RECOMMENDED PROTOCOL FOR THE DECONTAMINATION OF AMBULANCES AND EMERGENCY VEHICLES IN RELATION TO COVID-19 AND OTHER PATHOGENS

IMPORTANT

ANY REFERENCE TO A PARTICULAR PRODUCT OR BRAND NAME DOES NOT INFER AN ENDORSEMENT OF THAT PRODUCT. WE GIVE REFERENCE TO THESE PRODUCTS AND OR BRAND NAMES AS THE RESULT OF HAVING EXPERIENCE WITH THEM IN PREVIOUS SIMILAR SUCCESSFUL DECONTAMINATION PROTOCOLS, SUCH AS THE EBOLA VIRUS ENCOUNTER

John B. Whidden PhD
President
Brookway Group, Inc.

April 20, 2020

Introduction

Professionals working on Ambulances (either in service, maintenance or cleaning) will be following the Center for Disease Control (CDC) and Occupational Safety and Health Administration's (OSHA) standard(s)[1] to limit occupational exposure to pathogens, blood and other potentially infectious materials. Any exposure could result in transmissions of viruses (such as COVID-19) and bacteria (including but not limited to Bloodborne Pathogens) which could lead to illness or death.

Individuals working on an ambulance that has been in-service are at risk for exposure to blood, bodily fluids and/or contaminated material either organic or non-organic if the vehicle has not been thoroughly decontaminated and cleaned.

All applicable employees or contractors will receive training at least annually about the information contained in this program and will be expected to follow the procedures outlined and use of Personal Protective Equipment, Decontamination Chemical(s), and documentation provided.

This document is a recommended protocol for the decontamination and cleaning of ambulances to a safe level of sanitization when they have been exposed to pathogens including the COVID-19 virus. It is assumed that individuals responsible for ensuring a safe working condition for operational personnel are thoroughly trained in the complexities of the interactions and relationships of the COVID-19 virus with various essential functions of the human body.

With this assumption, several elements must addressed in developing a protocol to disinfect an emergency vehicle.

1. Identify a disinfectant that is approved by EPA to be used in the disinfectant process.
    a. Does it work to destroy the COVID-19 and other viruses/bacteria?
    b. Will it cause collateral damage to the infrastructure and equipment (monitors; triage equipment/material; surfaces such as metal, fabric, and/or working surfaces; restraint devices; electronics; oxygen systems, etc.)?
    c. Can it be used in a very timely manner with little disruption of service availability?
    d. Will it have an adverse effect for operational personnel, patients and/or service personnel?
    e. Time period disinfectant remains viable.
    f. Does disinfectant of vehicle need to be performed at a specific location?
    g. Is PPE other than eye protection, gloves and approved medical mask required to disinfect vehicle?
    h. What BBP issues must be addressed during disinfectant process?
    i. What OSHA/EPA issues must be addressed?

[1] 29 CFR 1910.1030, Occupational Exposure to Bloodborne Pathogens

j. What training must be provided to operational and service personnel with regard to disinfecting vehicles?
k. How is waste (if any) disposed of (Bio Hazard and non-Bio Hazard) during the disinfection process?
l. Direct and Indirect cost of performing a disinfection to one vehicle.
m. Availability of approved disinfectant.
n. Does disinfectant reach all inaccessible areas of patient area in vehicle; webbing (seat belts, restraints, etc.); flooring; seams in upholstery, etc.?

In addition, the Centers for Disease Control (CDC)[2] has established *Guidelines: Cleaning EMS Transport Vehicles after Transporting a PUI or Patient with Confirmed COVID-19*. The following are *general* CDC guidelines for cleaning or maintaining EMS transport vehicles and equipment after transporting a PUI:

- After transporting the patient, leave the rear doors of the transport vehicle open to allow for sufficient air changes to remove potentially infectious particles.
    - The time to complete transfer of the patient to the receiving facility and complete all documentation should provide sufficient air changes.
- When cleaning the vehicle, EMS clinicians should wear a disposable gown and gloves. A face shield or facemask and goggles should also be worn if splashes or sprays during cleaning are anticipated.
- Ensure that environmental cleaning and disinfection procedures are followed consistently and correctly, to include the provision of adequate ventilation when chemicals are in use. Doors should remain open when cleaning the vehicle.
- Routine cleaning and disinfection procedures (e.g., using cleaners and water to pre-clean surfaces prior to applying an EPA-registered (N-List EPA), hospital-grade disinfectant to frequently touched surfaces or objects for appropriate contact times as indicated on the product's label) are appropriate for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in healthcare settings, including those patient-care areas in which aerosol-generating procedures are performed.
- Products with EPA-approved emerging viral pathogens claims are recommended for use against SARS-CoV-2[3] (COVID-19). Refer to List N on the EPA website for EPA-registered disinfectants that have qualified under EPA's emerging viral pathogens program for use against SARS-CoV-2.[4]

[2] Please refer to the CDC website at www.cdc.gov/coronavirus/2019- ncov/ for additional information on the outbreak.

[3] COVID-19 is caused by SARS-CoV-2 (Coronavirus). Sterilex Ultra Disinfectant Cleaner Solution 1, when mixed with Sterilex Ultra Activator Solution, kills similar viruses and therefore can be used against SARS-CoV-2 when used in accordance with the directions for use against Feline Calicivirus.

[4] EPA published guidance in 2016 outlining a pathway for EPA registrants to make claims against emerging viral pathogens that are not included on the EPA-registered label. This policy is intended to provide companies with an avenue to make claims against pathogens of major public health concern that cannot reasonably be added to a product label in a timely manner. Coronavirus (SARS-CoV-2 (COVID 19)) currently falls under this pathway. In order to make these claims, companies must complete a 2-stage process:

- Have proven efficacy against key viral pathogens and add the designated emerging viral pathogen statement to their master label.

- Clean and disinfect the vehicle in accordance with standard operating procedures. All surfaces that may have come in contact with the patient or materials contaminated during patient care (e.g., stretcher, rails, control panels, floors, walls, work surfaces) should be thoroughly cleaned and disinfected using an EPA-registered hospital grade disinfectant in accordance with the product label.
- Clean and disinfect reusable patient-care equipment before use on another patient, according to manufacturer's instructions.
- Follow standard operating procedures for the containment and disposal of used PPE and regulated medical waste.
- Follow standard operating procedures for containing and laundering used linen. Avoid shaking the linen.

The Disinfectant

The selection of a disinfectant is most important and must address several of the considerations listed above. ANY DISINFECTANT USED MUST BE ON AN EPA APPROVED LIST. Our experience with a product called Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list)[5] was successfully utilized in a similar decontamination program during the Ebola crisis. Accordingly, we are citing this product for REFERNCE only. This company and product are listed on an excerpt from EPA N list shown on the following page..

- Agree to abide by the restrictions of the Emerging Viral Pathogen policy and remove claims once the outbreak has ended.

The current policy lists three viral subgroups, organized in a hierarchy. Demonstrated efficacy against viral pathogens in a higher class would imply efficacy against pathogens in a lower class.

- Small, non-enveloped viruses
- Large, non-enveloped viruses
- Enveloped viruses

Coronavirus (SARS-CoV-2) falls under the enveloped virus category of pathogens. In order for disinfectants to make claims against emerging enveloped viruses, they must have demonstrated efficacy against **at least** one large or one small non-enveloped virus. Both Sterilex products have demonstrated efficacy against Feline calicivirus — a small, non-enveloped virus — implying efficacy over an enveloped virus such as Coronavirus (SARS-CoV-2).

[5] ANY REFERENCE TO A PARTICULAR PRODUCT OR BRAND NAME DOES NOT INFER AN ENDORSEMENT OF THAT PRODUCT. WE GIVE REFERENCE TO THESE PRODUCTS AND OR BRAND NAMES AS THE RESULT OF HAVING EXPERIENCE WITH THEM IN PREVIOUS SIMILAR SUCCESSFUL DECONTAMINATION PROTOCOLS, SUCH AS THE EBOLA VIRUS ENCOUNTER

Excerpt[6] from EPA N List and products with emerging viral pathogens and human coronavirus claims for use against SARS-CoV-2 COVID-19

EPA Registration Number	Active Ingredients	Product Name	Company	Follow the disinfectant directions and preparation for the following virus	Contact time (in minutes)	Formulation Type	Surface Types for Use	Use Site	Emerging Viral Pathogen Claim?	Date Added to List N
63761-10	Quaternary Ammonium Sodium Carbonate Peroxyhydrate	Sterilex Ultra Step	Sterilex	Feline Calicivirus Rotavirus	10	Dilutable	Hard nonporous	Healthcare, Institutional	Yes	03/03/2020
63761-8	Quaternary Ammonium Hydrogen Peroxide	Sterilex Ultra Disinfectant Cleaner Solution 1	Sterilex	Feline Calicivirus	10	Dilutable	Hard nonporous	Healthcare, institutional, residential	Yes	03/03/2020
63761-5	Quaternary Ammonium; Sodium Carbonate peroxyhydrate	Sterilex Ultra Powder	Sterilex	Feline Calicivirus norovirus	10	Dilutable	Hard nonporous	Healthcare, institutional,	No	03/26/2020

[6] Complete List available at https://www.epa.gov/pesticide-registration/list-n. If a product doesn't have an EPA registration number, then EPA has not reviewed any data on whether the product will kill public health pathogens such as viruses. EPA will not add products to List N that do not have an EPA registration number because they have no data showing they will work and can be used safely.

In addition to the disinfectant meeting the requirements for efficacy (as documented on the EPA N-list above), it must also be tested with regard to the effect it will have on materials that would normally be in the interior of an ambulance. In so doing, it can be determined if the application of the disinfectant on surfaces will cause either short or long term damage to the vehicle. The following compatibility chart gives data with the dilutions of Sterilex Ultra Disinfectant Cleaner Solution 1 and Sterilex Ultra Activator solution. Compatibility testing was conducted for 10 consecutive days (14,400 minutes) of use which simulates 5.5 years of daily treatments

METAL	COMPATIBILITY	PLASTIC	COMPATIBILITY
304 Stainless	Compatible	IIDPE	Compatible
316 Stainless	Compatible	LDPE	Compatible
Copper	Compatible	Polyethylene	Compatible
Carbon Steel	Semi- Compatible	Polypropylene	Compatible
Cast Iron	Non-Compatible	PVC	Compatible
Galvanized	Non-Compatible	Teflon	Compatible
Brass	Non-Compatible	Karez	Compatible
Aluminum (Non-Anodized)	Non-Compatible	Delrin (Polyacetal)	Compatible
		EPDM	Compatible
		Buna-N	Compatible
		PET	Compatible
		Vitron	Semi-Compatible
		Polycarbonate	Semi-Compatible

Pathogenic Issues in the Environment of In-Service Ambulance Decontamination:

Possible areas that could be contaminated with Pathogens:

- Every interior space and entry way of an ambulance that has been in service could be potential for contamination; therefore it is mandatory that all safety precautions be taken when decontaminating these areas.
- Exposed Medical equipment and supplies
- When cleaning and decontaminating an ambulance including any patient care equipment, safety universal precautions must be followed.

Universal Precautions:

- Non-sterile gloves and safety glasses with side shields[7] will be used at all times during the cleaning and decontamination process as exposure to body fluids, secretions and excretions as well as contaminated articles are very probable.
- Hands shall be washed immediately after taking gloves off upon completion of each cleaning or decontamination procedure.
- Wear fluid resistant coveralls when cleaning and if soiling is anticipated with blood and/or body fluids, secretions or excretions.
- Eye Protection (goggles), will be used upon initial cleaning and if exposure to blood and/or body fluids is anticipated.
- A medical grade face mask will be worn when cleaning or if fluids of any type are encountered during the cleaning/decontamination process..
- Dispose of any sharps encountered in proper receptacles. Only recap needles by using one hand to hold the base of the needle as you slide it back into the protective cap. Do not stick your hand or fingers in a sharp's container or place garbage in a Bio-Hazard sharp container.
- Do not eat, drink, smoke, apply makeup or lip balm or adjust contact lenses while cleaning or decontaminating the vehicle. Personal hygiene, including hand washing must be done BEFORE DURING & AFTER undertaking the process.

Personal Protective Equipment, cleaning and decontamination chemicals that should be utilized:

- Non-sterile latex free gloves.
- Tyvek full coverage coveralls
- Foot covers
- Goggles
- Medical grade face mask
- Sharps disposal system
- Fluid absorbent, dust pan and whisk broom
- Small sealable (i.e. Zip Lock®) bags
- Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list)
- Hand cleaner with a minimum 60% alcohol
- Two 5 Gallon Buckets
- Synthetic sponges
- Assortment of waste cloths
- Red Biohazard Bags

HBV Immunizations:

Any contractor and/or employee working on the cleaning/decontamination of vehicles that have been in service will have a complete series of Hepatitis B Immunizations.

- Immunizations should be started within ten (10) working days of employment, unless the team member refuses, or has medical documentation that states that the team member does not need the immunization.
- Employer will also provide annual education on precautionary measures, epidemiology, and modes of transmission.

Types of significant exposure:

- Contact with your non-intact skin i.e., rash, lesion, open/healing wound, etc.
- Direct contact with positive test COVID-19 patient
- Contact with your eyes.
- Contact with your mouth, nose, or mucous membranes.
- Puncture or penetration of your skin by any contaminated object.

Steps to follow when exposed to body secretions:

- Immediately notify supervisor
    - Fill out an exposure report to include:
        - (a) how exposure occurred;
        - (b) material or fluid exposed to;
        - (b) any precautions that were taken at time of incident.
- If testing is needed, employee will contact medical provider.
- Copies of all reports must be kept on file with the primary employer. (These files will be kept confidential in accordance with HIPPA).

If you test positive for COVID-19 you MUST follow instructions of medical provider, including but not limited to 14 days isolation. All testing should be done as soon as possible

Instructions for Exposed Materials:

- ALL contaminated items (including soiled fabric) will be placed in a red Biohazard bag and disposed utilizing the approved biohazard waste procedures[8]
- Contaminated clothing shall be placed in red bags and taken to a commercial cleaners. Do not take contaminated clothing home to be washed.

Option #1
DECONTAMINATION AND CLEANING

The protocol presented in this document is intended to address the decontamination of ambulances between operational dispatches. The issue of contamination has been established, however, we must also address time and manpower constraints in sanitizing a vehicle between calls. This process has two distinct levels of implementation. Of primary concern is the decontamination of the internal areas of the ambulance. This must be done after providing patient medical care and transportation to a hospital or other medical facility and before going on the next dispatch.

[8] Biohazard waste procedures are contained in Appendix A

The cleaning process occurs when gross contamination occurs or between crew shift changes. In the matter of gross contamination, the cleaning process must be done before and after decontamination.

Ambulance Decontamination:

ALL Ambulances that have been in service will be cleaned and decontaminated after a call where exposure to infectious viruses and/or other disease (particularly COVID-19) occurred. Decontamination will be done prior to making the next call. If an ambulance is to be taken out of service it will be parked in a quarantine area until processed, NO EXCEPTIONS.

The process of decontamination and cleaning follows a sequential process that maintains a precise step by step progression of tasks resulting in a vehicle that will be reduced to an acceptable level of exposure to potentially hazardous pathogens.

1. **Materials to use for decontamination:**
    - Non-sterile latex free gloves.
    - Safety Glasses with Side Shields
    - Tyvek full coverage coveralls[9]
    - Foot covers
    - Goggles
    - Medical grade face masks
    - Sharps disposal system
    - Fluid absorbent, dust pan and whisk broom
    - Small sealable (Zip Lock®) bags
    - Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list)
    - Hand cleaner with a minimum of 60% alcohol
    - Two 5 Gallon Buckets (optional)
    - Synthetic sponges
    - Bleach wipe down wipes
    - Clean cloth towels
    - Broom and dustpan
    - Dawn Dishwashing Detergent
    - Red Biohazard Bags

2. **Procedures for Decontamination:**
    1. Inspect and put on the following Personal Protective Equipment (PPE):
        - Non-sterile latex gloves.
        - Goggles
        - Tyvek full coverage coveralls[9]
        - Foot Covers
        - Medical grade face mask

[9] If the interior of the vehicle does NOT have obvious indications of staining, fluids, dressings or other signs of contamination, the Tyvek coveralls do not have to be worn, however, the foot coverings MUST be worn.

2. Inspect, prepare and have available the following material to be used during the decontamination process:
    - Sharps disposal system
    - Fluid absorbent, dust pan and whisk broom
    - Small, medium and Large sealable bags
    - Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list)
    - Clean cloth towels
    - 5 Gallon bucket (clean water use)
    - Synthetic sponges
    - Hand cleaner with a minimum of 60% alcohol (Sani Wipes®)
    - Broom and dustpan
    - Red Biohazard Bags

3. Inspect the vehicle, inside and outside, to determine the condition of cleanliness, damage, potential exposure to contaminated surfaces, dressings, materials, and Sharps
4. Remove all used sharps that are evident and dispose in the Sharps container.
5. Using Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list) apply the solution (prepare per manufacturer's instructions BEFORE beginning cleaning process) to an area approximately 5'x5' beginning at the highest point in the patient care area. Decontaminate the ceiling, all side surfaces (including cabinets, seating and horizontal surface areas. DO NOT remove any bench assemblies, seats, Gurneys or other components until decontaminated. EXTREME caution must be taken when working around crevices, spaces behind or under benches or in any areas that are difficult to see. These areas may contain sharps or other contaminated material that could seriously injure the individual(s) performing the task.
6. After applying two 5'x5' areas with Sterilex Ultra Disinfectant Cleaning Solution 1© (disinfectant can be any disinfectant on the EPA Approval list) for a period of no shorter than 3 minutes and no longer than 10 minutes to allow the solution to be effective. Remove the solution utilizing fresh water and wipe down the area at least three times, rinsing with clean water between each wipe down. DO NOT allow the solution to dry before wiping down. If there is any possibility that the solution is not completely removed, continue wiping with clean water until removed. ***Particular attention must be given to aluminum surfaces***. Sterilex ultra disinfectant cleaning solution 1© is a corrosive and if allowed to be left on an aluminum (non-anodized) surface for extended periods it may cause pitting ruining the appearance of the surface. In addition, the solution cannot be used on an aluminum (non-anodized) surface more than a few times until damage may occur no matter how sufficient wipe downs are performed.
7. AFTER the exposed surfaces of the interior of the vehicle (patient care area AND driver/crew compartment) have been decontaminated, the

components that can be removed (benches, seats, etc.) should be prepared for removal if deep cleaning is indicated. Undersurfaces and areas that were not decontaminated in the initial process are to be decontaminated and rinsed before removal from the vehicle. Caution should be taken to avoid exposure to sharps and/or contaminated materials during this process.

In addition, when decontaminating and rinsing during this phase of the process, avoid splashes onto areas that have been previously decontaminated. If splashes do occur, rinse as previously discussed.

When items that have *not* been fully decontaminated (bottoms, backs and areas difficult to reach), they may be removed from the vehicle and placed in a secure area for total decontamination using caution not to intermingle these items with fully decontaminated equipment/materials[10].

8. When the vehicle has been decontaminated and applicable items removed, the decontamination individual/crew can remove their PPE and wash with soap and water any exposed skin (face, hands, etc.). Hand cleaner with a minimum of 60% alcohol should be applied to the hands after thoroughly washing with soap and warm water. If any personal clothing came into contact with ANY fluids, staining or other contaminated material, they must be removed and washed or cleaned. DO NOT take potentially contaminated items home, rather, have them cleaned or washed commercially such as at Laundromat. As a precaution, wipe down the top, sides and bottom of footwear with Sani Wipes BEFORE proceeding with the next step.
9. The process of cleaning the vehicle is the next step in the process.

Ambulance Cleaning[11]:

1. Inspect and put on the following Personal Protective Equipment (PPE):
    - Non-sterile latex free gloves.
    - Safety Glasses with Side Shields
2. Inspect, prepare and have available the following material to be used during the cleaning process:
    - Clean cloth towels
    - Two 5 Gallon buckets
    - Synthetic sponges
    - Hand cleaner with a minimum of 60% alcohol
    - Sani Wipes®
    - Broom and dustpan

[10] If removed items are to be disposed of they must be discarded in accordance with Solid Waste Regulations and the policies of the local waste disposal authority.
[11] NOTE: Ambulance should be decontaminated BEFORE cleaning UNLESS gross contamination has occurred then the cleaning will occur BEFORE and AFTER decontamination.

- Dawn® Dishwashing Detergent

3. Using a clean five gallon bucket filled ¾ full, mix fresh water and ¼ teaspoon of Dawn® Dishwashing Detergent to be used during the cleaning process. Use second bucket for clean rinse water.
4. Utilizing a synthetic sponge (to be used with the soap solution only), wash down all surfaces starting with the ceiling and finish with the floor. Using the same method used for decontamination, washing a 5'x5' area then rinse with clean water and a sponge (used for rinsing only). Change the rinse water often and keep all sponges clean. It is recommended that all surfaces be rinsed at least two times with clean water during the cleaning process.

When the vehicle has been cleaned, the cleaning individual/crew can remove their PPE and wash with soap and water any exposed skin (face, hands, etc.). Hand cleaner (Purell)© should be applied to the hands after thoroughly washing with soap and warm water.

1. Documentation:

1. Upon completion of the decontamination/cleaning process, the *Certification of Decontamination and Cleaning* form[12] is to be completed and signed by the individual or crew leader performing the job. The *Certification of Decontamination and Cleaning* form is to be maintained by the company for a period of three years.

OTHER FORMS OF DECONTAMINATION

There are two additional methods to provide a more aggressive method of disinfecting. The protocols in this document do not cover either of these methods, however, we list them here to inform you of their availability.

Option #2
Spraying Disinfectant

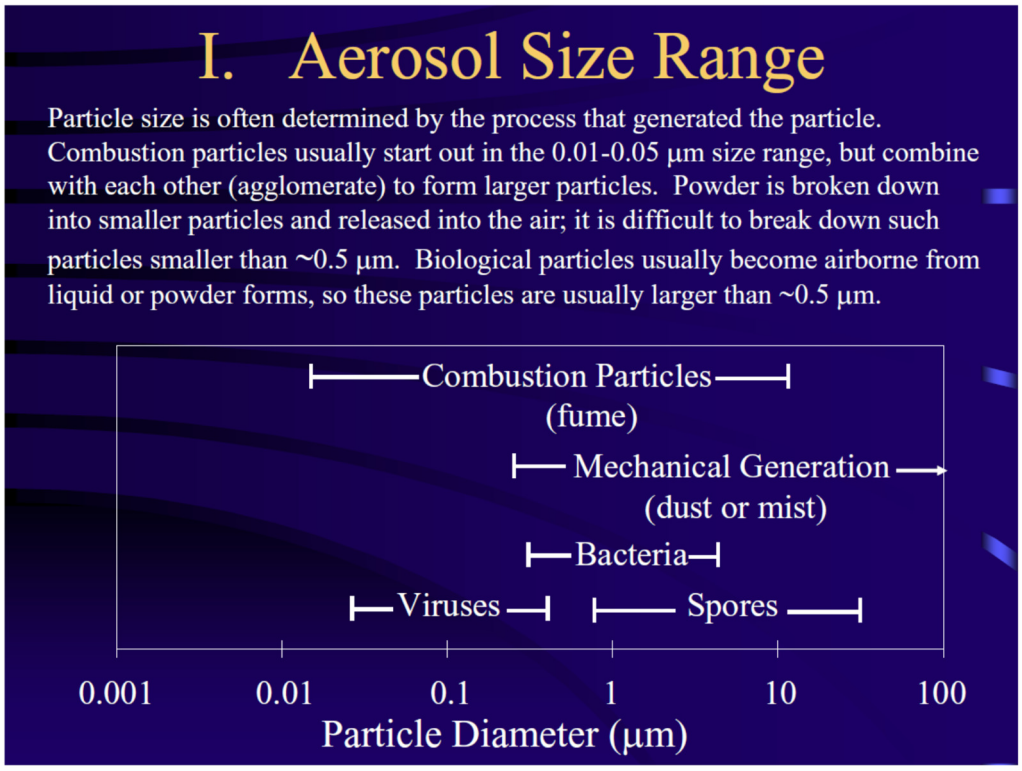
Spraying is an effective manner to disperse a disinfectant on a surface. This is not recommended when the turnaround time between calls in insufficient to allow the decontaminated surface to dry completely after wiping it with clean water as described above[13]. The volume of disinfectant dispersed in spraying is greater than either a wipe down or fogging process. Accordingly, surfaces such as restraint webbing may remain wet after repeated applications.

Spraying disinfectant is viable when a concentrated innate cleaning is indicated. Usually the ambulance will be out of service for at least 60 minutes AFTER following a protocol for spraying disinfectant.

[12] Appendix B
[13] Most disinfectants require a through wipe down of clean water after application. Failure to do so may result in damage to the surface it was applied to.

Option #3
Fogging of Disinfectant

The most effective method of disinfecting an ambulance is by fogging or reducing a disinfectant into an aerosol that has a particle size from 4 to 10 µm. An aerosol (abbreviation of "aero-solution") is a suspension of fine liquid droplets in air or another gas. Aerosols can be natural or anthropogenic. Examples of natural aerosols are fog, mist, dust, forest exudates and geyser steam. Examples of anthropogenic aerosols are particulate air pollutants and smoke. The liquid or solid particles have diameters typically less than **10 µm**; larger particles with a significant settling speed make the mixture a suspension, but the distinction is not clear-cut. In general conversation, aerosol usually refers to an aerosol spray that delivers a consumer product from a can or similar container. Other technological applications of aerosols include dispersal of disinfectants, medical treatment of respiratory illnesses, and combustion technology. Diseases can also spread by means of small droplets in the breath, also called aerosols (or sometimes bioaerosols).



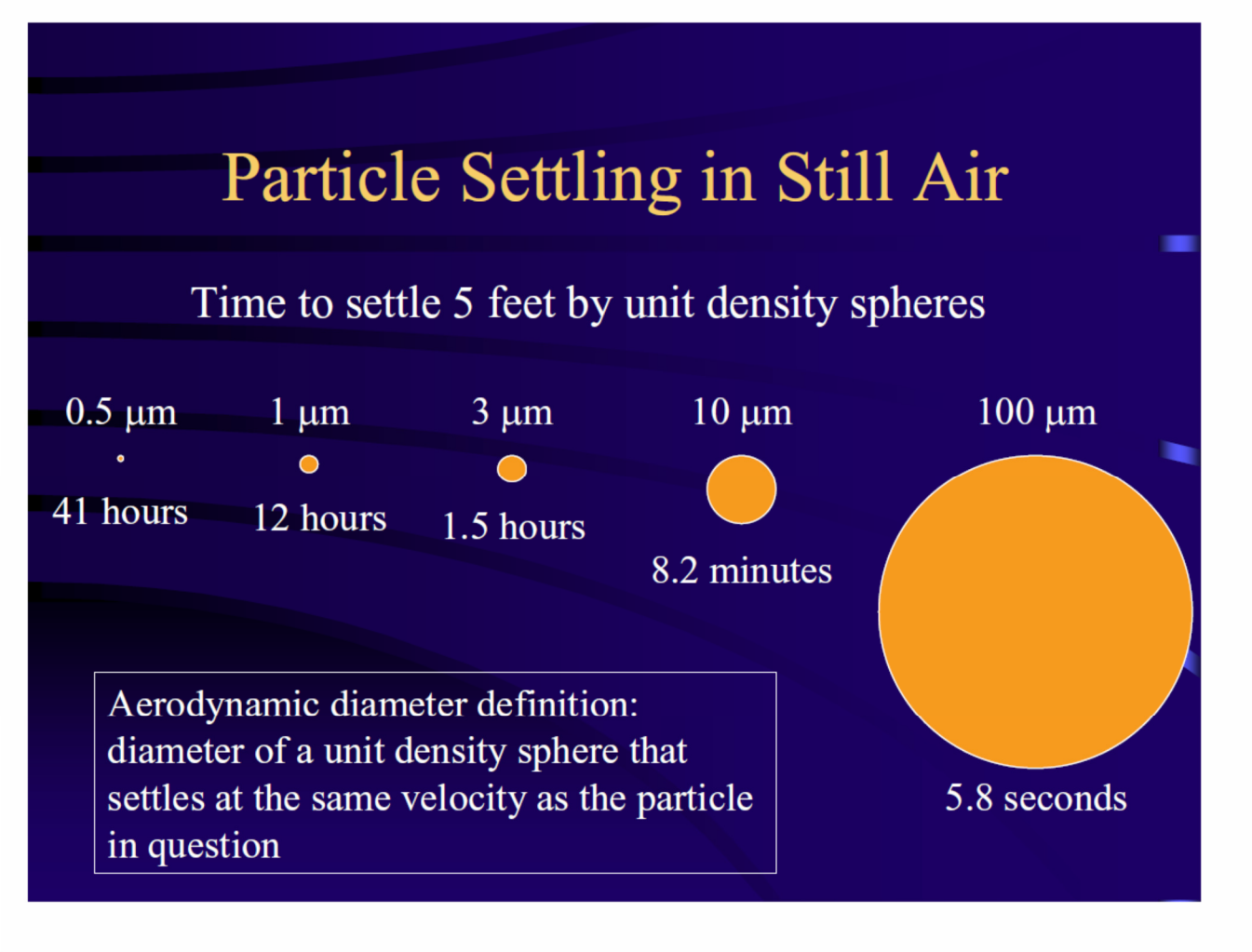
In general, the smaller and lighter a particle is, the longer it will stay in the air. Larger particles tend to settle to the ground by gravity in a matter of hours whereas the smallest particles (less than 1 micrometer) can stay in the atmosphere for weeks and are mostly removed by precipitation.

The basic idea of making an aerosol is very simple: A fluid (disinfectant) is stored under **high pressure** which is used to propel the disinfectant fluid out of a container . To understand how this works, you need to know a little about fluids and fluid pressure.

In this methodology, you pour in the liquid product (disinfectant), seal the tank, and then pump a gaseous propellant (air) under high pressure into the holding tank.. The gas is pumped in at high-pressure, so it pushes down on the liquid product with a good amount of force. When the valve is open, the pressure on the disinfectant is instantly reduced. Particles break free, forming a gas layer at the top of the tank. This pressurized gas layer pushes the disinfectant up the tube to the nozzle. When the liquid flows through the nozzle, the disinfectant rapidly expands into gas. This action helps to atomize the product, forming an extremely fine spray. In other designs, the evaporating disinfectant forms bubbles in the product, creating a foam. The consistency of the expelled product depends on several factors, including:

- The chemical makeup of the propellant
- The ratio of high pressure air to product
- The high pressure level
- The size and shape of the valve system

In context physics terms, the difference between liquid and aerosol is that **liquid** is (physics) a substance that is flowing, and keeping no shape, such as water; a substance of which the molecules, while not tending to separate from one another like those of a gas, readily change their relative position, and which therefore retains no definite shape, except that determined by the containing receptacle; an inelastic fluid while **aerosol** is (physics) a colloidal system in which the dispersed phase is composed of either solid or liquid particles and in which the dispersal medium is some gas, usually air. As nouns, the difference between liquid and aerosol is that liquid is (physics) a substance that is flowing, and keeping no shape, such as water; a substance of which the molecules, while not tending to separate from one another like those of a gas, readily change their relative position, and which therefore retains no definite shape, except that determined by the containing receptacle; an inelastic fluid while aerosol is a gaseous or airborne cloud of particulate matter, either as a solid, liquid, or gas. As an adjective, liquid is flowing freely like water; fluid; not solid and not gaseous; composed of particles that move freely among each other on the slightest pressure.



There are three primary areas that have a significant negative bearing on using this process:

1. An ambulance must be out of service for at least 90 minutes to properly apply a disinfectant by the fogging method
    a. The vehicle must be cleaned, as described above prior to fogging (30 minutes). The fogging process may take 60 minutes to do properly which includes wiping down with clean water (see Footnote 13).
2. The cost of equipment to perform the fogging process can cost up to $20,000,00 which will add to operating expenses. It is noted that one Fogging machine can be utilized for multiple vehicles (only one vehicle can be disinfected at a time).
3. The cost is determined by the equipment accurately and consistently addressing:
    - the ratio of high pressure air to product
    - The high pressure level
    - The size and shape of the valve system

Less expensive equipment will be less likely to consistently address these areas causing unsatisfactory application of the selected disinfectant.

It is most important to understand and comply with the requirement that **ANY** disinfectant utilized to disinfect against COVID-19 must be listed on the *List N: Disinfectants for use Against SARS-CoV-2*[14]. All products on this list meet EPA's criteria for use against SARS-CoV-2, the virus that causes COVID-19.

It is of utmost importance that manufacturers instructions are precisely followed for the disinfectant selected. NOT ALL disinfectants can be used in an Aerosol applicator as they are intended for wipe down and/or spraying only. Always obtain and gain knowledge of applicable Safety Data Sheets (SDS) before use of any disinfectant used.

[14] https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

REFERENCES

- For the most current information about COVID-19, including up-to-date guidance documents and related materials, visit www.CDC.gov.
- Lists of EPA-registered disinfectants can be found at http://www.epa.gov/oppad001/chemregindex.htm.
- Information on Federal Emergency Medical Services programs can be found at http://www.ems.gov
- *CCDC Guidelines for Ambulance Decontamination Guidelines* www.CDC.gov
- OSHA Instruction CPL 2-2.69 Dated: November 27, 2001 *Enforcement Procedures for the Occupational Exposure to Bloodborne Pathogens*
- *Guide for the Selection of Chemical, Biological, Radiological, and Nuclear Decontamination Equipment for Emergency First Responders****;*** Preparedness Directorate Office of Grants and Training; Guide 103–06; March 2007; 2nd Edition
- U.S. Department of Justice; Office of Justice Programs; National Institute of Justice; Law Enforcement and Corrections Standards and Testing Program*; Guide for the Selection of Chemical and Biological Decontamination Equipment for Emergency First Responders*; NIJ Guide 103–00; Volume I; October 2001
- Government of Australia, Department of Defence, Defence Science and Technology; *Vaporous Decontamination Methods: Potential Uses and Research Priorities for Chemical and Biological Contamination Control;* Andrew M. McAnoy*;* Human Protection and Performance Division; Defence Science and Technology Organisation; DSTO-GD-0465; Abstract
- *Gram-negative Bacteria Infections*; Centers for Disease Control and Prevention

APPENDIX A

Biohazard Waste Procedures

All Emergency Vehicle Operational organizations must maintain a relationship with an approved Bio Hazardous waste organization to dispose of Bio Hazardous materials in their managed waste stream that is a controlled and regulated system.

All bio-hazards are to be placed in appropriate containers as specified in OSHA Standard 29 CFR 1910.1030, *Occupational Exposure to Bloodborne Pathogens* and OSHA Instruction CPL 2.103*, Field Inspection Reference Manual.* Specific sections of the standard that individuals involved in decontamination and cleaning must be aware of and understand are:

- Engineering and Work Practice Controls—1910.1030(d)(2)
- Personal Protective Equipment --1910.1030(d)(3)(i)
- Housekeeping—1910.1030 (d)(4)

APPENDIX B

Certification of Decontamination and Cleaning Form

Certification of Decontamination and Cleaning

DATE:	**VEHICLE #:**
CLEANED BY:	**VEHICLE OWNER:**
ARRIVAL DATE:	**FINISH DATE:**
INSPECTED BY:	

A. INSPECTION- List all items found that may or are potential contamination issues (use additional sheets if required)

1. External Issues:
2. Drivers/Crew Compartment Issues:
3. Patient Care Compartment Issues:

B. PERSONAL PROTECTIVE EQUIPMENT USED IN DECONTAMINATION- Check all that are used

- € Non-sterile latex free gloves.
- € Goggles
- € Tyvek full coverage coveralls[15]
- € Foot Covers
- € Medical grade face mask

C. MATERIAL/CHEMICALS USED IN DECONTAMINATION- Check all that are used

- € Sharps disposal system
- € Fluid absorbent, dust pan and whisk broom
- € Small, medium and Large sealable bags
- € Red Biohazard bags

[15] If the interior of the vehicle does NOT have obvious indications of staining, fluids, dressings or other signs of contamination, the Tyvek coveralls do not have to be worn, however, the foot coverings MUST be worn.

- € Disinfectant cleaning solution (disinfectant can be any disinfectant on the EPA Approval list)
- € Five Gallon bucket/s (clean water use)
- € Synthetic sponges
- € Hand cleaner with a minimum of 60% alcohol
- € Sani Wipes®
- € Clean cloth towels
- € Broom and dustpan

D. HAVE ALL PPE AND MATERIALS/CHEMICALS USED BEEN INSPECTED FOR DEFECTS PRIOR TO USE?

- € YES
- € NO

E. DID YOU MIX A FRESH SOLUTION OF CHEMICAL DECONTAMINATE FOR THIS JOB?

- € YES
- € NO

F. DECONTAMINATION PROCESS- Check all items that were completed

Visible Contamination Identified

- € Sharps Removed
- € Dressings Removed
- € Other Material(s) Removed
- € Fluids diluted with disinfectant cleaning solution (disinfectant can be any disinfectant on the EPA Approval list)
  - € Fluids absorbed with disposable towel (Placed in Red Biohazard Bag)
- € Stains soaked with disinfectant cleaning solution (disinfectant can be any disinfectant on the EPA Approval list)
  - € Stains absorbed with disposable towel (Placed in Red Biohazard Bag)
- € Sweep out and collect debris (Placed in Red Biohazard Bag)

Decontaminated and Rinsed (Patient Care Compartment)

- € Ceiling
- € Front Bulkhead (Including benches, seats, jump seats and restraints)
- € Curb Side Door (If Applicable)
- € Curb Side Bulkhead
- € Curb Side Cabinets (Inside and Outside)
- € Curb Side Horizontal Surfaces (Including benches, seats, jump seats and restraints)
- € Rear Doors including door and door frame and outside door handle
- € Street Side Door (If Applicable)
- € Street Side Bulkhead
- € Street Side Cabinets (Inside and Outside)
- € Street Side Horizontal Surfaces (Including benches, seats, jump seats and restraints)

- € Floor, Including kick plates (Front to Back)

Decontaminated and Rinsed (Driver/Crew Compartment)

- € Driver's Side Door(s) including door and door frame and outside door handle
- € Seats (Including all surfaces, exposed frames, benches, jump seats and restraints)
- € Ceiling
- € All glass surfaces
- € Steering wheel and column
- € Dash Board
- € Instrument Panel and Vertical Surfaces including Glove Box
- € Center Console including communication (radio/microphone(s))and light/warning equipment
- € Control Panels
- € Passenger Side Door(s) including door and door frame and outside door handle

H. PPE AND PERSONAL CLOTHING USED IN DECONTAMINATION- Check all that are used

- € Remove Tyvek Coveralls (if applicable), Foot Covers , gloves and face mask and place in Red Biohazard Bag
- € Wipe down footwear with Sani Wipes (including bottom of footwear
- € If personal clothing touched contaminated surfaces, change and have cleaned commercially
- € Wash hands and any exposed skin in warm water and soap, use Hand Sanitizer as follow-up

K. CLEANING PROCESS- Check all items that were completed

- € Mix solution of Dawn© Detergent and water and have fresh rinse water and separate synthetic sponges for washing and rinsing

Cleaned and Rinsed (Patient Care Compartment)

- € Ceiling
- € Front Bulkhead (Including benches, seats, jump seats and restraints)
- € Curb Side Door (If Applicable)
- € Curb Side Bulkhead
- € Curb Side Cabinets (Inside and Outside)
- € Curb Side Horizontal Surfaces (Including benches, seats, jump seats and restraints)
- € Rear Doors including door and door frame and outside door handle
- € Street Side Door (If Applicable)
- € Street Side Bulkhead
- € Street Side Cabinets (Inside and Outside)
- € Street Side Horizontal Surfaces (Including benches, seats, jump seats and restraints)
- € Floor, Including kick plates (Front to Back)

Cleaned and Rinsed (Driver/Crew Compartment)

- € Driver's Side Door(s) including door and door frame and outside door handle
- € Seats (Including all surfaces, exposed frames, benches, jump seats and restraints)
- € Ceiling
- € All glass surfaces
- € Steering wheel and column
- € Dash Board
- € Instrument Panel and Vertical Surfaces including Glove Box
- € Center Console including communication (radio/microphone(s))and light/warning equipment
- € Control Panels
- € Passenger Side Door(s) including door and door frame and outside door handle
- € Floor including all mats, brake pedal, accelerator pedal, etc.

I. PERSONAL PROTECTION EQUIPMENT USED IN CLEANING- Check all that are used

- € Non-sterile latex free gloves.
- € Goggles

J. MATERIALS/CHEMICALS USED IN CLEANING- Check all that are used

- € Towels
- € 5 Gallon buckets
- € Synthetic sponges
- € Hand cleaner
- € Sani Wipes®
- € Towels
- € Broom and dustpan
- € Dawn Dishwashing Detergent
- € Disinfectant cleaning solution (disinfectant can be any disinfectant on the N List EPA Approval list)

L. DISPOSAL OF BIOHAZARD AND/OR CONTAMINATED MATERIAL PROCESS- Check all items that were completed

- € Dispose Decontamination Solution and Cleaning Solution in waste water drain
- € Wash all sponges and wipe down towels in warm soap and water, rinse, air dry
- € Take used Red Biohazard Bags to an approved Bio-Hazard transfer point or storage area for proper disposal
- € After ensuring items to be disposed have been decontaminated and cleaned, dispose of as regular solid waste in appropriate waste receptacle

- € Wash hands with warm water and soap, follow-up with 60% alcohol hand sanitizer

M. CERTIFCATION

I hereby certify that I have personally (or was the Team Leader) completed all the items contained in this checklist in conformance with the *Policy And Procedure For The Decontamination And Cleaning Of In-Service Ambulances*.

Printed Name	Signature

Date Completed:_____

THIS FORM MUST BE RETAINED WITH THE APPLICABLE VEHICLE FILES FOR A MINIMUM OF THREE YEARS WHEN WORK IS COMPLETED