TRIAL REPORT

Project title	Misting trial at Chilled Environment Pack House		
Sector	Produce Packing	Collaborator	Restricted
Participants	Restricted		
Start date	27/08/2020	Location	Restricted

Project aim

The aim of this project was to assess the decontamination efficacy of hypochlorous acid (HOCl) applied as a mist in communal spaces. This was achieved by measuring micro bioburden on hand-touch surfaces / the factory environment before and after the misting process.

Project Outline

It is imperative that people are kept safe at work, especially in confined spaces / areas with high concentrations of workers / areas with high rates of travel.

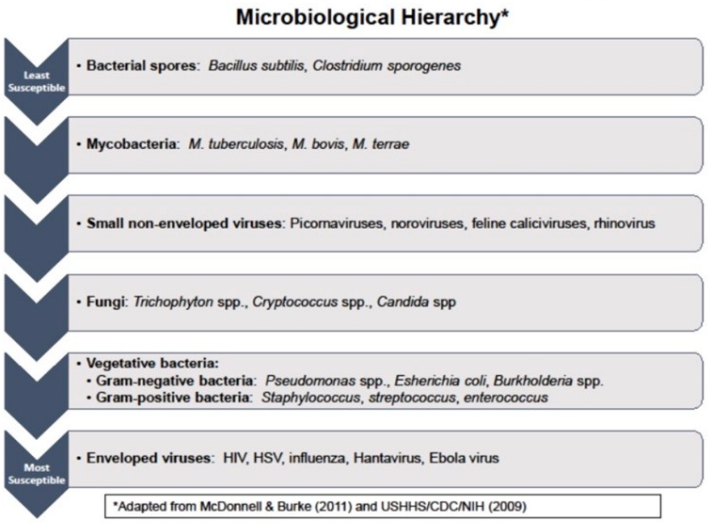
SARS-CoV-2 is an enveloped virus approximately 60-140nm in diameter. Transmission occurs through touch or aerosol spreading. During speech, humans emit thousands of oral fluid droplets per second which can remain airborne for 8-14 minutes (Stadnytskyi *et al*., 2020). SARS-CoV-2 is detectable in surface aerosols for up to three hours, up to four hours on copper, up to 24h on cardboard and up to 2-3 days on plastic and stainless steel (van Doremalen *et al*., 2020). There are also reports suggesting that coronaviruses can survive for 10 to 100 days in water, depending on the temperature (Gundy and Gerba, 2009), with the virus remaining for longer in lower (<4^{o}C) temperature than higher (>23^{o}C) temperature water.

There is a need to disinfect surfaces potentially exposed to SARS-CoV-2 to prevent / reduce the risk of transmission from healthy but asymptomatic people. An ideal disinfectant and sanitiser must be fast acting, broad spectrum, safe for humans and the environment, easy to use and relatively inexpensive. Hypochlorous acid may be the disinfectant of choice. Salvesan hypochlorous acid is effective against bacteria, viruses, protozoa, fungi, yeasts, moulds and spores (BS EN accreditations include 1276:2009, 13697:2001, 13704:2002, 14476:2013). Figure 1 shows the general order of susceptibility of various classes of microorganisms to disinfectants. Different classes of microorganisms exhibit different degrees of susceptibility due to biochemical and biophysical characteristics of the organism. Enveloped viruses, such as coronavirus, are the most susceptible to disinfectants ie the easiest to kill.

Figure 1: Order of susceptibility of microorganisms to disinfectants

EPA Draft White Paper September 4, 2015

Figure 1. Microbiological disinfection hierarchy. Examples of microorganisms in each category are provided.



Hypochlorous acid has very low contact times and is safe for people and the environment. It can be misted into the environment when people are in place with no deleterious effects. It can be sprayed onto a surface and left with no fear of toxic residues. Workers do not need any PPE to handle it. It can be used on soft and hard surfaces. It is extremely versatile and can be used as a dip, spray, mist or fog. It is simple to use therefore compliance is high. It does not lose efficacy at low temperatures. It has a 12 month shelf life if kept under suitable storage conditions. As such Salvesan offers a safe and efficacious disinfection option in domestic, commercial, community and healthcare settings.

Selecting the most suitable disinfectant is one of the two components essential for effective environmental disinfection. The other component is ensuring that the disinfectant contacts all surfaces, is given the correct dwell time and that manufacturers label instructions are followed. There has been considerable interest from all sectors in the potential of mist as a decontamination strategy: environmental misting potentially allows a disinfectant to reach areas that would not normally be sanitised, requires minimal human input and provides visual reassurance that something positive is being done.

At Aqualution Systems we have carried out extensive misting work over the last decade and have several commercial applications where misting is highly effective, both against bacteria and viruses (eg the decontamination of

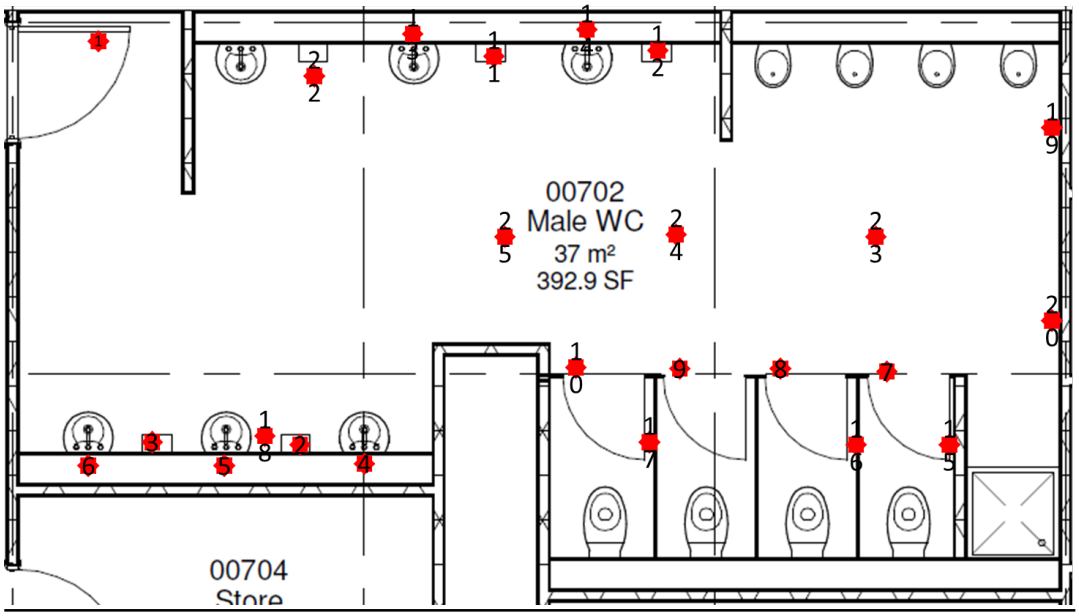
raspberries amid fears of Hepatitis A and Norovirus). To date our experiments in healthcare have consistently demonstrated that there is no substitution for "elbow grease" and that the highest decontamination rates are achieved using a traditional spray and wipe technique. This is because dust, dirt and organic matter can create protective reservoirs for pathogens if not effectively removed. However, we have found that misting after physical cleaning can achieve additional decontamination benefits above physical cleaning alone.

The aim of the current study was to assess how effective misting Salvesan is in the communal areas of a commercial factory that had experienced Covid 19 positive employees. We investigated decontamination rates on a range of surfaces immediately after environmental misting with Salvesan. We chose the gents lavatories next to the canteen / break area as these facilities are heavily used by many people. A newly developed misting technology was utilised for this study.

Methodology

The domestic staff were asked not to clean the area prior to our arrival to ensure that it was well trafficked and had sufficient levels of microbial contamination. We began the trial at 2pm, after the shift had taken their lunch break. Figure 2 shows the layout of the area and where swabs were taken from. 25 sites were chosen in total.

Figure 2: Swabbing sites



All samples were taken using sterile trans-swabs. Sterile templates were used to ensure that the same area was sampled with each swab. Templates measure 10cm x 10cm therefore the swab result is cfu/100cm^2. Some areas were not sufficiently large to accommodate a template so they were swabbed free hand. When swabbing free hand care was taken to choose an area that would be easy to replicate ie the whole lock mechanism on the internal door samples and the whole push section of the soap dispenser. Initial samples were taken under "as found" conditions. The area was then misted at the rate of 2ml/m^3 using a handheld mister. Misting took approximately 6 minutes. This was followed by a 5 minute dwell time. The same areas were then re-swabbed by the same person using the same technique – these were the post-mist samples.

A total of 50 swabs were obtained. Swabs were couriered to the lab (One Scientific, Avonmouth) to arrive before 9am the following morning. Swabs were analysed for aerobic colony counts (ACC) using the pour-plate technique.

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Results

All swabs were successfully analysed by the lab. The results are shown below in table 1.

Table 1: Aerobic Colony Counts (ACC) before and after treatment (colony forming units, cfu)

Swab site	Sampling site	Swabbing area		ACC (cfu per swab)			Log		
		Template: 100cm^2	Free hand	Pre	Post	Reduction	Pre	Post	Reduction
1	Entrance door	*		1100	90	1010	3	1	2
2	Under hand dryer (LHS)	*		2700	<10	2699	3	0	3
3	Under hand dryer (RHS)	*		180	<10	179	2	0	2
4	Soap dispenser: Red		*	6000	<10	5999	3	0	3
5	Soap dispenser: Green		*	140	<10	139	2	0	2
6	Soap dispenser: Grey		*	8000	<10	7999	3	0	3
7	Cubicle door 1	*		140	<10	139	2	0	2
8	Cubicle door 2	*		<10	<10	0	0	0	0
9	Cubicle door 3	*		29000	<10	28999	4	0	4
10	Cubicle door 4	*		<10	<10	0	0	0	0
11	Under hand dryer (LHS)	*		130	30	100	2	1	1
12	Under hand dryer (RHS)	*		150000	<10	149999	5	0	5
13	Soap dispenser: Red		*	10	20	-10	1	1	0
14	Soap dispenser: Green		*	90	10	80	1	1	0
15	Internal door lock 1		*	2700000	460	2699540	6	2	4
16	Internal door lock 2		*	3800000	<10	3799999	6	0	6
17	Internal door lock 4		*	600000	10	599990	5	1	4
18	Underneath dryer		*	<10	<10	0	0	0	0
19	Wall by urinal	*		<10	<10	0	0	0	0
20	Wall by shower cubicle	*		<10	<10	0	0	0	0
21	Wall by entrance	*		10	<10	9	1	0	1
22	Underneath dryer	*		30	<10	29	1	0	1
23	Floor: near urinal	*		>10000000	40000	9960000	7	4	3
24	Floor: near cubicles	*		>10000000	360	9999640	7	2	5
25	Floor: near sinks	*		>10000000	13000	9987000	7	4	3

Results

The grand mean pre treatment count is 1,491,901 cfu (range <10 to >10,000,000 cfu) and the grand mean post treatment count is 2,160 cfu (range <10 to 40,000 cfu).

On average microbial burden was reduced by 2 logs after misting hypochlorous acid with up to 6 log reductions observed. 18 of the 25 sampling sites showed at least one log reduction. Seven showed no log change: 5 of these had pre counts <10 cfu and 2 were 10-100 cfu. 21 of the 25 post treatment samples were <100 cfu / swab (<1 cfu/cm^2) with the majority (16/25) achieving 0 log counts (<10 cfu per swab).

The highest counts were observed in the three floor samples where all pre counts were >10,000,000 cfu (post treatment average was 17,786 cfu). Despite the very high initial loading misting still achieved a 3-5 log reduction in counts. Floors are the most challenging area for mist as there is organic matter present which can consume the mist / provide a protective layer for the microorganisms present. If the floor samples are excluded then the pre treatment average is 331,706 cfu and the post treatment average is 29 cfu.

Hand touch sites were generally within a 2 to 4 log range pre-treatment (0-1 logs after treatment). The exception was the internal lock mechanisms on the toilet cubicles where counts were consistently high (5, 6 and 6 logs). Misting reduced these counts to 2, 0 and 1 log.

Conclusions

Pre treatment counts were variable with floor swabs achieving the highest counts. Microbial loading pre-treatment counts on hand touch sites were within expected parameters which is indicative of a good level of cleaning. The highest levels of microbial burden (with the exception of the floor) were the internal lock mechanisms in the toilet cubicles.

Misting with hypochlorous resulted in a significant and repeatable effect on log counts.

APPENDIX: Raw Data

Summary table of raw data

SWAB SITE	PRE TREATMENT COUNT (cfu / swab)	POST TREATMENT COUNT (cfu / swab)
1	1100	90
2	2700	<10
3	180	<10
4	6000	<10
5	140	<10
6	8000	<10
7	140	<10
8	<10	<10
9	29000	<10
10	<10	<10
11	130	30
12	150000	<10
13	10	20
14	90	10
15	2700000	460
16	3800000	<10
17	600000	10
18	<10	<10
19	<10	<10
20	<10	<10
21	10	<10
22	30	<10
23	>10000000	40000
24	>10000000	360
25	>10000000	1300

Raw data (as supplied by One Scientific, independent laboratory)

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Aqualution Systems
19 Fenkle Street
Alnwick
NE66 1HW

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Report Date: 07/09/2020
Submission No: 20-34957
Test Date: 28/08/2020

Date Received: 28/08/2020
Sample Type: ENVIRONMENTAL SWAB

Lab Ref. Sample Details	M001(LF) cfu/swab Aerobic colony count at 30°C 48 hours				
4392690 1 1 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time: 1445	1100				
	Deviation Assessment: N				
4392691 2 2 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	2700				
	Deviation Assessment: C				
4392692 3 3 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	180				
	Deviation Assessment: C				
4392693 4 4 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	6000				
	Deviation Assessment: C				
4392694 5 5 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	140				
	Deviation Assessment: C				
4392695 6 6 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	8000				
	Deviation Assessment: C				

Abbreviations: X = testing not required, (P) = presumptive, ~ = approximately, > = approximately greater than, < = less than. Tests marked with * are outside the UKAS scope of accreditation for One Scientific Ltd. Tests marked with # have been subcontracted to an external laboratory. Location of testing is shown in brackets after the method code: LF = One Scientific Ltd. Unit F, 7A4 Victoria Road, Avonmouth, Bristol BS11 9DB, L3 = One Scientific Ltd. Unit 3, Avon Riverside Estate, Victoria Road, Avonmouth, Bristol BS11 9DB. This report shall not be reproduced except in full, without the written approval of One Scientific Ltd. Information relating to sample/s before receipt by the laboratory are provided by the customer unless otherwise stated as a comment, and this information can affect the validity of results. These results are representative of the sample as supplied by the client. Calculations of energy values are performed according to Regulation (EU) No 1169/2011 that takes into account contribution from dietary fibre where requested. Unless reported, alcohol, polyols and organic acids have not been considered in the energy calculation. Calculations of meat content are performed according to Meat Product Regulations 2003 (amended 2008) and are not applicable to QUID regulations. Meat contents are corrected for cereal fillers where known to be added, but are not corrected for other sources of protein including; soya; caseinate; milk powder and nonmeat sources of fat. Meat content may be an overestimate if connective tissue analysis is not requested. Comments, opinions and interpretations expressed herein are outside the scope of UKAS accreditation. Deviation assessments have been carried out on all samples submitted for testing. Deviating samples have been allocated a code determined by the reason for deviation. As a result of the deviation the reliability of the results may be affected. Explanation of this coding is as follows: A) Insufficient sample provided (see comments), B) Sample not submitted in an appropriate container/sample does not contain an appropriate preservative/neutralising agent, C) No sampling date/time/conditions provided when pertinent, D) Sample submitted outside permitted holding/transit times/conditions, E) Analysis not carried out within permitted test holding times, G) Sample used to perform temperature check, H) The sample DNA is of low quality/quantity and may affect the LOD of the test, I) Chemistry sample not submitted at the correct temp/cond, F) Other - see comments, N) No deviations.

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4392696 7 7 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	140				
	Deviation Assessment: C				
4392697 8 8 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392698 9 9 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	29000				
	Deviation Assessment: C				
4392699 10 10 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392700 11 11 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	130				
	Deviation Assessment: C				
4392701 12 12 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	150000				
	Deviation Assessment: C				

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4392702 13 13 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	10				
	Deviation Assessment: C				
4392703 14 14 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	90				
	Deviation Assessment: C				
4392704 15 15 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	2700000				
	Deviation Assessment: C				
4392705 16 16 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	~ 3800000				
	Deviation Assessment: C				
4392706 17 17 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	600000				
	Deviation Assessment: C				
4392707 18 18 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				

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4392708 19 19 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392709 20 20 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392710 21 21 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	10				
	Deviation Assessment: C				
4392711 22 22 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	30				
	Deviation Assessment: C				
4392712 23 23 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	> 10000000				
	Deviation Assessment: C				
4392713 24 24 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	> 10000000				
	Deviation Assessment: C				

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4392714	25 25 pre System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	> 10000000				
		Deviation Assessment: C				
4392715	26 1 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	90				
		Deviation Assessment: C				
4392716	27 2 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
		Deviation Assessment: C				
4392717	28 3 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
		Deviation Assessment: C				
4392718	29 4 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
		Deviation Assessment: C				
4392719	30 5 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
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4392720 31 6 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392721 32 7 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392722 33 8 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392723 34 9 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392724 35 10 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392725 36 11 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	30				
	Deviation Assessment: C				

Abbreviations: X = testing not required, (P) = presumptive, ~ = approximately, > = approximately greater than, < = less than. Tests marked with * are outside the UKAS scope of accreditation for One Scientific Ltd. Tests marked with # have been subcontracted to an external laboratory. Location of testing is shown in brackets after the method code: LF = One Scientific Ltd. Unit F, 7A4 Victoria Road, Avonmouth, Bristol BS11 9DB, L3 = One Scientific Ltd. Unit 3, Avon Riverside Estate, Victoria Road, Avonmouth, Bristol BS11 9DB. This report shall not be reproduced except in full, without the written approval of One Scientific Ltd. Information relating to sample/s before receipt by the laboratory are provided by the customer unless otherwise stated as a comment, and this information can affect the validity of results. These results are representative of the sample as supplied by the client. Calculations of energy values are performed according to Regulation (EU) No 1169/2011 that takes into account contribution from dietary fibre where requested. Unless reported, alcohol, polyols and organic acids have not been considered in the energy calculation. Calculations of meat content are performed according to Meat Product Regulations 2003 (amended 2008) and are not applicable to QUID regulations. Meat contents are corrected for cereal fillers where known to be added, but are not corrected for other sources of protein including; soya; caseinate; milk powder and nonmeat sources of fat. Meat content may be an overestimate if connective tissue analysis is not requested. Comments, opinions and interpretations expressed herein are outside the scope of UKAS accreditation. Deviation assessments have been carried out on all samples submitted for testing. Deviating samples have been allocated a code determined by the reason for deviation. As a result of the deviation the reliability of the results may be affected. Explanation of this coding is as follows: A) Insufficient sample provided (see comments), B) Sample not submitted in an appropriate container/sample does not contain an appropriate preservative/neutralising agent, C) No sampling date/time/conditions provided when pertinent, D) Sample submitted outside permitted holding/transit times/conditions, E) Analysis not carried out within permitted test holding times, G) Sample used to perform temperature check, H) The sample DNA is of low quality/quantity and may affect the LOD of the test, I) Chemistry sample not submitted at the correct temp/cond, F) Other - see comments, N) No deviations.

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UKAS TESTING 2048

CERTIFICATE OF ANALYSIS

Aqualution Systems
19 Fenkle Street
Alnwick
NE66 1HW

Certificate no: 20-34957_1
Report Date: 07/09/2020
Submission No: 20-34957
Test Date: 28/08/2020

Date Received: 28/08/2020
Sample Type: ENVIRONMENTAL SWAB

Lab Ref. Sample Details	M001(LF) cfu/swab Aerobic colony count at 30°C 48 hours				
4392726 37 12 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392727 38 13 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	20				
	Deviation Assessment: C				
4392728 39 14 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	10				
	Deviation Assessment: C				
4392729 40 15 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	460				
	Deviation Assessment: C				
4392730 41 16 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392731 42 17 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	10				
	Deviation Assessment: C				

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Report Date: 07/09/2020
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Test Date: 28/08/2020

Date Received: 28/08/2020
Sample Type: ENVIRONMENTAL SWAB

Lab Ref. Sample Details	M001(LF) cfu/swab Aerobic colony count at 30°C 48 hours				
4392732 43 18 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392733 44 19 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392734 45 20 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	10				
	Deviation Assessment: C				
4392735 46 21 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392736 47 22 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	< 10				
	Deviation Assessment: C				
4392737 48 23 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	40000				
	Deviation Assessment: C				

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Date Received: 28/08/2020
Sample Type: ENVIRONMENTAL SWAB

Lab Ref. Sample Details	M001(LF) cfu/swab Aerobic colony count at 30°C 48 hours				
4392738 49 24 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time:	360				
	Deviation Assessment: C				
4392739 50 25 post System: Area: Sample Ref: Samp Date: 27/08/2020 ,Time: 1525	13000				
	Deviation Assessment: N				

Signed by:

Monika Pauziene, Deputy Laboratory Manager

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