1.0 Executive Summary

1.1 As per the client protocol "Brightbot" Document No: Brightbot Protocol_001 version: 01, the objective of this study was to verify and obtain scientific evidence of the effectiveness of a UVC (ultraviolet-C) disinfectant tower against multiple organisms. The study includes the organism testes and different time points and distances. See Tables 1 through 5 for a summary of results differentiated by organism type.

Table 1 – Summary of Results

Test/Method	*Acceptance Criteria*	*Results*	*Status*
Escherichia coli ≥ $1x10^6$ ·5ft/5mins	≥ 3 log reduction	5.86 Log Reduction	Pass
Escherichia coli ≥ $1x10^6$ · 5ft/10mins	≥ 3 log reduction	5.86 Log Reduction	Pass
Escherichia coli ≥ $1x10^6$ · 10ft/5mins	≥ 3 log reduction	5.86 Log Reduction	Pass
Escherichia coli ≥ $1x10^6$ · 10ft/10mins	≥ 3 log reduction	5.86 Log Reduction	Pass

Table 2 – Summary of Results

Test/Method	*Acceptance Criteria*	*Results*	*Status*
Escherichia coli w/soil≥ $1x10^6$ -5ft/5mins	≥ 3 log reduction	3.71 Log Reduction	Pass
Escherichia coli w/soil≥ $1x10^6$ · 5ft/10mins	≥ 3 log reduction	3.71 Log Reduction	Pass
Escherichia coli w/soil≥ $1x10^6$ · 10ft/5mins	≥ 3 log reduction	3.31 Log Reduction	Pass
Escherichia coli ≥ $1x10^6$ · 10ft/10mins	≥ 3 log reduction	3.71 Log Reduction	Pass

Table 3 – Summary of Results

Test/Method	*Acceptance Criteria*	*Results*	*Status*
Methicillin-resistant *Staphylococcus aureus*≥ $1x10^6$ · 5ft/5mins	≥ 3 log reduction	4.96 Log Reduction	Pass
Methicillin-resistant *Staphylococcus aureus* ≥ $1x10^6$ · 5ft/10mins	≥ 3 log reduction	4.96 Log Reduction	Pass
Methicillin-resistant *Staphylococcus aureus* ≥ $1x10^6$ · 10ft/5mins	≥ 3 log reduction	4.36 Log Reduction	Pass
Methicillin-resistant *Staphylococcus aureus* ≥ $1x10^6$ · 10ft/10mins	≥ 3 log reduction	4.96 Log Reduction	Pass

Table 4 – Summary of Results

Test/Method	*Acceptance Criteria*	*Results*	*Status*
Candida auris≥ $1x10^6$ -5ft/5mins	≥ 3 log reduction	3.41 Log Reduction	Pass
Candida auris ≥ $1x10^6$ · 5ft/10mins	≥ 3 log reduction	3.41 Log Reduction	Pass
Candida auris ≥ $1x10^6$ · 10ft/5mins	≥ 3 log reduction	3.41 Log Reduction	Pass
Candida auris ≥ $1x10^6$ · 10ft/10mins	≥ 3 log reduction	2.71 Log Reduction	Pass

** Testing performed at 20 minutes for information purposes as well.

Table 5 – Summary of Results

Test/Method	*Acceptance Criteria*	*Results*	*Status*
Clostridioides difficile≥ $1x10^6$ -5ft/10mins	≥ 2 log reduction	1.60 Log Reduction	Pass
Clostridioides difficile ≥ $1x10^6$ - 5ft/20mins	≥ 2 log reduction	2.15 Log Reduction	Pass
Clostridioides difficile ≥ $1x10^6$ - 10ft/10mins	≥ 2 log reduction	2.38 Log Reduction	Pass
Clostridioides difficile ≥ $1x10^6$ - 10ft/20mins	≥ 2 log reduction	2.38 Log Reduction	Pass

2.0 Scope and Applicability

2.1 This test was limited to one material of construction (Stainless Steel), four client selected organisms with one including soil, one contact time and UVC.

2.2 The following organisms were used: *Escherichia coli* (E.c.) ATCC 11229, Methicillin-resistant *Staphylococcus aureus* (S.a.) ATCC 33591, *Candida auris* (C.a.) AR-Bank#0385 and *Clostridioides difficile* (C.d.) ATCC 43598.

2.3 There was one dry contact time of thirty (30) minutes used on the panel. The panels were exposed to the UVC at a 5' and 10' distance with 5 minute and 10 minute intervals for vegetative bacteria and fungi and 10 minute and 20 minute intervals for spore forming bacteria and fungi.

2.4 The log reduction values were based on the theory that test coupons were inoculated with organism counts equal to the recovered positive control counts.

	Signature /Title / Company	Date
Author	Victor Dghaoui / Sr. Microbiologist / Azzur Labs	19 May 2023
Quality Review	/ Sr Director / Azzur Labs	19 may 2023
Client Approval	/ BrightBot	22 May 2023

3.0 Procedure

3.1 All participants who executed this study have appropriately documented their credentials on the participant log located on Appendix 01 attached to this summary report. All technicians have been appropriately trained to perform this testing and have documented their understanding of the protocol and its' requirements.

3.2 All materials and equipment used in execution of this study were documented in Appendices 02 and 03. These appendices are attached to this summary report. All materials used were appropriately qualified by Azzur Labs prior to use and were within acceptable expiration. All equipment used was appropriately documented and within calibration requirements during execution of this testing.

3.3 The client provided the UVC devise used for the testing. All coupons were sterilized prior to use by steam sterilization using a tabletop autoclave. This information is documented on Appendix 05, attached to this summary report.

4.0 Test Set up

4.1 The client protocol was correctly followed for this procedure. Testing was conducted on 19 Jan 2023, 09 Feb 2023, 22 Mar 2023, 31 Mar 2023 and 09 May 2023. Testing for E.c. with soil and S.a. was conducted on the same day while other organisms were set up on separate dates. The C.a. was performed on two different dates, 22 Mar 2023 and 31 Mar 2023 with its own negative and positive controls. Distances 5' and 10' were performed on both dates with 5 minute and 10 minute interval performed on 22 Mar 2023 and 20 minute interval performed on 31 Mar 2023. Protocol appendices are attached and can be used as verification of testing appropriateness.

4.2 When setting up the organism, the test coupons were inoculated with the required population of each organism and allowed to dry for at least 30 minutes. The inoculated test areas were swabbed as per the swabbing technique detailed in section 8.10 of the positive control. The extraction process was followed as detailed in section 8.7 of the protocol. A serial dilution using 0.9% saline was completed and the dilutions were plated in duplicate using appropriate media.

4.3 There were difficulties growing the *Clostridioides difficile* on the reinforced clostridial agar as detailed in section 8.11 of the protocol for inoculation and swabbing of test samples. The client was notified of the issues and a subsequent deviation was initiated to use blood agar per deviation #1. The client was notified about the change in deviation via email on 24 Apr 2023. See section 5.0 in deviation summary.

4.4 All vegetative bacterial plates were incubated at 30°C to 35°C for 48 hours to 4 days. All spore forming bacteria were incubated at 35°C to 40°C for 48 hours to 4 days. All fungal plates were incubated at 20°C to 25°C for 72 hours to 5 days. The resulting growth was counted and compared to determine the log reduction.

4.5 See Tables 6 and 7 for negative and positive results. The average positive population recovery for each of the organisms used was calculated. The average test sample population recovery for each of the organisms evaluated for each coupon was calculated. The following calculation was used to determine the total log reduction:

Log (Average of the positive control count)- Log (Average of the actual count) = Population present

Table 6- Negative Control Results

Test setup Organism/ Date	Material	Result (cfu)	Acceptance Criteria	Status
E.c. / 19Jan2023	Stainless Steel	0 CFU	No Growth	Pass
E.c. with soil / 09Feb2023	Stainless Steel	0 CFU	No Growth	Pass
S.a. / 09Feb2023	Stainless Steel	0 CFU	No Growth	Pass
C.a. / 22Mar2023	Stainless Steel	0 CFU	No Growth	Pass
C.a. / 31Mar2023	Stainless Steel	0 CFU	No Growth	Pass
C.d. / 09May2023	Stainless Steel	0 CFU	No Growth	Pass

Table 7- Positive Control Results

Test setup Organism/ Date	Material	Average Calculated Population	Acceptance Criteria	Status
E.c. / 19Jan2023	Stainless Steel	$5.5x10^7$	$\geq 1x10^6$	Pass
E.c. with soil / 09Feb2023	Stainless Steel	$5.1x10^7$	$\geq 1x10^6$	Pass
S.a. / 09Feb2023	Stainless Steel	$5.9x10^7$	$\geq 1x10^6$	Pass
C.a. / 22Mar2023	Stainless Steel	$1.1x10^7$	$\geq 1x10^6$	Pass
C.a. / 31Mar2023	Stainless Steel	$4.2x10^6$	$\geq 1x10^6$	Pass
C.d. / 09May2023	Stainless Steel	$9.7x10^6$	$\geq 1x10^6$	Pass

5.0 Deviation / Observation Summary.

5.1 There were no observed or documented procedural observations during the execution of this study.

5.2 Deviation #1- The use of TSA with blood during the sample test set was used instead of reinforced clostridia agar as detailed in the protocol.

5.2.1 This was a planned deviation approved prior to testing initiation. The original set up for C.d. was performed on 31 Mar 2023. The positive result was too low to be considered for test set up with a result of $4x10^1$. This result is below the expected population of $1.0x10^6$. The retest for the C.d. using blood agar yielded an average population count of $9.7x10^6$.

6.0 Results Summary

6.1 Overall, the UVC disinfectant tower was able to produce the desired log reduction requirements across all distances and time points within the protocol with the exception of the 20 minute exposure for C.a., which was for information only.

6.2 All controls, both positive and negative, met acceptance criteria.