

Fact Sheet: Ultraviolet Germicidal Irradiation (UVGI)

What is ultraviolet light and how does it kill bacteria?¹

Ultraviolet (UV) light is like sunlight (in that it is electromagnetic irradiation) except that it has a different wave-length (usually 100-280nm). To our eyes, it looks blue, and if it has a shorter wavelength it is invisible. UV light is responsible for the 'tan' or browning of the skin that we experience with too much sunlight. UV light is effective at killing bacteria, including *M. tuberculosis* by damaging bacterial DNA and preventing bacterial replication. UV light can be produced by low-pressure mercury vapour lamps which are used in commercial ultraviolet germicidal irradiation (UVGI) fittings.

What is the role of upper-air germicidal irradiation in TB infection control?

UVGI is a method of air cleaning but it is not a substitute for other methods of air cleaning, nor can it be used as the only method of TB infection control in a facility. It is best used as an additional protective method to reduce the infectivity of droplet nuclei. UVGI fittings are expensive; good TB infection control can be achieved in resource limited settings without UVGI. UV light kills bacteria when it shines on them for sufficient length of time and with enough intensity (brightness). UV light can damage human skin, and cornea, so UV fittings are designed to allow UV light to shine in the upper room only. UVGI therefore relies on mixing of air from lower to upper room. This means that air circulation must be present where UVGI fittings are installed. Air circulation can be achieved by opening windows and by use of fans. Some UVGI fittings have inbuilt fans to ensure air mixing.

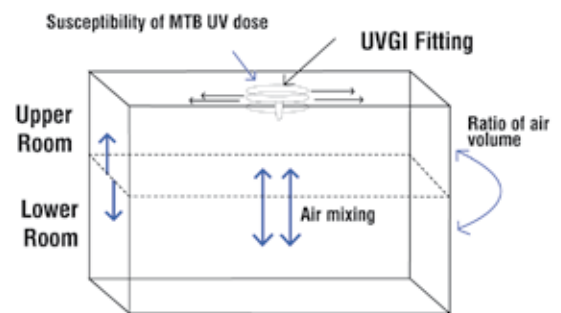
Design of UVGI fittings

Upper-air UVGI fittings are suspended from the ceiling or installed on the walls. UV light is harmful, so shields (disc-shaped louvers) are placed on the fittings to ensure that no UV light is directed downwards.

How many UVGI fittings does my facility need?

Current American guidelines² indicate that one 30W lamp, or two 15W lamps should be used for every 19m² of floor area. Where conditions are crowded, one UVGI fitting for every 7 room occupants should be used.

Figure 1. Factors affecting effectiveness of upper room ultraviolet germicidal irradiation in TB infection control



Maintaining effectiveness of UVGI fittings:²

UV fittings attract dust. Dust reduces the amount of UV light released from the lamp. Therefore regular cleaning of UVGI fittings is necessary. Always be sure to switch off power from the fitting before cleaning. In addition, UV light output of lamps declines with age, so lamps should be replaced at appropriate intervals. Make sure the maintenance of these fittings is included as part of your facility's TB infection control plan. Monitoring of UV intensity and output of the fitting should be conducted. Request the assistance of your public works administrator.

Safety considerations² when using UVGI fittings

Over-exposure to UV light can cause redness of the skin, (erythema), inflammation of the cornea (photokeratitis) and inflammation of the conjunctiva (conjunctivitis). Symptoms of these conditions include a feeling of sand in the eyes, tearing and sensitivity to light. These conditions are reversible. Typically they commence 6-12 hours after exposure. If staff complain of these symptoms, UV light is escaping into the lower part of the room. Either the lamp is poorly positioned, or the UV light is being reflected off shiny surfaces. Consider repositioning the lamp.

Factors affecting the effectiveness of upper airway germicidal irradiation

The effectiveness of the UVGI fitting depends upon (see Figure 1):

The rate of upper-room disinfection, which depends upon

- The dose of UV light delivered to each bacterium
- How sensitive the bacteria are to UV light.

The ratio upper room volume relative to the lower room volume

- Air mixing between the upper and lower room.

Because of these factors, some recommendations can be made about how many fittings to install, and how to improve and maintain the effectiveness of the UVGI fitting. See the box above.

Did you know?

Air MIXING is essential if UVGI is to be effective