

## Taken from ASHRAE Public Article on Disinfection

Note: NM refers to the wavelength of light in nanometers

### *Pulsed Xenon (Pulsed UV)*

- High-powered UV lamps (generally containing xenon gas) used in rapid pulses of intense energy.
- Emits a broad band of visible and ultraviolet wavelengths, with a significant fraction in the UV-C band.
  - Uses significantly higher power outputs than usual UV-C techniques.
  - Inactivates viruses, bacteria and fungi using the same mechanisms as standard UV-C systems.
- Typically used for healthcare surface disinfection, but can be used in HVAC systems for air and surface disinfection.

For more information, see the [FAQ on Germicidal Ultraviolet \(GUV\)](#) published by the Illuminating Engineering Society (IES) Photobiology Committee.

### *405 nm Visible Light*

- Sometimes referred to as a “Near UV,” although not in the UV spectrum.
- Generally integrated into standard room lighting systems.
- Kills bacteria and fungi via a different mechanism than UV-C.
  - Targets and excites naturally-occurring porphyrin molecules inside organisms, creating reactive oxygen species.
  - Reactive oxygen species kill by a mechanism similar to bleach.
- Effectiveness at killing viruses, including SARS-CoV-2, is not as well documented.
- Provides continuous disinfection of air and exposed surfaces in occupied spaces.
- In the [FAQs on Germicidal Ultraviolet \(GUV\)](#), the Illuminating Engineering Society (IES) Photobiology Committee notes that effectiveness is approximately 1000 times less than UV-C and the effective doses are not practical in an occupied environment.

### *Far Ultraviolet*

- Far UV spectrum is 205 to 230 nm.
- Some deactivation of bacteria and viruses at the 207 nm and 222 nm range.
- 222 nm said to effectively penetrate microorganisms 1µm in size and smaller.
- Unable to fully penetrate larger microorganisms.

- UV Dose required to inactivate microorganisms is significantly higher at these wavelengths than in the UV-C range.
- While safety concerns are reduced, can still cause damage to eyes and skin.

For more information, see the [FAQs on Germicidal Ultraviolet \(GUV\)](#) published by the Illuminating Engineering Society (IES) Photobiology Committee.

### *Special Precautions*

- Exposure to UV-C energy can cause eye and skin damage.
  - Photokeratitis (inflammation of the cornea)
  - Keratoconjunctivitis (inflammation of the ocular lining of the eye)
- Symptoms may not be evident until several hours after exposure and may include an abrupt sensation of sand in the eyes, tearing, and eye pain, possibly severe.
  - Symptoms usually appear 6 to 12 hours after UV exposure.
  - Symptoms are fully reversible and resolve within 24 to 48 hours.
- Maintenance workers should receive special training before working on UV-C systems.
- If exposures are likely to exceed safe levels, special personal protective equipment (PPE) is required for exposed eyes and skin.
  - Eyewear that blocks UV-C energy
  - Clothing, suits, or gowns known to be nontransparent to UV-C

### *Summary*

- It is likely, but not yet shown, that COVID19 could be spread through the air.
- Air cleaning can help mitigate disease transmission.
- Options for air cleaning include:
  - HVAC systems
  - In-Room devices
- Technologies that can be effective include:
  - Mechanical Air Filters
  - Electronic Air Filters/Air Cleaners
  - UV-C Systems
  - Other Emerging Technologies
- Care and professional judgement should be taken to understand choices for filtration and air disinfection, pros and cons of each and impact(s) on existing buildings systems.

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