



Decontamination of Vehicles & Equipment Used for Transportation of Potential Ebola Virus Disease (EVD) Patients or Related Equipment

Technical Information Paper 13-031-0914

1. Purpose. This information paper provides guidance for decontaminating vehicles used to transport personnel or equipment in the Area of Operations (AO) impacted by Ebola virus disease (EVD). It is not intended to change any existing Department of Defense (DoD) directives, policies, or procedures provided by Combatant Commands, CONPLANS, or OPORDs in the AO or the AFRICOM AOR.

2. Applicability. This information is applicable to DOD-owned vehicles and equipment. This is preliminary information based upon limited available data. This document is not intended to be a step-by-step instruction and should be read and understood in its entirety prior to commencing any vehicle decontamination activity. Hence, there is an expectation that personnel involved with decontamination activities have familiarity with the proper use of personnel protective equipment, respirator protection program, working with hazardous materials, hazards associated with working with infected persons and remains, and waste management and disposal practices.

3. Background. The U.S. Centers for Disease Control and Prevention (CDC) notes that the 2014 outbreak is the largest outbreak of EVD in history and the first in West Africa. There may be instances during responses to the outbreak when DOD vehicles may be used for the transport of suspected and/or confirmed EVD patients, equipment, or medical waste.

4. References. Established military procedures for decontamination of several types of military equipment are found in Field Manual (FM)3-11.5/MCWP 3-37.3/NTTP 3-11.26/AFTTP(I)3-2.60, CBRN Decontamination: Multiservice Tactics, Techniques, and Procedures for Chemical Biological Radiological and Nuclear Decontamination, April 2006. Additional references are listed at the end of this document.

5. EVD transmission.

a. Body fluids and tissue from individuals who develop symptoms of EVD are very infectious. EVD spreads in the community through human-to-human transmission, with infection resulting primarily from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids. According to the limited research available, isolation of cases, disease contact tracing, proper handling of blood/body fluids and remains of the deceased, and proper use of personal protective equipment when in contact with EVD-infected persons is required to stop further spread.

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TIP 13-031-0914

b. Persons in contact with suspected and/or confirmed EVD patients must consistently apply appropriate infection control procedures (standard, contact and droplet precautions). These include basic hand hygiene, respiratory hygiene, personal protective equipment (PPE) to reduce the risk from splashes or other contact with infected materials, and patient isolation. Prevention guidelines for medical and transport personnel who may come in contact with EVD patients or their bodily fluids are available at: <http://www.cdc.gov/vhf/ebola/hcp/index.html>.

c. Given the apparent low infectious dose, potential for high virus titers in the blood of ill patients, and disease severity, higher levels of precaution are warranted to reduce the potential risk posed by contaminated surfaces in the patient care environment.¹

d. Infection control guidelines addressing procedures to disinfect healthcare settings are readily available from the CDC. The CDC also provides guidance for decontamination procedures for air medical transport of EVD patients and disinfection for airport cargo and cleaning personnel. This document is intended to augment these resources by providing decontamination information specific to DOD vehicles deployed to EVD affected areas.

6. Vehicles in the AO where EVD is present or suspected. Vehicles in the AO that do not come in contact with persons ill with EVD or items potentially contaminated with Ebola virus do not require special decontamination but should follow normal wash/rinse protocols for military vehicles as established in DoD Regulation 4500.36, Management, Acquisition, and Use of Motor Vehicles.

7. Vehicles that have transported a suspected and/or confirmed EVD patient. As soon as possible after transport, decontaminate vehicles exposed to a suspected and/or confirmed Ebola patient as follows:

a. Select PPE. Personnel cleaning and disinfecting vehicles should wear PPE. Reusable PPE items will require proper cleaning and disinfection after use.

(1) Donning and doffing of PPE are critical steps in the prevention of exposure and it is imperative that personnel carefully remove PPE after working in potentially contaminated environments to avoid exposure of non-protected skin and mucous membranes. It is highly recommended that donning and doffing of PPE is performed in pairs or with supervision to minimize potential for unprotected exposures. Instructions for putting on and removing PPE are available at <http://www.cdc.gov/HAI/prevent/ppe.html> and <http://www.cdc.gov/vhf/ebola/pdf/ppe-poster.pdf>.

(2) At minimum, PPE should include disposable gloves, gown (fluid resistant/impermeable), eye protection (face shield), and facemask to protect against direct skin

TIP 13-031-0914

and mucous membrane exposure of cleaning chemicals, contamination, and splashes or spatters during cleaning and disinfection activities. Additional barriers (e.g., leg covers, shoe covers) should be used in cases where the vehicle contains visible bodily fluids. Consider double-gloving if cleaning large amounts of blood or other body fluids.

(3) For more heavily contaminated environments or where there is a greater risk of splashes or splatters during cleaning and disinfection activities, consider utilizing full Tyvek[®] coverall suit, and overboots, heavy gauge rubber gloves over disposable gloves taped to the coverall suit, along with surgical mask and goggles or splash shield to protect against direct skin and mucous membrane exposure. Additional respiratory protection, such as a personal air purifying respirator (PAPR), should not be needed, but may provide additional physical comfort to personnel wearing PPE in warm climates due to airflow occurring within the mask. (Tyvek[®] is a registered trademark of E.I. DuPont de Nemours and Company.)

b. Surface Preparation. Before disinfecting a surface, cleaning should be performed to remove all bodily fluids, trash and dust build-up. In contrast to disinfection where specific chemicals are used, soap and water can be used for the cleaning process. Gross debris, if contaminated, is and will likely remain potentially infectious, so its management is important. Use disposable cleaning cloths, mop cloths, and wipes to manually clean the surfaces with the soap and water solution. Dispose of used materials along with any trash and debris in leak-proof bags. Use a rigid waste receptacle designed to support the bag to help minimize contamination of the bag's exterior. Care should be taken to prevent splashes and/or spread of fluids beyond the area of contamination.

8. Selection of decontamination method. There are a number of procedures and materials that can be used to decontaminate surfaces suspected of Ebola virus contamination. Not all decontamination methods are suitable or amenable to the material/item that is suspected of contamination. The best method to use will depend on the type of material that is contaminated, how the material is contaminated, the ability to obtain decontamination supplies, and other factors specific to the location. One key element impacting decontamination is the type of material (porous or non-porous) and whether electronics are present.

a. Porous. These are materials that will allow liquid and gas to pass through them. These will vary in hardness, density and porosity. As a result, liquids spilled or applied to these will absorb into the material making it more difficult to remove or decontaminate. Examples of porous materials include paper, fabric, and wood.

b. Non-porous. These are materials that will limit or prevent liquid and gas from passing through them. Liquids spilled or applied to these materials will pool or run off the material. Examples of non-porous materials include glass, metals and plastics.

TIP 13-031-0914

c. Electronics. These are items containing electronic circuitry, switches, batteries, wiring, and so forth. These may or may not be installed or manufactured in a manner to prevent exposure to vapors and liquids such as contaminants and materiel used for decontamination.

9. Chemical decontamination. Selected disinfectants and bleach are recommended for killing the Ebola virus. Note that while alcohol is part of any hand sanitation/infection control program (alcohol-based hand sanitizer), it is not effective for decontaminating objects that have been in contact with the Ebola virus.

a. Commercial disinfectants. The U.S. Environmental Protection Agency (EPA) has identified a number of disinfectants suitable for Ebola virus decontamination. The disinfectants on *List G: EPA's Registered Antimicrobial Products Effective Against Norovirus* have been identified as being acceptable for use against Ebola virus. A large number of these are peroxide and acidic/alkaline-based cleaners.² Prepare and use commercial disinfectant per the directions on the package.

Table. National Stock Numbers for Some EPA-Approved Disinfectants

NSN	Trade Name	Nomenclature
6840-01-389-6088	Dispatch [®]	Disinfectant-Detergent, General Purpose
6840-01-491-4889	Dispatch	Disinfectant-Detergent, General Purpose
7930-01-084-3103	Spray Nine [®]	Cleaner, Industrial, Multi-Purpose
7930-01-177-0795	Spray Nine	Cleaner, Industrial, Multi-Purpose
7930-01-346-5280	Spray Nine	Cleaner, Industrial, Multi-Purpose
7930-01-346-5281	Spray Nine	Cleaner, Industrial, Multi-Purpose
7930-01-346-5284	Spray Nine	Cleaner, Industrial, Multi-Purpose
7930-01-393-6747	Spray Nine	Cleaning Compound Solvent Detergent Liquid Disinfectant 25oz 12s

Notes:

Dispatch is a registered of The Clorox Company.

SprayNine is a registered trademark of the U.S. EPA.

b. Bleach. Dilute bleach is highly effective at decontaminating surfaces and items contaminated with the Ebola virus. Non-porous surfaces that are relatively free of debris and caked or pooled material can be decontaminated with a solution of 1% bleach [1:100 (~8 teaspoons of bleach added to 1 gallon of water or 10 mL of bleach to 990 mL of water)]. For unclean, soiled, dirty and porous surfaces, or when decontaminating an item via immersion, a solution of 10% bleach solution should be used [1:10 (1 cup of bleach added to 9 cups of water or 100 mL of bleach added to 900 mL of water)].³ Even at the higher concentration of bleach solution, disinfection will be more successful if gross debris is removed prior to disinfection. Organic matter will neutralize bleach solution. Bleach solution should remain in contact with surfaces/items for at least 10 minutes.

TIP 13-031-0914

(1) Full strength bleach emits toxic vapors and should never be used in small or enclosed spaces. Ideally, mix your solution outside. If that is not an option, go to a large, well-ventilated room and open the windows.

(2) Carefully pour the bleach into the container first, and then add cold water. Mixing the solution in this order will prevent the bleach from splashing up on you. If you do get any bleach on your skin, wipe it off immediately with a damp cloth.

(3) Place the lid on the container and gently invert the container back and forth a few times to mix. The solution is now ready to use. Never add any other ingredients to the bleach solution because many substances, including vinegar, create harmful fumes when mixed with chlorine bleach.

(4) Chlorine bleach solution begins to lose its disinfectant power quickly when exposed to heat, sunlight, and evaporation. To ensure the solution is still strong enough to kill germs, mix a fresh batch each day using cold water and discard whatever amount you don't use at the end of the day.

c. MicroChem Plus™ solution. MicroChem Plus solution is highly effective at decontaminating surfaces and items contaminated with the Ebola virus. Approximately 190mL of MicroChem Plus solution can be added to 1 gallon of water to achieve the correct dilution for decontaminating surfaces. The MicroChem Plus solution should remain in contact with the surfaces/items for at least 15 minutes. An advantage of MicroChem Plus is that it is not believed to be degraded by organic matter to the degree that bleach is. (Micro-Chem Plus™ is a trademark of National Chemical Laboratories, Inc.).⁴

10. Decontamination of non-porous surfaces (e.g., glass, metal, painted surfaces, plastics).

a. Clean the surface of loose debris, fluids and caked material using soapy water. (See surface preparation section above.)

b. Spray the surface with disinfectant and let stand for 10-30 minutes. Ensure the surface remains visibly wet for at least 10 minutes. During this time, a disinfectant saturated media (i.e., sponge, rag, wipe) can be used to gently spread the disinfectant across and around the surface.

c. Wipe clean with a moistened towel or sponge and let dry. Repeat if disinfectant residue is apparent.

TIP 13-031-0914

11. Decontamination of porous surfaces. For porous surfaces (e.g., removed clothing, bedding, mattresses, seat cushions), decontamination will require a decision as to whether the item will be reutilized.

a. Items with porous surfaces that WILL NOT be reutilized. Saturate items with disinfectant and place into a leak-proof biohazard bag and secure for disposal.

b. Items with porous surfaces that WILL BE reutilized:

(1) Remove debris and free liquids/solids from the item and place in a leak-proof biohazard bag, saturate with disinfectant, and dispose as described below.

(2) Immerse the items in disinfectant for 10-30 minutes depending on the size and volume of the item being disinfected.

(3) Remove the items from the disinfectant and allow excess fluids to drain.

(4) Immerse the items in clean rinse water and allow sufficient time to remove excess disinfectant. One or more rinses may be required depending on the absorbent qualities of the material.

(5) Remove the items from the rinse water and allow to dry.

NOTE: If the item is such that it cannot be immersed due to size or detached from a mount, the item will need to be saturated with disinfectant in place. The item would then be rinsed in the same manner one or more times to remove disinfectant residuals.

12. Disposal of wastewater.

a. Although decontamination is intended to destroy or inactivate Ebola virus, it is possible that wastewater from decontamination of vehicles could still contain some active virus. Disposing of the wastewater through sanitary sewers is only a good option if additional disinfection occurs as part of the wastewater treatment process. However, in the areas of Africa where EVD has been found recently, functioning modern sewers with disinfection prior to discharge are not routinely available.

b. Using a soakage pit is an option if the site selected is completely isolated from any surface water or any subsurface source of drinking water. If soakage pits are used, after the rinse water enters, add enough lime to achieve a pH of 12 or above and maintain it at that level for 2 hours without adding more lime. Each time the pH slips below 12, add more lime and wait a full 2 hours from the time the additional lime was added.⁵ After the pH has successfully been maintained for 2 hours as described above,

TIP 13-031-0914

cover the area with earth and secure the area so that it is not used for farming, irrigation, digging of wells, and so forth.

c. Lime is usually available at farm supply stores in the United States as a soil pH adjustment and may be available in less developed areas of the world. The lime addition rate to the pit should be approximately a 50 pound (23 kilograms) bag per 1,000 gallons (3785 liters) of rinse water. The lime will react with water to produce heat. It is best to add the lime as a slurry to the pit by premixing it with other water (NOT the rinse water), rather than pouring powdered lime directly into the rinse water.

13. Encapsulated treatment. This method requires encapsulating an item, or area to be decontaminated, within a sealed enclosure whereupon all items within the enclosure are subjected to treatment. Treatment may be in the form of heating, vaporized chemical oxidizers (e.g., hydrogen peroxide vapor, chlorine dioxide), or disinfectant bombs/fogs (e.g., formaldehyde/paraformaldehyde fumigation). The amount of time required to effectively decontaminate the area depends on the concentration used, the contact time, environmental controls (maintaining the temperature and/or concentrations), the size of the space (this will be a factor for reaching the desired concentration), and the integrity of the encapsulation (maintained positive pressure, sealed, and so forth). Failure of any one of these may compromise the decontamination process. Additionally, it will be necessary to validate the treatment process to demonstrate all locations within the enclosed area were adequately subjected to the particular treatment used.

The drawback to encapsulation is the potential for the treatment itself to adversely impact sensitive items contained within the enclosure (i.e., corrosion of electronics, melting of plastics, chemical residues). This form of treatment should only be used in those instances where surface decontamination or disposal of the contaminated item is not feasible due to the total area requiring treatment, when contamination is not limited to the surface, and/or when the cost to replace the item is excessive. Specialized equipment for dispersing reagents, PPE, and controlling the environment will be required.

14. Management and disposal of surface preparation and decontamination solid waste.

a. Waste generated from vehicle decontamination (to include PPE) should be placed in leak-proof bags and disposed as infectious waste.⁶ To minimize contamination of the exterior of the waste bag, place this bag in a rigid waste receptacle designed for this use.

TIP 13-031-0914

b. Incineration is the preferred and most effective disposal method for this waste stream; however, incineration options may be limited. Some possible options include:

(1) Collaborating with local hospitals which have incineration capabilities.

(2) Determining whether there are DOD Mediburn incinerators in the AO and coordinating for their use.

c. DoD Instruction (DoDI) 4715.19, *Use of Open-Air Burn Pits in Contingency Operations*, prohibits the disposal of waste in open-air burn pits during contingency operations except in circumstances in which no alternative disposal method is feasible as determined in accordance with the procedures in this document. Refer to DoDI 4715.19 for details.

d. The World Health Organization provides the option of burying the waste in a designated pit of appropriate depth (2 meters (m) or about 7 feet (ft)) and filled to a depth of 1–1.5 m (about 3–5 ft). After each waste load, the waste should be covered with a layer of soil 10 –15 centimeters (4-6 inches) deep.⁷

15. Point of contact. The point of contact for this document is the Army Institute of Public Health Waste Management Program at 410-436-3651 or DSN 584-3651.

References:

¹<http://www.cdc.gov/vhf/ebola/hcp/environmental-infection-control-in-hospitals.html>

²http://www.epa.gov/oppad001/list_g_norovirus.pdf

³<http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php>

⁴http://www.nclonline.com/products/view/MICRO_CHEM_PLUS_

⁵Title 40 Code of Federal Regulation, Part 503, Rules on lime stabilization of biosolids

⁶<http://www.cdc.gov/vhf/ebola/hcp/environmental-infection-control-in-hospitals.html>

⁷<http://www.who.int/csr/resources/who-ipc-guidance-ebolafinal-09082014.pdf>, page 9