



TECHNICAL BULLETIN

FAQ – THE SCIENCE BEHIND BLUESCIENCE



UV
LED's



KILLS
VIRUSES



NEUTRALISES
ODOURS

Frequently Asked Questions – the Science behind BlueScience

- How effective is BlueScience?
- What data have you got to support its effectiveness?
- Will it kill COVID-19?
- How is BlueScience an air purification tool?
- Will BlueScience produce Ozone?
- Can BlueScience be run continuously?
- What type of air conditioning unit is BlueScience suitable for?
- Have you got any case studies I can reference?

How effective is BlueScience? - the data to support it.

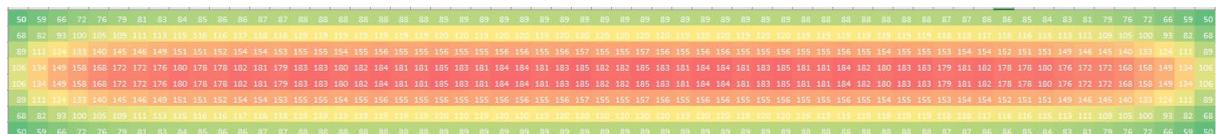
To understand the effectiveness of BlueScience, an industry standard should firstly be set. In 2015 ASHRAE's Handbook HVAC Applications published Chapter 60.8, TC2.9 stating that a minimum irradiation level of 50-100 $\mu\text{W}/\text{cm}^2$ was required for cooling coil applications. This requirement is a minimum threshold across the entire coil surface and forms the basis of which BlueScience is deemed effective.

The second stage of effectiveness is to determine what is being measured. In the application of BlueScience 2 factors are typically being considered.

1. Continuous surface treatment of coil, drain-pan and fan / filters.
2. Treatment or effectiveness of killing pathogens in the moving air flow.

Continuous surface treatment of coil, drain-pan and fan / filters: The standard for UV-c lamps is to mount the lamp at a distance of 12 inches (300mm) from the surface of the coil, in a Mini Split air conditioner the space physically does not lend itself to this distance so we have therefore based our results on the UV-c strip being mounted at a distance of 2 inches (5cm) from the coil surface.

BlueScience when mounted at a distance of 5cm from a coil will irradiate sufficient dosage to meet ASHRAE chapter 60.8 TC2.9. The following illustration is a surface view of the UV-c irradiation against a section of a fan coil measuring 600x80mm:-



A scaled up excel version is available on request, numbers indicates the irradiation level.

RED = +155 $\mu\text{W}/\text{cm}^2$

AMBER = 154 - 105 $\mu\text{W}/\text{cm}^2$

YELLOW = 104 - 90 $\mu\text{W}/\text{cm}^2$

GREEN = 89 - 50 $\mu\text{W}/\text{cm}^2$

In maintaining a $50\mu\text{W}/\text{cm}^2$ or above to the entire surface BlueScience can be deemed efficient for occupant comfort & indoor air quality and will assist in keeping coil surfaces, drain-pans, fans and filters free of organic build up and/or prevent it from returning. (subject to how it is installed)

Treatment or effectiveness of killing pathogens in the moving air flow: To eliminate pathogens in a moving airstream it is not possible for BlueScience to offer a definitive 'kill rate'. Factors such as airspeed through the unit, pathogen type and concentration, size of the unit, air recirculation time within a room, room size or room population are all factors that will massively influence any performance or effectiveness figures quoted. Something as simple as an open window or an older less efficient unit can alter the effectiveness.

To ensure pathogens in a moving airflow are made inactive research suggests the dosage of UV-c would need to be somewhere in the range of $1000 - 10,000 \mu\text{W}/\text{cm}^2$, this level of UV-c being irradiated comes with its own set of safety concerns and professional advice from a qualified expert in this field is advised. No official standard or test method has been formalised for this approach. The higher powered fluorescent strips and bulbs traditionally used retail only for surface treatment.

These calculations do not take into effect any reflectance multipliers which can increase UV-c energy, different material can enhance the UV-c dosage by bouncing off the surface Aluminium for example has a UV-c multiplier of 1.75.

Addition of the Pro-Kit will enhance the UV-c dosage or assist with covering larger coils.

99.9% of viruses and bacteria on the surface of the coil will be irradiated by UV-c but inactivation times will vary depending on the microorganism and irradiation level exposed to the particular area of the coil.

Will it kill COVID-19?

Given the variety of applications, and limited research and resources available it would be misleading for BlueScience to quote any specific kill rates exclusively for COVID-19.

It is however well documented that when biological organisms are exposed to UV-c light it is absorbed by DNA, RNA, and proteins. Absorption of UV-c by proteins leads to a rupture of the cell wall and inactivation of the organism. With sufficient exposure, the DNA replication process is disrupted, and the cell cannot replicate, in fact, when the organism tries to replicate, it dies.

How is BlueScience an air purification tool?

All Mini Split units will pull in air from its surrounding environment, and with this also collect any airborne particles within the airstream. The filters will be the 1st line of defence to collect microorganisms and prevent these from continuing to pass through the unit and back into the atmosphere. Microorganisms that bypass the filter can collect on surfaces such as the coil and fan blades, which have the ability to sporadically hold and release microorganisms into the air flow if left untreated.

In exposing these areas to UV-c BlueScience has the capability to enhance the quality of air being emitted from the unit.

Air flowing through the irradiation zone will also be treated, however effectiveness cannot be accurately determined due to many variables such as fan speed and dwell time. For air disinfection usage the air must remain unchanged and recirculate through the unit multiple times.

Will BlueScience produce Ozone?

Ozone is only created at a wavelength of 200nm or less, BlueScience UV-c LED'S are within a wavelength of 265-278nm and therefore do not carry this concern. The UV-c LED's are classed as Germicidal which actually breaks down Ozone.

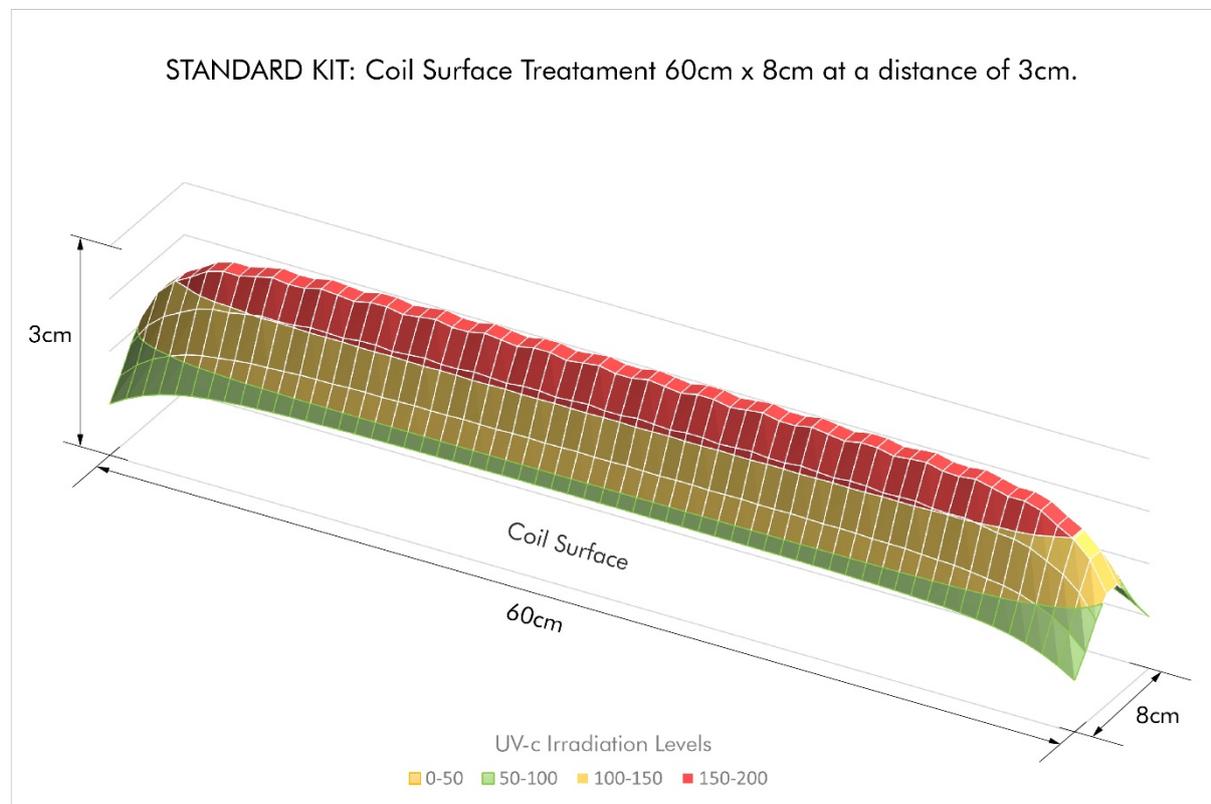
Can BlueScience be run continuously?

Yes, and we would encourage this. Having the UV-c LED's on continuously will increase the length of exposure time to UV-c. An increased exposure time will increase effectiveness over a longer period of time, which is required for targeted disinfection. If possible when cooling is not required, we would recommend setting the AC system to 'fan only' mode and maintaining a constant recirculation of the air. This will provide an on-going replenishment of UV-c exposure to the air being recirculated.

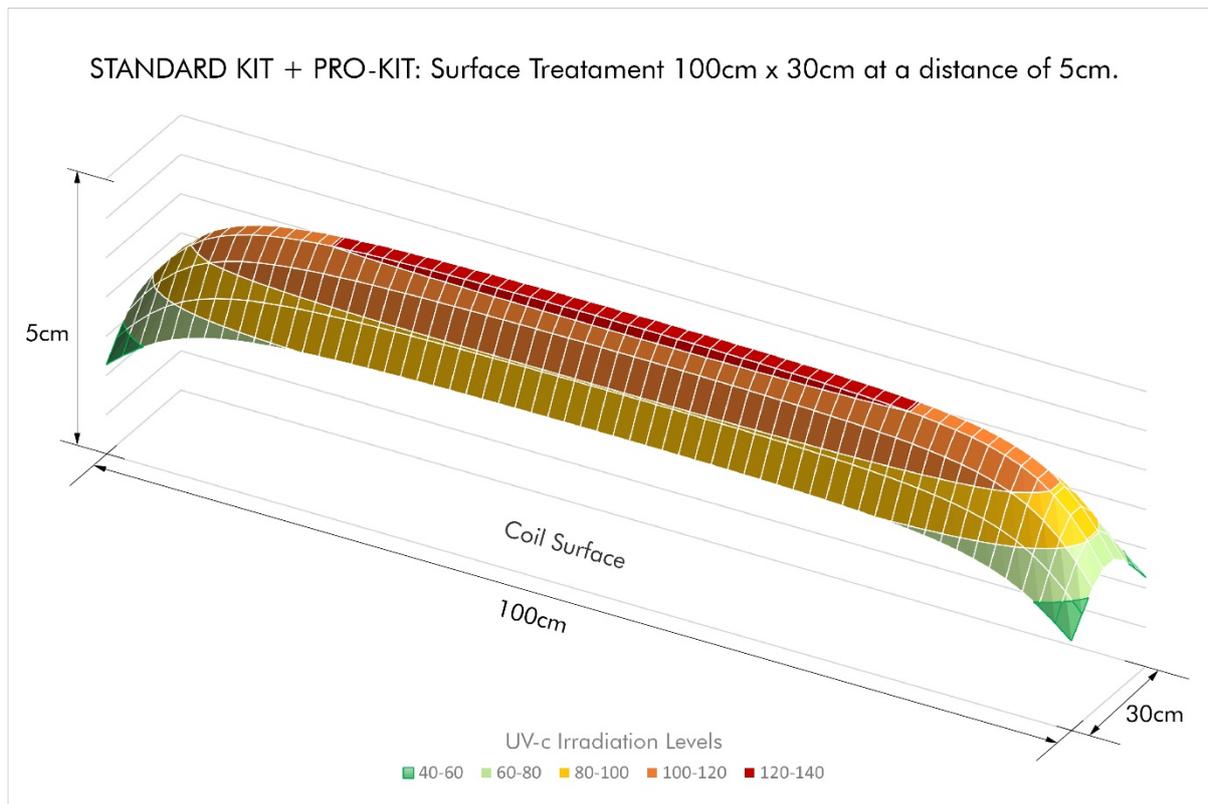
What type of air conditioning unit is BlueScience suitable for?

Development has been driven towards Mini Split wall mounted applications where sufficient space is not available to fit a lamp. In these application BlueScience is the only option that will install in the limited space.

Mini Split / Wall mounted Units: against a coil surface of 600 x 80mm a BlueScience Standard Kit will irradiate sufficient dosage to meet ASHRAE chapter 60.8 TC2.9 when the UV-c is being mounted at a maximum distance of 2 inches (5cm) from the coil surface.



On other FCU's up to 22KW: with a coil surface of 1000mm X 300mm our calculations show that when using a BlueScience Standard + Pro-Kit, the UV-c LEDs must be mounted 1.2 inches (3cm) from the coil surface in order for it to be deemed effective and to meet the ASHRAE guideline. Spacing of the UV-c LED strip & Pro-Kit would need to be mounted 3 inches (8cm) parallel to each other in order to ensure a sufficient overlap is achieved and all areas of the coil surface are being exposed to the required dosage of UV-c outlined in the ASHRAE standard.



We do not recommend installing BlueScience on the square ceiling cassette 4-way units.

Have you got any case studies I can reference?

BlueScience is technology that is being newly introduced into the European Mini Split market, as the product is still in its infancy of being introduced and installed into the field we are still compiling the relevant information and data on the projects that our currently using BlueScience technology.

Case studies will be added to the website and social media posts throughout 2021.

Disclaimer: The information in this document is guidance only believed to be reliable and given in good faith. No warranty or guarantee is either expressed or implied to the accuracy and completeness of this information. No responsibility is assumed or implied for any loss or damage resulting from inaccuracies or omissions. The user bears full responsibility for making their own determination as to the suitability of BlueScience for its own particular use.

Each user must identify and perform all tests and analysis necessary to ensure the final application is fit for purpose and is safe and suitable for use. Each installer for BlueScience assumes full responsibility to become educated in and how to protect from harmful irradiation. All safety guidelines must be followed when installing or carrying out maintenance on any BlueScience product.

BlueScience is not a substitute for any Government guidelines.