24-Hr HAZWOPER Module 6

Site Control and Decontamination

Section 6.1 Overview of Site Control

6.1.1 Elements of the Site Control Program

The Site Control Program consists of various elements aimed at reducing worker and public exposure to chemical, physical, biologic, and safety hazards. Some of the key procedures to implement include:

1. **Site Mapping**: Compile a detailed site map that outlines the layout, potential hazards, and designated work zones within the site.
2. **Site Preparation**: Properly prepare the site for subsequent activities by addressing any immediate risks or hazards present.
3. **Work Zones**: Establish clearly defined work zones to control access and minimize the potential for cross-contamination between different areas of the site.
4. **Buddy System**: Implement the buddy system when necessary, ensuring that workers are paired up to provide mutual assistance and support.
5. **Decontamination Procedures**: Develop and strictly enforce decontamination procedures for both personnel and equipment to prevent the spread of hazardous substances.
6. **Site Security**: Establish appropriate site security measures to prevent unauthorized access and ensure the safety of personnel and the surrounding community.
7. **Communication Networks**: Set up effective communication networks to facilitate information sharing and emergency response within the site.
8. **Safe Work Practices**: Enforce safe work practices throughout the site, including the proper use of PPE and adherence to established protocols.

The level of site control required will vary based on site characteristics, size, and proximity to the community. The Site Control Program should be established early on in the planning stages of the project and be adaptable to evolving information and assessments. In many cases, it may be necessary to implement multiple measures simultaneously to ensure adequate site control and worker safety.

6.1.2 Site Mapping and Site Preparation

A detailed site map is an essential tool for planning and managing hazardous waste cleanup operations. It should include key information such as topographic features, prevailing wind direction, drainage patterns, and the locations of buildings, containers, impoundments, pits, ponds, and tanks. The site map serves multiple purposes, including:

- Planning activities and assigning personnel based on the layout of the site
- Identifying access routes, evacuation routes, and areas that may pose challenges or risks
- Determining areas of the site where PPE is necessary
- Supplementing daily safety and health briefings for field teams

The site map should be prepared before entering the site and updated regularly throughout the cleanup operations. Updates should reflect any accidents, changes in site activities, emergencies, newly identified hazards, introduction of new materials on site, instances of vandalism, and changes in weather conditions. Overlays can be used to provide additional information without overcrowding the map.

Proper site preparation is crucial to ensure smooth cleanup operations and the safety of workers. The process of site preparation can be just as hazardous as the actual clean-up, and safety measures must be given equal attention during this stage.

6.1.3 Site Work Zones

Work zones should be clearly delineated within the site, and the movement of personnel among these zones should be controlled to prevent the accidental spread of hazardous substances. Establishing work zones serves several purposes:

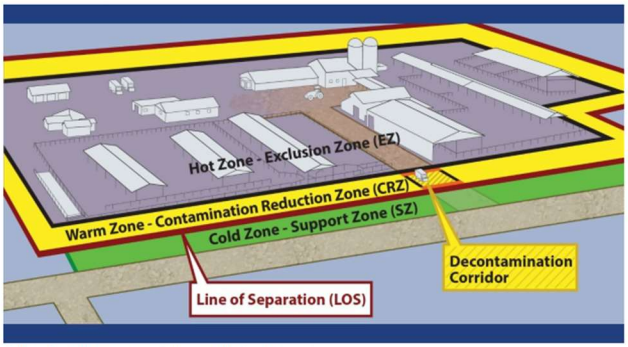
- Ensuring that personnel are adequately protected from hazards in their designated work areas
- Confining work activities and contamination to appropriate zones
- Enabling easy location and evacuation of personnel in case of emergencies

Three commonly used zones are:

1. **Exclusion or Hot Zone**: The contaminated area where hazardous substances are present
2. **Contamination Reduction Zone**: The area designated for decontamination activities
3. **Support Zone:** The uncontaminated area where workers should not be exposed to hazardous conditions

The delineation of these zones should be based on sampling and monitoring results, as well as an evaluation of potential routes and the dispersion of contaminants in the event of a release. Movement of personnel and equipment between zones should be minimized and restricted to specific Access Control Points to prevent cross-contamination from contaminated areas to clean areas. Figure 6.1, from the United States Department of Agriculture, provides a schematic representation of the layout of work zones for reference.

Figure 6.1 Layout of Work Zones



Source: Dani Ausen, Andrew Kingsbury, Iowa State University.

Exclusion Zone

The Exclusion Zone, also known as the "Hot Zone," is the area where contamination is present or likely to occur during hazardous waste clean-up operations. This zone is involved in activities such as site characterization, well installation for groundwater monitoring, and clean-up work. To enhance safety and operational efficiency, the Exclusion Zone can be divided into subareas based on the type and degree of hazard or incompatibility of waste streams. Different levels of protection (A, B, C, or D) required by the Site Safety Plan should be worn by personnel working in the Exclusion Zone, depending on the assigned tasks and the level of hazard. It is important to clearly specify and mark the required level of protection in each subarea. Assigning different levels of protection within the Exclusion Zone can promote flexibility and cost-effectiveness while maintaining a high level of safety.

The Hotline

The Hotline serves as the outer boundary of the Exclusion Zone and must be clearly marked or enclosed by lines, placards, hazard tape, signs, chains, fences, or ropes. Establishing the Hotline involves visually surveying the immediate site surroundings, evaluating data from initial site surveys, considering safety distances, site operations, meteorological conditions, and potential contaminant dispersion. The location of the Hotline may need adjustments based on new information. Its purpose is to prevent the spread of hazardous substances beyond the Exclusion Zone.

Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) acts as a transition area between the contaminated Exclusion Zone and the clean Support Zone. The CRZ is designed to minimize the transfer of hazardous substances into clean areas and reduce the risk of contamination. Within the CRZ, decontamination procedures for personnel, equipment, and samples take place. The CRZ should be well-designed to facilitate emergency response, equipment resupply, sample packaging, worker rest areas, and proper drainage. Personnel stationed in the CRZ, including the Site Safety Officer, Personnel Decontamination Station Operator, and emergency response personnel, should maintain communication, line-of-sight contact with work parties, work party monitoring, and site security.

Decontamination Corridor or Contamination Reduction Corridor

The Contamination Reduction Corridor (CRC) is a designated area within the CRZ where decontamination procedures occur. At least two lines of decontamination stations should be established within the CRC, one for personnel and one for heavy equipment. The CRC serves as the starting point for decontamination, and personnel and equipment proceed through the designated lines to ensure proper decontamination before entering the clean areas.

Access Control Points

Access Control Points regulate the entry and exit of personnel and equipment between the Exclusion Zone and the CRZ. They are established at the periphery of the Exclusion Zone and verify compliance with entry and exit procedures.

Line of Separation or Contamination Control Line

The Contamination Control Line marks the boundary between the CRZ and the clean Support Zone. Personnel entering the CRZ must wear appropriate personal protective clothing and equipment, which should be removed before reentering the Support Zone through the personnel exit Access Control Point.

Support Zone

The Support Zone serves as the administrative and support area for hazardous waste clean-up operations. Functions that do not require direct exposure to hazardous or potentially hazardous areas are performed here. Personnel in the Support Zone may wear normal work clothes, and any potentially contaminated clothing, equipment, or samples must remain in the CRZ until decontamination is completed. The Support Zone houses facilities and resources necessary for the operations, such as the Command Post Supervisor, Project Team Leader, and support personnel. Emergency contact numbers, evacuation route maps, and vehicle keys should be kept in the Support Zone. Facilities in the Support Zone should be strategically placed to ensure accessibility, availability of resources, visibility of activities in the Exclusion Zone, wind direction considerations, and a safe distance from the Exclusion Zone.

Section 6.2 Site Security

6.2.1 Security Measures

Site security is crucial to prevent unauthorized individuals from being exposed to site hazards, deter theft, and prevent increased risks from vandals or those attempting to abandon additional waste on the site. To maintain site security during working hours, the following measures should be implemented:

- **Support Zone and Access Control**: Implement robust security measures in the Support Zone and at Access Control Points to manage access and safeguard against unauthorized entry. This involves assigning personnel to oversee these points and ensuring compliance with entry and exit requirements.
- **Identification System**: Develop an identification system to validate authorized personnel and their approved activities. This system helps in maintaining a log of individuals present on-site and their specific roles.
- **Visitor Approval and Accompaniment**: All visitors should have explicit approval from the Project Team Leader. Trained site personnel must accompany them, providing appropriate protective equipment.

- **Physical Barriers**: Erect fences or other physical barriers around the perimeter of the site to enhance security. In the absence of a fence, utilize warning signs and employ guards to patrol the site, thereby deterring unauthorized access and potential vandalism.
- **Training for Guards**: Ensure that guards are fully informed about site hazards and are trained in emergency procedures to effectively respond to potential incidents.
- **Buddy System**: Implement a buddy system for activities in contaminated or hazardous areas. This system ensures mutual assistance, observation of exposure signs, integrity checks of protective clothing, and immediate communication to supervisors in emergencies. Enforce this system at the Access Control Point for the Exclusion Zone and maintain constant visual or communication contact with a designated person in the Support Zone.

To maintain site security during off-duty hours, implement the following measures:

- **Surveillance During Off-Duty Hours**: Employ trained, in-house technicians familiar with the site, hazards, and safety protocols for surveillance. If using security guards, ensure they are extensively trained in safety procedures. Collaborate with local law enforcement agencies for sites posing significant health and safety risks.
- **Equipment Security Measures**: Implement strategies to secure equipment during non-operational hours, including locking mechanisms and surveillance.

6.2.2 Standing Orders

Standing Orders refer to those safety procedures that must always be followed when operating in a contaminated area. A list of standing orders should be developed to maintain a strong safety awareness and enforce safe procedures at the site. Separate standing orders should be established for the CRZ and the Exclusion Zone if hazards significantly differ. These standing orders should be distributed to all personnel entering the site, posted conspicuously at the Command Post and entrance Access Control Points, and reviewed with the field crew by the Field Team Leader or Project Team Leader at the start of each workday. Employees should be briefed on this chemical information at the beginning of the project or when they first join the work team. Daily safety meetings should be conducted for all employees.

Section 6.3 Decontamination

6.3.1 Decontamination Plan and SOPs

A well-defined Decontamination Plan should be developed as part of the Site Safety Plan. This plan should determine the number and layout of decontamination stations, identify required decontamination equipment, establish appropriate decontamination methods, devise procedures to prevent contamination of clean areas, and outline measures to minimize worker contact with contaminants during the removal of personal protective clothing and equipment. It should also include methods for disposing of clothing and equipment that cannot be fully

decontaminated. The Decontamination Plan should be periodically revised to accommodate changes in PPE, site conditions, or reassessment of site hazards.

Establishing SOPs is an initial step in the decontamination process to maximize worker protection by minimizing contact with waste and potential contamination. These SOPs can include practices such as avoiding direct contact with hazardous substances, utilizing remote sampling and handling techniques, protecting monitoring and sampling instruments through bagging, using disposable outer garments and equipment when appropriate, encasing sources of contaminants with plastic sheeting or overpacks, and adopting proper procedures for dressing before entering the Exclusion Zone. These procedures should be effectively communicated, enforced, and regularly reviewed during site operations to ensure compliance and worker safety.

6.3.2 Chemical Removal

After physically removing gross contamination, a wash/rinse process using cleaning solutions is necessary. Chemical removal of surface contaminants can be achieved by dissolving them in a solvent. It is important to select a solvent that is chemically compatible with the equipment being cleaned, especially when decontaminating personal protective clothing made of organic materials that may be damaged or dissolved by certain solvents. Caution should be exercised when using flammable or potentially toxic organic solvents, such as alcohols, ethers, ketones, aromatics, straight-chain alkanes, and common petroleum products. Halogenated solvents should only be used in extreme cases where other cleaning agents are ineffective, as they are generally toxic and incompatible with PPE. Consultation with an industrial hygienist or qualified health professional is recommended when chemical decontamination is necessary due to potential hazards.

6.3.3 Testing Decontamination Effectiveness

Testing the effectiveness of decontamination methods is essential to ensure the successful removal of different substances. It is recommended to assess the effectiveness of decontamination at the beginning of a program and periodically throughout its duration. If contaminants are not effectively removed or are penetrating protective clothing, the decontamination program should be revised. The following methods can be utilized to assess the effectiveness of decontamination:

Visual Observation: Although there is no immediate and reliable test for determining the effectiveness of decontamination, visual observation can provide some estimation. Discolorations, stains, corrosive effects, visible dirt, or changes in clothing fabric may indicate the presence of remaining contaminants. However, it's important to note that not all contaminants leave visible traces, especially those that can permeate clothing and are not easily observed.

Natural Light: Inspecting objects under natural light can help identify visible signs of contamination. Discolorations, stains, or alterations in appearance may indicate inadequate decontamination. However, this method may not be effective for all contaminants, as some may not be readily visible.

Ultraviolet Light: Ultraviolet light can be used to detect certain contaminants that fluoresce under its illumination. For example, polycyclic aromatic hydrocarbons found in oils and solvent wastes can be visually detected when exposed to ultraviolet light. However, it's important to consider that some areas of the skin may naturally fluoresce, which can introduce uncertainty to the test. Additionally, the use of ultraviolet light carries risks of skin cancer and eye damage, so the benefits and risks should be assessed by a qualified health professional before implementation.

Wipe Sampling: Wipe testing involves using a dry or wet cloth, glass fiber filter paper, or swab to wipe the surface of potentially contaminated objects. These wipes are then analyzed in a laboratory to determine the presence of contaminants. Both the inner and outer surfaces of protective clothing should be tested, and skin can also be tested using wipe samples.

Cleaning Solution Analysis: Analyzing the cleaning solutions for the presence of contaminants can be another effective way to assess the success of decontamination procedures. Elevated levels of contaminants in the final rinse solution may indicate the need for additional cleaning and rinsing.

Testing for Permeation: To test for the presence of chemical contaminants that have permeated protective garments, pieces of the clothing should be sent to a laboratory for analysis. This method helps identify whether the contaminants have penetrated the protective material.

Regular testing using these methods will provide valuable insights into the effectiveness of decontamination procedures and allow for necessary adjustments to ensure proper protection against hazardous substances.

6.3.4 Hazards in Decontamination

While decontamination is crucial for health and safety, it's important to be aware of potential hazards associated with the process. Certain circumstances can pose risks during decontamination. Some hazards related to decontamination include:

Incompatibility with Hazardous Substances: Decontamination methods must be compatible with the hazardous substances being removed. Some methods may react with contaminants, leading to explosions, heat generation, or the formation of toxic byproducts. It is necessary to assess the chemical compatibility of decontamination methods before their application.

Incompatibility with Clothing or Equipment: Decontamination methods should be compatible with the clothing or equipment being decontaminated. For instance, certain organic solvents

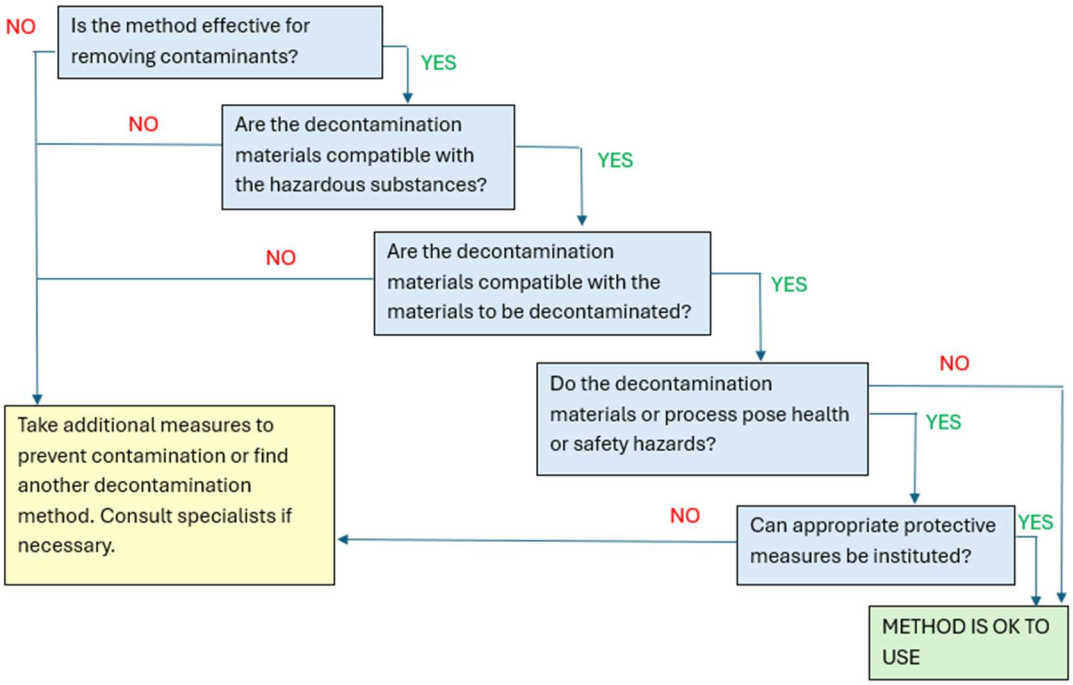
have the potential to permeate or degrade protective clothing. It is essential to consider the compatibility of decontamination methods with the specific materials to avoid compromising their effectiveness.

Direct Health Hazards: Some decontamination methods may directly pose health hazards to workers. Vapors from chemical decontamination solutions, for example, can be harmful if inhaled or they can be flammable. It is crucial to assess the potential health risks associated with decontamination solutions and take necessary precautions to protect both decontamination workers and those being decontaminated.

Prior to using any decontamination method, it is important to determine the chemical and physical compatibility of the decontamination solutions or materials. Any method that impairs the functioning of PPE by permeating, degrading, damaging, or compromising its safety should not be used. For decontamination methods posing direct health hazards, appropriate measures must be implemented to ensure the safety of decontamination workers and those undergoing the decontamination process.

The decision tree below provides guidance for evaluating the health and safety aspects of decontamination methods:

Figure 6.2 Decision Tree for Evaluating Decontamination Methods



6.3.5 Decontamination Facility Design

Decontamination procedures should be well-organized and follow a specific sequence to effectively reduce contamination levels. The process should involve multiple procedures

performed at separate stations along a designated decontamination line. Outer, heavily contaminated items should be decontaminated and removed first, followed by the decontamination of inner, less contaminated items. This prevents cross-contamination and maintains a clear flow of decontamination.

It is essential to physically separate stations to prevent cross-contamination and arrange them in order of decreasing contamination. Flow patterns and stations should be designed to isolate workers from different contamination zones containing incompatible wastes. Entry and exit points should be clearly marked, and separate entry points should be provided for accessing the CRZ from the Exclusion Zone and vice versa. Dressing stations for entering the CRZ should be separate from re-dressing areas for exiting the CRZ. Personnel intending to enter clean areas of the decontamination facility, such as locker rooms, should undergo complete decontamination.