Waste Site Worker Safety

40 Hour HAZWOPER

Emergency Procedures

Module 19
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### Acronyms Used In This Module

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<tr>
<td>CPR</td>
<td>Cardiopulmonary resuscitation</td>
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<tr>
<td>NRC</td>
<td>National Response Center</td>
</tr>
<tr>
<td>NRP</td>
<td>National Response Plan</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>SCBA</td>
<td>Self-contained Breathing Apparatus</td>
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Overview

Anticipating and preplanning for emergency situations at hazardous waste sites are essential to preparing and maintaining a safe working environment. Timely, organized responses on the part of employees to emergencies save lives. Employees should be alert to the potential for hazardous situations and take preventative action where possible. Individual responsibilities must be established. Training needed to perform those responsibilities must be carried out before hazardous waste operations begin. Site security, site evacuation routes, and safe distances need to be established in response to potential emergency situations.

Terminal Learning Objective

Explain the various considerations in an emergency and the importance of proper planning and actions for personal safety and the safety of others.

Enabling Objectives

1. Describe the elements of an effective emergency contingency/spill response plan.

2. Identify guidelines for establishing safe evacuation routes and procedures.

3. Describe the importance of a Site Control Log that is located at the access check points.

4. State the importance of not participating in a spill response if training or equipment is inadequate.

5. Outline the steps to follow during an emergency response.

6. Identify key elements of an emergency response plan.
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Emergency Procedures

The nature of the work at hazardous waste sites makes emergencies a continual possibility, no matter how infrequently they may actually occur. An emergency may be as limited as a worker experiencing heat stress, or as vast as an explosion that spreads toxic fumes throughout a community. Any hazard on site can lead to an emergency: chemicals, biologic agents, radiation, or physical hazards may act alone or in concert to create explosions, fires, spills, toxic atmospheres, or other dangerous and harmful situations.

Emergencies happen quickly and unexpectedly and require immediate response. Rescue personnel attempting to remove injured workers may themselves become victims. This variability means that advance planning, including anticipation of different emergency scenarios and thorough preparation for contingencies, is essential to protect worker and community health and safety.

This chapter outlines important factors to be considered when planning for and responding to emergencies. It defines the nature of site emergencies, lists the types of emergencies that may occur, and outlines a Contingency Plan and its components.

Planning

When an emergency occurs, decisive action is required. Rapidly made choices may have far-reaching, long-term consequences. Delays of minutes can create life-threatening situations. Personnel must be ready to rescue or respond immediately; equipment must be on hand and in good working order. In order to handle emergencies effectively, planning is essential. For this purpose, an Emergency Response Plan or Contingency Plan should be developed.

A Contingency Plan is a written document that sets forth policies and procedures for responding to site emergencies. The plan shall incorporate the following:

- 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 which are not covered by the site safety and health plan.

Emergency medical treatment and first aid.

Emergency alerting and response procedures.

Critique of response and follow-up.

PPE and emergency equipment.

The contingency plan should be:

- Designed as a discrete section of the Site Safety Plan.
- Compatible and integrated with the pollution response, disaster, fire, and emergency plans of local, state, and federal agencies.
- Rehearsed regularly using drills and mock situations.
- Reviewed periodically in response to new or changing site conditions or information

**Personnel**

The Personnel component of the plan includes not only on-site and off-site personnel with specific emergency response roles, but also others who may be on site, such as contractors, other agency representatives, and visitors.

Emergency personnel may be deployed in a variety of ways. Depending on the nature and scope of the emergency, the size of the site, and the number of personnel, the emergency response cadre can include individuals, small or large teams, or several interacting teams. Although deployment is determined on a site-by-site basis, pertinent general guidelines and recommendations are listed below. In all cases the organizational structure should show a clear chain-of-command. Every individual should know his or her position and authority, and the chain-of-command must be flexible enough to handle multiple emergencies, such as a rescue and a spill response or two rescues with a fire and spill response.

**On-Site Personnel**

The Contingency Plan should identify all individuals and teams who will participate in emergency response and define their roles. All personnel, whether directly involved in emergency response or not, should know...
their own responsibilities in an emergency. They must also know the names of those in authority, and the extent of the authority.

**Leader**

In an emergency situation, one person must be able to assume total control and decision-making on site. This leader must:

- Be identified in the emergency response plan. This person may be, for example, the Project Team Leader, Site Safety Officer, or Field Team Leader.
- Be backed up by a specified alternate(s).
- Have the authority to resolve all disputes about health and safety requirements and precautions.
- Be authorized to seek and purchase supplies as necessary.
- Have control over activities of everyone entering the site, for example, contractors, fire departments, and police.
- Have the clear support of management.

**Teams**

Although individuals (e.g., the Site Safety Officer) may perform certain tasks in emergencies, in most cases teams provide greater efficiency and safety. Teams composed of on-site personnel may be created for specific emergency purposes, such as decontamination, rescue, and entry. Rescue teams can be used during a particularly dangerous operation or at large sites with multiple work parties in the Exclusion Zone. Their sole function is to remain near hazardous work areas, partially dressed in protective gear, ready for full suiting and immediate rescue of any endangered worker. These teams should be capable of administering cardiopulmonary resuscitation (CPR) and emergency first aid. Other teams can be formed for responding to containment emergencies and fire fighting until off-site assistance arrives.

**Off-Site Personnel**

Off-site personnel may include individual experts such as meteorologists or toxicologists. Others may include representatives from local, state, and federal organizations offering rescue, response, or support. As part of advance planning, site personnel should:

- Make arrangements with individual experts to provide guidance as needed.
- Arrange with the appropriate agencies (e.g., local fire department, state environmental
Agency, EPA regional office) for support.

- Alert these authorities to the types of emergencies that may arise.
- Determine their estimated response time and resources.
- Identify backup facilities.
- Provide training and information about hazards on site and special procedures for handling them.
- Establish a contact person and means for notification at each agency.

**Site emergencies involving significant chemical releases** should be coordinated with federal response organizations. The federal government has established a National Response Plan (NRP) to promote the coordination and direction of federal and state response systems. The NRP also encourages the development of local government and private capabilities to handle chemical emergencies involving chemical releases.

If a significant chemical release occurs at a hazardous waste site, the National Response Center in Washington, D.C., should be contacted (Telephone: 800-424-8802). The NRC will activate federal response under the National Response Plan.

**Training**

Since immediate, informed response is essential in an emergency, all site personnel and others entering the site (visitors, contractors, off-site emergency response groups, and other agency representatives) must have some level of emergency training.

Any training program should:

- Relate directly to site-specific, anticipated situations.
- Be brief and repeated often.
- Be realistic and practical.
- Provide an opportunity for special skills to be practiced regularly.
- Feature drills frequently (e.g., site-specific mock rescue operations).
- Ensure that training records are maintained in a training logbook.

Everyone entering the site must be made aware of the hazards and of hazardous actions which are forbidden or should be avoided (such as
smoking). They must also know what to do in case of an emergency. Visitors should be briefed on basic emergency procedures such as decontamination, emergency signals, and evacuation routes.

Personnel without defined emergency response roles (contractors, federal agency representatives, and others) must still receive a level of training that includes at a minimum:

- Hazard recognition.
- Standard operating procedures.
- How to signal an emergency: the alarm used, how to summon help, what information to give, and who should receive it.
- Evacuation routes and refuges.
- The person or station to report to when an alarm sounds.

**Training Requirements On-Site Emergency Personnel**

On-site emergency personnel who have emergency roles in addition to their ordinary duties must have a thorough understanding of emergency response. Training should be directly related to their specific roles and should include subjects such as:

- Emergency chain-of-command.
- Communication methods and signals.
- How to call for help.
- Emergency equipment and its use.
- Emergency evacuation while wearing protective equipment.
- Removing injured personnel from enclosed spaces.
- Off-site support and how to use it.

These personnel should obtain certification in first aid and CPR. They should practice treatment techniques regularly, with an emphasis on:

- Recognizing and treating chemical and physical injuries.
- Recognizing and treating heat and cold stress.

**Information for Off-Site Emergency Personnel**

Off-site emergency personnel, such as local fire fighters and ambulance crews, often are first responders and run a risk of acute hazard exposure equal to that of any on-site worker. These personnel should be informed of ways to recognize and deal effectively with on-site hazards. Lack of
information may inadvertently worsen an emergency by improper actions (for example, spraying water on a water-reactive chemical and causing an explosion). Inadequate knowledge of the on-site emergency chain-of-command may cause confusion and delays. Site management should, at a minimum, provide off-site emergency personnel with information about:

- Site-specific hazards.
- Appropriate response techniques.
- Site emergency procedures.
- Decontamination procedures.

**Emergency Recognition and Prevention**

On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meetings should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, air tank changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

**Communications**

In an emergency, crucial messages must be conveyed quickly and accurately. Site staff must be able to communicate information such as the location of injured personnel, orders to evacuate the site, and notice of blocked evacuation routes, even through noise and confusion. Outside support sources must be reached, help obtained, and measures for public notification ensured, if necessary. To do this, a separate set of internal emergency signals should be developed and rehearsed daily. External communication systems and procedures should be clear and accessible to all workers.
Internal Communications

Internal emergency communication systems are used to alert workers to danger, to convey safety information, and to maintain site control. Any effective system or combination of systems may be employed. Radios or field telephones are often used when work teams are far from the Command Post. Alarms or short clear messages can be conveyed by audible signals (bullhorns, megaphones, sirens, bells, or whistles) or visual signals (colored flags, flares, lights, and hand or whole-body movements). The primary system must have a backup.

For example, hand signals may be used as a backup if radio communications fail.

Internal systems should be:

- Clearly understood by all personnel.
- Checked and practiced daily.
- Intrinsically safe (spark-free).

A special set of emergency signals should be set up. Emergency signals should be:

- Different from ordinary signals.
- Brief and exact.
- Limited in number so that they are easily remembered.

Examples include: "Stop," "Evacuate," "Help," and "All Clear." Any set of signals may be used to convey these messages as long as all personnel understand their meanings.

When designing and practicing communication systems, remember that:

- Background noise on-site will interfere with talking and listening.
- Wearing personal protective equipment will impede hearing and limit vision (e.g., the ability to recognize hand and body signals).
- Inexperienced radio users may need practice in speaking clearly.

External Communications

Off-site sources must be contacted to get assistance or to inform officials about hazardous conditions that may affect public or environmental safety. The telephone is the most common mode of off-site communication; phone hook-ups are considered a necessity on all but the most remote sites.

The NRC, or National Response Center (Telephone: 800-424-8802), should be contacted in the event of a significant chemical release. The NRC will contact the appropriate Federal On-Scene Coordinator.
All personnel must be familiar with the protocol (phone number or emergency code, contact person) for contacting public emergency aid teams such as fire departments, ambulance units, and hospitals.

If there is no site telephone system, all personnel must know the location of the nearest public telephone. A supply of telephone change and the necessary phone numbers must be readily available.

**Site Mapping**

Detailed information about the site is essential for advance planning. For this purpose, a site map is a valuable tool. It serves as a graphic record of the locations and types of hazards, a reference source, and a method of documentation. This map can be a duplicate of one developed for a Site Safety Plan, but it should focus on potential areas where emergencies may develop. Pins and colored flags can be used to mark changes in personnel deployment, hazard areas, and equipment locations. The map should highlight:

- Hazard areas, especially potential IDLH conditions.
- Site terrain: topography, buildings, and barriers.
- Evacuation routes.
- Site accessibility by land, sea, and air.
- Work crew locations.
- Changes (e.g., work activities, vandalism, and accidents).
- Off-site populations or environments at potential risk.

The map can be used for planning and training. It can serve as a basis for developing potential emergency scenarios and alternative response strategies.

When an emergency occurs, the problem areas should be pinpointed on the map. Pertinent information such as weather and wind conditions, temperature, and forecast should be added. The map can then be used to design the emergency plan; for example, to define zones; determine evacuation routes; and identify emergency first-aid, decontamination, and Command Post stations. When using the map for such purposes, the accuracy of the data obtained and the potential for overestimating or underestimating a hazard should be considered.

Even if the emergency develops so fast that the map cannot be used for on-the-spot planning, prior familiarity with it will aid in making informed decisions.
Safe Distances and Refuges

Refuges (Safety Stations)

On-site refuges (safety stations) can be set up for localized emergencies that do not require site evacuation. These refuges should only be used for essential needs, such as short rest breaks, emergency response strategy meetings, or temporary relief during mild cases of muscle strain and heat stress. The refuge should be located in a relatively safe, but not necessarily "clean" area; for example, along the upwind fence line in specially cleared places or on the boundary of the Exclusion Zone. The refuge should never be used for activities such as eating, drinking, or air changes.

Typical items located in a refuge area include:

- A sitting/resting area that should be shaded if possible.
- Water for decontamination.
- Wind indicator.
- Communication system with the Command Post.
- First-aid supplies (e.g., eyewash, stretcher, blanket).
- Special monitoring devices (e.g., extra detector tubes and personal monitors).
- Bolt cutters.
- Fire extinguisher.
- Hand tools.

Other refuges can be set up in the Support Zone, or in the case of site-wide evacuations, off-site at the safe exit destination. These will provide for emergency needs such as first aid for injured personnel, clean dry clothing and wash water for chemical exposure victims, and communications with the Command Post. In a site-wide evacuation, they can be used to house evacuation exit equipment, thereby reducing security problems.

These refuges should be stocked with such items as:

- Decontamination supplies.
- Oxygen and/or air.
- Water.
- Special testing equipment (e.g., pH paper, cyanide paper).
- First aid supplies.
- A communication system.
Safe Distances

No single recommendation can be given for evacuation or safe distances because of the wide variety of hazardous substances and releases found at a site. For example, a "small" chlorine leak may call for an isolation distance of only 140 feet (43 meters), while a "large" leak may require an evacuation distance of 1 mile (1.6 kilometers) or more, depending on the wind direction.

Safe distances can only be determined at the time of an emergency, based on a combination of site and incident specific factors. However, planning and outlining potential emergency scenarios will help familiarize personnel with points to consider.

Factors that influence safe distances include:

- The toxicological properties of the substance.
- The physical state of the substance.
- The quantity released.
- The rate of release.
- The method of release.
- The vapor pressure of the substance.
- Vapor density relative to air.
- Wind speed and direction.
- Atmospheric stability.
- The height of release.
- Air temperature and temperature change with altitude.
- Local Topography (e.g., barriers may enhance or retard a cloud or plume, and attenuate a blast).

Public Evacuation

If an incident may threaten the health or safety of the surrounding community, the public will need to be informed and possibly evacuated from the area. Site management should plan for this in coordination with the appropriate local, state, and federal groups, such as the Federal Emergency Management Agency, Civil Defense, county sheriff, local radio and television stations, municipal transportation systems, National Guard, and police.

Site Security and Control

In an emergency, the Project Team Leader (or designated representative) must know who is on site and must be
able to control the entry of personnel into the hazardous areas to prevent additional injury and exposure. Only necessary rescue and response personnel should be allowed into the Exclusion Zone.

One control technique is a checkpoint or series of checkpoints through which all personnel entering or exiting the site must pass (e.g., a Support Zone checkpoint). Identification or authorization must be presented to a Checkpoint Control Manager, who records for each person who passes through:

- Name (and affiliation of off-site personnel).
- Status (in or out).
- Time of entry.
- Anticipated exit time.
- Zones or areas to be entered.
- Team or "buddy."
- Task being performed.
- Location of task.
- Protective equipment worn; airtime left.
- Rescue and response equipment used.

The emergency area Checkpoint Control Manager should inform the Project Team Leader if a person remains in the emergency area beyond his or her anticipated exit time.

**Personal Locator Systems**

In an emergency, it is vital for the Project Team Leader (or designee) and rescue personnel to rapidly determine where workers are located and who may be injured. A passive locator system (i.e., a written record of the location of all personnel on site at any time) could be used to help find personnel in an emergency. Any such system should be:

- Graphic (such as a drawing with a written key).
- Roughly drawn to scale, with the scale and visible landmarks included.
- Kept current.
- Easy to locate.
- Stored outside the Exclusion Zone.

A good passive locator system is a site map with flags or color-headed pins identifying each worker.
Active locator systems can also be used. These are worn or carried by individual personnel and are activated by actions such as flipping a switch, a decrease in air supply, or a fall. They have the advantage of precisely locating individuals.

**Evacuation Routes and Procedures**

A severe emergency, such as a fire or explosion, may cut workers off from the normal exit near the Command Post. Therefore, alternate routes for evacuating victims and endangered personnel should be established in advance, marked, and kept clear. Routes should be directed (1) from the Exclusion Zone through an upwind Contamination Reduction Zone to the Support Zone and (2) from the Support Zone to an off-site location in case conditions necessitate a general site evacuation.

The following guidelines will help in establishing safe evacuation routes.

- Make escape routes known to all who go on-site. Place the evacuation routes in the predominantly upwind direction of the Exclusion Zone. (At a very large site, or one with many obstacles, some exits may be placed in the downwind fence-line, normally an undesirable location. If this is done, workers must know that they are not "out" until they reach the designated safety area.)

- Run the evacuation routes through the Contamination Reduction Zone. Even if there is not enough time to process the evacuees through decontamination procedures, there should be a mechanism for accounting for all personnel.

- Consider the accessibility of potential routes. Take into account obstructions such as gates, trenches, pits, tanks, drums, or other barriers, and the extra time or equipment needed to maneuver around or through them.

- Develop two or more routes that lead to safe areas and that are separate or remote from each other. Multiple routes are necessary in case one is blocked by a fire, spill, or vapor cloud. These routes must not overlap because if a common point were obstructed by a fire or other emergency, all intersecting routes would be blocked.

- Mark routes "safe" or "not safe" on a daily basis according to wind direction and other factors.

- Mark evacuation routes with materials such as barricade tape, flagging, or traffic cones. Equally important, mark areas that do NOT offer safe escape or that should NOT be used in an emergency, such as low ground, which can fill with gases or vapors, or routes blocked by natural barriers, such as cliffs or streams.
Consider the mobility constraints of personnel wearing protective clothing and equipment. They will have difficulty crossing even small streams and going up and down banks.

Place ladders across any cut or excavation that is more than 3 feet (1 meter) deep. For long cuts, place ladders at least every 25 feet (7.5 meters), and for deep cuts, place plywood or planks on top of ladders.

Provide ladders for rapid descent from areas or structures elevated more than 3 feet (1 meter). Use only ladders capable of supporting a 250 lb (114 kg) load. Secure ladders to prevent slipping.

Place standard cleated ramps ("chicken-board") across ditches and other similar obstacles. Add a railing and toe boards if the board is narrow or steeply sloped.

Check the toe and body clearance of ladders to make sure that personnel wearing protective clothing and SCBA can use them. Check the clearance of access ports, such as crawl spaces, hatches, manholes, and tunnels to make sure that personnel wearing a protective ensemble can get through. In any case, access ports should be at least 3 feet (1 meter) in diameter where possible. (Standard tank man-ways are smaller.)

### Emergency Decontamination

When planning for decontamination in medical emergencies, procedures should be developed for:

- Decontaminating the victim.
- Protecting medical personnel.
- Disposing of contaminated protective equipment and wash solutions.

These activities should be coordinated. The decision whether or not to decontaminate a victim is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life-saving first aid. For others, decontamination may aggravate the injury or delay life-saving treatment.

If decontamination does NOT interfere with essential treatment, it should be performed.
Waste Site Worker Safety

<table>
<thead>
<tr>
<th>Wash, rinse and/or cut off protective clothing and equipment.</th>
<th>Wrap the victim in blankets, plastic, or rubber to reduce contamination of other personnel.</th>
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</thead>
<tbody>
<tr>
<td>Alert emergency and off-site medical personnel to potential contamination; instruct them about specific decontamination procedures if necessary.</td>
<td>Send along site personnel familiar with the incident.</td>
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</table>

**Emergency Equipment**

In an emergency, equipment will be necessary to rescue and treat victims, to protect response personnel, and to mitigate hazardous conditions on site (e.g., to contain chemicals or fight fires).

**Regular Heavy Equipment**

Some regular equipment can double for emergency use. Because of its high cost, most heavy equipment (e.g., bulldozers, drum movers, pumps) employed in emergencies will also be used for regular work assignments. All equipment should be in working order, fueled, and available when an emergency occurs. Provide safe and unobstructed access for all fire-fighting and emergency equipment at all times.

Consider adopting the following daily work procedures:

- Refuel all heavy equipment when there is still one-half to one-quarter of a tank of fuel left.
- Require all equipment repairs to take place at the time the problem is discovered.
- Separate two similar pieces of equipment (e.g., two front-loaders or a bulldozer and a front loader); park each at a different spot on site and do not use them at the same time in a hazardous area unless absolutely necessary. (This will minimize the possibility of both pieces of equipment being damaged in the same explosion or fire.)

**Personal Protective Equipment**

For personal protective equipment:

- Refill all empty self-contained breathing apparatus (SCBA) tanks and prepare them for emergencies immediately after normal use.

- Stock higher levels of protective equipment than required for anticipated hazards (e.g., a site where Level C equipment is normally used should have Level A and B equipment available for emergencies.)
Special Equipment

Special equipment should be obtained depending on the specific types of emergencies that may occur at a particular site and the capabilities of backup off-site personnel. For example, if the nearest fire department is small and only carries one bucket of foaming solution because of its high cost and short shelf-life, a site may need to stock a large quantity of foam.

When determining the type and quantity of special equipment, the following factors should be considered:

- The types of emergencies that may arise. For each emergency, consider a probable scenario and a worst-case scenario.
- The types of hazards that site personnel may be exposed to and the appropriate containment, mitigation (i.e., controlling), and protective measures.
- The capabilities and estimated response times of off-site emergency personnel.
- The number of site personnel who could be victims during an emergency.
- The probable number of personnel available for response.

Medical Treatment and First Aid

In emergencies, toxic exposures and hazardous situations that cause injuries and illness will vary from site to site. Medical treatment may range from bandaging of minor cuts and abrasions to life-saving techniques. In many cases, essential medical help may not be immediately available. For this reason, it is vital to train on-site emergency personnel in on-the-spot treatment techniques, to establish and maintain telephone contact with medical experts (e.g., toxicologists), and to establish liaisons with local hospitals and ambulance services. When designing this program, these essential points should be included:

Train a cadre of personnel in emergency treatment such as first aid and CPR. Training should be thorough, frequently repeated, and geared to site-specific hazards.

Establish liaison with local medical personnel (for example, 24-hour on-call physician, medical specialists, local hospitals, ambulance service, and poison control center). Inform and educate these personnel about site-specific hazards so that they can be optimally helpful if an emergency occurs. Develop procedures for contacting them; familiarize all on-site emergency personnel with these procedures.
Set up on-site emergency first-aid stations; see that they are well supplied and restocked immediately after each emergency.

**Emergency Response Procedures**

Response operations usually follow a sequence that starts with the notification of trouble and continues through the preparation of equipment and personnel for the next emergency.

**Notification**

Alert personnel to the emergency. Sound a site alarm to:

- Notify personnel.
- Stop work activities, if necessary.
- Lower background noise in order to speed communication.
- Begin emergency procedures.

Notify on-site emergency response personnel about the emergency and include essential information:

- What happened.
- Where it happened.
- To whom it happened.
- When it happened.
- How it happened.
- The extent of damage.
- What aid is needed.

**Evaluation**

Available information about the incident and emergency response capabilities should be evaluated. The following information should be determined, to the extent possible:

1. What happened:
   a. Type of incident.
   b. Cause of incident.
   c. Extent of chemical release and transport.
   d. Extent of damage to structures, equipment, and terrain.

2. Casualties:
   a. Victims (number, location, and condition).
   b. Treatment required.
c. Missing Personnel.

3. What could happen? Consider:
   a. Types of chemicals on site.
   b. Potential for fire, explosion, and release of hazardous substances.
   c. Location of all personnel on site relative to hazardous areas.
   d. Potential for danger to off-site population or environment.

4. What can be done? Consider:
   a. Equipment and personnel resources needed for victim rescue and hazard mitigation.
   b. Number of uninjured personnel available for response.
   c. Resources available on site.
   d. Resources available from outside groups and agencies.
   e. Time for outside resources to reach the site.
   f. Hazards involved in rescue and response.

**Rescue/Response Action**

Based on the available information, the type of action required should be decided and the necessary steps implemented. Some actions may be done concurrently. No one should attempt emergency response or rescue until backup personnel and evacuation routes have been identified. Rescue/response actions may include:

- Enforce the buddy system. Allow no one to enter an Exclusion Zone or hazardous area without a partner. At all times, personnel in the Exclusion Zone should be in line-of-sight or communications contact with the Command Post Supervisor or designee.

- Survey Casualties. Locate all victims and assess their condition. Determine resources needed for stabilization and transport.

- Assess existing and potential hazards to site personnel and to the off-site population. Determine:
  - Whether and how to respond.
  - Need to evacuate site personnel and off-site population.
  - The resources needed for evacuation and response.
Allocate resources. Allocate on-site personnel and equipment to the rescue and incident response operations.

Request Aid. Contact the required off-site personnel or facilities, such as the ambulance, fire department, and police.

Control. Bring the hazardous situation under complete or temporary control; use measures to prevent the spread of the emergency.

Extricate. Remove or assist victims from area.

Decontaminate. Use established procedures to decontaminate uninjured personnel in the Contamination Reduction Zone. If the emergency makes this area unsafe, establish a new decontamination area at an appropriate distance. Decontaminate victims before or after stabilization as their medical condition indicates.

Stabilize. Administer any medical procedures that are necessary before the victims can be moved. Stabilize or permanently fix the hazardous condition (e.g., empty filled runoff dikes). Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks).

Transport. Take measures to minimize chemical contamination of the transport vehicle and ambulance and hospital personnel. Adequately protected rescuers should decontaminate the victims before transport. If this is not possible, cover the victims with adequate sheeting. Before transportation, determine the level of protection necessary for transport personnel. Provide them with disposable coveralls, disposable gloves, and supplied air, as necessary, for their protection. If appropriate, have response personnel accompany victims to the medical facility to advise on decontamination.

Evacuate. Move site personnel to a safe distance upwind of the incident. Monitor the incident for significant changes. The hazards may diminish, permitting personnel to reenter the site, or increase and require public evacuation.

Inform public safety personnel when there is a potential or actual need to evacuate the off-site population. Do not attempt large-scale public evacuation. This is the responsibility of government authorities.

**Follow-Up**

**Notify**

Before normal site activities are resumed, personnel must be fully prepared and equipped to handle another emergency. Notify appropriate government agencies as
required. For example, OSHA must be notified if there have been any fatalities or five or more hospitalizations.

**Restock**

Restock all equipment and supplies. Replace or repair damaged equipment. Clean and refuel equipment for future use.

**Review**

Review and revise all aspects of the Contingency Plan according to new site conditions and lessons learned from the emergency response. When reviewing the information, consider typical questions such as:

- **Cause:** What caused the emergency?
- **Prevention:** Was it preventable? If so, how?
- **Procedures:** Were inadequate or incorrect orders given or actions taken? Were these the result of bad judgment, wrong or insufficient information, or poor procedures? Can procedures or training be improved?
- **Site profile:** How does the incident affect the site profile? How are other site cleanup activities affected?
- **Community:** How is community safety affected?

**Liability:** Who is liable for damage payments?

### Documentation

The Project Team Leader should initiate the investigation and documentation of the incident. This is important in all cases, but especially so when the incident has resulted in personal injury, on-site property damage, or damage to the surrounding environment.

Documentation may be used to help avert recurrences, as evidence in future legal action, for assessment of liability by insurance companies, and for review by government agencies. Methods of documenting can include a written transcript taken from tape recordings made during the emergency or a bound field book (not a loose-leaf book) with notes. The document must be:

<table>
<thead>
<tr>
<th>Accurate</th>
<th>All information must be recorded objectively.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentic</td>
<td>A chain-of-custody procedure should be used. Each person making an entry must date and sign the document. Keep the number of documenters to a minimum (to avoid confusion and because they may have to give testimony at hearings or in court). Nothing should be erased. If details change or revisions are needed, the person making the notation should mark a horizontal line through the old material and initial the change.</td>
</tr>
<tr>
<td>Complete</td>
<td>At a minimum, the following should be included: Chronological history of the incident.</td>
</tr>
</tbody>
</table>
Spill Response

Because of the potential risks of fire, explosion, chemical reactions, and release of gases and vapors, it is imperative that proper methods and procedures are used to handle spills from containers of hazardous materials. This section includes conditions to be alert for and to be considered in containing and controlling spills of hazardous materials.

Spill containment and remediation activities shall, by necessity, be determined and directed by the Emergency Response Coordinator at the scene of the incident. The coordinator will base activities on the circumstances current to the incident. However, these activities will be directed according to the following:

- **Priority 1** The protection of human life, health, and safety.
- **Priority 2** The mitigation of environmental harm.
- **Priority 3** The protection of property.

Chemical Spill Response Guidance

Four factors affect the behavior of the released hazardous material.

- The quantity of the hazardous material.
- Inherent properties of the material and of the container.
- Natural laws of physics and chemistry.
- The environment, including the physical surroundings and the conditions.

On-Site Coordinator

The on-scene coordinator must consider the consequences of additional spills, leakage, and other incidents that can aggravate a spill situation prior to the clean-up efforts. If a drum has failed, it is likely that other drums and containers in the area may have failed or are about to fail also. Each step in the response needs to be planned carefully. Accidents are most likely to occur when drums and containers are being handled for the first time in an emergency.

Develop a plan based on the results of the above to include:

- Procedures based on hazards likely to be encountered.
• Equipment and supplies required.
• Number of drums or containers to be moved.
• Methods for moving drums or containers.
• Number of responders required.
• Number and type of support personnel required.
• Levels of protection required by responders and support personnel.
• Rescue plan in event of failure.

Entry Team

Teams should observe the following general guidelines when handling an emergency response to a spill of a hazardous substance:

• Identify, to the extent possible, all hazards.
• Get help from specialists who can give technical advice or assistance.
• Use proper personal protective equipment.
• If possible, do not come in direct contact with the hazardous substance.
• Use SCBA unless air monitoring shows a decreased level of protection is acceptable.
• Work in teams of two or more, the buddy system.
• Have back-up personnel with equipment stand-by.
• Respond to directions from the site safety official.
• Maintain communications with other members of the team through eye contact, hand signals or voice.
• Maintain contact with the on-scene coordinator or site safety officer.
• Use appropriate decontamination procedures.
• Contain and control the release.
• Clean up the release

Equipment and Materials

Overpack or Salvage Drums

Overpack drums are heavy-duty, open-ended drums with a capacity of approximately 85 gallons. The purpose of these drums is to contain a damaged or a repaired drum and its
contents. There are several types of overpack drums designed to contain different materials. The most common is an epoxy coated 85-gallon steel drum.

It has a removable head that contains a bung that can be used to vent a closed drum. The head is secured to the body of the drum with a band and bolt assembly. A leak-proof seal is provided by a gasket. The next common overpack drum is made of plastic and not harmed by most corrosive materials. This type of drum has a screw-on head that contains a venting bung and gasket to ensure a seal.

**Absorption Materials**

Absorption is the process in which materials hold liquids through the process of wetting. Absorption is accompanied by an increase in the volume to sorbate/sorbent system through the process of swelling. Some common materials used are:

**Floor Dry** - Clay made up of hydrous aluminum and iron magnesium silicates.

**Sand** - Used to control large spills of oil and other viscous materials.

**Diatomaceous Earth** - Fine granular calcium-based material.

**Polypropylene** - Lightweight fibrous material for water and organic based chemicals and a second form for hydrocarbons.

**Hazard** - A proprietary product made of highly expanded silicates.

**Vermiculite** - Common lightweight granular material often used in shipping containers.

**Activated Carbon** - A granular form of carbon that absorbs vapors and liquids.

**Spill Pillows** - Absorbent products that most commonly contain amorphous silicate particles or polypropylene. They may contain any of the dry absorbents.

**Control Pillows** - Also known as pigs, dikes, and socks. These vary in size and shape to help...
in the control of spilled materials. They may contain any of the dry absorbents.

**Gel Forming Agents**

Gel-forming agents or bonding agents are dry granular materials specifically designed to gel or coagulate aqueous or petroleum-based liquids. Unlike absorbents that soak up the liquid through physical actions, gel-forming agents chemically bond to the liquid. The chemical bond keeps the liquid from separating from the absorbent.

**Neutralization Materials**

Most corrosives can be neutralized by applying another material to the spilled corrosive acid or base that will react chemically with it to form a less harmful substance. Neutralization reactions generally give off heat and are subject to splattering.

Common materials are:

- Soda Ash - For acids.
- Sodium Bicarbonate - For acids.
- Lime - For acids.
- Citric Acid - For bases.
- Dilute Hydrochloric Acid - For bases.
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Review Questions

1. List five elements of an effective emergency contingency/spill response plan.

2. Describe two considerations when identifying evacuation routes and procedures.

3. What are the priorities when planning for decontamination in medical emergencies?

4. What is the importance of not participating in a spill response if training or equipment is inadequate?

5. Describe the steps to follow during an emergency response.

6. Identify items that should be available for spill control.