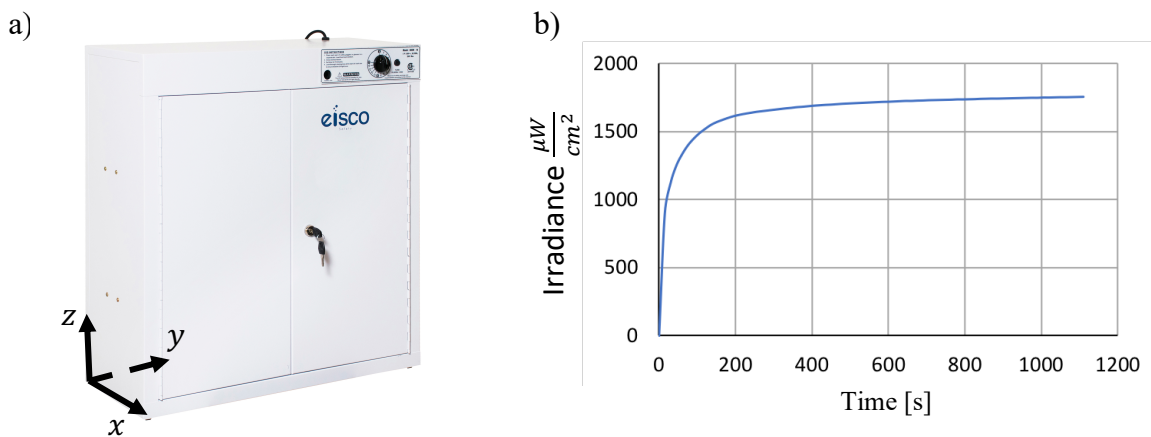


## Goggle Sanitizer (GGSN10) UVC Irradiance & Dosage

**Abstract:** In this white paper, we provide measurements of the UVC irradiance and dose delivered in the Goggle Sanitizer (GGSN10).

### *Irradiance and Dosage Measurements*

The GGSN10 cabinet ships with an internal wire-frame since it is intended to reduce contamination of transparent safety goggles used in scientific laboratories. So that the complexity of shadowing from the wire-frame would not influence our measurements, we first removed the frame. We also chose to use an older, previously used Philips TUV T8 bulb (about 2 years old) rather than a new bulb so that our measurements would provide typical dosage estimates after prolonged use instead of dosage estimates immediately after purchase. A picture of the cabinet is given in Fig. 1(a) along with the coordinate system.



*Figure 1. a) Goggle Sanitizer GGSN10 and measurement coordinate system. b) Irradiance as a function of time in the vertical direction at a distance of 4.5" x 12" from the rear left corner of the cabinet at a distance of 3.5" below the bulb.*

All measurements were taken using a General UV512C Digital UVC Meter. Two sets of measurements were taken. The first set of measurements explore the time dependence of the irradiance. The second set of measurements give the spatial dependence of the irradiance on a vertically oriented detector throughout two horizontal planes at the top and bottom of the cabinet.

### *Time-Dependence*

The cabinet comes with a built-in 15 minute timer; we measured the irradiance in 15 second intervals until the timer expired. Measurements are shown in Fig. 1(b) and were taken 3.5 inches below the bulb in the approximate center of the cabinet, 4.5 inches from the back and 12 inches from the left side of the cabinet when facing the doors. Understanding the time-dependence of the bulb is important because the bulb takes about 3 minutes to achieve 90% of the steady-state brightness as it warms up from room-temperature. Consequently, in a given location in the cabinet, the full 15 min dose after starting at room-temperature as determined by integrating the irradiance measurements is only about 92% of the dose calculated using the steady-state irradiance measurement for that location. Additionally, though the timer actually ran for 18.5 min in total, we base our calculations on a 15 min duration to provide a conservative lower bound on the total dose. In typical practice, when the whole timer duration is used, the total dose will increase from the numbers reported here by about 25%.

### *Spatial-Dependence*

Irradiance measurements on the vertically-oriented detector in the horizontal planes and the associated 15 min dose are given in Fig. 2. Measurements were taken every 3 inches along the width of the cabinet and every 1.5 inches along the depth at a height of 3.4 in (87 mm) below the bulb and 24.4 in (620 mm) below the bulb (1.3 inches or 34 mm above the bottom of the cabinet). Positions are measured in inches from the back left corner of the cabinet. The bulb was allowed to warm up, and then measurements were taken throughout the two horizontal planes. The 15 min dose was determined by multiplying the measured irradiance by 900 seconds and multiplying by 92% to take into account reduced radiation from the bulb as it warms up.

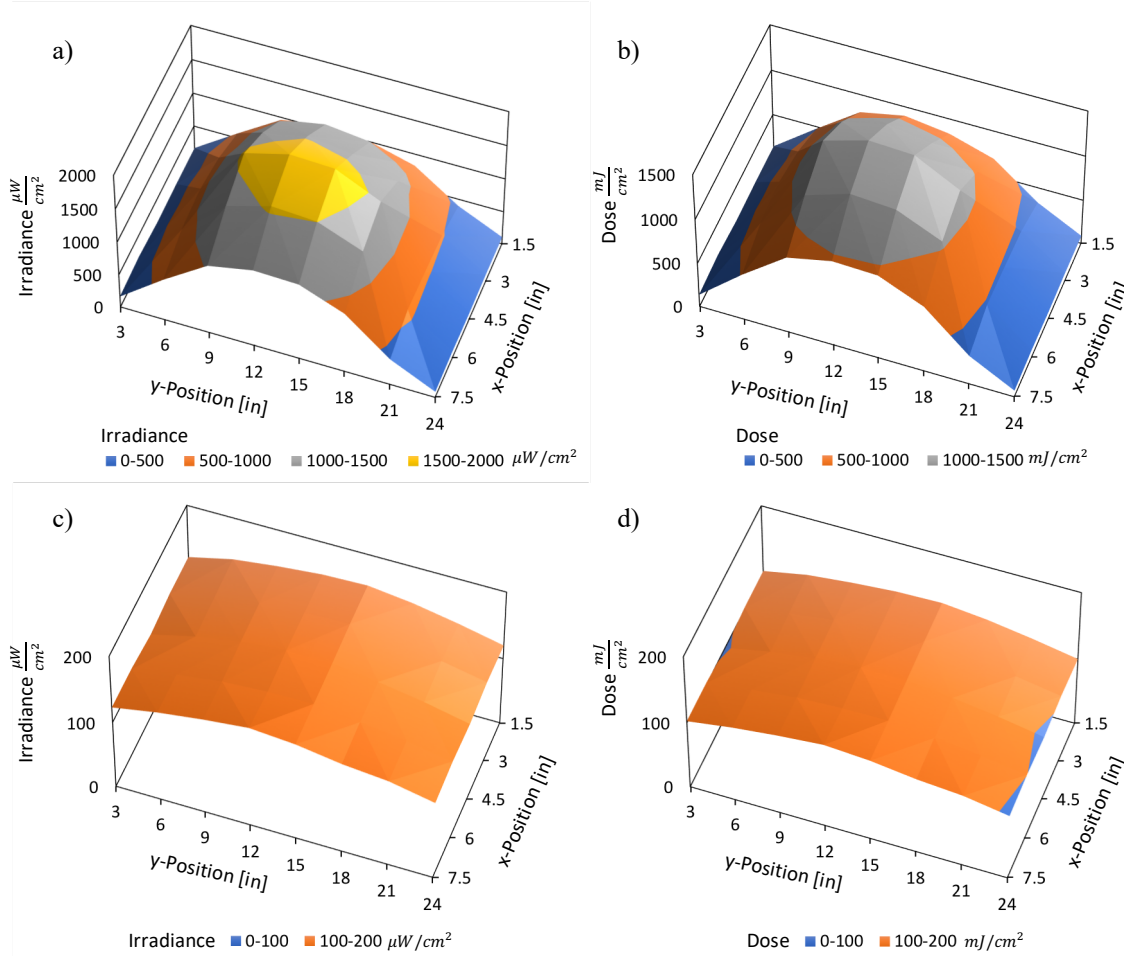


Figure 2. a) Measured irradiance and b) calculated dose in a horizontal plane 3.4" from bulb. c) Measured irradiance and d) calculated dose in a horizontal plane 24.4" from bulb. All measurements taken with detector oriented in the vertical direction with positions measured in inches from the rear left corner of the cabinet.

It is easy to see in Fig. 2(b) that the 15 minute dose exceeds 1 J/cm<sup>2</sup> over a 6" x 9" region and 500 mJ/cm<sup>2</sup> over a 7.5" x 15" region on the horizontal surface located 3.5" below the bulb. Even on the bottom surface, the 15 min dose exceeds 2-5 mJ/cm<sup>2</sup> by a factor of about 20 over the entire region.

We gratefully acknowledge assistance from Steriliz, LLC. in taking the UVC measurements.

**GGSN10 Manufacturer Information:**  
 Electronic Instrumentation  
 12 Mahesh Nagar, Ambala Cantt  
 Haryana, INDIA 133001  
 P: +91.171.400.8595  
 EPA Est. No. 97947-IND-1