



# **EBOLA CLEANUP WORK PROCEDURES**

(Exposure Control Plan)

Environmental Contractors Association of New York City

## **1. Introduction**

The epidemic of the Ebola virus in a number of West African nations that began in April 2014 resulted in over 15,000 infections and 5,400 deaths by December of that year. While only a small number of confirmed cases of individuals with Ebola virus have been reported in the United States, those cases, and the expectation of more people returning from West Africa as part of medical intervention teams, means that the potential for facilities and surfaces in need of decontamination is real.

Most current information related to decontamination of surfaces, including the personal protective equipment necessary for those conducting the work, is directed at the healthcare community. For closely controlled situations, such as hospitals and treatment facilities, there are guidance documents that can be referenced from the Centers for Disease Control and Prevention (CDC) and other government agencies. The Occupational Safety and Health Administration (OSHA) has issued a number of fact sheets related to Ebola, including one that describes procedures for cleaning contaminated surfaces outside of a medical setting, which are also useful.

Nevertheless, there currently is no standard protocol that is widely accepted for the proper cleaning of spaces that are not healthcare related, such as airplanes, cruise ships, public transport buses and railcars, schools, commercial establishments, apartments, and homes. This document is intended to meet that need by providing detailed procedures for two levels of cleaning.

This document was developed by members of the Environmental Contractors Association of New York City (ECA) in consultation with industry experts. It represents a consensus opinion of ECA contractors who received training related to blood borne pathogens and Ebola contamination. The described cleaning procedures are both comprehensive and conservative in their approach because the ECA is dedicated to advancing the needs of professional environmental contractors by adhering to high professional, safety, and integrity standards. These Ebola cleanup work procedures are based on the experience of over 50 member companies that

specialize in hazardous materials removal, emergency response, asbestos removal, infectious clean up, oil/sewage/chemical spills, trauma scene response, brownfields, and contaminated water work.

## **2. Two Types of Situations Requiring an Ebola Style Cleanup**

While procedures for each cleanup project need to be adjusted for the specific details of the situation, these recommended procedures are divided into two types of projects. If cleaning is intended as a proactive or protective activity to address occupant or community concerns, the processes and procedures described in section 3 should be used. Those procedures for proactive/protective cleaning are less stringent than the techniques explained in section 4, which should be used when there is known or reasonably suspected Ebola contamination.

Cleaning activities to address occupant or community concerns are modeled after the procedures used in a variety of situations where the chance of an Ebola exposure is present but not likely. The precautions and work procedures for that level of cleaning are similar to those used by Homeland Security and customs officials when they are screening passengers coming from nations known to harbor the virus. In addition, the procedures build on the requirements of the OSHA blood borne pathogens standard to ensure that environmental contractors adequately protect their employees and minimize their liability when undertaking cleanup activities sparked by concerns of possible Ebola contamination.

The OSHA blood borne pathogen standard, along with the Cal/OSHA Ebola protection guidelines, form the basis of the more detailed cleaning procedures for suspected or confirmed cases of Ebola contamination. However, in those situations additional engineering controls and enhanced personal protective equipment is called for due to the greater risk of exposure. It should be noted that the recommended cleaning procedures are based on the recognition that exposure to the virus comes from contact with infected bodily fluids. While many government agencies have stated that the Ebola virus is not transmitted in the air, they all recognize that airborne droplets of contaminated fluids are a vector for the transmission of the disease. Since many cleaning activities, by their very nature, can produce aerosolized droplets, the guidelines are designed as if there was potential airborne exposure.

In addition to the two cleaning procedures related to Ebola, additional information is provided in section 5 which describes general setup and work procedure steps for a standard trauma scene cleanup. This description of a non-Ebola type of project is provided for comparison purposes.

### 3. Proactive/Protective Cleaning to Address Community Concerns

There have been a number of reported cases where secondary exposure concerns related to Ebola prompted the implementation of specialized cleaning. Two of the more public examples serve as a useful model of how to respond in such situations. The first case involved a commercial jetliner that transported a nurse who was later confirmed to be infected with Ebola. However, at the time of her initial travel on the airplane the nurse was not symptomatic, and therefore, not able to spread the contagion. Even so, disinfection style cleaning of the aircraft was completed. Another case involved the cleaning of an entire school in Garland, Texas, after the parents of one of the students had been passengers on a flight on which an infected individual was symptomatic.

In both of those cases, there was no evidence of Ebola contamination, and the likelihood that it was present was relatively low. Nevertheless, appropriate cleaning is prudent to protect individuals and address public concerns. The recommended steps for such a cleaning process are explained in this section.

#### a. Necessary Equipment/Supplies

- Materials to construct a one-stage decontamination unit
- Personal protective equipment (PPE) including disposable suits with hoods and booties, face shields, and rubber gloves. Disposable suits should have a dry particle holdout of 1 micron or better.
- Respiratory protection consisting of N-100 filtering facepiece, half face respirator with HEPA filters, or full face negative pressure respirator with HEPA filters
- Adequate cleaning supplies—including disinfecting chemicals that meet the CDC's interim guidance for chemicals to use when addressing the Ebola virus—disposable cleaning cloths, and spray or foam applicators
- HEPA vacuum
- Six-mil disposal bags
- Equipment such as foggers, specialty sprayers, or other devices that can disinfect large surface areas, for use post cleaning

#### b. Set-up of Engineering Controls

Designate or construct an appropriate one-stage decontamination area. The decontamination unit should be large enough to allow workers to disinfect and doff PPE, as well as decontaminate equipment following cleaning. Unless an entry vestibule or other enclosed area near the entrance is selected, the decontamination unit should be set up to allow for easy egress from the structure. Temporary decontamination units can be set up with plastic isolation barriers and

flap or zipper doors as is common for mold remediation, asbestos abatement, and work with hazardous materials.

A drop cloth staging area should be set up next to the decontamination area (on the work side) with the necessary equipment and supplies appropriate for the cleaning.

c. Donning Personal Protective Equipment

Individuals conducting the cleaning should put on appropriate PPE inside the decontamination area. The minimum recommended personal protective equipment includes a disposable protective suit with hood, shoe covers, surgical style gloves, and a face shield in addition to appropriate respiratory protection. The minimum recommended respiratory protection is an N-100 filtering facepiece, although half face or full face respirators with appropriate filters may be necessary depending on the types of cleaning chemicals being utilized.

Gloves and shoe/boot covers should be taped to the disposable suit in a fashion that leaves a tape tab so that the items can be easily removed at the end of the cleaning process.

d. General Work Procedures

It is recommended that surface cleaning be conducted with an emphasis on touch points (doorknobs and push bars, light switches, elevator keypads, cafeteria tables, bathroom fixtures, computer keyboards, telephones, etc.). A three-step process that involves HEPA vacuuming, cleaning of essential surfaces with a disinfecting chemical, and disinfection of the entire space following physical cleaning is the preferred method for conducting proactive/protective cleaning.

HEPA vacuuming all horizontal surfaces removes surface dirt, allowing disinfection of the surfaces to be completed more effectively.

The second step of cleaning should be done in a manner that minimizes the generation of airborne droplets. As such, application of disinfecting materials with a foam generator rather than pump sprayers, garden sprayers, or airless sprayers is recommended. Chemicals should be allowed to remain on surfaces for the minimum dwell time specified by the manufacturer. This can range from 30 seconds to 10 minutes, depending on the product selected for dealing with Ebola. After the chemical has been in contact with the surface for the appropriate amount of time, wipe or neutralize the residue according to manufacturer's instructions.

e. Post-Cleaning Disinfection

Although the risk of transmission of the Ebola virus is low in the sorts of situations where proactive or protective cleaning is utilized, the consequences of the disease are significant enough to warrant utilization of specialty disinfection processes following the surface cleaning. Selection of appropriate chemicals and application equipment will allow treatment of both hard and soft surfaces and contents, although there may not be a guaranteed level of effectiveness for the treatment of porous materials.

There are a number of chemical products designated as antimicrobials that can be applied with hot or cold foggers. Water-based chemicals can be applied using ultra low volume (ULV) fogging equipment to prevent surfaces from becoming saturated.

Newer systems that use plasma to vaporize hydrogen peroxide, carbon dioxide to control the flammability of alcohol sterilants, or high intensity ultraviolet light could be incorporated as the final step after physical cleaning has been completed. The addition of such processes should always follow EPA/CDC/OSHA recommendations.

f. Packaging of Waste

Any solid waste produced during the cleaning process—including used suits, gloves, and other PPE—should be bagged in substantial disposal bags with a thickness of at least six mils. Since this is proactive/preventive cleaning without any evidence of actual Ebola virus present, the waste does not need to be sealed in red biohazard bags. If there is liquid waste, absorbent material should be added to the bag in order to avoid leaking.

Disposal bags should be sealed by tying or taping. Sealed bags should be placed in the drop cloth staging area or decontamination unit, where the outsides of the bags are cleaned by damp wiping with an antimicrobial prior to moving them out for transport or disposal.

g. Disposal of Materials Removed from the Site

Bagged or wrapped waste from proactive/preventive cleaning can be disposed of as a regular trash. It is strongly recommended that waste from such cleaning not be put into on-site garbage bins or dumpsters or any other receptacle that is not under the control of the environment contractor.

h. Decontamination of Personnel

Cleaning personnel should remove their PPE in the decontamination area. Removal should proceed from the item likely to be the most contaminated to the item of least contamination, although the respirator is always the last piece of PPE to be removed.

Outer work gloves, if two pairs of gloves were utilized, will come off first. Disposable items should be placed in a disposal bag immediately after removal. Shoe or boot covers would be removed next, followed by the inner pair of gloves. The disposable suit should be removed by unzipping, pulling the arms inside out, then rolling the suit down off the shoulders, back, and legs so that the inside surface of the suit is the primary site exposed to the environment as the suit is removed. These items would also be bagged for disposal.

The face shield and respiratory protection should be removed and disposed of unless those items are designed to be decontaminated and reused, in which case they should be set aside for thorough decontamination and disinfection prior to removal from the decontamination unit.

After exiting the decontamination unit, individuals should wash their hands and face at a nearby sink or with pre-wetted disposable wipes. If wipes are used ensure that they are designed for cleaning hands and face rather than surfaces.

#### **4. Known or Suspected Ebola Contamination**

Most of the information currently available from government sources deals with cleaning a medical or healthcare facility. For example, CDC guidance is designed primarily for hospitals. While OSHA has some fact sheets available that address non-healthcare/non-laboratory settings, they offer little specific guidance for environmental cleaning that involves a significant amount of content removal and surface cleaning where the potential for aerosolization of droplets is greater than in other work environments. Further, certain industries (*e.g.*, the aviation industry) can have specific requirements for the types of cleaning chemicals and cleaning methods that may be utilized.

Because of these limitations, the experienced professionals of the Environmental Contractors Association of New York City have developed this consensus approach to dealing with environmental cleanup where Ebola contamination is known or credibly suspected. These procedures are offered as minimum recommendations with the goal of protecting the workers undertaking the cleanup, the general public, and the organization tasked with completing the project. These recommendations are based on the best information available at this time, including OSHA's Blood Borne Pathogens Standard (29CFR1910.1030), Personal Protective Equipment Standard (29CFR1910.132), Hazard

Communication Standard (29CFR1910.1200), and Cleaning and Decontamination of Ebola on Surfaces Fact Sheet—Guidance for Workers and Employers in Non-Healthcare/Non-Laboratory Settings, and CDC guidance. The procedures build on the cleaning method described in section 3. Recommendations may change as additional information becomes available and will be distributed by the ECA.

a. Necessary Equipment/Supplies

- Materials to construct a four-stage decontamination unit with fully operational shower and two catch basins for foam decontamination of personnel
- Barrels to collect shower drain water so that it can be disinfected prior to disposal
- Secure storage for the workers' personal clothing and valuables while they are inside the work area
- Personal protective equipment including outer disposable suits with hoods and booties (water resistant and a dry particle holdout of 1 micron or better), disposable under suits or washable athletic undergarments such as those made with Lycra, short cuff rubber gloves, long cuff rubber gloves, and washable safety boots.
- Respiratory protection consisting of full face negative pressure respirator with HEPA filters or full face powered air purifying respirator with HEPA filters. Self-contained breathing apparatus may be used, especially if a hoods style respirator is desired rather than a tightfitting facepiece.
- Adequate cleaning supplies, including disinfecting chemicals that meet the CDC's interim guidance for chemicals to use for addressing the Ebola virus, disposable towels, disposable cleaning cloths, and spray or foam applicators
- HEPA vacuum
- HEPA filtered negative air machine and pressure differential monitoring equipment
- Six-mil disposal bags marked "biohazard", along with solid containers that meet the Department of Transportation requirements for movement of class A waste.
- Post-cleaning equipment such as foggers, specialty sprayers, or other devices that can disinfect large surface areas

b. Set up of Engineering Controls

The area to be cleaned should be reviewed and the appropriate setup determined that will allow impacted areas to be isolated and placed under negative pressure with a contiguous four-stage decontamination unit. If necessary, consider

connecting the work area to the decontamination unit by the use of an isolation tunnel.

Temporary isolation barriers constructed of six-mil plastic or solid materials should be erected if contaminated spaces are adjacent to areas shown to be non-impacted. All HVAC supply and return vents should be sealed to avoid the potential for cross-contamination during cleaning activities. Temporary heating or cooling should be provided as necessary to protect the workers from heat stress or excessive cold.

A HEPA-filtered negative air machine should be set up with the exhaust directed out-of-doors and an additional second-stage filter secured to the outdoor end of the exhaust duct. The negative air machine exhaust should utilize flex duct rather than lay-flat in order to ensure that the negative pressure in the work area is not compromised if the machine is moved during the cleaning process. The size and number of negative air machines should be calculated so that there is enough negative pressure drop during the cleaning process to create a minimum of four room air changes per hour—approximately -0.02 inches of water column or -5 Pascal.

The decontamination chamber should be set up so that the workers enter from a non-impacted area and move into the work area through a clean room, shower, undergarment decontamination station, and outer garment decontamination station. Each room of the decontamination unit should be separated by flap or zipper doorways. The shower in the decontamination unit should be fully functional with hot and cold running water controlled from in the shower. A water pump should be used to direct drain water to barrels for disinfection prior to disposal in the sanitary sewer.

c. Donning Personal Protective Equipment

Ebola cleanup workers should don the appropriate PPE in the clean room or in a visually isolated change room outside the clean room. All street clothes should be removed and stored securely. Because of the importance of proper PPE, a site supervisor should observe and monitor for correct PPE use and adherence to protocol for donning and doffing PPE.

Disposable undergarments or washable athletic wear (chosen for keeping workers cool or warm, depending on the work environment) should be put on as a first layer. If disposable undergarments are used they should be matched with a water-resistant disposable suit with boots and hood. If athletic wear is utilized it should

be matched with disposable socks and a water-resistant disposable suit with boots and hood.

Short cuff gloves are put on next and secured to the athletic wear or suit with duct tape. Fold over a tab at the end of the duct tape to ensure easy removal at the end of the work shift. Then an appropriate respirator should be donned and a fit check conducted to ensure that no leaks are present. If a hood style powered air purifying respirator is utilized it may be necessary to don the respirator hood after the outer suit is put on and tuck the neck pieces of the hood into the suit.

A fluid impermeable suit with boots and hood attached is put on next. The worker then steps into slip-on rubber safety boots. Long cuff gloves are put on and secured to the outer suit with duct tape. If a respirator with a tightfitting facepiece is utilized the hood of the outer suit is pulled up over the head and taped to the edges of the facepiece.

Prior to entering the work area through the decontamination unit the PPE of each worker should be reviewed to ensure proper fit and function.

d. General Work Procedures

Any visible bodily fluids or residue should be contained. The suspect material should be treated with a disinfectant chemical. Application of the disinfectant should be done in a way that minimizes the potential for creation of airborne droplets. If possible, the disinfectant chemical should be foamed over suspect contamination so that it completely covers the material.

Body fluids and spills will then be covered with absorbent material, such as disposable towels, which should be saturated with disinfectant. Saturated material will be allowed to soak according to the manufacturer's recommendations. Foam-covered materials should be scooped up and placed into a bio-hazard bag that has additional disinfecting chemical already foamed into the bottom of the bag.

Clean and decontaminate all surfaces, machinery, bathrooms, and furniture. Dry surfaces should be HEPA vacuumed and then cleaned by wiping with an EPA-approved disinfectant.

Package waste using leak proof bags as specified in section 4f. After decontamination of the exterior container and labeling, move the waste to a designated storage area until it can be loaded into an appropriate truck or dumpster for transport. Waste will be managed as Category A material.

e. Post-Cleaning Disinfection

Although the detailed cleaning process should result in the removal of Ebola contamination, additional disinfecting is appropriate given the level of hazard posed by the virus. Therefore, workers will perform a final disinfection of the entire work area, including floors, walls, bathrooms, furniture, and equipment. Selection of the appropriate chemicals and application equipment will allow treatment of both hard and soft surfaces and contents, although there may not be a guaranteed level of effectiveness for the treatment of porous materials.

There are a number of chemical products designated as antimicrobials that can be applied with hot or cold foggers. Water-based chemicals can be applied using ultra low volume (ULV) fogging equipment to prevent surfaces from becoming saturated.

Newer systems that use plasma to vaporize hydrogen peroxide, carbon dioxide to control the flammability of alcohol sterilants, or high intensity ultraviolet light could also be incorporated as the final step after physical cleaning has been completed. The addition of such processes should always follow EPA/CDC/OSHA recommendations.

f. Packaging and Disposal of Waste

Waste packaging must follow the procedures outlined in the DOT document, *Guidance for Preparing Packages of Ebola Contaminated Waste for Transportation and Disposal*. This ten step process requires materials suspected of being contaminated with Ebola to be handled in a specific way.

- 1) The suspect contaminated waste will be placed into bags that meet the specification for handling waste deemed a biological hazard.
- 2) As the material is being placed into the bag, apply disinfectant so that all surfaces of the waste come in contact with the disinfectant chemical.
- 3) Waste bags should be sealed by twisting and tying the tops or twisting and taping. If possible, leave enough room at the top of the bag to utilize a gooseneck seal.
- 4) Use a chemical disinfectant to clean the outside of the bag.
- 5) Place the clean sealed waste bag inside a second bag, which has disinfectant chemicals applied to the inside of the bag. Seal the second bag in a manner similar to the inner bag.
- 6) Disinfect the outer bag in a manner similar to that used for the inner bag.
- 7) Place the double bagged material in a hard container that meets the DOT regulations for an overpack container. Make sure that there is adequate

sorbent on the bottom of the container to capture any liquid that might escape from the inner bags in case of a rupture.

- 8) Seal the outer container.
- 9) Disinfect the exterior of the outer container with a disinfectant chemical.
- 10) Apply a biohazard label to any container that does not have a pre-printed label or markings.

Any variances from this waste packing process (such as wrapping large items rather than cutting them into pieces small enough to fit into bags) requires a non-site specific special permit from the Pipeline and Hazardous Material Safety Administration (PHMSA). That special permit (DOT-SP 16279) authorizes the transportation of waste contaminated with, or suspected of having, the Ebola virus for disposal in ways different from the hazardous materials regulations noted above.

The water from the drain from the personnel shower should be pumped into temporary storage barrels. When a barrel is three quarters full, the water should be treated with a chemical disinfectant in quantities sufficient to ensure the inactivation of any biological pathogens. After a one-hour dwell time, a second treatment of the drain water should be conducted. Waste water can then be disposed of into a sanitary sewer as the CDC notes:

*Ebola-associated waste that has been appropriately incinerated, autoclaved, or otherwise inactivated is not infectious, does not pose a health risk, and is not considered to be regulated medical waste or a hazardous material under Federal law.*

g. Decontamination of Materials Being Removed from the Site

Any supplies, equipment, or tools that have been in the work area must be properly decontaminated prior to removal from the site. Decontamination of materials will follow a process similar to that used for personnel who are exiting the work area.

Materials to be decontaminated will go through a two-step foam cleaning process with disinfectant. Following the foam cleanings each item will be showered or wet wiped, depending on its ability to pass through a shower. Items should be dried in the shower prior to being moved into the clean room in order to minimize waste water moving out of the shower area.

h. Decontamination of Personnel

Workers will exit to the first decon chamber where their outer suit and other PPE will be decontaminated using a foam cleaning process. The worker will then doff the outer layer of PPE under supervision. Used PPE will be placed into disposal bags in accordance with the waste packaging rules.

Workers will move to the next chamber where the inner layer of disposable garments or athletic wear and personal protective equipment is decontaminated with a foam process. After the foam decontamination the workers will remove the inner layer of disposable personal protective equipment prior to moving to the shower. Respirators and athletic style undergarments are worn into the shower. As with the initial decontamination these efforts will be conducted under supervision.

Workers will then proceed into the shower and wash with soap and water. Any athletic wear or equipment that is to be reused (boots, respirators, etc.) will be removed in the shower and thoroughly washed. The showered workers then move to the last chamber where they put on street clothes and exit.

## 5. Standard Trauma Scene Cleanup Procedures

Although the potential presence of Ebola viruses calls for a higher level of concern in regards to dealing with exposure situations that involve bodily fluids, there are other significant hazards which are associated with any trauma scene cleanup. Controlling these hazards requires appropriate engineering controls, personal protective equipment, and specific work procedures. The recommended steps for such a cleaning process are explained in this section.

a. Necessary Equipment/Supplies

- Materials to construct a two-stage decontamination unit
- Personal protective equipment including outer disposable suits with hoods and booties (water resistant and a dry particle holdout of 1 micron or better), disposable under suits or washable athletic undergarments such as those made with Lycra, face shields, rubber gloves, protective work gloves and washable safety boots.
- Respiratory protection consisting of N-100 filtering facepiece, half face respirator with HEPA filters, or full face negative pressure respirator with HEPA filters
- Adequate cleaning supplies including disinfecting chemicals, disposable cleaning cloths, and spray or foam applicators
- HEPA vacuum
- Six-mil disposal bags

- HEPA filtered negative air machine and pressure differential monitoring equipment
- Six-mil disposal bags marked “biohazard”, along with solid containers that meet the Department of Transportation requirements for movement of biohazard waste.
- Equipment such as foggers, specialty sprayers, or other devices that can disinfect large surface areas, for use during post cleaning

b. Set-up of Engineering Controls

The project should be segregated into three areas: contained zone, transition zone, and staging zone. The contained zone should be isolated through the use of existing walls or with plastic barriers so that it can be placed under negative pressure prior to the start of active decontamination. Typically, the two-stage decontamination unit serves as the transition zone with an area set aside outside of the decontamination unit for the staging of equipment and supplies. If the staging zone is in an area that is visible to the public, visual barriers of black plastic or other materials should be erected.

A HEPA-filtered negative air machine should be set up with the exhaust directed out-of-doors and an additional second-stage filter secured to the outdoor end of the exhaust duct. The negative air machine exhaust should utilize flex duct rather than lay-flat in order to ensure that the negative pressure in the work area is not compromised if the machine is moved during the cleaning process. The size and number of negative air machines should be calculated so that there is enough negative pressure drop during the cleaning process to create a minimum of four room air changes per hour—approximately -0.02 inches of water column or -5 Pascal.

Designate or construct an appropriate two-stage decontamination area. The decontamination unit should be large enough to allow workers to disinfect and doff PPE, as well as decontaminate equipment following cleaning. It should also be large enough to allow for the proper packaging of the waste and be stocked with the necessary equipment and supplies appropriate for the cleaning. Unless an entry vestibule or other enclosed area near the entrance is selected, the decontamination unit should be set up to allow for easy egress from the structure. Temporary decontamination units can be set up with plastic isolation barriers and flap or zipper doors as is common for mold remediation, asbestos abatement, and work with hazardous materials.

A sticky step off pad should be set up next to the decontamination area (on the clean side) to minimize the potential for cross-contamination from shoes or boots.

c. Donning Personal Protective Equipment

Individuals conducting the cleaning should put on appropriate PPE before entering the decontamination area. The minimum recommended personal protective equipment includes washable or disposable undergarments instead of street clothes, a disposable protective suit with hood, washable rubber safety boots, surgical style gloves, and a face shield matched with a half face respirator or some form of full face respiratory protection. The minimum recommended respiratory protection is an N-100 filtering facepiece, although half face or full face respirators with appropriate filters may be necessary depending on the types of cleaning chemicals being utilized.

Gloves and shoe/boot covers should be taped to the disposable suit in a fashion that leaves a tape tab so that the items can be easily removed at the end of the cleaning process.

d. General Work Procedures

Any visible bodily fluids or residue should be contained. All visible residue should be treated with a disinfectant chemical. Application of the disinfectant should be done in a way that minimizes the potential for creation of airborne droplets. If possible, the disinfectant chemical should be foamed over suspect contamination so that it completely covers the material.

Chemicals should be allowed to remain on surfaces for the minimum dwell time specified by the manufacturer. This can range from 30 seconds to 10 minutes, depending on the product selected. After the chemical has been in contact with the surface for the appropriate amount of time, wipe or neutralize the residue according to manufacturer's instructions.

Body fluids and spills will then be covered with absorbent material, such as disposable towels, which should be saturated with disinfectant. Saturated material will be allowed to soak according to the manufacturer's recommendations. Foam-covered materials should be scooped up and placed into a bio-hazard bag that has additional disinfecting chemical already foamed into the bottom of the bag.

Package waste using leak proof bags as specified in section 5f. After decontamination of the exterior container and labeling, move the waste to a

designated storage area until it can be loaded into an appropriate truck or dumpster for transport.

Following the removal of all gross debris and impacted contents (including porous finish materials and sections of porous furniture that were contaminated with visible residue) clean and decontaminate all surfaces within the work area. This includes ceilings, walls, and floors, as well as other furnishings and fixtures. The work crew should be prepared to properly clean machinery, bathrooms, and furniture, and appliances. Dry surfaces should be HEPA vacuumed and then cleaned by wiping with an EPA-approved disinfectant.

e. Post-Cleaning Disinfection

Depending on the situation, additional disinfection of surfaces may be appropriate. Various types of chemicals and application equipment will allow treatment of both hard and soft surfaces and contents, although there may not be a guaranteed level of effectiveness for the treatment of porous materials.

There are a number of chemical products designated as antimicrobials that can be applied with hot or cold foggers. Water-based chemicals can be applied using ultra low volume (ULV) fogging equipment to prevent surfaces from becoming saturated.

Newer systems that use plasma to vaporize hydrogen peroxide, carbon dioxide to control the flammability of alcohol sterilants, or high intensity ultraviolet light could be incorporated as the final step after physical cleaning has been completed. The addition of such processes should always follow EPA/CDC/OSHA recommendations.

f. Packaging of Waste

Any solid waste produced during the cleaning process—including used suits, gloves, and other PPE—should be bagged in appropriately marked disposal bags (generally red biohazard bags) with a thickness of at least six mils. If there is liquid waste, absorbent material should be added to the bag in order to avoid leaking.

Disposal bags should be sealed by tying or taping. Sealed bags should be placed in the workroom side of the decontamination unit. Once in the decontamination unit the outsides of the bags are cleaned by damp wiping with an antimicrobial prior to moving them into the second decontamination chamber where they are loaded into hard sided transport containers. The outer packaging should meet the

local requirements for transport of biohazards; generally disposable boxes made of cardboard or plastic corrugated material or more substantive transport containers such as barrels or tubs with tightfitting lids.

g. Disposal of Materials Removed from the Site

Bagged or wrapped waste from trauma scene cleaning must be disposed of as biohazard debris. It is strongly recommended that waste from such cleaning be transported from the site and disposed of by a licensed waste hauler with experience in dealing a biohazard waste. All waste should remain under the control of the environmental contractor until it is put in the designated waste receptacle, dumpster, or vehicle provided by the waste hauler. Since disposal rules for biohazard waste vary from state to state, the contractor should ensure that the waste hauler is providing information consistent with the state regulations for the location of the project.

h. Decontamination of Personnel

Cleaning personnel should remove their PPE in the decontamination area. Removal should proceed from the item likely to be the most contaminated to the item of least contamination, although the respirator is always the last piece of PPE to be removed.

Outer work gloves, if two pairs of gloves were utilized, will come off first. Disposable items should be placed in a disposal bag immediately after removal. Shoe or boot covers would be removed next, followed by the inner pair of gloves. The disposable suit should be removed by unzipping, pulling the arms inside out, then rolling the suit down off the shoulders, back, and legs so that the inside surface of the suit is the primary surface exposed to the environment as the suit is removed. These items would also be bagged for disposal.

The face shield and respiratory protection should be removed and disposed of unless those items are designed to be decontaminated and reused, in which case they should be set aside for thorough decontamination and disinfection prior to removal from the decontamination unit.

After exiting the decontamination unit, individuals should wash their hands and face at a nearby sink or with pre-wetted disposable wipes. If wipes are used ensure that they are designed for cleaning hands and face rather than surfaces.

## **6. Evaluating the Effectiveness of the Cleaning Process**

Prior to the start of the project any criteria that the client recommends for confirming the effectiveness of the cleaning activities must be discussed. Recommended criteria include the documentation of surface cleanliness through a detailed visual inspection. The visual inspection may also be supplemented by the use of surface testing for biological residue using an ATP meter or the use of surface samples cultured in a manner that recovers the Ebola virus. Any evaluation that incorporates methods beyond a visual inspection or direct read field instruments for sampling will require that the work area engineering controls stay intact until all results have been received and meet the pre-established criteria.

Since the decontamination unit and other engineering controls are essential to the safe functioning of the project, those items will stay in place until the results of successful project evaluation are received. Isolation barriers and other engineering controls will be removed prior to the breakdown of the decontamination unit. Waste bags and equipment utilized as engineering controls will be decontaminated as noted in section 4g. The negative air machine will remain running as an air scrubber (without exhaust to the outside) during the final breakdown of engineering controls. It will be shut off and decontaminated just prior to the final removal of the decontamination unit.

The decontamination unit will be disassembled starting at the work side and moving toward the clean room. As each section of the decontamination unit is dismantled the materials will be bagged for disposal or decontaminated through the remaining sections of the unit. All parts of the shower should be thoroughly disinfected prior to removing it from the site.

A post-remediation visual inspection will be completed following the disassembly of the engineering controls and decontamination unit. Any areas of possible contamination identified during the disassembly will be cleaned according to the procedures in section 3d, 4d, or 5d; depending on the type of project.



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