secondary pollution from run-off. Irrigation can waste water. Parks, especially those in arid climates should: use low-volume drip irrigation systems; water deeply and only when needed; use mulches to retain water, reduce weed growth, and prevent erosion; fertilize only when needed; and use integrated pest management (IPM), the goal of which is to control pests, not eradicate them.

Paint Application and Cleanup

Paints with chromium and lead pigments pose serious environmental and health hazards. Paint operations can generate large volumes of hazardous waste such as leftover paints, dirty thinner, and volatile organic compound (VOC) emissions. Parks should use rigid inventory control and good house-keeping; consider non-hazardous thinners and test for effectiveness; not purchase spray cans; dispose of unused oil-based paints as hazardous waste; and wait until unused latex hardens and dispose in dumpster.

Used Antifreeze

Antifreeze is a deadly poison and unfortunately contains a product, ethylene glycol, which is sweet and attractive to children and animals. Used antifreeze is exempt from being considered a hazardous waste only when recycled, and therefore parks must recycle antifreeze. Parks should segregate antifreeze from other wastes and may consider on-site recycling units (\$2,000 and up) that use filtration. As an alternative, propylene glycol (e.g., "Sierra" brand antifreeze) is biodegradable and non-toxic to animals. It must still be recycled; otherwise it is considered a hazardous waste due to the presence of heavy metals.



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Notes:

Laboratories

Laboratories use reagents and cleaning solvents with chlorinated compounds that are hazardous to the brain, lung, liver, and nervous system, can cause cancer, and are flammable. In addition, they necessitate an expensive cleanup and are a significant threat to the ozone layer. Parks should: consider alternative materials; recycle on-site; evaluate label washer alternatives; use non-toxic, citrus-based cleaners; dedicate certain wash stations for specific cleaning purposes only; practice good inventory and housekeeping techniques; and provide an ongoing training program.

Used Filters

Improperly drained oil filters are a major source of used oil waste. "Fully-drained" non-terne-plated spent oil filters for recycling are exempt from hazardous waste regulations. "Hot-drained" oil filters, punctured around the dome and drained, are considered fully drained. Used transmission and fuel filters are not regulated as hazardous waste if they are thoroughly drained. Parks should treat air conditioner filters containing CFC-12 or Freon as a regulated hazardous waste.

Used Batteries

Lead-acid batteries contain corrosive acid and high concentrations of lead. Dry cell batteries may contain mercury; if so they must be disposed of as hazardous waste. Parks should seek recycling options and ensure that the selected recycler is licensed. Ask the battery distributor to take batteries on a "turn key" basis (one-for-one exchange); store all lead-acid batteries in a spill containment area; and consider solar options and rechargeable batteries. Look for EPA labels or markings on batteries that indicate "universal waste battery," "waste battery," or "used battery," for clues regarding proper disposal.

Fuels

Fuels, including gasoline and diesel fuel, contain benzene, toluene, xylene, other hydrocarbons and chlorinated compounds. These items are carcinogenic, affect the nervous system, and are flammable. Preventing spills is

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important because cleanup activities are expensive. Waste fuels must be disposed of according to hazardous waste regulations. Parks should: never use any fuel to degrease or clean parts; minimize used gasoline; use spill prevention techniques; filter water-contaminated gasoline or diesel fuel through chamois to remove the water which is not classified as a hazardous waste; treat wet gas tank sediments as hazardous waste (if dry, it is not considered a hazardous waste); and never use new or spent fuels as floor cleaners or to remove floor stains.

Notes:

Landfills and "Boneyards"

To decrease the amount of materials added to landfills on park property, parks should follow proper office procedures such as two-sided copying, use of electronic mail, use of reduced font sizes, and maximization of on-screen editing of documents. Separate hazardous wastes from non-hazardous wastes to ensure that hazardous wastes do not get co-mingled with municipal waste. Should waste material be identified at a "boneyard" consider re-using the material if possible. Encourage employee initiatives and recycling programs.

Absorbents and Wipers

Rags and wipes pose a significant health and flammability risk. Rags and wipes take on the character of the fluid with which they are used, that is, they become hazardous waste if the absorbed fluids are hazardous wastes. (Note, however, that rags that are laundered commercially are considered "recycled" and not hazardous waste, even if they contain hazardous components.) Parks should be aware that States' policies vary regarding rags and wipes. Parks should dry wipe when possible and store used rags and wipes in sealed, labeled, appropriate waste containers.

Other Wastes

Other wastes that may be present at national parks include ammunition, explosives, asbestos, broken glass, treated wood, used concrete and asphalt, pesticides, laser printer toner cartridges, water filters, smoke and fire detectors, spent halon and fluorescent lights, and mercury-containing products.



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Notes:

One other P2 and waste minimization technique is energy conservation. Parks should adhere to the following six steps to saving energy:

1. Tabulate the two previous years of energy use and costs.
2. Do a simple energy audit.
3. List energy reduction options.
4. Prioritize energy reduction options.
5. Do each energy reduction option on the list.
6. Keep track of the energy savings.

IN SUMMARY

There are many opportunities for parks to participate in P2 and waste minimization activities. Parks should use available references and other resources to identify opportunities, share experiences with parks using Maintenance Bulletin Boards (including the "Green Alert" Bulletin Board) and with other NPS Divisions such as Interpretation, Natural Resources, and Protection. NPS is in the process of developing "ENVIROFACTS Sheets" on a variety of topics related to hazardous materials management and other environmental issues.

Parks should also involve concessionaires in all P2/waste minimization discussions; solicit employee suggestions and/or recommendations for improvements; and use incentives for P2 and waste minimization programs. In summary, park personnel in charge of P2 and waste minimization programs can facilitate use of the programs by asking themselves the following questions on an on-going basis:

- ◆ Are there less toxic alternatives available?
- ◆ Can the process be refined?
- ◆ Is waste reduction training for workers a possibility?
- ◆ Might a fellow professional or friend have a use for my leftover hazardous waste/materials?
- ◆ What about collective waste disposal (co-op with other facilities)?
- ◆ Have I used all of my waste minimization resources?

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Further information/assistance on pollution prevention and waste minimization is available from database programs such as: *Strategic Waste Minimization Initiative (SWAMI)*, EPA, Office of Research and Development, Washington, D.C. or Pollution Prevention Information Exchange System (PPIES), EPA (202-260-3161 phone, 703-506-1025 fax). Parks can also refer to the *U.S. Postal Service Waste Reduction Guide* available from the U.S. Postal Service, Environmental Management Division, 475 L'Enfant Plaza S.W., Room 4130, Washington, D.C. 20260.

Notes:





**Module 9
Review/
8-Hour Refresher**

HAZWOPER

**24-Hour
Training Manual**



Notes:

MODULE NINE – REVIEW/8-HOUR REFRESHER

In this module, students will review or complete:

- ◆ Legal requirements/updates
- ◆ HAZMAT acronym
- ◆ Personal protective equipment
- ◆ Field exercise

LEGAL REQUIREMENTS FOR FIRST RESPONDER (OPERATIONAL LEVEL)

OSHA Standard 29 CFR § 1910.120 (q) sets forth requirements for employees responsible for emergency response to hazardous substance releases. The 24-hour course is designed to meet the training requirements presented at 29 CFR § 1910.120 (q)(6)(ii) for the First Responder (Operations Level). These training requirements are not applicable to individuals working at hazardous waste cleanup sites regulated under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or RCRA treatment, storage, and disposal facilities. The training requirements for these employees are covered under another portion of the HAZWOPER standard.

First responders at the operational level "*...respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release*" (29 CFR § 1910.120(q)(6)(ii)). They:

- ◆ Perform **defensive** control activities;
- ◆ Contain the emergency release from a safe distance;
- ◆ Keep the release from spreading; and
- ◆ Prevent exposures.

LEGAL UPDATES

Note: Instructor will discuss any legal updates.



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Notes:

RESPONDING TO THE INCIDENT ("HAZMAT" ACRONYM REVIEW)

First responders at the operational level should activate the Incident Command System (ICS), and the senior emergency responder should assume the role of Incident Commander. The Incident Commander should report the release to the required agency(ies), such as the NRC in the case of a release of a hazardous substance into the environment, and call for backup assistance if warranted by the situation.

Responders may implement use of the concepts identified by the acronym "HAZMAT" to respond to the release.

H azard Identification:	Preliminary evaluation of the situation prior to entry.
A ction Plan:	Steps to respond to or control the release.
Z oning:	Controlling the risk and securing the scene appropriately.
M anaging the Incident:	Implementing the Incident Command System.
A ssistance:	Reporting the spill and determining additional resources needed.
T ermination:	Decontamination, conclusion of the incident, post-incident analysis, medical surveillance.

Hazard Identification

First responders should conduct hazard identification procedures prior to rushing into a release site. Activities include identifying the hazardous substance by:

- ◆ Using binoculars or spotting scopes from a safe distance and upwind to view the site;
- ◆ Taking note of odors and visual appearance (e.g., stained vegetation, dead wildlife);

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- ◆ Examining container shapes, warning labels, and placards on vehicles;
 - ◆ Reading and interpreting MSDSs, manifests, and shipping papers;
 - ◆ Using sampling and monitoring equipment;
 - ◆ Contacting emergency response organizations (e.g., CHEMTREC); and
 - ◆ Using published reference documents to identify the required response action (e.g., *The DOT North American Emergency Response Guidebook*.)
- Notes:

Action Plan

First Responders at the operational level should only take defensive measures to control a release and should always assume that an incident involves hazardous materials unless positive identification proves otherwise. **NPS employees must never enter a situation that is Immediately Dangerous to Life and Health (IDLH).**

Actions that can be taken to control a release include:

- ◆ Isolating leaking containers;
- ◆ Absorption/Adsorption;
- ◆ Damming/Diking;
- ◆ Dilution;
- ◆ Retention/Diversion;
- ◆ Vapor dispersion/Vapor suppression;
- ◆ Evacuation of the scene; and
- ◆ Engineering/institutional controls.

Incidents can be categorized into three general levels. The required response will depend into which level an incident falls.



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Notes:

Emergency responders must implement use of the Health and Safety Plan and follow the emergency procedures identified in the emergency response plan portion of the Health and Safety Plan. The Emergency Response Plan should address:

- ◆ Pre-emergency planning;
- ◆ Personnel roles, lines of authority, and communication;
- ◆ Emergency recognition and prevention;
- ◆ Safe distances and places of refuge;
- ◆ Site security and control;
- ◆ Evacuation routes and procedures;
- ◆ Decontamination procedures that are not covered by the Health and Safety Plan;
- ◆ Emergency medical treatment and first-aid;
- ◆ Emergency altering and response procedures;
- ◆ Critiques of response and follow-up; and
- ◆ Personal protective equipment (PPE) and emergency equipment.

Zoning

The Incident Commander should establish zones around the incident to prevent spectators and other non-essential or untrained personnel from entering the area. The size of the zones will depend on the incident conditions and the product involved. Initially, however, an elaborate system is not necessary due to time constraints. Zones include the:

Exclusion Zone – the area where the hazardous substance is located. Only trained personnel wearing the appropriate personal protective equipment should enter this zone.

Contamination Reduction Zone – the area for decontamination procedures for equipment, workers, and sample containers, worker rest, and emergency response such as first aid.

Support Zone – a clean area used for site control directly outside the contamination zone. The Incident Command post and all other support activities should be located upwind of the release.

Managing the Incident

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Notes:

The first senior official assigned to emergency response duties who arrives on the scene assumes the role of Incident Commander and immediately activates the Incident Command System (ICS). The ICS is a widely recognized organizational structure that uses interrelated components and assigns duties to personnel to maintain order during an emergency. Components of the ICS include:

- ◆ Common terminology;
- ◆ Modular organization;
- ◆ Integrated communications;
- ◆ Unified command structure;
- ◆ Consolidated action plan;
- ◆ Manageable span-of-control; and
- ◆ Comprehensive resource management.

The ICS is generally divided into five hierarchical functional areas, each of which is managed by one individual and his or her subordinates, who may also manage individuals. NPS First Responders may assume all or some of the hierarchical roles depending on the size and magnitude of the incident.

- ◆ **Incident Command.** The Incident Commander is the official in charge of the command section responsible for managing the entire response action. The first responder assumes the role of Incident Commander until relieved of such duties by a higher-ranking emergency response individual on the scene.
- ◆ **Operations.** As an incident grows in complexity, the Incident Commander will appoint an individual to be the Operations Officer. The operations officer directs all tactical operations used to control the incident.
- ◆ **Logistics.** The Logistical Officer plans the use of and acquires equipment, supplies, and other support services needed to effectively respond to the emergency.



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Notes:

- ◆ **Planning.** The Planning Officer is responsible for gathering and analyzing data regarding the incident operations and assigned resources, developing alternatives for tactical operations, conducting the planning meetings, and preparing the action plan for each operational period.
- ◆ **Finance.** The finance section is established for incidents when there is a specific need for finance services, such as procurement and recordkeeping. All resources expended responding to emergency releases of a hazardous substance should be tracked for potential cost recovery litigation.

Assistance

The First Responder should seek assistance immediately and throughout the response process as necessary. Federal law requires that First Responders report spills to the appropriate authorities. Park policy requires that individuals report releases to park managers.

First Responders must report releases or substantial threats of releases of a hazardous substance to the **National Response Center (NRC): 1-800-424-8802**. Federal law requires that individuals report to the NRC as soon as that person has knowledge of any release or substantial threat of a release of a hazardous substance in a quantity equal to or greater than the substance's reportable quantity (RQ). Assistance can also be obtained from:

- ◆ Fire departments;
- ◆ Police departments;
- ◆ Park health centers or clinics;
- ◆ Contractors;
- ◆ Technical specialists (e.g., universities);
- ◆ Pollution control organizations;
- ◆ Federal Regional Response Teams; and/or
- ◆ State emergency response organizations.

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Termination

Notes:

Decontamination is the chemical or physical process of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

Decontamination is the most critical element in the control of hazards to ensure the health and safety of responders. Decontamination is necessary to protect responders from excessive exposures that may contaminate and eventually permeate the protective clothing, as well as respiratory equipment, tools, vehicles, and other equipment used at the scene. It protects all on-scene personnel by minimizing the transfer of harmful materials into clean areas.

Standard health and safety regulations require that the development of a decontamination plan (as part of the Site Health and Safety Plan) be in operation before any personnel or equipment may enter any areas where the potential for exposure for hazardous substances exists.

Seven points to consider when developing a decontamination plan:

- ◆ Determine the number and layout of decontamination stations;
- ◆ Determine the decontamination equipment needed (e.g., chemicals to neutralize, brushes);
- ◆ Determine the appropriate decontamination methods;
- ◆ Establish procedures to prevent contamination of clean areas;
- ◆ Establish methods and procedures to minimize responder contact with contaminants during removal of PPE;
- ◆ Establish methods for disposing of clothing and equipment which are not completely decontaminated; and
- ◆ Undergo revision whenever the type of personal protective clothing or equipment changes, the scene conditions change, or the scene hazards are reassessed based on new information.

Decontamination procedures should be tailored to the specific hazards of the site and may vary in complexity and number of steps, depending on the level of hazard and the employee's exposure to the hazard. Decontamination procedures and PPE decontamination methods will vary depending



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Notes:

upon the specific substance, since one procedure or method may not work for all substances. Evaluation of decontamination methods and procedures should be performed, as necessary, to ensure that employees are not exposed to hazards by re-using PPE.

People and objects can be decontaminated in numerous ways, including being splashed, tracking through soil and liquids, inhaling airborne particulate, and using contaminated equipment. Therefore, all equipment and personnel must be decontaminated properly.

Prevention of contamination is the first step. The subsequent steps are:

- ◆ Assess the hazardous situation;
- ◆ Locate the hazardous material;
- ◆ Identify the hazardous materials and its physical state;
- ◆ Survey the extent of contamination;
- ◆ Identify the work to be done; and
- ◆ Choose the proper level of PPE.

General Methods of Decontamination

Personal and equipment decontamination procedures vary according to the level and type of contaminant identified. Unless otherwise known, always assume a worst-case scenario. Testing at a later time may prove that a lesser degree of protection and decontamination procedures are warranted.

There are seven basic methods for decontaminating personnel and equipment.

- ◆ Dilution and Washing;
- ◆ Chemical Neutralization or Degradation;
- ◆ Absorption or Adsorption;
- ◆ Isolation and Disposal;
- ◆ Physical Removal; and
- ◆ Dry Decontamination.



Hazards of Decontamination

Notes:

While decontamination is performed to protect health and safety, it can pose hazards under certain circumstances. Decontamination methods may:

- ◆ Be incompatible with the hazardous substances being removed;
- ◆ Be incompatible with the clothing or equipment being decontaminated; and
- ◆ Pose a direct health hazard to responders.

Factors That Determine the Levels and Type of Decontamination

- ◆ The chemical, physical, and toxicological properties of the materials;
- ◆ The pathogenicity of infectious wastes;
- ◆ The amount, location, and containment of contaminants;
- ◆ The potential for, and location of, exposure based on assigned responder duties, activities, and functions;
- ◆ The potential for materials to permeate, degrade, or penetrate materials used for PPE, equipment, vehicles, tools, buildings, and structures;
- ◆ The proximity of incompatible materials;
- ◆ The movement of personnel and equipment among different zones;
- ◆ Emergencies;
- ◆ The methods available for protecting responders during decontamination; and
- ◆ The impact of the decontamination process and compounds on responder safety and health.



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Notes:

Emergency Decontamination

There are times when responders or victims must be decontaminated quickly. Emergency decon can be provided in the “Yellow Zone” without formal establishment of a contamination reduction corridor, either by use of dry decon procedures, or by dilution if the contaminant is water compatible. The spread of the contaminants must be minimized by containment of the runoff and proper handling and disposal of potentially contaminated outer garments.

SELECTING PPE

Personal protective equipment (PPE) is necessary to protect the First Responder from adverse health affects of working with hazardous materials. Wisely chosen PPE can provide protection against some chemical hazards. **No PPE is sufficient for all hazards.**

PPE is required by OSHA to protect individuals from acute and chronic effects of exposures. The EPA has established levels of protection for emergency response for all occupations.

Table 9-1 presents the EPA standards for the four levels of PPE.

Table 9-1 Levels of PPE
Level A – Fully encapsulating suit, positive pressure, self contained breathing apparatus (PP-SCBA) inside
Level B – Chemically resistant clothing with PP-SCBA
Level C – Chemical resistant clothing with full face air purifying respirator
Level D – Work clothes, hard hat, eye protection, steel toed boots

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Level A protection should be selected when the greatest level of skin, respiratory, and eye protection is required. Level A is mandatory for all IDLH situations.

Notes:

Level B protection should be used when the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.

Level C protection is selected when the type of airborne substance is known, concentration measured, and skin and eye exposure unlikely.

Level D is primarily a work uniform worn on any site where respiratory or skin hazards do not exist.



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Notes:

CLASSROOM REVIEW EXERCISE

Use any source available to fill in the blanks below regarding: **Gasoline**

UN/NA Placard No. _____
Guide No. _____
Synonyms _____
Chemical Formula _____
DOT Class _____
Shipping Label _____
Molecular Weight _____
NIOSH/OSHA/ACGIH Ceiling Levels _____
IDLH Level _____
ACGIH TLV/TWA _____
Last ACGIH Upgrade _____
Chemical Abstract Number _____
Physical Properties _____

Boiling Point _____
Vapor Density _____
Solubility In Water _____
Flammable Range _____
Incompatibilities _____

Personnel Protective Equipment _____

Exposure Symptoms _____

Target Organs _____
Fire and Explosion Hazards _____

Fire Evacuation Distances _____

First Aid Procedures _____

Small Spill Isolation/Protect Downwind Distance _____
 Day _____
 Night _____
Large Spill Isolation/Protect Downwind Distance _____
 Day _____
 Night _____
Spill or Leak Procedures _____

Fire Fighting Procedures _____
Usual Shipping Containers _____

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Storage Recommendations _____

Notes:

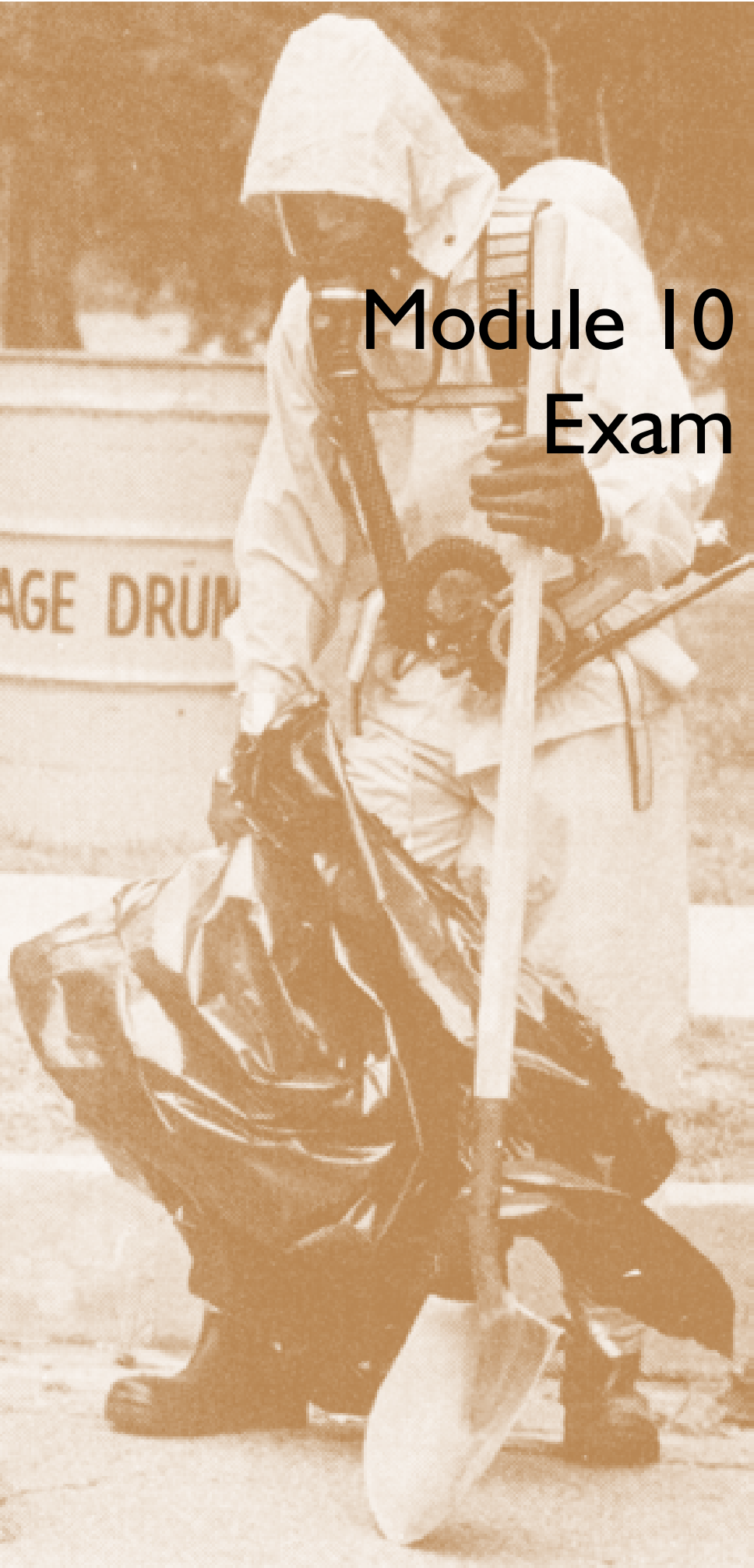
Park Areas Utilized _____

Applicable Regulations _____

Threshold Planning Quantity _____

General Safety Comments _____

(Instructors: Conduct field exercise.)



**Module 10
Exam**

HAZWOPER

**24-Hour
Training Manual**

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Name: _____

Date: _____

Instructions: Each of the following 39 questions are multiple choice or fill in the blank. Circle the most appropriate answer to each question. Be sure to include your name on first page and your initials on every other page of this exam.

1. According to OSHA Standard 29 CFR § 1910.120, a Hazardous Waste Emergency First Responder (Operational Level) must have a minimum of how many hours of training?
 - A. 8 hours
 - B. 40 hours
 - C. 24 hours
 - D. 16 hours
 - E. None of the above

2. Chemicals enter into the bloodstream through which of the following pathways?
 - A. Ingestion
 - B. Inhalation
 - C. Skin absorption
 - D. A & B only
 - E. All of the above

3. According to the Hazard Communication Standard, supervisors must provide employees with an MSDS in:
 - A. English
 - B. Spanish
 - C. Employee's language
 - D. English and Spanish
 - E. None of the above



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4. Match the description with the type of health hazard.
- | | |
|----------------------------------|-----------------|
| _____ Burns skin | A. Irritant |
| _____ Causes cancer | B. Corrosive |
| _____ Skin itch | C. Target organ |
| _____ Gene damage (sperm or egg) | D. Sensitizer |
| _____ Allergic response | E. Carcinogen |
| _____ Liver damage | F. Teratogen |
| _____ Fetus damage | G. Mutagen |
| _____ Freezes skin | H. Potentiation |
| | I. Cryogenic |
5. Will you know if you have been sensitized to a chemical at the time of your first exposure?
- A. Yes
 - B. No
6. Which of the following lists contain only major elements of a HazCom program Plan:
- A. Labeling, MSDSs, PPE, training, chemical inventory listing
 - B. Manifests, PPE, training, labeling, respirator management
 - C. MSDS, PPE, labeling, hazardous waste storage, training
 - D. Emergency spill response planning, PPE, hazardous materials inventory, labeling, respirator management
 - E. None of the above

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7. Label each statement either TRUE or FALSE.
- _____ I'll always be able to see, smell, or taste an exposure hazard.
 - _____ Most airborne hazards cannot be seen.
 - _____ If a smell disappears, I am no longer breathing the substance.
 - _____ Monitoring may be required to detect hazardous chemical exposures.
 - _____ Any chemical I can smell or taste is entering my body.
8. Workers need to know about the _____ in their workplace.
9. _____ are on chemical containers and provide information about the chemical contents.
10. _____ are chemicals that produce heat, gas, fire, or explode when mixed together.
11. As required by Subtitle C of the Resource Conservation and Recovery Act (RCRA), the mechanism for tracking the ultimate fate of a hazardous waste is known as a:
- A. UN/NA Label
 - B. HMIS Label
 - C. Uniform Hazardous Waste Manifest
 - D. Hazard Communication Inventory
 - E. None of the above
12. The process of removing hazardous chemicals from PPE is called _____.
13. As a First Responder on a spill site you should rush to the aid of a fallen co-worker.
- A. True
 - B. False



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14. First Responders should approach a spill site upwind and upgrade.
- A. True
 - B. False
15. The first reference you should utilize at a hazardous chemical spill site involving a tractor-trailer rig would be which one of the following:
- A. *NIOSH Pocket Guide*
 - B. *ACGIH Threshold Limit Value Guide*
 - C. *DOT Spill Response Guidebook*
 - D. NFPA Hazardous Chemicals Guidebook
16. According to the National Contingency Plan (NCP), spills or other non-permitted releases of petroleum and hazardous substances must be reported to:
- A. OSHA
 - B. The National Response Center (NRC)
 - C. FEMA
 - D. CHEMTREC
 - E. The State
17. An open-head drum is used to contain solid materials.
- A. True
 - B. False
18. An overpack is used to contain a leaking 55-gallon drum.
- A. True
 - B. False

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19. A high-efficiency particulate air (HEPA) filter removes what percentage of 0.3 micron smoke particles from the air?
- A. 100 percent
 - B. 99.97 percent
 - C. 94.97 percent
 - D. 88.88 percent
20. Organic vapor respirator cartridges are color-coded:
- A. Yellow
 - B. Green
 - C. Black
 - D. Purple
21. EPA mandates different levels of PPE. The level of PPE that consists of work clothes and no respirator is:
- A. Level A
 - B. Level B
 - C. Level C
 - D. Level D
22. Which one of the following materials or products listed below is not listed in the EPA's initial procurement guidelines for recovered-content purchases?
- A. Cement and concrete containing fly ash
 - B. Retreaded tires
 - C. Re-refined oil
 - D. Automotive batteries
 - E. Building insulation



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23. OSHA's permissible exposure limits (PELs) are outlined in which section of the Code of Federal Regulations (CFR)?
- A. 29 CFR 1910.134
 - B. 29 CFR 1910.1200
 - C. 29 CFR 1910.120
 - D. 29 CFR 1910.1000
24. 24-hour technical assistance (regarding hazardous chemicals) can be obtained by contacting:
- A. The US Department of Interior
 - B. CHEMTREC
 - C. NIOSH
 - D. ACGIH
 - E. All of the above
25. According to 29 CFR § 1910.1030, employees who are in contact with _____ would be eligible to receive Hepatitis B Vaccinations and related awareness training:
- A. Hazardous waste
 - B. Radioactive waste
 - C. Blood products or other body fluids
 - D. Hostile bosses
 - E. None of the above
26. What is the target organ for the following chemicals: alcohol, carbon tetrachloride, kepone, and vinyl chloride?
- A. Brain
 - B. Liver
 - C. Kidneys
 - D. Heart

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27. A medical surveillance program is required under OSHA 29 CFR 1910.120 for employees who are exposed to hazardous substances at or above exposure limits for 30 days or more per year.
- A. True
 - B. False
28. OSHA's confined space regulations are found in which set of regulations:
- A. 29 CFR 1910.134
 - B. 29 CFR 1910.119
 - C. 29 CFR 1910.146
 - D. 29 CFR 1910.120
29. Which of the following would not be considered a confined space under the definition provided in 29 CFR 1910.146?
- A. A sewage lift station
 - B. A trench
 - C. A utility vault
 - D. NPS Seasonal Employee Housing
 - E. All of the above
 - F. None of the above
30. The first piece of analytical equipment that you should use on a spill site to identify potential hazards is the:
- A. Oxygen meter
 - B. Combustible gas indicator
 - C. Dragger sampling tubes
 - D. Radiation meter



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31. Detector tubes have a minimum shelf life of:
- A. 4 years
 - B. 2 years
 - C. Indefinite
 - D. 10 years
32. According to RCRA, the characteristics for determining if a substance is a hazardous waste are:
- A. Reactive, stable, ignitable, corrosive
 - B. Reactive, ignitable, corrosive, toxic
 - C. Explosive, reactive, corrosive, unstable
 - D. Flammable, reactive, radioactive, synergistic
 - E. None of the above
33. Which Federal agency promulgated the HM-181 regulations?
- A. Department of Transportation
 - B. Department of Commerce
 - C. EPA
 - D. OSHA
34. Hazardous waste treatment, storage, transport, and disposal regulations are found in?
- A. 29 CFR
 - B. 49 CFR
 - C. 10 USC
 - D. 40 CFR

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35. If you were entering a spill site and your combustible gas indicator read 25% of the L.E.L. you should:
- A. Proceed with caution
 - B. Leave the site immediately
 - C. Continue with the survey
 - D. None of the above
36. According to Subtitle C of RCRA, NPS is responsible for hazardous waste from the day it is generated until:
- A. It is lawfully disposed of
 - B. It is transported off-site
 - C. Forever
 - D. A signed manifest is received from the TSDF
 - E. All of the above
37. The key focus of a pollution prevention (P2) program should be:
- A. Using "upstream" technologies to remove the product from the waste stream at the source (e.g., product substitution)
 - B. Recycling generated wastes (e.g., used oil, etc.)
 - C. Developing emergency spill response procedures
 - D. Labeling all hazardous materials in use at the facility
38. Who is responsible for your health and safety when working with hazardous materials?
- A. NPS
 - B. Your supervisor
 - C. You
 - D. All of the above
 - E. None of the above



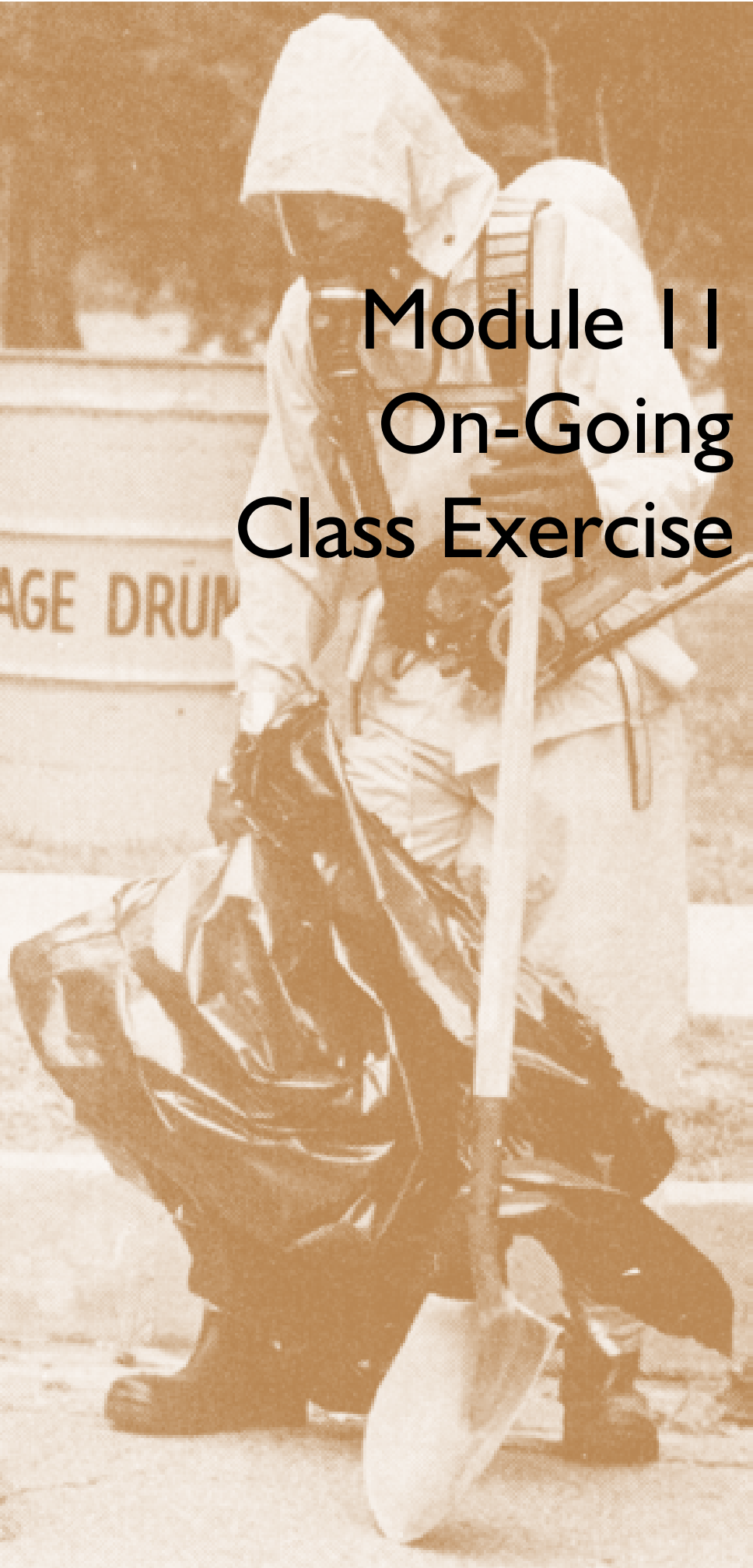
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39. Compliance with the Hazard Communication Standard (a.k.a. "Right-to-Know") is required by:
- A. Federal Regulation (29 CFR § 1910.1200)
 - B. Executive Order (E.O. 12196)
 - C. Departmental policy (485 DM)
 - D. Agency guideline (NPS 50)
 - E. All of the above

FINAL SCORE: _____



**Module 11
On-Going
Class Exercise**

HAZWOPER

**24-Hour
Training Manual**



MODULE ELEVEN: ON-GOING CLASS EXERCISE

Hazardous Material/Substance Spill

The following exercise will be on-going throughout the course of the class. Refer to the initial description during each part of the exercise for clues regarding the appropriate answer to the question.

Incident Description:

While patrolling the park, a park ranger receives word from dispatch that a truck has overturned on a main road through the park. The accident has occurred near NPS seasonal employee lodging facilities and a children's outdoor natural history interpretation center, which is currently presenting to park visitors. The temperature is 85 degrees with a steady wind to the south. The children's outdoor natural history interpretation center is directly downwind of the spill; the seasonal employee lodging facilities are somewhat downwind of the spill. Across the road is a gas station run by a concessionaire. It is upwind of the spill and sits at a lower elevation than the street. A creek is on the other side of the gas station and a sewage manhole is in the direct path of the spill.

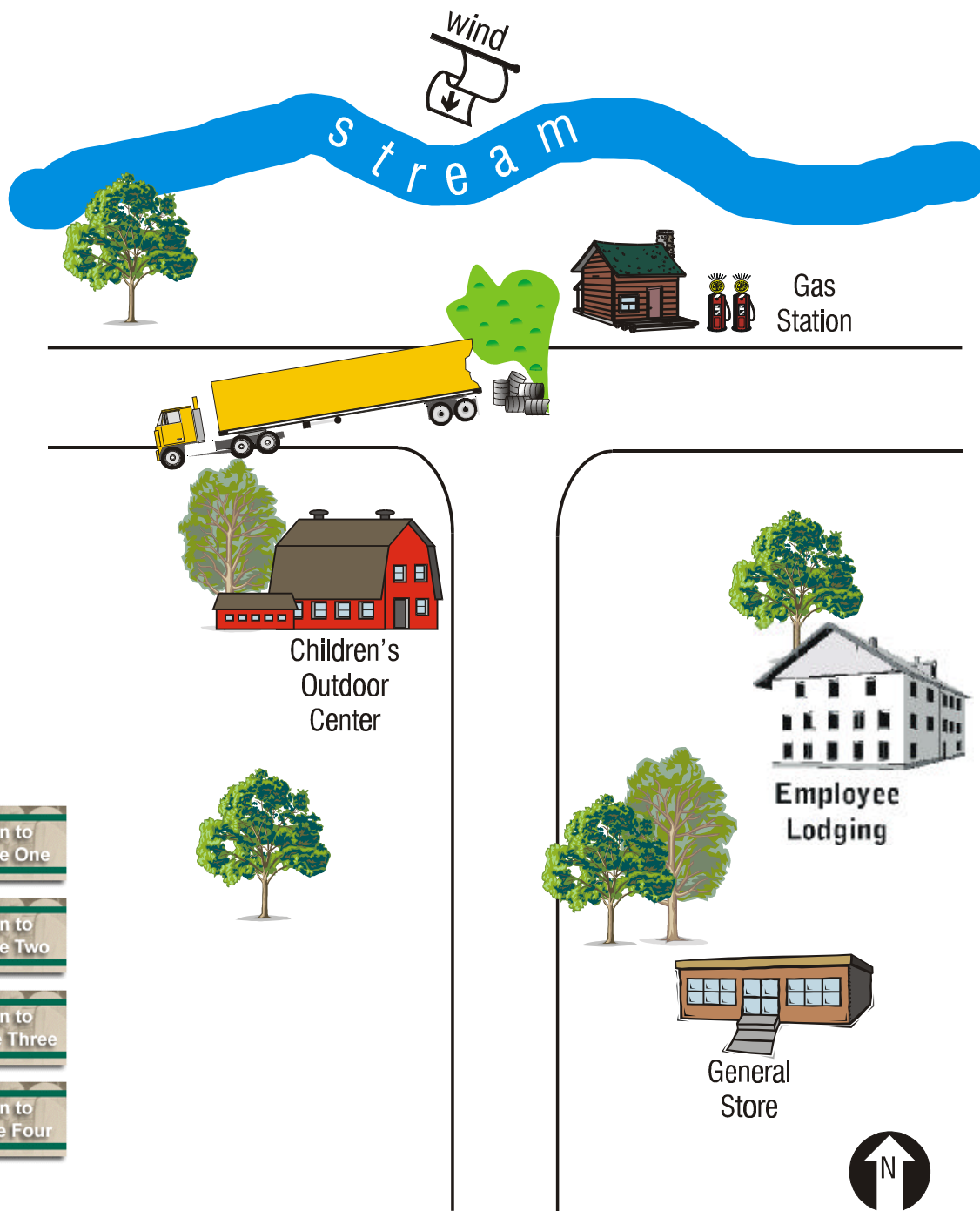
Upon arrival, you find that a crowd has formed made up of visitors, some park personnel from a nearby park store, and the park naturalists who were presenting the interpretation. A large tractor trailer is laying on its side; the driver cannot be seen. A product is leaking out of several drums located on the truck and in the road onto the pavement. No visible label can be readily found on the drums; however, an identifying placard on the truck reads:





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On-Going Class Exercise – Part One (Corresponds to Module Three, Page 16)

Using the information provided in the incident description, the picture of the scene, and the knowledge you've gained, answer the following questions.

1. **Based on initial observation of visual clues, is a hazardous material/substance present?**

If so, what is it?

2. **In what DOT class does the known hazardous material fall?**
3. **In what NFPA 704 Standard class does the material fall?**
4. **What PPE is required for this type of hazard?**

Review Exercise
Diagram

Return to
Module Three



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On-Going Class Exercise – Part Two (Corresponds to Module Six, Page 8)

1. **Should you rush in to find and possibly save the driver of the truck?**
2. **What tools can you use to safely assess the situation beyond that of visual inspection of the placards?**
3. **Use the DOT North American Guidebook to determine the product involved in the spill.**
4. **Use the NIOSH Pocket Guide to Chemical Hazards to identify the permissible exposure limits (PELs) to the product.**

Review Exercise
Diagram

Return to
Module Six

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On-Going Class Exercise – Part Three (Corresponds to Module Six, Page 21)

1. **Where should you look to find procedures for responding to incidents?**
2. **What immediate, yet defensive, actions should you take to protect human health, welfare, and the environment?**
3. **Who is the Incident Commander of the scene: You, the other park employees that were first to arrive on the scene, or the local fire department's HAZMAT team who arrive soon after you do?**
4. **Draw the required zones on the picture of the scene and indicate the locations of the Incident Command post, equipment and personnel decontamination corridor, and first-aid responses.**

Review Exercise
Diagram

Return to
Module Six



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On-Going Class Exercise – Part Four (Corresponds to Module Six, Page 27)

1. **Who else can you contact for assistance?**
2. **To which Federal agency must you report the spill?**
3. **What type of decontamination procedures will be necessary for the cleanup of this spill?**
4. **Which factors should you consider when investigating the drainage of the hazardous substance into a nearby sewage manhole.**
5. **What type of medical procedures should be followed for those responders exposed to the hazardous substance?**

