Customer Name	Novaerus (Ireland) Ltd.
Customer Address	DCU Alpha, Old Finglas Road, Glasnevin, Dublin 11
Contact	Felipe Soberon
Customer PO number	n/a
Test Requested	To assess the impact of Air cleaner on Clostridium difficile spores
Sample Description	Novaerus air cleaner device (NV1050), 3 replacement filters (Ozone filter, Kompaktfilter & Megalam panel filter)
Number of Samples	1 NV1050 and 3 x filters
Date of Receipt	06/04/2018
ASC Code	ASC003569, ASC003648, ASC003649
Report Number	ASCR092328
Report Date	08/02/2019

Contents

1. Purpose

The purpose of the testing is to assess the performance of the Novaerus (NV1050) air purifier in removing aerosolised Clostridium difficile spores.

2. Test Item Description

The Novaerus (NV1050) air purifier was received by **airmid healthgroup** on 06/04/2018 (Figure 2.1).

Figure 2.1. Novaerus (NV1050) air purifier tested at **airmid healthgroup**

3. Protocol

3.1. Test conditions:

3.1.1. The impact of Novaerus (NV1050) air purifier on aerosolised C. difficle spores (ATCC 43593) was conducted in the 28.5m^3 environmental test chamber.

3.1.2. The test chamber was pre-conditioned to 20 ± 3 °C and 55 ± 5% relative humidity. During testing, the air handling unit was shut down, which reduces the number of air changes to as close to zero as possible.

3.2. Test Procedure & Analysis:

3.2.1. A total of 6 runs were performed to test the impact of the The Novaerus (NV1050) air purifier on aerosolised C. difficile spores. (3 Test and 3 Control runs).

3.2.2. During the test runs the air purifier was placed in the centre of the test chamber and operated at full speed mode. During the control runs the air purifier was switched off.

3.2.3. The spores of the test organism were prepared under anaerobic conditions using an optimised in-house procedure. A detection kit was used to confirm that the spores were Clostridium difficile. They were diluted to a pre-determined concentration of 10^5 colony forming units (CFU) prior to nebulisation.

3.2.4. The C. difficile spores were nebulised into the chamber for a fixed time and mixed with a ceiling fan.

3.2.5. Biostage impactors were used to sample the air. The sampling points for both test and control runs were as follows:

Air sampling time-points			
Test Stage	**Air Sampling Details**	**Time-point (t)**	**Sample Duration (min)**
I	Immediately after nebulisation	-3 - 0	3
Air Purifier On (Test Runs)			
II	during run	15 - 20	5
III	during run	35 - 40	5

3.2.6. At each sampling point, triplicate air samples were collected.

3.2.7. For the test runs, the air purifier was turned on remotely at t=0 min and operated throughout the test period.

3.2.8. At the end of the test, the test chamber was set to full air dump. The agar plates were removed from the biostage impactors and brought to the laboratory.

3.2.9. After each run, the test chamber was decontaminated by exposing the walls and floor to 5% Bleach and rinsing with water. The chamber surfaces were then exposed to UV lamps for at least 120 mins with full air dump.

3.2.10. The agar plates were incubated at 37 °C for 24 hrs under anaerobic conditions.

3.2.11. After 24 hrs, the number CFU's on the plates were counted, corrected for positive hole correlation and converted to CFU per cubic meter of air sampled (CFU/m^3). CFU/m^3 results were then converted to Log_{10} values for the graph.

3.2.12. The % Reduction was calculated from the following formula:

% Reduction at t = x:

$$= 100 - \left(\left(\frac{\text{Bacteria spore CFU/m}^3 \text{ with A/C on at t} = x}{\text{Bacteria spore CFU/m}^3 \text{ with no A/C on at t} = x} \right) \times 100 \right)$$

x = - 3, 15 and 35 min

The formula was calculated by comparing test to control runs at each time point.

4. Results and Discussion:

The number of colony forming units per cubic meter of air (CFU/m^3) obtained from test and control runs at each air sampling time-point were averaged and the results are reported in Tables 5.1 and 5.2 below.

Table 5.1: Average number of CFU/m^3 recovered from the 3 Control Runs

	Control 1	Control 2	Control 3	Average
-3 - 0 min	14242	15133	13584	14320
15 - 20 min	7050	9428	7967	8148
35 - 40 min	5529	6910	6533	6324

Table 5.2: Average number of CFU/m^3 recovered from the 3 Test runs

	Test 1	Test 2	Test 3	Average
-3 - 0 min	14492	16279	14595	15122
15 - 20 min	45	55	3	34
35 - 40 min	0	3	0	1

Figure 5.1 shows the the logarithmic representation of the number of C. difficile spores recovered at each time-point for the 3 control and 3 test runs. The concentration of C. difficile recovered in the control runs indicates that there was minimal natural decay. In contrast, in the

test runs there was a marked decay of C. difficile spores observed within 20 mins of turning the air purifier on, increasing to almost zero by the end of the test.

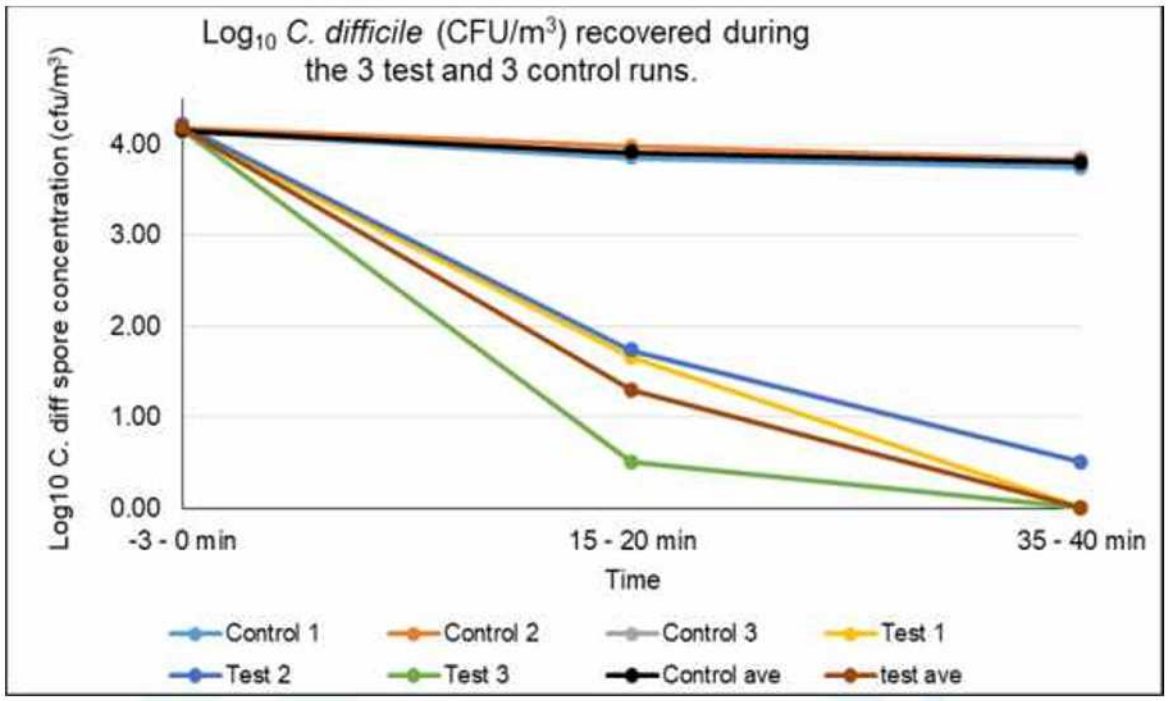

Figure 5.1: Log_{10} concentration of C. difficile recovered in the test chamber in the 3 control runs with the air purifier off and in the 3 test runs with the air purifier on.

Calculation of the % reduction shows that 99.6 % of C. difficile spores were removed by the air purifier within the first 20 min compared to natural decay. This increased to > 99.9% after 40 min of air purifier operation.

4 Conclusion

The results achieved during the testing show that the Novaerus (NV1050) demonstrated to be effective in reducing the airborne C. difficile by 99.6% within the first 20 min and this increased to > 99.9% after 40 min of the air purifier operation.

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End of Report