Waste Site Worker Safety

40 Hour HAZWOPER

Hazard Recognition

Module 4
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Acronyms Used In This Module

CFR                Code of Federal Regulations
dB A               Decibels on the A-weighted scale
DOT                Department of Transportation
HASP               Health and Safety Program
HBV                Hepatitis B Virus
HCV                Hepatitis C Virus
HIV                Human Immunodeficiency Virus
AIDS               Acquired Immune Deficiency Virus
HCS                Hazard Communication Standard
JHA                Job Hazard Analysis
JSA                Job Safety Analysis
MSDS               Material Safety Data Sheet
NFPA               National Fire Protection Association
OSHA               Occupational Safety and Health Administration
PPE                Personal Protective Equipment
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Overview

Through better understanding of the various methods used in hazard recognition, workers will see the need to implement the appropriate engineering controls, safe work practices, or personal protective equipment to protect themselves and other personnel.

Terminal Learning Objective

Perform a Job Hazard Analysis (JHA), on an assigned task, to determine what unsafe conditions may exist that could result in exposure to hazards and unsafe conditions that could impact worker health and safety.

Enabling Objectives

1. Describe specific hazards posed by working on a hazardous waste site.

2. Define:
   a. Hazard
   b. Risk
   c. Safety

3. Identify measures that can be taken to prevent injury from identified hazards:
   a. Noise
   b. Electrical
   c. Work site and equipment
   d. Heat Stress
   e. Cold Exposure
   f. Biological
   g. Blood borne pathogens

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Hazard Recognition

Hazardous waste sites present a multitude of health and safety concerns, any one of which could result in serious injury or death. An accurate assessment of all the hazards posed by the waste site is nearly impossible due to the large number and variety of substances. Any individual location may contain hundreds or even thousands of chemicals. In addition, workers are subject to dangers posed by the disorderly physical environment of hazardous waste sites and the stress of working in protective clothing.

The combination of these conditions results in a working environment that is characterized by numerous and varied hazards. These include:

- Chemical Exposure
- Ionizing Radiation
- Fire And Explosion
- Oxygen Deficiency
- Site And Equipment Hazards
- Electrical Hazards
- Heat Stress
- Cold Exposure
- Biological Hazards

In approaching a site, it is wise to assume that all these hazards are present until site characterization has shown otherwise. A site health and safety program (HASP) must provide comprehensive protection against all potential hazards and specific protection against individual known hazards. It should be continuously adapted to new information and changing site conditions.

Hazard and Safety Analysis

Job Hazard Analysis (JHA)

One model that can be utilized for hazard recognition is a job hazard or job safety analysis (JSA). A JHA assesses the potential hazards posed
by doing a specific task. The assessment protects workers by resulting in further training, engineering or administrative controls, proper work practices, or proper selection of PPE. To accomplish a thorough JHA, the following steps are necessary:

- Identify the site tasks that have the potential for injury or illness. It might be necessary to focus on those with the greatest potential hazards first.

- Have the supervisor and the worker who performs the task list the steps involved, from start to finish, in as much detail as necessary to accurately identify possible hazards.

- Using the steps listed; identify potential hazards associated with each step.

- From the hazards identified at each step, determine the best method of protection: engineering or administrative controls, work practices, and PPE.

JHA should provide an identification of the hazards associated with a particular task and the practice or process to protect the worker. It also creates a record, which can be included in the Health and Safety Plan. The JHA can be used in training to ensure that the worker is made aware of the hazards of a task, of any standing orders that apply, and of how they are expected to protect themselves.

**Defining Hazard, Risk, and Safety**

The whole purpose for identifying hazards at a waste site is to keep the worker safe while on the job. A common definition of safety is “freedom from danger or harm.” In reality, nothing is completely safe, but we can always make a situation safer by being aware of the hazards involved and taking steps to protect workers.

**Hazard**

Hazard is defined as any substance, situation, or condition that is capable of harming human health, property, or the environment. A hazard represents a potential for harm. A potential hazard, however, does NOT indicate how serious the harm might be or how likely it may be for harm to occur. For example, a direct hit by a meteorite is a potential hazard of life on earth. This says nothing about the seriousness or the likelihood of harm.
Risk

Risk is defined as a measure of the probability and severity of a hazard to harm human health, property, or the environment. Risk is a measure of how likely harm is to occur and an indication of how serious the harm might be if it does. The severity of a direct hit on you by a meteorite is quite great but the probability of this happening is very low. Thus the risk is very low.

Safety

Safety may be defined as a judgment of the acceptability of risk. That is, once we have identified a hazard and estimated how risky it is, we make a judgment about whether we can accept that level of risk or whether something needs to be done to lower the risk, if possible. The Site Health and Safety Officer is responsible for thoroughly addressing safety during planning. The officer must also ensure that workers are made aware of the hazard/safety issues as well as any technologies, work practices, or PPE that are required to protect them during a particular activity. The protective methods must be identified in the site-specific HASP.

Chemical Hazard Identification Systems

Exposure to toxic chemicals is a great concern at hazardous waste-sites, although these days more injuries occur to workers from hazards other than chemicals. This may be a result of good prior planning, including the identification of potential hazards. Commonly used identification systems that help in recognizing potential chemical hazards are NFPA (National Fire Protection Association) signage on buildings and DOT (Department of Transportation) package labels.
**NFPA 704 System**

The NFPA marking system involves the identification of three areas of concern to first responders as they may need to enter a building or area to respond to a potential fire situation. Each area of concern is identified by a color and takes up one fourth of a diamond shaped sign; the fourth quarter, which is white, is reserved for noting special hazard situations. Each colored area contains a number ranging from 0 to 4 representing the degree of danger for that area. A rating of 4 indicates the highest level of concern.

<table>
<thead>
<tr>
<th>NFPA 704 System</th>
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<tbody>
<tr>
<td><strong>BLUE - Health Hazard</strong></td>
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<td>4</td>
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<tr>
<td>3</td>
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<td>2</td>
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<tr>
<td><strong>RED - Flammability Hazard</strong></td>
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<tr>
<td><strong>YELLOW - Reactivity Hazard</strong></td>
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<tr>
<td>4</td>
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<tr>
<td>3</td>
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<tr>
<td>2</td>
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<tr>
<td>1</td>
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<tr>
<td>0</td>
</tr>
<tr>
<td><strong>WHITE - Special Information</strong></td>
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<tr>
<td>This block is designated for special information about a chemical present. For example, it may indicate that a material is radioactive by displaying the standard radioactive symbol, or unusually water reactive by displaying a large W with a slash through it. For a more complete discussion of these various hazards, consult the NFPA Standard 704 M (NFPA, 1986).</td>
</tr>
</tbody>
</table>
**DOT Labels**

The Department of Transportation has defined nine hazard classes, which have corresponding labels associated with them. Some of the classes have subdivisions and are noted by a decimal and a subdivision number following the hazard class number. These labels should be found on any packages that contain hazardous materials and were transported. At a waste site these could be drums, tanks, laboratory boxes, or compressed gas cylinders. The labels indicate a general hazard but not specific chemical names. Each label tells the name and number of the hazard class and uses unique color combinations to distinguish the classes from one another.

**Hazards**

**Ionizing Radiation**

Radiological hazards are discussed in great detail in a separate lesson in this book.

**Chemical Exposure**

Further information regarding chemical hazards is detailed in the Toxicology and Chemical Awareness lessons in this book.

**Fire and Explosions**

There are many potential causes of fires and explosions at hazardous waste sites. Fires and explosions are dependent on the materials involved and the conditions to which the materials are subjected. The following list illustrates OSHA's chemical categories related to this hazard and how they might behave. These groups are very similar in characteristics and definitions to DOT's hazard classes with some minor differences.

**Combustible Liquids/Flammable Gases, Aerosols, and Liquids**

These chemicals can ignite spontaneously or when exposed to an ignition source or an oxidizer, such as air. Some common examples are coal tar distillate, acetylene, methane, toluene, and naphtha.
Flammable Solids

A solid, other than a blasting agent or explosive, that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing. If ignited, a flammable solid burns so vigorously that it creates a serious hazard. Examples include some metals, naphthalene, dinitrotoluene, and methyl parathion.

Explosives

An explosive is a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature. DOT recognizes six subcategories of explosives, depending upon their specific behavior. Some examples of explosives are initiating explosives or blasting agents, grenades, rocket engine propellant, fuse igniters, and explosive cable cutters.

Pyrophorics

Pyrophoric means a chemical that will ignite spontaneously in air at or below 130 degrees Fahrenheit. Some examples are phosphorous, trimethyl aluminum, powdered cesium, and dimethyl zinc.

Oxidizers

Oxidizers initiate or promote combustion in other organic materials through the release of oxygen or other gases that support the burning process. The oxidizers themselves do not burn. Another fuel must be present. Some examples are nitrates, chlorine, fluorine, hydrogen peroxide, permanganates, and hypochlorites.

Organic Peroxides

Organic compounds that are considered a structural derivative of hydrogen peroxide fall in this category. They chemically contain both the oxidizer and the fuel to support combustion and under conditions such as contamination, elevated temperatures, and friction, they can act as contact explosives. Examples include benzoyl peroxide, t-butyl peracetate, isopropyl percarbonate, and t-amyl peroxyprivalate.

Unstable/Reactives

Reactives are chemicals that will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, or temperature. This can cause a sudden release of materials under pressure or chemical reactions that produce explosions, fire, or heat. Examples include acetylene and vinyl chloride.
Water Reactives

Chemicals in this group react with water to release a gas that is flammable or presents a health hazard. Water reactive chemicals can cause fire, explosion, or excessive pressure leading to container failure. Examples include sodium metal, sulfuric acid, vinyl chloride, arsine, and trifluorochloroethylene.

Explosions and fires may arise spontaneously. However, more commonly they result from problems during site activity. Potentially dangerous activities include moving drums, accidentally mixing incompatible chemicals, or introducing an ignition source (such as a spark from equipment) into an explosive or flammable environment. At hazardous waste sites, explosions and fires not only pose the obvious hazards of intense heat, open flame, smoke inhalation, and flying objects, but also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on-site and the general public living or working nearby.

To protect against the explosion and fire hazard, the site health and safety plan must include the following procedures:

- Allow only qualified personnel to field monitor for explosive atmospheres and flammable vapors.
- Use proper precautions and procedures when staging and storing incompatible/reactive materials.
- Keep all potential ignition sources away from an explosive or flammable environment.
- Use non-sparking, explosion-proof equipment.
- Follow established safe work practices when performing any task that might result in the agitation or release of chemicals.

Oxygen Deficiency

The oxygen content of normal air at sea level is approximately 21 percent. Physiological effects become readily apparent when the oxygen concentration in the air decreases toward 16 percent. These effects include impaired attention, judgment and coordination, and increased breathing and heart rate.

If the oxygen concentration should drop lower than 16 percent, the effect is much more severe. A concentration this low can result in nausea and vomiting, brain damage, heart damage, unconsciousness, and death. To account for individual physiological responses as well as errors in measurement, OSHA requires the use of air-supplied respirators at concentrations of 19.5 percent oxygen or lower.
Oxygen deficiency may result from the displacement of oxygen by another gas or from the consumption of oxygen by a chemical reaction. Confined spaces or low-lying areas are particularly vulnerable to oxygen deficiency and must always be monitored prior to entry. If the conditions remain which caused the oxygen deficiency, the area must be continuously monitored. Only qualified field personnel may monitor oxygen levels.

Site and Equipment Hazards

The physical environment of hazardous waste sites may contain numerous safety hazards such as:

- Holes or ditches.
- Precariously positioned objects, such as drums or boards that may fall.
- Sharp objects, such as nails, metal shards, and broken glass.
- Slippery surfaces.
- Steep grades.
- Uneven terrain.
- Unstable surfaces, such as walls that may cave in or flooring that may give way.
- Overhead and underground utilities.
- The presence of compressed gas cylinders.

Noise

If workers are unable to communicate and are distracted, the chances of being injured increase. Work involving large equipment often creates excessive noise.

The effects of noise can include:

- Workers being startled, annoyed, or distracted.
- Physical damage to the ear, pain, and temporary or permanent hearing loss.
- Inability to communicate, interference.

The OSHA limit for employee exposure to noise is an 8-hour, time-weighted average sound level of 90 dBA (decibels on the A-weighted scale). If the limit might be exceeded, the employer must use feasible administrative or engineering controls. In addition, whenever employee noise exposures equal or exceed an 8-hour, time weighted average
sound level of 85 dBA, employers must administer a continuing, effective hearing conservation program as described in OSHA regulation 29 CFR PART 1910.95.

**Other Safety Hazards**

Other safety hazards are a function of the work itself. Examples include:

- Heavy equipment.
- Protective equipment, which impairs a worker's agility, hearing, and vision.
- Power tools, which may create a hazard when used improperly or without safety guards or precautions.
- Lifting and moving drums and other containers.
- Slipping, tripping, or falling on walking or working surfaces.
- The presence of pneumatic or hydraulic energy sources.

**Excavation Hazards**

Accidents involving physical hazards not only can injure workers but also can create additional hazards. For example, an accident could lead to increased chemical exposure due to damaged protective equipment or danger of explosion, due to the mixing of chemicals. Site personnel should constantly look out for potential safety hazards and should immediately inform their supervisors of any new hazards so that precautions may be taken.

**Electrical Hazards**

Hazardous waste sites require an electrical supply for lighting, cooling, equipment, and tools. Whenever electricity is used, proper precautions and procedures are necessary to avoid electrocution and shock. However, at a waste site other electrical hazards exist:

- Overhead power lines.
- Downed electrical lines.
- Unmarked buried cables.
- Defective insulation on lines and equipment.
- Charged capacitors.
- Lightning.
Preplanning

In order to prevent electrical accidents, preplanning is needed as well as worker awareness of the hazards. Actions to consider in pre-planning could include:

- Before using heavy equipment, locate buried cable and note location of overhead lines.
- Isolate and cut off the power to downed or abandoned power lines.
- Instruct workers in the proper precautions for using electrical tools.
- Regularly inspect electrical tools and cords for defects and safeguards.
- Use low voltage equipment with ground-fault interrupters and watertight, corrosion resistant connecting cables.
- Employ proper grounding procedures.
- Monitor weather conditions; suspend work during electrical storms.

OSHA's standard 29 CFR part 1910.137 describes clothing and equipment for protection against electrical hazards.

Heat Stress

Heat stress is a major hazard, especially for workers wearing protective clothing. The same protective materials that shield the body from chemical exposure also limit the body's ability to get rid of heat and moisture. Personal protective clothing can therefore create a hazardous condition.

Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. It can pose as great a danger to worker health as chemical exposure. In its early stages, heat stress can cause rashes, cramps, discomfort, and drowsiness. These problems result in impaired functional ability, which threatens the safety of both the individual and co-workers. Continued heat stress can lead to heat stroke and death.

Protection against heat stress includes the following strategies:

- Avoid overprotection by selecting an appropriate level of PPE.
- Train personnel that will wear PPE.
- Frequently monitor personnel through communication.
- Carefully schedule work and rest periods.
- Drink plenty of fluids.

For further information on heat stress consult the topic "Personal Protective Equipment: Clothing/Ensembles."

**Cold Exposure**

Exposure to low temperatures and wind-chill factors may cause injury (i.e., frostbite and hypothermia) and may impair one’s ability to work. Frostbite is a local injury, which can range from a sudden whitening of the skin to cold, pale, and solid skin. Hypothermia, a condition of abnormally low body temperature, may result from exposure to freezing or rapidly dropping temperatures.

Cold stress can be detected early by signs of shivering as well as tingling, pain, or numbness in extremities (i.e., hands and feet). Signs of advanced cold exposure may include forgetfulness, apathy (inattention), slow pulse, difficulty with speech, freezing of extremities, and unconsciousness.

**Prevention**

To guard against these hazards:

- Wear appropriate clothing.
- Have warm shelter readily available.
- Carefully schedule work and rest periods.
- Monitor workers' physical conditions.

**Monitoring**

Wind chill is a factor of combining outdoor temperature and wind speed. Determining wind chill requires a thermometer, a wind speed indicator, and a wind chill chart. The chart will indicate the relative dangers of wind chill levels.

**Treatment**

Move the victim to a warm indoor area. If the worker is conscious, provide warm beverages containing NO caffeine or alcohol. Frost-damaged areas should be treated as follows:
Seek medical attention immediately.

Re-warm the frozen part quickly by immersing it in water maintained at 102-105 degrees Fahrenheit (comfortably warm to the inner surface of an un-chilled forearm). Discontinue warming when the skin begins to look flushed, which is a sign of the return of blood flow.

Do NOT allow the victim to walk on frozen feet. Instead, allow the victim to exercise the feet with gentle movement.

Elevate the feet after warming.

Prevent contact between the injured part and any surface except a sterile bandage.

**Biological Hazards**

**Pathogens**

Pathogens are biological organisms that are capable of infecting or transmitting diseases to humans. Pathogenic (disease-causing) microorganisms, such as bacteria, viruses, and fungi, may be present in waste from hospitals and research facilities. If exposed, these microorganisms can be dispersed in water, where they can survive and maintain their infectious capabilities for significant periods of time. They may also be transported by air. Generally microorganisms survive for only a short time in the atmosphere due to the lack of nutrients and the presence of ultraviolet radiation from the sun. However, certain bacteria and fungi form spores (a microorganism in a resting state) and can survive for long periods.

Most diseases transmitted by waterborne pathogenic bacteria result in gastrointestinal disorders. Although this might seem like a minor symptom, take into account that cholera and typhoid are two examples of dangerous waterborne pathogenic bacteria.

Symptoms associated with waterborne viral infections may involve disorders of the nervous system; for example, polio. Viral pathogens also may cause infectious hepatitis.

Since there is no way of "monitoring" for bacterial waste, workers must be able to recognize biological hazards. The waste may be labeled as one of the following:
• Biomedical Material
• Biohazard
• Etiologic Agents
• Infectious Substance

At hospitals and research facilities, biological waste is disposed of by placing it in an incinerator or autoclave. An autoclave exposes the material to very high heat. Waste to be autoclaved is usually placed in a plastic bag, which is clearly marked with the biohazard symbol. Waste that is to be incinerated is packed in a solid red plastic bag. If either type of package is found, the waste generator should be contacted. If the generator is unknown, the bag should be incinerated unopened.

Biohazards such as research bacterial cultures may be sent through the mail if properly packaged. The package is actually a triple layer container, which is marked as a Biomedical Material. Should one of these packages be found on an abandoned waste-site, it should be left in place until the responsible state agency has been contacted. Each state is responsible for regulation of infectious wastes.

**Blood-Borne Diseases**

OSHA has developed a standard to address the risks of coming in contact with blood-borne pathogens in the workplace. The two viruses of greatest concern are Hepatitis B and HIV (human immunodeficiency virus). The standard is found in 29 CFR 1910.1030 and requires that the employer establish a written Exposure Control Program.

• The written program includes:

  • Universal Precautions, which means that all-human blood and certain human body fluids, are treated as if known to be infectious with blood-borne pathogens.

  • Work Practice Controls (including PPE) that minimize or eliminate employee exposure. Work practice controls alter the manner in which a task is performed (e.g., handling sharps, which are any objects that can penetrate the skin).

  • Engineering Controls, such as sharps disposal containers and self-sheathing needles.
Hand-washing facilities, to ensure good sanitation. For example, providing an adequate supply of running potable (drinkable) water, soap, and single use towels or hot air drying machines.

Other requirements of the standard include hepatitis B vaccinations for employees at risk; exposure evaluation and follow-up; hazardous material communication, such as biohazard labels; employee training; and confidential employee medical record keeping.

**Hepatitis B Virus (HBV)**

The hepatitis B virus infects the liver. In some individuals, HBV develops into serious or fatal problems, such as cirrhosis, liver cancer, or chronic liver disease. Some people have no problems or symptoms yet become carriers of the virus.

HBV is more common and is a much harder virus than HIV; it can exist on a surface outside the body for up to thirty days. For this reason, it poses a greater hazard to an exposed individual.

**Human Immunodeficiency Virus (HIV)**

HIV is the virus that causes AIDS by attacking the body's immune system, reducing its ability to fight disease. Early AIDS symptoms can include fever, loss of appetite, weight loss, chronic fatigue, and skin rashes. Later, the victim may develop unusual types of cancer or infections, including pneumonia, which the body can no longer fight off.

**Transmission**

These viruses can be transmitted through blood and other body fluids including:

- Semen
- Vaginal secretions
- Fluids surrounding internal organs and joints
- Amniotic fluid (fluid in which the embryo of a mammal is suspended)
- Saliva during dental procedures
- Body fluids do not include sweat or tears. Urine and saliva that do not contain visible blood are considered noninfectious.

Behaviors that lead to infection are:
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- Sexual contact with an infected partner
- Shared drug needles
- Accidental cuts or sticks from infected sharps
- Direct contact between broken or chaffed skin and blood/body fluids
- Direct contact between mucous membranes and blood/body fluids

Hepatitis B can also be transmitted through caked, dried blood and contaminated surfaces.

**Minimize Exposure**

Your chance of being directly exposed to blood-borne pathogens on the job is small. Keep in mind, though, that you cannot tell by looking at someone whether he or she is infected. There are some common sense rules that you can follow that will minimize any risk that exists:

- Do not clean up blood or body fluids unless you have been trained.
- Know what to do before an emergency occurs.
- Be sure to wash your hands and remove any PPE before eating, drinking, smoking, or handling contact lenses.
- Report any suspected exposure immediately to the health and safety officer.

**Other Biologic Hazards**

Other biological hazards that may be present on hazardous waste sites include:

- Plants, such as poison ivy, which cause severe allergic reactions in some people.
- Venomous insects, such as hornets, wasps and bees, which cause severe allergic reactions in some people.
- Snake and animal bites.
- Insect bites, such as ticks and spiders, which can cause severe illness.

Protective clothing and respiratory equipment can help reduce the chances of exposure to biological hazards. Thorough washing of any exposed body parts and equipment will help protect against infection. Workers with severe allergic reactions should inform the medical
surveillance program physician and those responsible for administering first aid on site.
Review Questions

1. List at least three specific hazards posed by working on a hazardous waste site.

2. Describe a model for hazard recognition.

3. What are some of the physical hazards in waste site work?

4. Describe how to recognize one specific kind of hazard and the measures that can be taken to prevent injury to the worker from that hazard.