UVC DISINFECTION:
Best Practices for the Swine Industry

Swine Health Information Center

WHAT IS UV LIGHT?

UV light is a type of electromagnetic energy that is invisible to humans. There are four categories based on wavelength range. In particular, UVC light (200–280 nm) is useful for disinfection in swine field settings. Inactivation of microorganisms by UVC is a function of the dose of radiation, which is determined by the intensity (irradiance) of radiation and time.

UVC inactivation varies by material and microorganism type. The peak absorption of UV light energy is 280 nm for proteins and 260-265 nm for DNA/RNA. Low-pressure mercury (Hg) bulbs (254 nm) are commonly used and quite effective for most microorganisms. Other UV lamp types are available, but are either more hazardous (e.g., medium- and high-pressure Hg) or more costly (e.g., LED).

UVC APPLICATIONS

UVC germicidal chambers are used in swine setting to reduce the microbial load on surface items. Chambers, which may be commercial or homemade, are usually constructed so that items to be disinfected are passed through from the dirty side (entry/hallway) to the clean side (office/break room).

UVC germicidal chambers are mostly used for small to medium items like lunch boxes, cell phones, small tools, and medications. Food and semen bags can also be passed through the chamber without negative effects. Repeat exposure of plastics to UVC light may lead to a change in the color or smell of the object. Paper and cardboard cannot be disinfected in a UVC germicidal chamber. Larger UVC chambers or UVC rooms can be built for larger items.

Follow these four steps to implement UVC disinfection:

- Set up the UVC germicidal chamber
- Estimate the necessary UVC dose
- Use and maintain the UVC germicidal chamber properly
- Train staff on safety precautions

SHIC UVC BEST PRACTICES WHITE PAPER

www.swinehealth.org/UVCwhitepaper

STEP 1:

SET UP UVC CHAMBER

The UVC Germicidal Chamber is composed of four parts.

Chamber: contains the UV lamp and sleeve; must be lined with a reflective surface like stainless steel or aluminum to enhance the effect of UVC light.

UVC lamps: select to fit producer needs; low-pressure germicidal UVC commonly used. Options may include power consumption (watts), bulb size (diameter), ozone level, base type, connection type, and length of lamp.

Quartz sleeve for UVC lamp: optional to seal and protect the UVC lamp.

Controller unit (ballast): used to adjust voltage or current output to the UVC lamp.

STEP 2:

ESTIMATE NECESSARY UVC DOSE

Published information on UV dose is available only for PRRSV, PEDV, and FMDV. For PRRSV and PEDV, studies showed that the UVC dose required for a 3 log10 reduction was well below the range delivered by a commercially available chamber (150–190 mJ/cm2, BioShift® Pass-Through UV-C Chamber, Once™). For FMDV, the UVC dose required for a 5 log10 reduction was also below the range delivered by a commercially available chamber (150–190 mJ/cm2, BioShift® Pass-Through UV-C Chamber, Once™).

For other swine pathogens, UVC dose must be extrapolated from members of the same genus (bacteria) or family (virus). Most pathogens are inactivated at 190 mJ/cm2, but some require doses greater than 150 mJ/cm2. A significant gap in the literature exists for many swine pathogens.

STEP 3:

USE/MAINTAIN UVC CHAMBER PROPERLY

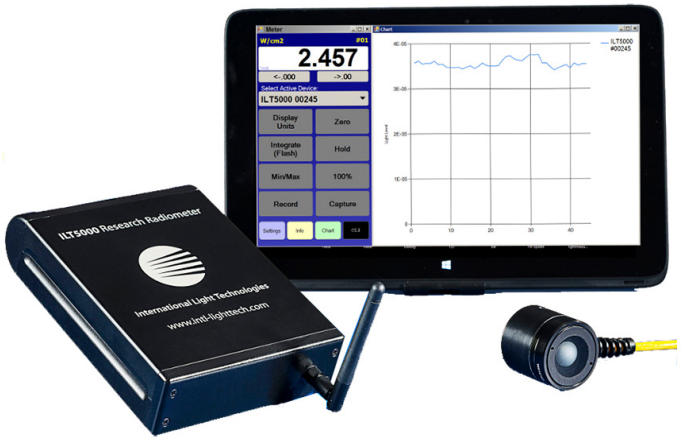
Follow these guidelines when using a UVC germicidal chamber on your farm. Remember, items to be disinfected must have direct exposure to UVC light.

- Remove organic matter (dirt) from items by wiping the surface prior to disinfection,
- Place items in single layer with space between them,
- Check for shadows and adjust item placement/spacing if necessary,
- Do not use secondary containers such as Tupperware or plastic baggies to contain items in the chamber; UVC light cannot penetrate these even if they are transparent,
- Rotate items in the chamber after the first cycle if needed to ensure that all sides are exposed to UVC light, or use a grid shelf, and
- Cycle UV lamps prior to first use for disinfection on cold days to bring bulb energy up.

Maintenance of a UVC germicidal chamber involves cleaning and monitoring. Follow these guidelines to maintain your chamber.

- Clean the chamber interior with a non-abrasive cleaner when dirty,
- Check and clean the UV lamps every three months; make sure to wear gloves and use an alcohol-based disinfectant on a soft cloth or gauze,
- Monitor UVC lamp intensity with a light meter (radiometer); place face-up in chamber for five minutes and record, then place face-down and record a second time in the same spot,
- Change UVC lamps and ballast once per year or after 1000 cycles (minimum), and
- Check intensity after installing new lamps.

In addition, develop a checklist for farm personnel to ensure they know how to operate the chamber. Run time and UVC intensity should be recorded. Item placement within the chamber can be monitored through the window or via cell phone video from within. Regular audits are recommended.



STEP 4:

TRAIN STAFF ON SAFETY PRECAUTIONS

UVC light is mutagenic and carcinogenic; however, UVC germicidal chambers are safe when operated and maintained properly. Follow these recommendations to keep farm personnel safe.

- Install warning labels and train all personnel,
- Do not expose skin or eyes to UVC light; make sure the chamber is completely enclosed,
- Use a radiometer to ensure that UVC light cannot penetrate the chamber windows or seams,
- Connect a hard-wired safety shutoff to doors and latches,
- Discontinue use and contact manufacturer if there is any malfunction in the safety controls, and
- Consider use of PPE including goggles or face shields designed for UV exposure, clothing, and sunblock.

150–190 MJ/CM2
UVC dose at which most swine pathogens are likely to be inactivated

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