

# DECONTAMINATION

## 1.0 INTRODUCTION

Decontamination, the process of removing or neutralizing contaminants, is critical to the health and safety of personnel working with hazardous materials and wastes.

Decontamination protects workers from hazardous substances that can eventually permeate protective clothing, respiratory equipment, tools, and vehicles. It protects field personnel by minimizing the spread of hazardous substances into clean areas on-site, prevents the mixing of incompatible wastes, and protects the community by preventing the migration of contaminants from the site. Personnel engaged in hazardous waste operations, emergency responses, laboratory activities, or other field procedures may become contaminated in a number of ways, including:

- Contacting vapors, gases, mists, or particulates in the air
- Being splashed by materials while sampling or opening containers
- Walking through puddles of liquids or sitting in contaminated soil
- Using contaminated instruments or equipment.

To prevent and minimize the severity of such incidents, follow proper personal hygiene practices and develop a decontamination plan. The decontamination plan should include measures for developing standard operating procedures (SOPs) to minimize contamination to personnel and the environment, procedures for full decontamination of employees and equipment, and a process for monitoring of decontamination procedures by the site supervisor. Advance planning is essential to providing safe and effective decontamination procedures. Decontamination plans will be driven by site specific hazards and conditions. Protective clothing and respirators help prevent the wearer from becoming contaminated or inhaling hazardous substances. Good work practices also minimize contamination of Personal Protective Equipment (PPE), instruments and equipment. Even with these safeguards, contamination may occur.

Cross contamination from protective clothing to the wearer, from equipment to personnel, and from one area to another can be minimized by combining decontamination and good personal hygiene practices, the correct methods for removing contaminated PPE, and the use of site work zones. This module presents an overview of decontamination and personal hygiene practices.

Even though disposable PPE is becoming more prevalent, some level of personnel decontamination is still needed to ensure that wearers can safely get out of their PPE.

### **Learning Objectives:**

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

- Recognize the importance of and the steps involved in planning for decontamination
- Determine basic decontamination and personal hygiene procedures

- Explain the necessity of good personal hygiene practices and decontamination procedures.

## **2.0 CONTAMINATION AVOIDANCE**

Contamination avoidance is a critical issue that is based on common sense. If it is at all possible to avoid contact or close proximity to a hazard, then do so. Standard operating procedures may be developed to assist in contamination avoidance, however, the following general guidelines are applicable:

- Stress work practices that minimize contact with hazardous substances:
  - Do not walk through areas of obvious contamination
  - Avoid touching potentially contaminated substances.
- Use remote sampling, handling, and container-opening techniques.
- Protect monitoring and sampling instruments by bagging. Make openings in the bags for sample ports and sensors that must contact site materials.
- Wear disposable outer garments and use disposable equipment where appropriate.
- Cover equipment and tools with a strippable coating which can be removed during decontamination.
- Encase the source of contaminants (e.g., with plastic sheeting or overpacks).

## **3.0 PLANNING FOR DECONTAMINATION**

Any field activity in which personnel have a potential for contact with hazardous materials should have a plan outlining decontamination procedures. These procedures should be made available to employees and should be implemented before anyone enters areas where there is suspected contamination. The plan must ensure that chosen decontamination methods are effective for the specific hazardous substances present, and that the methods themselves do not pose any health or safety hazards.

As the specific conditions in the field are evaluated, the plan is modified, eliminating unnecessary stations or otherwise adapting it to changing site conditions. For instance, site conditions may require that "Dry Decon" take place. This method consists of the person standing in a large plastic bag and carefully peeling their PPE off of themselves. This may be required in extreme weather conditions where personnel cannot get wet (e.g., very cold conditions), or in situations involving water-reactive hazards.

Other changes in field conditions relate to:

- The type of contaminant
- The amount of contamination
- Levels of protection required
- The type of protective clothing worn
- Location of contamination.

### **3.1 Type of Contaminant and Health and Safety Hazards**

Contaminants can be located either on the surface of PPE or permeated into the PPE material. Surface contaminants may be easy to detect and remove; however, contaminants that have permeated a material are difficult or impossible to detect and remove. If contaminants that have permeated a material are not removed by decontamination, they may continue to permeate to the surface of the material where they can cause an unexpected exposure.

Five major factors affect the extent of permeation:

- Contact time
- Concentration
- Temperature
- Size of contaminant molecules and pore space
- Physical state of hazardous materials and wastes.

Whenever it is known or suspected that personnel can become contaminated with highly toxic or skin-destructive substances, a full decontamination procedure should be followed. If less hazardous materials are involved, the procedure can be down-graded.

Planning for decontamination should also include measures to ensure that the decontamination methods do not result in any health and safety hazards.

Decontamination methods may pose hazards under certain circumstances because:

- They may be incompatible with the hazardous substances being removed (e.g., a decontamination solution may react with contaminants to produce an explosion, heat, or toxic product).
- They may be incompatible with the clothing or equipment being decontaminated (e.g., some organic solvents can permeate and/or degrade protective clothing).
- They may pose a direct health hazard to workers (e.g., vapors from chemical decontamination solutions may be hazardous if inhaled, or they may be flammable).

### **3.2 Amount of Contamination**

The amount of contamination on protective clothing is usually determined visually. If clothing is badly contaminated, a thorough decontamination is generally required since gross material remaining may degrade or permeate it. This likelihood increases with

higher air concentrations and greater amounts of liquid contamination. Gross contamination also increases the probability of personnel contact. Wipe tests may help determine the type and quantity of surface contaminants.

### **3.3 Type and Level of PPE**

The level of protection and specific pieces of clothing worn determine, on a preliminary basis, the layout of the decontamination line. Each level of protection incorporates different problems in decontamination and doffing of the equipment. Clothing variations and different levels of protection may require adding or deleting stations in the original decontamination procedure.

### **3.4 Work Function**

The work each person does determines the potential for contact with hazardous materials, which in turn determines the layout of the decontamination line. Different decontamination lines could be set up for different job functions, or certain stations in a line could be omitted for personnel performing certain tasks.

### **3.5 Location of Contamination**

Contamination on the upper areas of protective clothing poses a greater risk to the worker because volatile compounds may generate a hazardous breathing concentration both for the worker and for the decontamination personnel. There is also an increased probability of contact with skin when doffing the upper part of clothing.

### **3.6 Establishment of Procedures**

The established procedures determine the need and extent of decontamination. Once decontamination procedures have been established, all personnel requiring decontamination must be given precise instruction and, if necessary, practice. Compliance must be checked frequently and the time it takes for decontamination must be determined. Personnel wearing a self-contained breathing apparatus (SCBA) must leave the work area with sufficient air to walk to the contamination reduction corridor and undergo decontamination.

### **3.7 Unplanned Emergencies**

Decontamination depends on the nature and severity of any unplanned emergencies. Whether a worker was suffering from heat stress, physical injury, chemical exposure, or was experiencing equipment difficulties or any other type of emergency situation resulting in time constraints would dictate the decontamination procedures. In the case of threat to life, decontamination should be delayed until the victim is stabilized however, decontamination should always be performed first, when practical, if it can be done without interfering with essential life-saving techniques or first aid.

#### **4.0 PERSONAL HYGIENE PRACTICES**

The transfer of contaminants can also be minimized or eliminated by following good personal hygiene practices. After working with hazardous materials, personnel should remove all work clothing, ensure that it is properly disposed of or decontaminated, and shower before donning clean clothing. The following activities are prohibited within potentially contaminated areas:

- Eating
- Drinking
- Smoking
- Applying cosmetics.

Personnel working with hazardous materials should thoroughly wash their hands and face before undertaking any of the above activities, once they have left the contaminated area.

#### **5.0 DECONTAMINATION EQUIPMENT**

Decontamination equipment, materials, and supplies are generally selected based on availability. It is also necessary to consider whether the equipment itself can be decontaminated for reuse or can be easily disposed.

When hazardous materials operations take place at industrial plants or laboratories, existing emergency equipment, such as safety showers and eyewashes, can be used for emergency decontamination purposes. Portable versions of this equipment are often also found at emergency responses and hazardous waste sites.

These emergency systems must be:

- Kept clean
- Maintained and recharged
- Periodically inspected and tested
- Identified by signs or by other means (brightly painted)
- Kept accessible (not blocked)
- Suitably placed to allow access from various approaches.

#### **6.0 SUMMARY**

Decontamination protects workers from hazardous substances that may contaminate and eventually permeate the protective clothing, respiratory equipment, tools, vehicles and other equipment used on site. In order to prevent the transfer of contaminants, decontamination procedures should be developed and established before anyone enters a site and must be followed throughout site operations. Advance planning is essential to

executing safe and effective decontamination procedures. The extent and type of decontamination methods will be determined by the site-specific hazards and conditions.

Key concepts presented in this module are:

- Decontamination is an essential aspect of hazardous substance operations.
- Good work practices, including personal hygiene practices, can minimize contamination of PPE, instruments, equipment, and personnel.
- Contamination avoidance is another critical issue related to hazardous substance operations and should be practiced by all field personnel encountering hazardous materials.
- The health and safety hazards posed by contaminants depends on the degree of toxicity of the contaminant, the amount of contamination, the type and level of PPE used, and the location of contamination.
- Safety showers and eyewashes can also be used for emergency decontamination purposes.

Measures you can take to protect yourself against contamination include:

- Do not walk through areas of obvious contamination.
- Avoid touching potentially contaminated substances.
- Use remote sampling, handling, and container opening techniques.
- Protect monitoring instruments by bagging them.
- Use the appropriate PPE and ensure that it is cleaned or disposed of properly.
- Do not eat, drink, smoke, or apply cosmetics in potentially contaminated areas.
- Always wash your hands, face, or other exposed body parts after working with hazardous materials.
- Know the location of emergency decontamination equipment such as safety showers and eyewashes.
- Be aware of the hazardous materials and other contaminants in your surrounding work area.

## EXERCISE

Read the following questions and fill in the blank or circle the appropriate response.

1. Cross contamination from protective clothing or equipment to personnel can be minimized by a combination of:

\_\_\_\_\_ procedures

\_\_\_\_\_ practices

Correct methods \_\_\_\_\_

The use of \_\_\_\_\_.

2. Since you are protected by PPE, it is okay to walk through spills and leaks.

A. True

B. False

3. List some areas which should be addressed in a decontamination plan.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. The extent of permeation through a material is dependent on the following five factors:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. After working with hazardous materials, personnel should always remove contaminated clothing, shower, and don clean clothing.

A. True

B. False

## EXERCISE KEY

Read the following questions and fill in the blank or circle the appropriate response.

1. Cross contamination from protective clothing or equipment to personnel can be minimized by a combination of:

**Decontamination** procedures

**Personal hygiene** practices

Correct methods **for removal of contaminated PPE**

The use of **site work zones**.

2. Since you are protected by PPE, it is okay to walk through spills and leaks.

A. True                      **B. False**

3. List some areas which should be addressed in a decontamination plan.

**The number and placement of decontamination stations**

**The necessary decontamination equipment, techniques, and methods**

**SOPs to prevent cross-contamination**

**Methods for disposal of contaminated clothing and equipment**

**Method for disposal of rinsate**

4. The extent of permeation through a material is dependent on the following five factors:

**Contact time**

**Concentration**

**Temperature**

**Size of contaminant molecules and pore space**

**Physical state of hazardous materials and wastes**

5. After working with hazardous materials, personnel should always remove contaminated clothing, shower, and don clean clothing.

**A. True**                      B. False