40-Hr HAZWOPER Module 6

Site Control and Decontamination

Section 6.1 Overview of Site Control

According to OSHA CFR 29 1910.120(d), it is crucial to implement effective site control procedures to ensure the safety of employees and minimize their exposure to hazardous substances during clean-up operations. A comprehensive Site Control Program should be developed as part of the employer's overall Safety and Health Program. This program should be established during the planning stages of a hazardous waste clean-up operation and be continuously modified based on new information and site assessments.

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. The following steps should be taken during site preparation:

- Construct roadways to facilitate easy access for heavy equipment and vehicles, ensuring a stable roadbed.
- Establish traffic flow patterns to ensure safe and efficient operations.
- Eliminate physical hazards in the work area, such as ignition sources in flammable areas, exposed or ungrounded electrical wiring, sharp edges, debris, loose steps or flooring, and unsecured objects that could cause falls, puncture wounds, or other injuries.
- Install skid-resistant strips and anti-skid devices on slippery surfaces.
- Create operation pads for mobile facilities and temporary structures.
- Construct loading docks, processing and staging areas, and decontamination pads.
- Provide adequate illumination for work activities and ensure proper guarding of temporary lights to prevent accidental contact.
- Install all wiring and electrical equipment in compliance with the National Electric Code.

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:

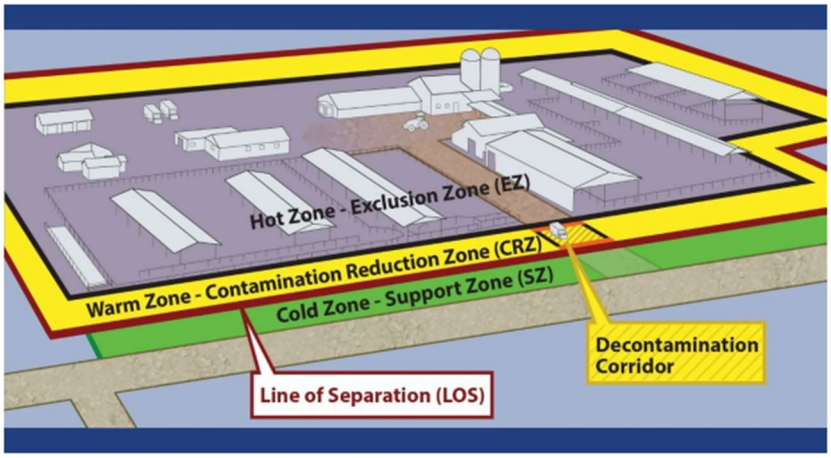
- Ensuring that personnel are adequately protected from hazards in their designated work areas
- Confining work activities and contamination to appropriate zones
- Enabling easy location and evacuation of personnel in case of emergencies

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.

Support Zone Stations

The Support Zone encompasses several stations and related activities essential for the smooth operation of hazardous waste clean-up activities. Duties at these stations include:

Command Post:

- Supervising all field operations and field teams
- Maintaining communications, including emergency lines of communication and recordkeeping
- Managing accident reports, chain-of-custody records, daily logbooks, manifest directories, orders, medical records, personnel training records, and site inventories
- Keeping up-to-date site safety plans and providing access to safety and health manuals and reference materials
- Interfacing with the public, government agencies, local politicians, medical personnel, the media, and other interested parties
- Monitoring work schedules, weather changes, and site security
- Providing sanitary facilities

Medical Station:

- Administering first aid and responding to medical emergencies
- Conducting medical monitoring activities and providing sanitary facilities
- Serving as equipment and supply centers
- Handling the supply, maintenance, and repair of communications, respiratory, and sampling equipment
- Managing vehicle maintenance and repair
- Replenishing expendable supplies
- Storing monitoring equipment and supplies (storage may be in the Medical Station or an on-site field laboratory)

Administration:

- Facilitating sample shipment
- Coordinating with the home office
- Maintaining emergency telephone numbers, evacuation route maps, and vehicle keys
- Managing coordination with transporters, disposal sites, and relevant federal, state, and local regulatory agencies

Field Laboratory:

- Coordinating and processing environmental and hazardous waste samples (sampling plans and procedures should be readily accessible in the laboratory)

- Packaging materials for analysis after decontamination of the sample containers' exteriors (this can also be done in a designated location within the CRZ)
- Storing laboratory notebooks in designated locations while in use and in the Command Post when not in use

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 Communication Systems

Two sets of communication systems are necessary: internal communication among on-site personnel and external communication between on-site and off-site personnel.

Internal Communications:

Internal communication is used for the following purposes:

- Alerting team members to emergencies
- Sharing safety information such as remaining airtime before the next rest period, air change, heat stress check, etc.
- Communicating changes in work assignments
- Maintaining Site Control

To facilitate effective internal communication, pre-arranged commands and signals should be established due to potential impediments such as background noise and personal protective equipment. Individual workers should be clearly identified through markings on their suits, such as names, color coding, numbers, or symbols. Flags can be used to locate personnel in areas with poor visibility. Communication devices used in potentially explosive atmospheres must be intrinsically safe and checked daily for proper operation.

External Communications:

An external communication system between on-site and off-site personnel is essential for coordinating emergency responses, reporting to management, and maintaining contact with essential off-site personnel. Telephone and radio systems are the primary means of external communication. If telephone lines are not available on-site, all team members should be aware of the nearest telephone location, and necessary telephone numbers and change should be readily accessible in the Support Zone.

6.2.3 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. Examples of Standing Orders are given below for your reference.

Sample Standing Orders

For personnel entering the Contamination Reduction Zone:

- No smoking, eating, or application of cosmetics in this zone.
- No matches or lighters in this zone.
- Check in at the entrance Access Control Point before you enter this zone.
- Check out at the exit Access Control Point before you enter this zone.

For personnel entering the Exclusion Zone:

- No smoking, eating, or application of cosmetics in this zone.
- No matches or lighters in this zone.
- Check in at the entrance Access Control Point before you enter this zone.
- Check out at the exit Access Control Point before you enter this zone.
- Always have your buddy with you in this zone.
- Wear a SCBA in this zone.
- If you discover any signs of radioactivity, explosivity, or unusual conditions such as dead animals at the site, exit immediately and report this finding to your supervisor.

Section 6.3 Decontamination Part 1

6.3.1 Introduction to Decontamination

Whenever there is a response to a spill or release of hazardous substances, it is crucial to decontaminate all equipment and personnel properly. Decontamination is a vital process that involves removing or neutralizing contaminants accumulated on personnel and equipment. It serves to protect workers, minimize the transfer of harmful materials, prevent mixing of incompatible chemicals, and safeguard the surrounding community. This section and the following section provide an overview of contamination types, factors influencing contamination extent, and methods for preventing or reducing contamination.

6.3.2 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.

6.3.3 Extent of Contamination and Decontamination Strategies

Contaminants can be present on the surface of PPE or they can be permeated into the material. Surface contaminants are relatively easy to detect and remove, while permeated contaminants are more challenging or impossible to detect and remove. Contact time, concentration, temperature, the size of contaminant molecules and pore space, and the physical state of the wastes are all factors that influence the extent of permeation.

All personnel, clothing, equipment, and samples leaving the contaminated area (Exclusion Zone) must undergo decontamination to eliminate harmful chemicals or infectious organisms. Decontamination strategies involve physically removing contaminants, chemically detoxifying or disinfecting/sterilizing them, or employing a combination of physical and chemical methods. Physical removal techniques include dislodging, rinsing, wiping, and evaporation. Gross contaminants can be removed through water or liquid rinses, anti-static solutions, scraping, brushing, and wiping. Adhesive contaminants may require additional methods like solidifying, freezing, adsorption/absorption, or melting. Volatile liquids can be evaporated followed by a water rinse, using caution to prevent worker inhalation of vapors.

By following appropriate decontamination procedures and implementing effective SOPs, workers can mitigate the risks associated with hazardous materials and ensure their safety while working at contaminated sites.

6.3.4 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. The following methods can be used to aid in the decontamination process.

Surfactants can be used to enhance physical cleaning methods by reducing adhesion forces between contaminants and surfaces, as well as preventing redeposition of contaminants. Common household detergents are often employed as surfactants. Some detergents can be used in conjunction with organic solvents to improve the dissolution and dispersal of contaminants.

Solidification is another method that can aid in the physical removal of liquid or gel contaminants. It involves removing moisture using absorbents like grounded clay or powdered lime, employing chemical reactions through polymerization catalysts and reagents, or utilizing freezing techniques with ice water.

Rinsing plays a crucial role in removing contaminants through dilution, physical attraction, and solubilization. Multiple rinses with clean solutions are more effective in removing contaminants compared to a single rinse with the same volume of solution. Continuous rinsing with large volumes of clean solution provides even greater removal of contaminants compared to multiple rinses with a lesser total volume.

Chemical disinfectants can be used to inactivate infectious agents. However, standard sterilization techniques are generally impractical for large equipment and personal protective clothing and equipment. Therefore, disposable PPE is recommended for use with infectious agents to ensure effective disinfection and prevent the spread of infections.

The solubility of various contaminant categories in different solvents is outlined in the table below.

Table 6.1 General Guide to Solubility of Contaminants in Four Solvent Types

Solvent	Soluble Contaminants
Water	• Low-chain hydrocarbons • Inorganic compounds • Salts • Some organic acids and other polar compounds
Dilute Acids	• Basic (caustic) compounds • Amines • Hydrazines
Dilute Bases For example: • Detergent	• Acidic compounds • Phenols • Thiols • Some nitro and sulfonic compounds

• Soap	
Organic Solvents*	• Nonpolar compounds (e.g., some organic compounds)

*Warning: Some organic solvents can permeate and/or degrade clothing.

6.3.5 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.

Section 6.4 Decontamination Part 2

6.4.1 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.

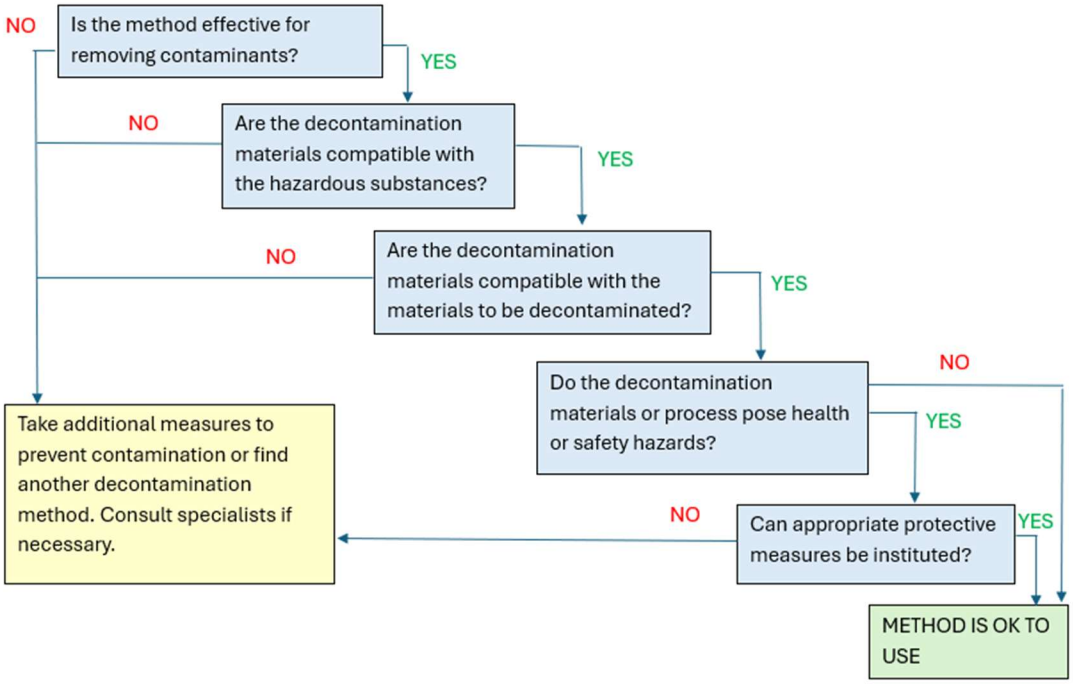
Incompatibility with Clothing or Equipment: Decontamination methods should be compatible with the clothing or equipment being decontaminated. For instance, certain organic solvents have the potential to permeate or degrade protective clothing. It is essential to consider the compatibility of decontamination 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



6.4.2 Decontamination Facility Design

Decontamination facility design plays a critical role in ensuring effective decontamination at hazardous waste sites. These facilities should be located in the CRZ, which acts as a buffer between the contaminated Exclusion Zone and the clean Support Zone. The design and procedures of the decontamination facility should be tailored to the specific site conditions and factors, including:

1. **Chemical, physical, and toxicological properties:** Consider the properties of the hazardous wastes or infectious materials to determine the appropriate decontamination procedures.
2. **Contamination amount, location, and containment:** Assess the extent of contamination, its distribution, and how it is contained to determine the level of decontamination required.
3. **Potential exposure based on worker duties and activities**: Evaluate the tasks and functions of workers to determine the potential for exposure and the necessary decontamination measures.
4. **Material compatibility**: Consider the potential for wastes to permeate, degrade, or penetrate personal protective clothing, equipment, vehicles, tools, buildings, and structures to ensure appropriate decontamination procedures and materials are used.
5. **Compatibility of wastes**: Take into account the proximity and potential interaction of incompatible wastes during decontamination processes.

6. **Movement of personnel and equipment:** Plan for the movement of workers and equipment between different zones or in emergency situations, considering the impact on decontamination requirements.
7. **Worker protection during decontamination**: Ensure that adequate measures are in place to protect workers during the decontamination process, considering their safety and health.

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.

6.4.3 Decontamination Equipment Selection and Disposal

When selecting decontamination equipment, consider whether the equipment can be effectively decontaminated for reuse or if it is disposable and can be easily discarded after use. This section discusses recommended equipment for decontaminating personnel, PPE, heavy equipment, and vehicles. It provides a list of suitable tools and resources specifically for this purpose. It's important to note that there may be additional equipment options not listed in these bulleted lists that could be applicable in certain circumstances.

Decontamination of Personnel and PPE

- Drop cloths of plastic or other suitable materials on which heavily contaminated equipment and outer protective clothing may be deposited
- Collection containers, such as drums or suitably lined trash cans, for storing disposable clothing and heavily contaminated personal protective clothing or equipment that must be discarded
- Lined box with absorbents for wiping or rinsing off gross contaminants and liquid contaminants
- Large galvanized tubs, stock tanks, or children’s wading pools to hold wash and rinse solutions (these should be at least large enough for a worker to place a booted foot in

and should have either no drain or a drain connected to a collection tank or appropriate treatment system)
- Wash solutions selected to wash off and reduce the hazards associated with the contaminants
- Rinse solutions selected to remove contaminants and contaminated wash solutions
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants
- Paper or cloth towels for drying protective clothing and equipment
- Lockers and cabinets for storage of decontaminated clothing and equipment
- Metal or plastic cans or drums for contaminated wash and rinse solutions
- Plastic sheeting, sealed pads with drains, or other appropriate methods for containing and collecting contaminated wash and rinse solutions spilled during decontamination
- Shower facilities for full body wash or, at a minimum, personal wash sinks (with drains connected to a collection tank or appropriate treatment system)
- Soap or wash solution, wash cloths, and towels for personnel

Decontamination of Heavy Equipment and Vehicles

- Storage tanks of appropriate treatment systems for temporary storage and/or treatment of contaminated wash and rinse solutions
- Drains or pumps for collection of contaminated wash and rinse solutions
- Long-handled brushes for general exterior cleaning
- Wash solutions selected to remove and reduce the hazards associated with the contamination
- Rinse solutions selected to remove contaminants and contaminated wash solutions
- Pressurized sprayers for washing and rinsing, particularly hard-to-reach areas
- Curtains, enclosures, or spray booths to contain splashes from pressurized sprays
- Long-handled brushes, rods, and shovels for dislodging contaminants and contaminated soil caught in tires and the undersides of vehicles and equipment
- Containers to hold contaminants and contaminated soil removed from tires and undersides of vehicles and equipment
- Wash and rinse buckets for use in the decontamination of operator areas inside vehicles and equipment
- Brooms and brushes for cleaning operator areas inside vehicles and equipment
- Containers for storage and disposal of contaminated wash and rinse solutions, damaged or heavily contaminated parts, and equipment to be discarded

Proper disposal methods should be followed for all decontamination equipment. This includes collecting and labeling buckets, brushes, clothing, tools, and other contaminated equipment, as well as properly disposing of spent solutions and wash water. Equipment and clothing that is not completely decontaminated should be securely placed in plastic bags for further decontamination or disposal.

6.4.4 Protection for Decontamination Workers

Decontamination workers who handle personnel and equipment leaving the Exclusion Zone require a higher level of protection compared to workers stationed at the last decontamination station. The level of PPE worn by decontamination workers may match that of workers in the Exclusion Zone or be one level lower (e.g., Level C protection instead of Level B), depending on the type of decontamination equipment used. Respiratory protection may vary for workers using steam jets due to the high moisture levels produced.

It's important to consider potential harmful vapors generated by cleaning solutions and removed wastes during decontamination. Qualified health and safety experts should select appropriate equipment and clothing to protect decontamination personnel based on the specific contaminants involved.

Decontamination workers themselves are in a contaminated area and must undergo decontamination before entering the clean Support Zone. The extent of their decontamination should be determined by the types of contaminants they may have encountered and the nature of their work.

6.4.5 Emergency Decontamination

Emergency decontamination procedures should be established in case of unforeseen circumstances. Immediate life-saving measures take precedence over decontamination, but if decontamination can be carried out without interfering with essential medical treatment, it should be performed promptly. In situations involving extremely toxic or corrosive materials that pose a severe risk to life, immediate decontamination is crucial. During emergencies, provisions must be made to protect medical personnel and appropriately dispose of contaminated clothing and equipment.