

UVAIRx Test Report for EMS Ambulance

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Abstract:

This test was conducted to specifically address the effect UVAIRx advanced disinfection technology has on the environment of an emergency vehicle located in Connecticut. Results of this test would be expected to be standard across any type of emergency vehicle. The vehicle was sanitized per normal procedures of the EMS station before the tests were conducted.

Pathogens are of great concern in this environment where sick or injured people are transported to hospitals, clinics or other treatment facilities via ambulances. The ambulance was sterilized per procedure before testing began. Before installing UVAIRx, eight (8) different areas of the emergency vehicle were tested resulting in the detection of ninety eight (98) colony forming units (CFUs) of pathogens. It was noted that the vehicle was very clean; however, very distinct and unpleasant odors were present in the vehicle prior to testing.

The tests were run with swabs being taken in eight (8) different areas of the emergency vehicle: the steering wheel, the front passenger seat, the Lucas Pad (defibrillator), the top rail of the passenger window, the "first in" bag, the blood pressure cuff, the Gurney handle and the Gurney mattress and belt. The 'after' swab tests were taken in immediately adjacent areas to the 'before' tests a week after installing the Ux105, which was strapped in the fire extinguisher location. The emergency vehicle was not used for the week the Ux105 was installed, though no one is sure that it was not opened or if the Gurney was used or not. Please note that the pathogens detected before on the Gurney handle were primarily *Alternaria* and after primarily *Aspergillus*.

Results were very positive for the use of the UVAIRx advanced disinfection system in this application. The CFUs detected before use of UVAIRx was ninety eight (98). They consisted of *Alternaria* (45), *Curvularia* (5), *Aspergillus* (32), and *Penicillium* (16). The total CFUs being reduced from ninety eight (98) to twenty six (26). The after CFUs consisted only of *Aspergillus* and *Penicillium*. Thirteen (13) of the twenty six (26) CFUs were on the Gurney handle. The original 13 were 10 *Alternaria* and four *Penicillium*. The after test results were three *Alternaria*, nine *Aspergillus* and one *Penicillium* on the Gurney handle. The decrease in *Alternaria* may be in line with what could be expected, as is the *Penicillium*, which is prevalent in environments such as an ambulance. The *Aspergillus*, which was not present in the before testing was not expected. Determination needs to be made as to why this is the case. Reasons could be the Gurney was used during the test period, the doors were opened prior to the after swab being taken or the handle was touched at some point prior to the after swab being taken. No one is sure that the Gurney was not used during the test period. No one is sure the Gurney handle was not touched. The thought is that the ambulance rear doors were opened before the after testing was done, resulting in the handles being exposed to pathogens from the station. It is evident that some differences occurred as the pathogens changed dramatically. Subsequent to the UVAIRx installation, there were no odors present.

Overall, *UVAIRx advanced disinfection technology showed conclusive positive results for emergency vehicles, specifically in being able to disinfect and protect patients and staff from pathogens.* It was proved that even after sanitizing the vehicle, pathogens were found and UVAIRx made a significant impact. If UVAIRx were installed, further monitoring (quarterly) by UVAIRx would continue the research into emergency vehicles, but testing to date shows results for the *UVAIRx advanced disinfection system for this application to be effective.*

Purpose:

The purpose of these tests and this report was to help evaluate use of UVAIRx technology in an emergency vehicle, evaluate safety, and show UVAIRx advanced disinfection techniques in emergency vehicles. The goal of this report was to address any previously unanswered questions about the UVAIRx process in this, and similar environments, such as:

- Does UVAIRx technology have the capability to address bacterial/viral and mold concerns in an emergency vehicle?
- Does UVAIRx technology have any impact on odors that may be present?
- What areas are of highest concern in this environment and how may they be addressed?

Setup:

Swabs were taken before and after in eight (8) spots around the vehicle. Swabs were generally in a 3" square area for a 30 second period. All swab areas were marked with tape, photographed and annotated to ensure similar test areas. *All swabs were evaluated by an independent, third-party source (EnviroScreen) to ensure unbiased results.* All swabs were taken with EMS staff present and observing swabs for consistent collection procedures.

Results:

Test Location	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
	Steering Wheel	Front Passenger Seat	Lucas Pad (Defib)	Top Rail of Passenger Side Window	First in Bag	Blood Pressure Cuff	Gurney Handle	Gurney Mattress & Pad
Result								
Before CFUs	2	7	0	39	19	1	14	16
After CFUs	0	3	0	5	1	2	13	2
Difference	(2)	(4)	0	(34)	(18)	1	(1)	(14)
Notes							Requires Investigation	

Analysis:

One UVAIRx 105 stand-alone unit was installed in the ambulance by strapping it into the area where the fire extinguisher was located. The ambulance had been sanitized per procedure prior to UVAIRx testing.

Pathogens: *Results were extremely positive, showing significant reduction on all samples except the Gurney handle. It is suspected that the back doors of the vehicle were opened prior to the after swab being taken resulting in the disparities noted in the testing. As was expected, the ambulance contamination was low to begin with since it had just been disinfected, but the residual pathogens were largely destroyed by UVAIRx.* The total pathogens detected before installation of UVAIRx was ninety eight (98) and after twenty six (26), thirteen (13) of which were on the Gurney handle and nine of which were Aspergillus, none of which were present before. UVAIRx believes we can devise a plan to treat the Gurney handles differently if necessary. After treatment with UVAIRx, the pathogens were for all practical purposes destroyed.

Samples 1 (Steering Wheel):

This test site was the Steering Wheel of the vehicle. Only two CFUs (Aspergillus) were detected and they were both destroyed.

Sample 2 (Front Passenger Seat):

This sample was taken on the surface of the seat. Seven CFUs (Aspergillus) were detected before UVAIRx installation and three CFUs after.

Sample 3 (Lucas Pad):

No pathogens were detected before or after UVAIRx testing.

Sample 4 (Top Rail Starboard Window):

The swab was taken above the window of the passenger seat. Thirty nine (39) CFUs (35 Alternaria) were detected before and zero (0) after. There were five CFUs of Aspergillus detected after.

Sample 5 (First in Bag):

Nineteen (19) CFUs of Aspergillus were detected before and one after.

Sample 6 (Blood Pressure Cuff):

One CFU of Aspergillus was detected before and two after.

Sample 7 (Stretcher Handle):

Ten CFUs of Alternaria were detected before and three after. Four CFUs of Penicillium were detected before and one after. Nine CFUs of Aspergillus were detected after and none before.

Sample 8 (Gurney Mattress and Belt):

Five CFUs of Curvularia were detected before and zero (0) after. Two CFUs of Penicillium were detected after.

Overall Analysis:

In entirety, the results of this set of tests is very positive showing UVAIRx's viability to augment treatment procedures in emergency vehicles. UVAIRx treatment destroyed the most concerning pathogens present. For instance, on the Gurney Handle, there were Ten (10) CFUs of Alternaria before testing and none after, though there were nine CFUs of Aspergillus after. Overall, there were 98 pathogens before and 26 after, 13 of which were Aspergillus on the Gurney Handle. Since it could not be verified that the gurney handle had been properly isolated during testing, if the Aspergillus were discounted, there were only 13 pathogens after. Odors were reduced significantly to nondetectable levels, also, providing a more pleasant and safe environment. UVAIRx was successful creating an added layer of protection over the current sterilization procedures against pathogens. UVAIRx is always concerned about transport of patients who may bring pathogens along with them. The UVAIRx technology provides protection to the staff operating the vehicle. UVAIRx provides 24/7 protection, providing a residual effect against pathogens. Since UVAIRx destroys pathogens in the air as well as on surfaces, crews are protected against airborne infection from pathogens such as influenza and even TB. If UVAIRx is installed, further evaluation will be conducted, and updates to this document will be periodically added as the space is monitored

(quarterly) in the future; however, initial results are very positive for the UVAIRx disinfection technology's ability to improve and protect the industry.

Conclusion:

UVAIRx advanced disinfection system was shown to cause a significant reduction in pathogens during this testing. UVAIRx recommends no changes in the procedures EMS currently uses. No harmful side effects were observed in conducting the tests. Overall, the tests in this environment were successful, and no further testing is required, but implementation of UVAIRx technology is recommended to mitigate any concern regarding transport of infected patients possibly causing infections for crew members. UVAIRx advanced disinfection technology destroys pathogens in the air, on surfaces and in cracks and crevices, wherever air may enter.

It is also recommended that the entire station be protected against pathogens, also. It is very likely that the *Aspergillus* detected on the Gurney handle came from the station environment. Diseases known as Aspergillosis are caused by *Aspergillus*:

Pulmonary aspergillosis

Aspergillosis is the group of diseases caused by *Aspergillus*. The most common subtype among paranasal sinus infections associated with aspergillosis is *A. fumigatus*. The symptoms include fever, cough, chest pain, or breathlessness, which also occur in many other illnesses, so diagnosis can be difficult. Usually, only patients with already weakened immune systems or who suffer other lung conditions are susceptible.

In humans, the major forms of disease are:

- Allergic bronchopulmonary aspergillosis, which affects patients with respiratory diseases such as asthma, cystic fibrosis, and sinusitis
- Acute invasive aspergillosis, a form that grows into surrounding tissue, more common in those with weakened immune systems such as AIDS or chemotherapy patients
- Disseminated invasive aspergillosis, an infection spread widely through the body
- Aspergilloma, a "fungus ball" that can form within cavities such as the lung

It is recommended that the station be tested for the presence of pathogens and UVAIRx be installed if UVAIRx were installed in the emergency vehicles. Installation in the base station will avoid contamination from the base station being transferred to the emergency vehicles and vice versa. One common problem in nursing homes is similar to this in that nursing or assisted living patients are transferred to hospitals and take with them issues from the nursing home to the hospital. When they leave the hospital, they take issues from the hospital to the nursing facility. Transport crews suffer the same risks both ways. Pathogens such as *C. diff* and norovirus are prevalent. Others such as MRSA and TB are not uncommon.

According to Jean Fleming, RN, MPM, CIC, emergency medical systems teams are constantly faced with challenges of preventing infection transmission. The emergence of antimicrobial-resistant microbes (e.g., healthcare-acquired and community-acquired methicillin-resistant *Staphylococcus aureus* [MRSA], vancomycin-resistant *Enterococcus* [VRE] and multidrug-resistant Gram-negative bacilli), along with growing concern regarding the spread of *Clostridia difficile* bacteria are problems facing all healthcare providers. A major challenge for EMS is the broad range of potentially transmissible infections, including the above pathogens and others that may be recognized or unrecognized when transporting patients. The UVAIRx advanced disinfection system was designed to mitigate such issues, operating 24/7, 365 and destroying pathogens in the air, on surfaces and in cracks and crevices, wherever air may enter, posing a great adjunct to current disinfection procedures.