



# RPAMS CCV (Ultraviolet-C) UVC Light Systems

A force multiplier in the fight to protect against COVID-19



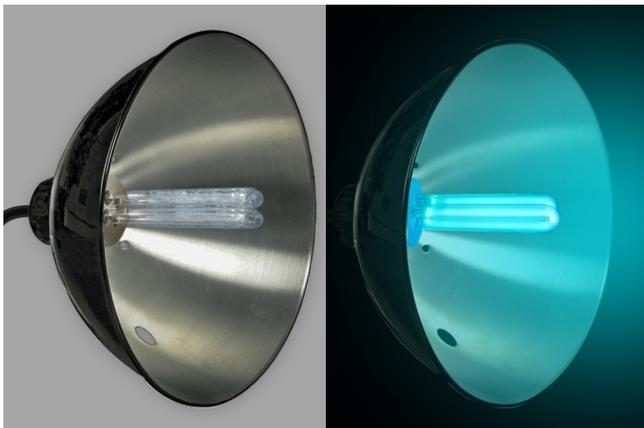
## COMBATting COVID-19

COVID-19 infections can be caused by contact with contaminated surfaces and then touching facial areas (less common than person-to-person, but still an issue). Minimizing this risk is key because COVID-19 virus can live on plastic, steel and other common 'touch' surfaces for days. Normal cleaning and disinfection may leave behind some residual contamination, which UVC can treat suggesting that a multiple disinfectant approach is effective and smart.

### RPAMS CCV CFL GX-23 Hand-Held Lamps



### RPAMS CCV Worklight Stand with Twin 60 Watt LED 265nm Emitters



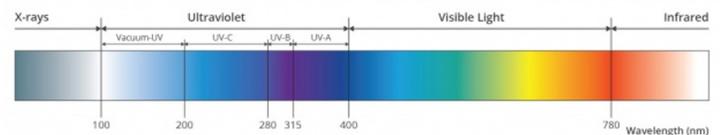
## THE RPAMS WAR ON COVID-19 What the Hell is a Coronavirus?!

Coronaviruses (CoV) are a family of enveloped viruses that were first discovered in the 1960s. Coronaviruses are most commonly found in animals, particularly camels and bats, and are not typically transmitted between animals and humans. Yet 6 strains of coronavirus were previously found to be capable of passing from animals to humans, the most well-known being SARS-CoV (Severe Acute Respiratory Syndrome Coronavirus) in 2003 and MERS-CoV (Middle East Respiratory Syndrome Coronavirus) in 2012. COVID-19 is caused by a coronavirus, which was initially named 2019-novel Coronavirus, or 2019-nCoV which was then renamed SARS-CoV-2. It was found that this coronavirus was the same species as SARS-CoV, the virus that caused a global outbreak of a respiratory illness in 2003, but a different strain, hence the designation "2".<sup>(1)</sup>

### So What's a Good Effective Means to Counter-Attack Transmission?

At the forefront of the RPAMS goal of developing an impressive arsenal of CCV (Counter COVID) equipment is UVC (UVC) technology.

In order to understand our rationale, one must understand UV light. UV is a form of energy defined as light having specific wavelengths. Wavelength is measured in units of length (which is meter). Since the wavelengths of EM waves are usually very small, fractions of a meter are used - most commonly **nm** (nanometer) or **Å** (Angstrom). Note that 1 nm = 10<sup>-9</sup> meters (or one millionth of a millimeter), 1 Å = 10<sup>-10</sup> meters. UVC is between 100 nanometers (nm, 1 billionth of a meter in length) and 400 nm. (the human eye is sensitive to light between about 400 nm [blue] and 700 nm [red]). UV light is further divided into UV-A, UV-B, and UV-C light. The wavelength of UV-C is 100 to 290 nm.



UVA: 315 nm to 400 nm; UVB: 280 nm to 315 nm; and UVC: 100 nm to 280 nm have the ability to trigger cellular actions - namely, cell proliferation, increased epidermal thickness and enhanced blood flow in the cutaneous capillaries which help facilitate wound debridement.

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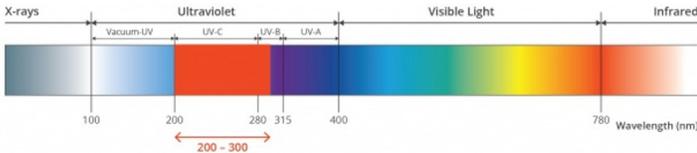
### INFORMATION & DEALER INQUIRIES

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# RPAMS *CCV* (Ultraviolet-C) UVC Light Systems

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In general, germicidal UV-C does not penetrate the earth's atmosphere so it is synthetic. Manmade UV light has long been known for its germicidal killing properties. It has been used to clean equipment and hospital areas.



According to the International Ultraviolet Association:

“The portion of the UV spectrum (the ‘germicidal’ region) that is important for the disinfection is the range that is absorbed by DNA (RNA in some viruses). This germicidal range is approximately 200-300nm.”

UV rays, specifically the germicidal range, has been shown to have bactericidal effects *in vitro*. UVC causes cellular damage by inducing changes in the chemical structure of deoxyribonucleic acid (DNA) chains.

## Building the Arsenal:

RPAMS recognizes that many variations of UVC devices are proliferating the market. Our company focus is to ensure we develop system-oriented equipment based on sound medical studies. Each system has been carefully crafted to include an emitter of effective UVC germicidal spectrum light (250-280nm) at a spectrum well suited for attacking pathogens and supplementing current CDC sanitation methods.

- RPAMS only uses silicon dioxide lenses and properly proportioned unmodified polymers best suited for optimal transmission. Each RPAMS emitter design considers effective UVC transmissivity. We use only those material shown to have minimal UV resistance. We do so because an *in vitro* study showed direct UVC has a bactericidal effect after short exposure (5 seconds) on gram-positive cocci, but when filtered through a transparent plastic sheet, UVC is ineffective. Many so-called UV lights have acrylic lenses which will allow UV light of wavelength greater than 375 nm to pass through the material, but they will not allow UVC germicidal wavelengths (100-290 nm) to pass. The ability

of UVC light to penetrate materials will depend on the chemical composition of the materials.

- The RPAMS UVC portable light systems are designed to be used with other technologies in a multi-barrier approach to ensure that whatever pathogen is not ‘killed’ by one method (say cleaning or sanitizing) is inactivated by UVC. In this way, UVC augment existing processes or reinforce existing protocols exhausted by extraordinary demands due to the current pandemic.
- All RPAMS UVC light emits in the 250-280nm (UVC or the germicidal range) which IUVA provided studies have shown inactivate (i.e. ‘kill’) at least two other coronaviruses that are near-relatives of the COVID-19 virus: 1) SARS-CoV-1 and 2) MERS-CoV.
- The RPAMS UVC lights are intended to be portable for use in numerous applications on multiple surfaces.
- RPAMS UVC systems also include protective glasses for the operator. This protects the user from the potentially damaging rays of UVC. Gloves are highly recommended.
- RPAMS UVC systems also include surface UVC ID tags to visibly measure adequate UVC coverage and best sanitary effect. UVC effectiveness can also be estimated by calculating the UV dose that will be delivered to the microbial population. The UV dose is calculated as follows:

$$\text{UV dose } \mu\text{Ws/cm}^2 = \text{UV intensity } \mu\text{W/cm}^2 \times \text{exposure time (seconds)}$$

- Each RPAMS UVC system also considers the application. As such, RPAMS has developed personal UVC tactical handheld emitters for personal coverage (phones, keyboard, etc), hand-held germicidal mercury lamp drop lights for larger area potable coverage and sustained UVC sanitation, stationary work lights for maximum sanitary coverage and even lamps that will ‘daisy-chain’ for UVC linear exposure in ducting, room-to-room use.

(1) Source: <https://www.cdc.gov/coronavirus/2019-ncov/faq.html>

### References:

Predicted Inactivation of Viruses of Relevance to Biodefense by Solar Radiation  
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Bactericidal Effect of Ultraviolet C (UVC), Direct and Filtered Through Transparent Plastic, on Gram-positive Cocci: An *In Vitro* Study  
<https://www.o-wm.com/content/bactericidal-effect-ultraviolet-c-uv-c-direct-and-filtered-through-transparent-plastic-gram-p>

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