Effectiveness and Safety of Ultraviolet Germicidal Irradiation Lamps Used for Disinfecting Surfaces Contaminated with the Ebola Virus

Technical Information Paper No. 24-001-1114

1. Purpose. To provide information on the usefulness and limitations of Ultraviolet Germicidal Irradiation (UVGI) lamps used for disinfecting surfaces contaminated with the Ebola virus, and to provide guidance on the safe use of these lamps.

2. Facts.

a. UVGI Lamps for Disinfection—Effectiveness and Limitations.

(1) The recent spread of the Ebola virus has renewed interest in UVGI lamps for disinfection in general, and UV surface disinfection in particular. A published study by Army scientists in 2011 demonstrated that UVGI was effective at disinfecting surfaces contaminated with Ebola and other viruses.

(2) UV radiation was first used for disinfecting surfaces in 1877, for water in 1910, and for air in 1935. Examples of UVGI lamps for air and surface disinfection are shown in Figures 1-3.

(3) Lamp technologies include continuously emitting low- and high-pressure mercury lamps, and pulsed xenon arc lamps. Studies have shown that these technologies—continuously emitting vs. pulsed—are comparably effective, though pulsed sources may be more practical if rapid disinfection is required.

(4) While UVGI is an excellent surface disinfectant, it does not penetrate surfaces and cannot disinfect soiled surfaces. The inability of the UV radiation to reach nooks and crannies of surfaces or to penetrate coverings like dust and other matter may negatively impact disinfection.

(5) A published study by Army scientists in 2005 stated that UVGI lamps could have some effect on the spread of infectious respiratory diseases, but there was inadequate evidence to support recommending their wide use.

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Updated: 24 November 2014

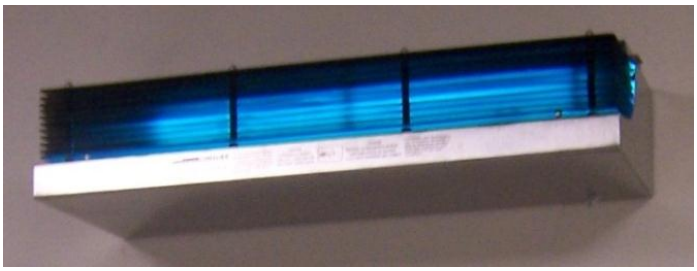

Figure 1. Upper Room UVGI Lamp for Air Disinfection

Figures 2-3. UVGI Lamps for Disinfecting Surfaces in Unoccupied Rooms (left) and for Disinfecting Tabletops and/or Floor Surfaces (right)

b. UVGI Lamp Safety.

(1) UVGI lamp emissions can pose a workplace safety and health hazard if the lamps are improperly used or installed. However, these lamps can be used safely if workers are informed regarding the hazards and follow appropriate precautions.

(2) Low- and high-pressure mercury UVGI lamps emit UV radiation that poses a hazard to the cornea and skin. Pulsed xenon arc UVGI lamps emit UV and visible radiation that poses a hazard to the retina, cornea, and skin. The UV emissions from these lamps are not considered a significant risk for cataract or cancer.

(3) Some types of UVGI lamps generate ozone. This can pose a workplace hazard, and only “ozone free” lamps made with doped quartz should be used for surface disinfection. Also, low- and high-pressure mercury lamps and pulsed xenon arc lamps should be disposed of in accordance with local regulations.

(4) To ensure UVGI lamps’ safe use, persons using UVGI lamps for surface disinfection should do the following: They should place temporary warning signs at access points to the area being disinfected. They should either vacate the area during disinfection, or place opaque barriers between the UVGI lamp and room occupants. If these areas must be occupied during disinfection, and exposures cannot be avoided (e.g. if using a handheld disinfecting UVGI “wand”), then personal protective equipment should be used. Those who may be exposed to the emissions from low- and high-pressure mercury UVGI lamps should wear plastic or glass face shields to protect the eyes and face, nitrile gloves or work gloves to protect the hands, and full-coverage clothing with tightly-woven fabrics to protect other exposed skin. Those who may view emissions from pulsed xenon arc UVGI lamps should also wear welding or cutting goggles to protect the eyes. Sunscreen lotions are ineffective for protecting skin against UV radiation produced by UVGI lamps.

c. Questions about the optical radiation hazards and protective measures for specific types of UVGI lamps should be directed to the Army Institute of Public Health (AIPH) Nonionizing Radiation Program at (410) 436-3932, or e-mail army.laser.safety@us.army.mil.

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Dated: November 2014