

Project Dublin Ireland

The COVID-19 pandemic has highlighted the importance of knowing and managing the risks that in the workplace can be represented by the presence of infectious agents.

And to guarantee the containment of their diffusion it is necessary to intervene at all levels of the organization: not only by raising awareness, informing and training workers, but also by equipping the structures with effective prevention systems that can protect operators at all stages in which they share the environments.

Biological risk in the workplace is defined as the more or less high probability that biological agents can cause damage to workers of varying degrees.

Biological agents dangerous to workers are generally bacteria, viruses and microscopic fungi. But so are parasites - microscopic and otherwise - and those animals that can be responsible for serious allergic reactions or act as disease carriers.

The experiments described here aimed to quantify the total bacterial count (TBC) and Molds/Yeasts (M/Y) detected in the Company's offices, located in Dublin, Ireland, by comparing the results obtained in five environments before and after the installation of lighting systems equipped with Biovitae® continuous sanitization technology.

The environments that were tested were two meeting rooms of different sizes, two bathrooms and the sports equipment room.

Description of the tested environments

The tests began on Monday 24 April 2023 and ended on Friday 28 April 2023.

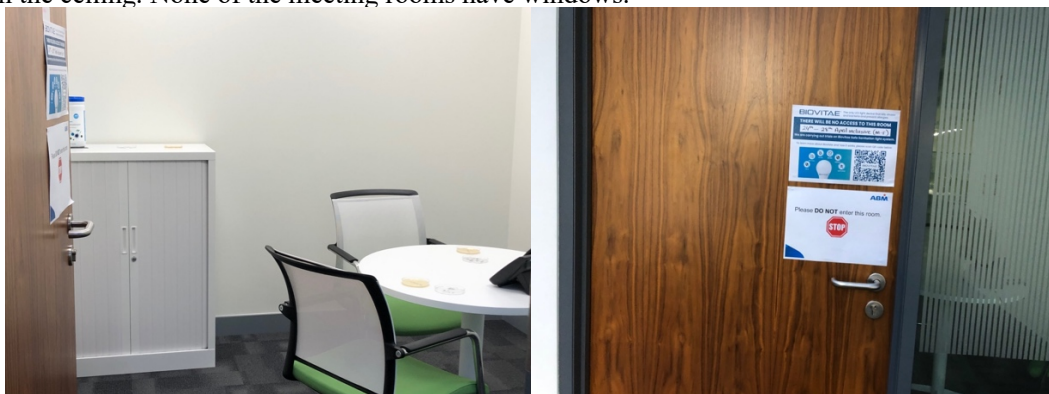
The five rooms covered by the study were identified as: small meeting room (room 1), large meeting room (room 2), gym (room 3), bathroom with disabled access (room 4), and standard bathroom (room 5).

These environments were chosen to represent the different typologies present inside the building.

At the beginning of the experiment, the rooms were numbered and provided with signs indicating that microbiological tests were in progress.

Meeting Rooms (rooms 1 and 2)

The two meeting rooms are located on the first floor of the building and overlook an open space that houses numerous workstations. They are used by operators for meetings both between colleagues and with customers or suppliers. The floor is covered with a carpet, the walls are painted and there is a large window that houses the wooden entrance door. Both are equipped with a heater and the general ventilation system is installed in the ceiling. None of the meeting rooms have windows.



Bathrooms (rooms 4 and 5)

The two bathrooms are located on the ground floor of the building, in a corridor with no windows or access to or from the outside. The floor is covered in non-slip plastic material. The walls are covered with white tiles and cement joints for a height of about 120 cm while the rest of the wall is painted with washable paint. The automatic ventilation system is installed in the false ceiling.



Bathroom 1 (Room 4)



Bathroom 2 (Room 5)



Gym (room 3)

The room used as a gym is located on the first floor of the building. It has only one entrance door and no access to or from the outside or windows. The floor is covered in non-slip plastic material. The walls are painted with washable paint. The automatic ventilation system is installed in the false ceiling.



Materials and methods

Two types of TBC and M/Y selective Petri dishes (PD) were used for the test:

1. Tryptone Soy Agar (Harmonised). Producer Fannin L.I.P Ireland (ref. W11245, expiration on 06 Jan 2023).
2. SDA (Harmonised). Producer Fannin L.I.P Ireland (ref. W11238, expiration on 08 Dec 2023).

The PDs were always placed in the same spot on each day of the tests. They were left open, with the cover lid removed, to allow collection of microbial populations. At the end of each test they were sealed, collected, and kept at the correct storage temperature until they were delivered to the laboratory.

At the end of the two days of tests conducted under standard lighting, Biovitae[®] tubes T8-1500 light sources were installed in all the rooms, distributed as described below:

- Room 1: 1x tube T8-1500
 - Distance from surface 1.5 m
 - Illuminance: 314 lx
 - Irradiance (400-420nm): 0.0201 mW cm⁻²
- Room 2: 2x tube T8-1500
 - Distance from surface 1.5 m
 - Illuminance: 628 lx
 - Irradiance (400-420nm): 0.0402 mW cm⁻²
- Room 3: 2x tube T8-1500
 - Distance from surface 1.5 m
 - Illuminance: 628 lx
 - Irradiance (400-420nm): 0.0402 mW cm⁻²
- Room 4: 1x tube T8-1500
 - Distance from surface 1.5 m
 - Illuminance: 314 lx
 - Irradiance (400-420nm): 0.0201 mW cm⁻²
- Room 5: 1x tube T8-1500
 - Distance from surface 1.5 m
 - Illuminance: 314 lx
 - Irradiance (400-420nm): 0.0201 mW cm⁻²

Placement and removal sequence of plates					
	TBC plate 1 (#1)	TBC Plate 2 (#2)	Y/M Plate (#3)		
	Placement Time Under Standard Lighting			Removal Time	
24 April	09:00 AM	09:00 AM	09:00 AM *	#1, #2, #3	03:30 PM - 24 Apr
	03:30 PM	03:30 PM	03:30 PM	#1, #2, #3	09:00 AM - 25 Apr
25 April	09:00 AM	09:00 AM	09:00 AM	#1, #2	03:30 PM – 25 Apr
	03:30 PM	03:30 PM		#1, #2, #3	09:00 AM – 26 Apr
	Biovitae® installation times			Start: 08:00 AM	
				End: 10:30 AM	
	Placement Time Under Biovitae® Lighting			Removal Time	
26 April	10:30 AM	10:30 AM	10:30 AM	#1, #2	04.30 PM – 26 Apr
	04:30 PM	04:30 PM		#1, #2, #3	10.30 AM – 27 Apr
27 April	10:30 AM	10:30 AM	10:30 AM	#1, #2	04.30 PM - 27 Apr
	04:30 PM	04:30 PM		#1, #2, #3	10.30 AM - 28 Apr

* On the first day of testing, 24 April, #3 was replaced with #1 and #2.

On the following days, #3 was left in place for 24 hours, while all other plates were removed at 03.30 PM to be replaced with identical ones that will be removed the next day at 09.00 AM.

After the installation of the Biovitae® T8 tube, Petri dishes were placed at 10:00 AM and replaced at 04:30 PM. On Friday 20th April, last day of testing, the plates were removed at 10:30 am.

Test results

TBC and M/Y under standard lighting																				
Test dates	Room 1 Meeting Room				Room 2 Meeting Room				Room 3 Gym				Room 4 Bathroom				Room 5 Bathroom			
	TBC		M/Y		TBC		M/Y		TBC		M/Y		TBC		M/Y		TBC		M/Y	
	P1	P2	P3	P3	P1	P2	P3	P3	P1	P2	P3	P3	P1	P2	P3	P3	P1	P2	P3	P3
Monday 24 from 09:00 AM to 03:00 PM	9	300	2	1	87	20	0	0	300	6	0	0	8	300	5	0	300	8	4	0
			8	0			7	1			0	0			5	0			4	0
Monday 24 from 03:00 PM to 09:00 AM	2	2	8	0	1	10	7	1	5	8	0	0	2	1	5	0	11	300	4	0
Tuesday 25 from 09:00 AM to 03:00 PM	3	4			6	nd			4	2			14	14			24	16		
Tuesday 25 from 03:00 PM to 09:00 AM	35	34	12	0	4	36	0	1	26	5	11	0	24	14	150	0	95	45	18	0

TBC and M/Y under Biovitae®																				
Test dates	Room 1 Meeting Room				Room 2 Meeting Room				Room 3 Gym				Room 4 Bathroom				Room 5 Bathroom			
	TBC		M/Y		TBC		M/Y		TBC		M/Y		TBC		M/Y		TBC		M/Y	
	P1	P2	P3		P1	P2	P3		P1	P2	P3		P1	P2	P3		P1	P2	P3	
Wednesday 26 from 09:00 AM to 03:00 PM	0	0	3	0	0	10	0	1	0	0	8	0	0	0	6	1	0	9	10	0
Wednesday 26 from 03:00 PM to 09:00 AM	4	2			1	0			2	4			5	0			5	5		
Thursday 27 from 09:00 AM to 03:00 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	15	0	0
Thursday 27 from 03:00 PM to 09:00 AM	5	0			1	1			5	1			2	2			4	3		

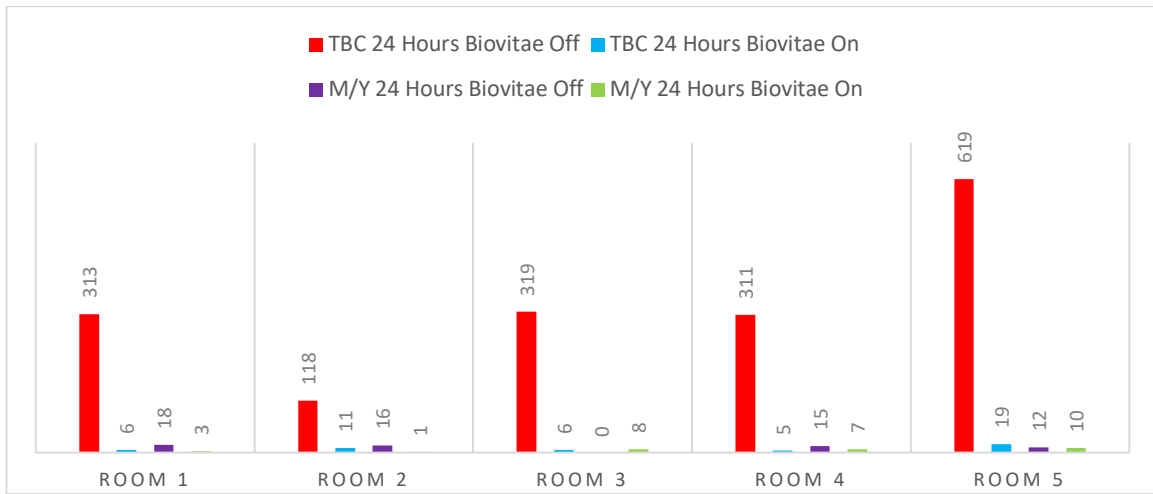


Fig. 1 - Comparing the TBC in the first half of 24 hours testing.

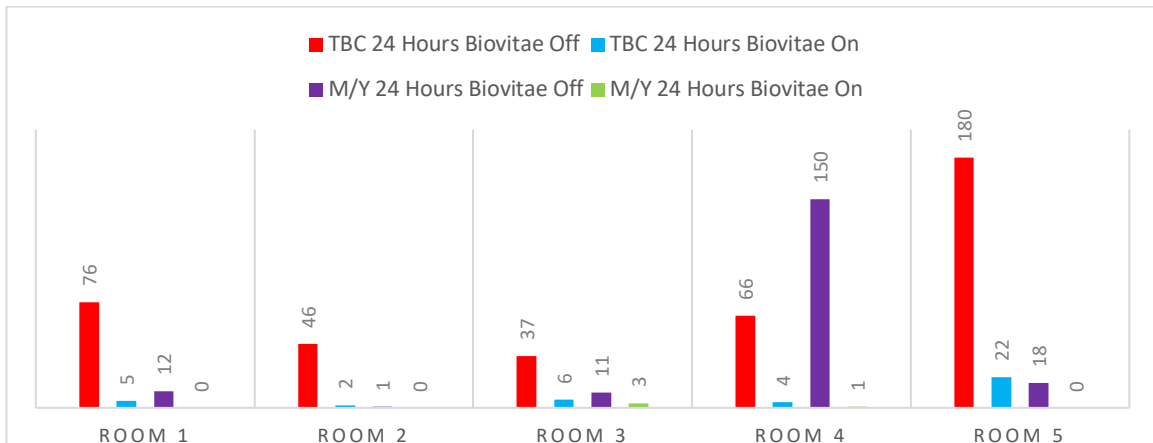


Fig. 2 - Comparing the TBC in the second half of 24 hours testing.

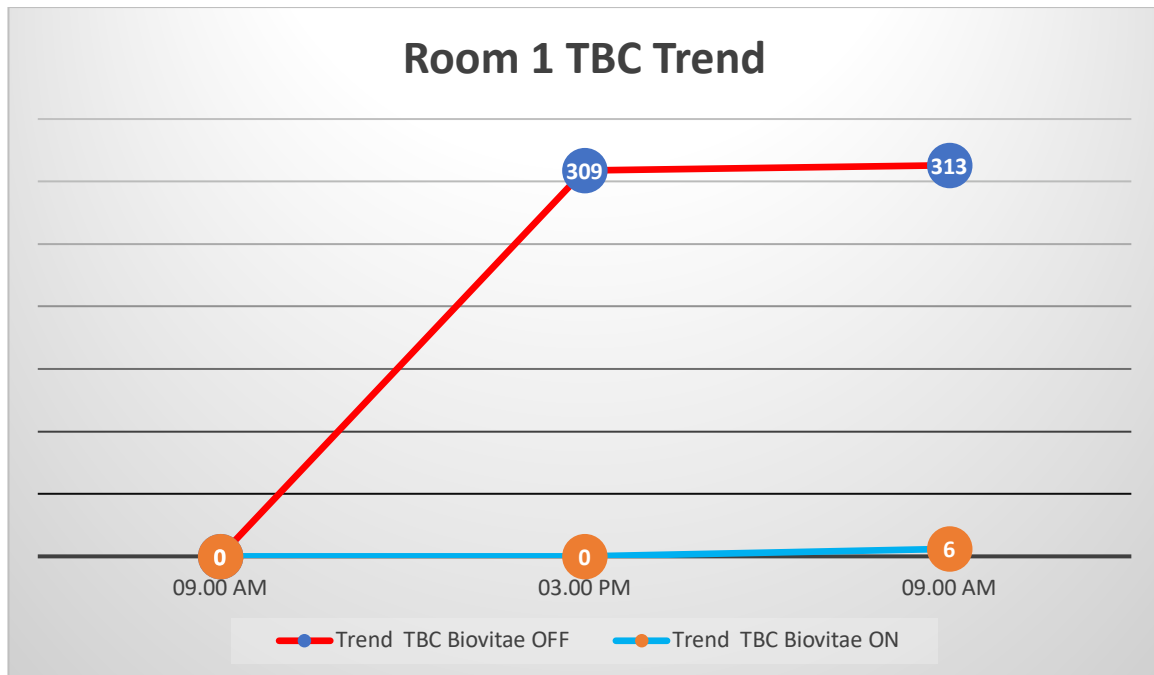


Fig. 3 - ROOM 1, TEST 1 (TBC: -98.10%): comparing the TBC trends in Meeting Room 1 (Room 1), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

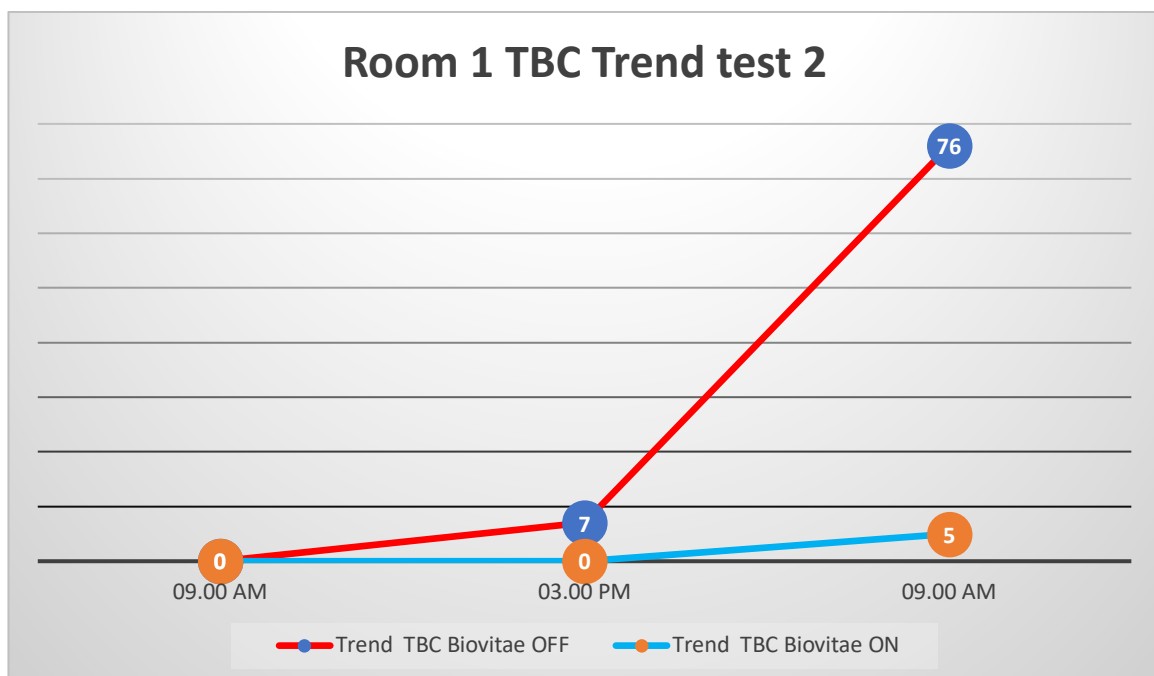


Fig. 4 - ROOM 1, TEST 2 (TBC: -93.42%): comparing TBC trends in Meeting Room 1 (Room 1), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

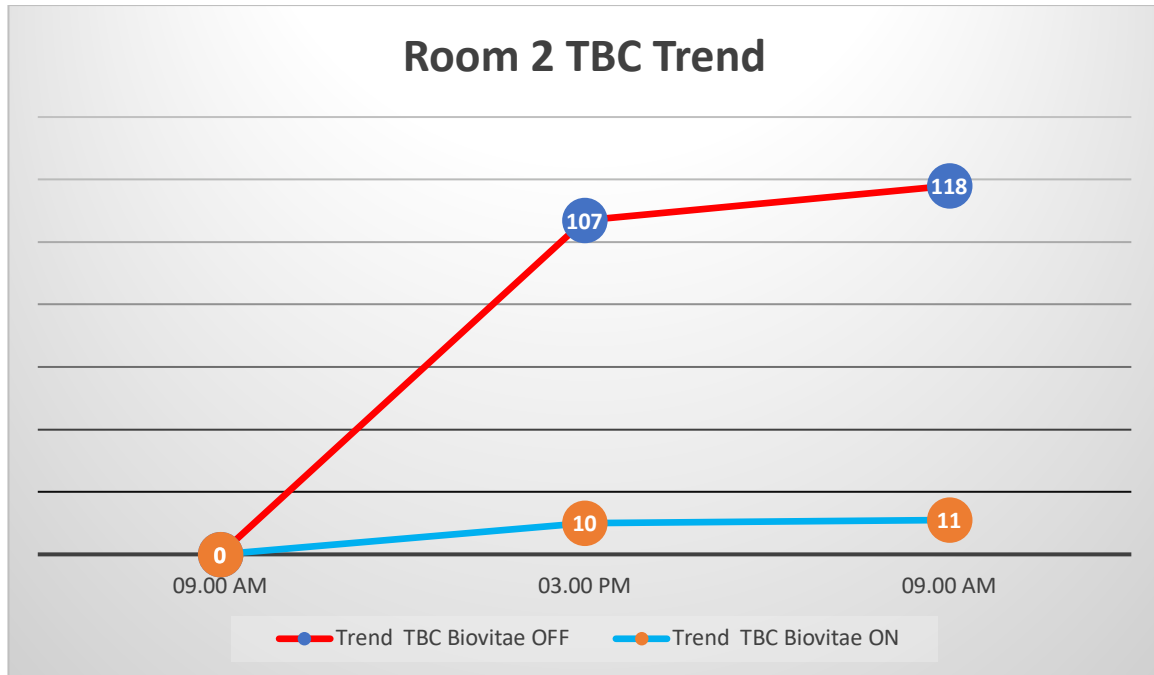


Fig. 5 - ROOM 2, TEST 1 (TBC: -90.67%): comparing TBC trends in Meeting Room 2 (Room 2), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

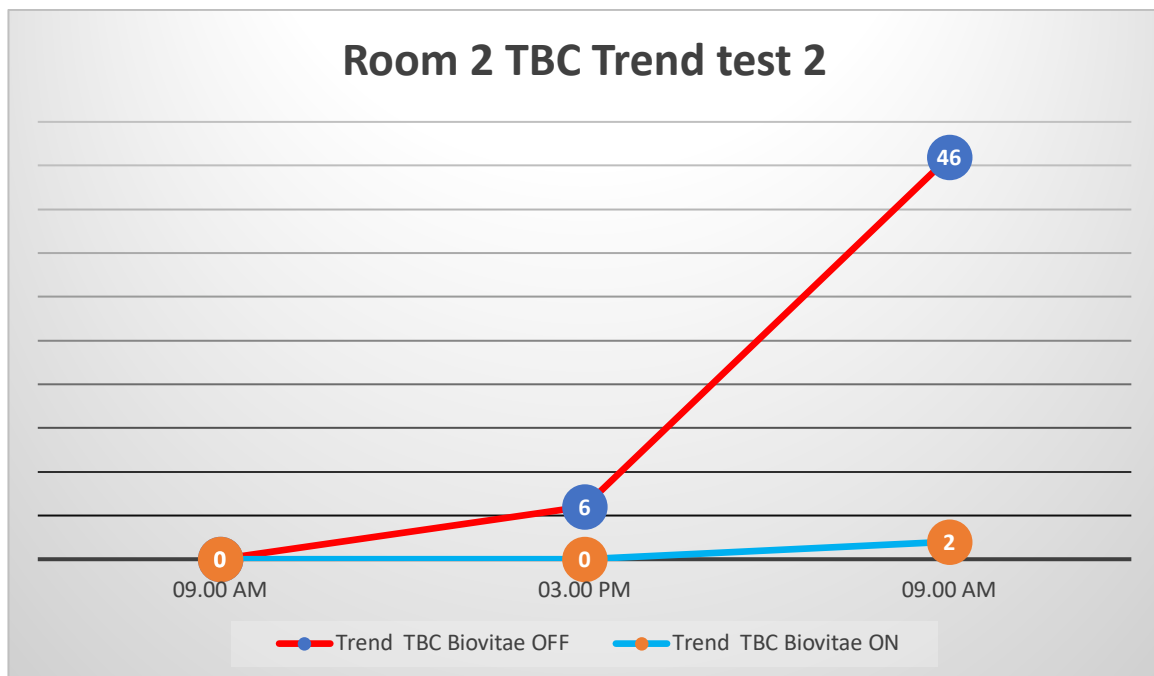


Fig.6 - ROOM 2, TEST 2 (TBC: -95.65%): comparing TBC trends in Meeting Room 2 (Room 2), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

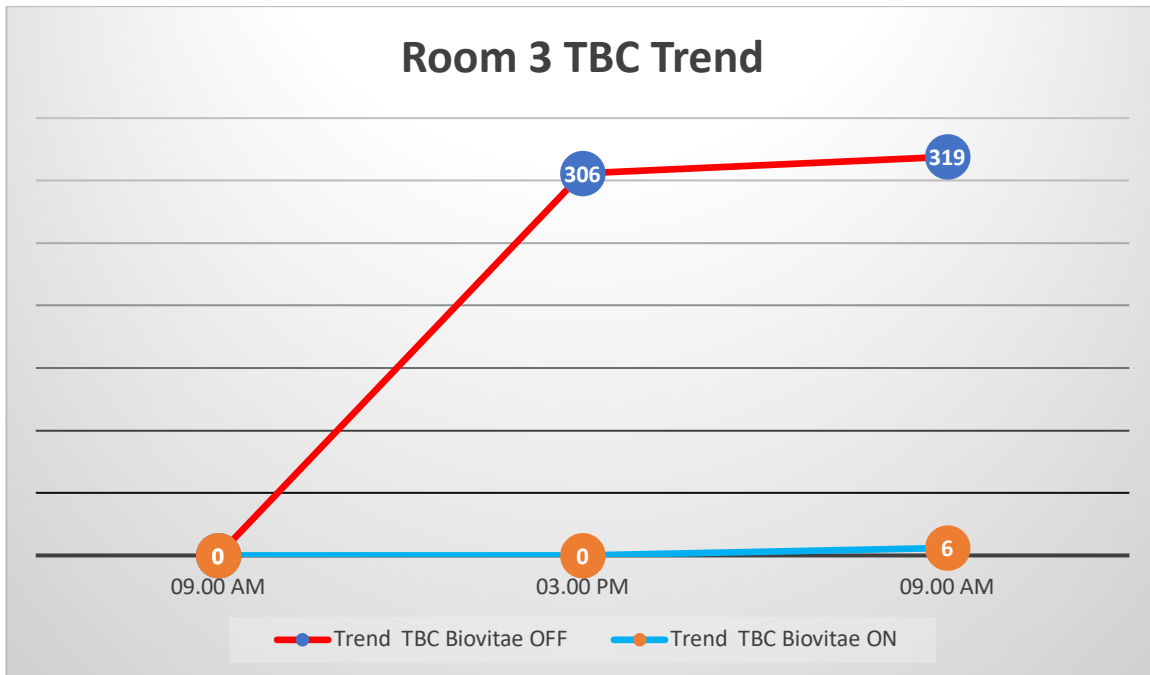


Fig. 7 - ROOM 3, TEST 1 (TBC: -98.11%): comparing TBC trends in the Gym (Room 3), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

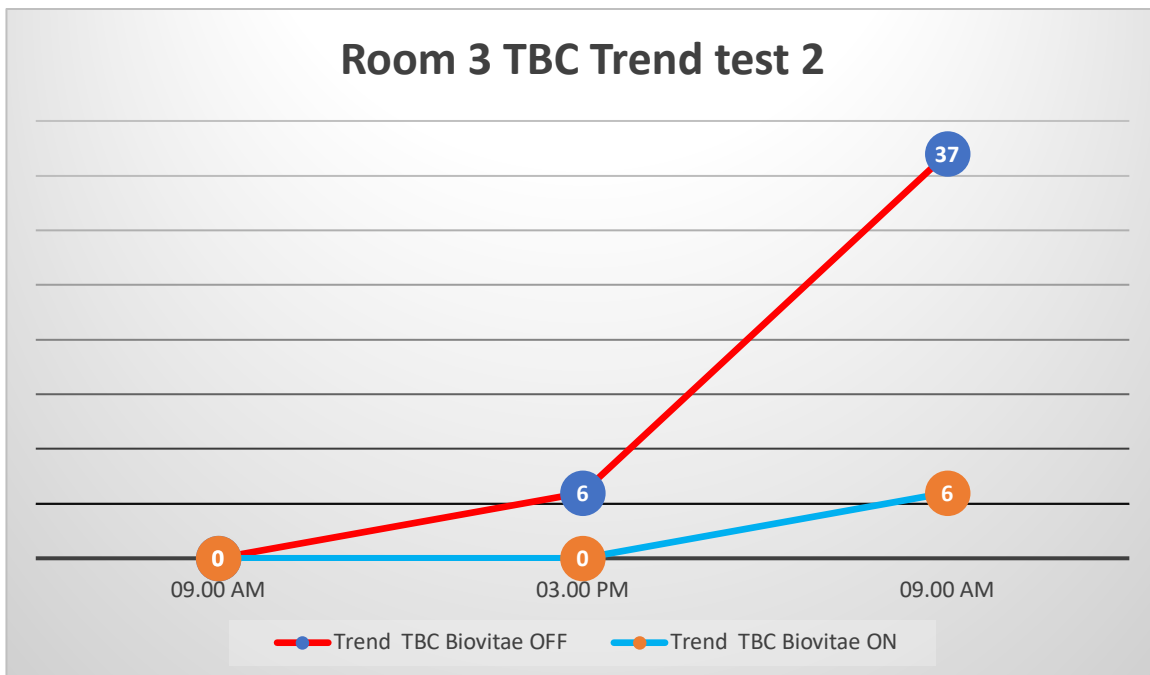


Fig. 8 - ROOM 3, TEST 2 (TBC: -83.78%): comparing TBC trends in the Gym (Room 3), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

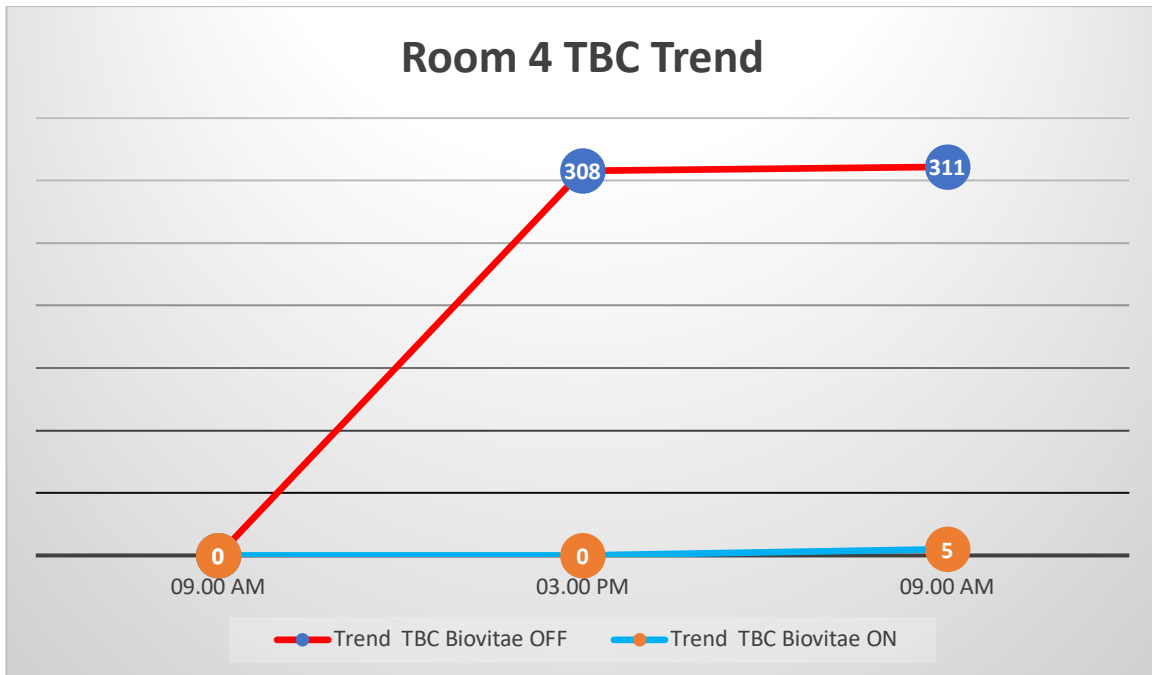


Fig. 9 - ROOM 4, TEST 1 (TBC: -98.39%): comparing TBC trends in Bathroom 1 (Room 4), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

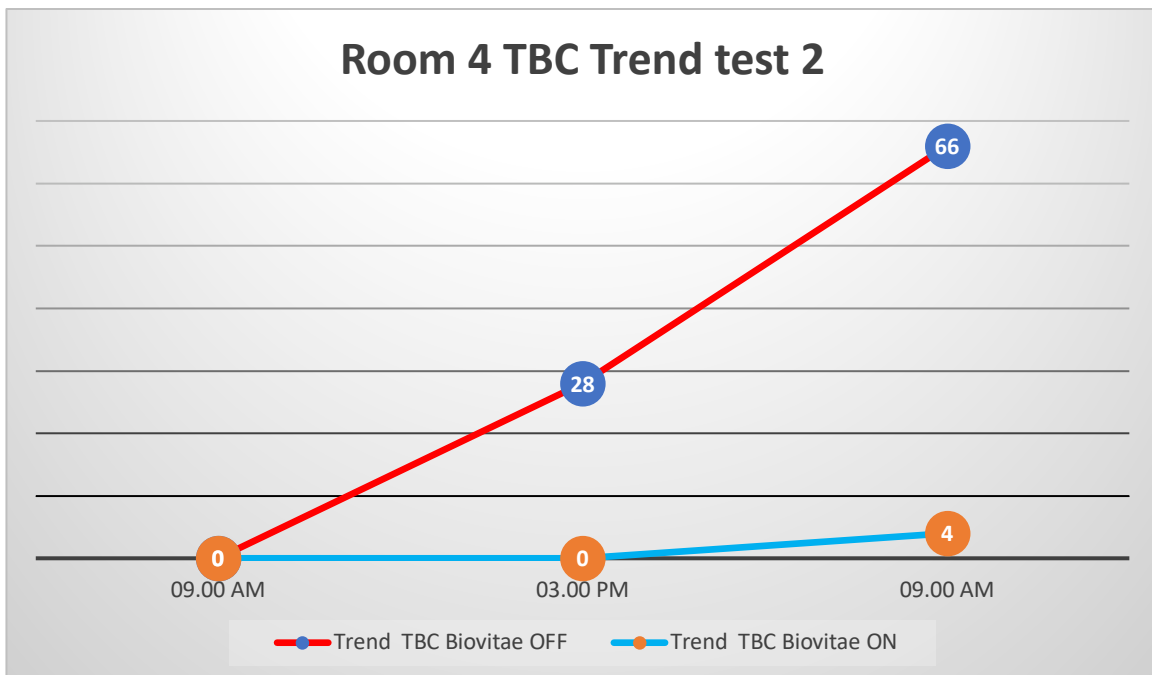


Fig. 10 - ROOM 4, TEST 2 (TBC: -93.93%): comparing TBC trends in Bathroom 1 (Room 4), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

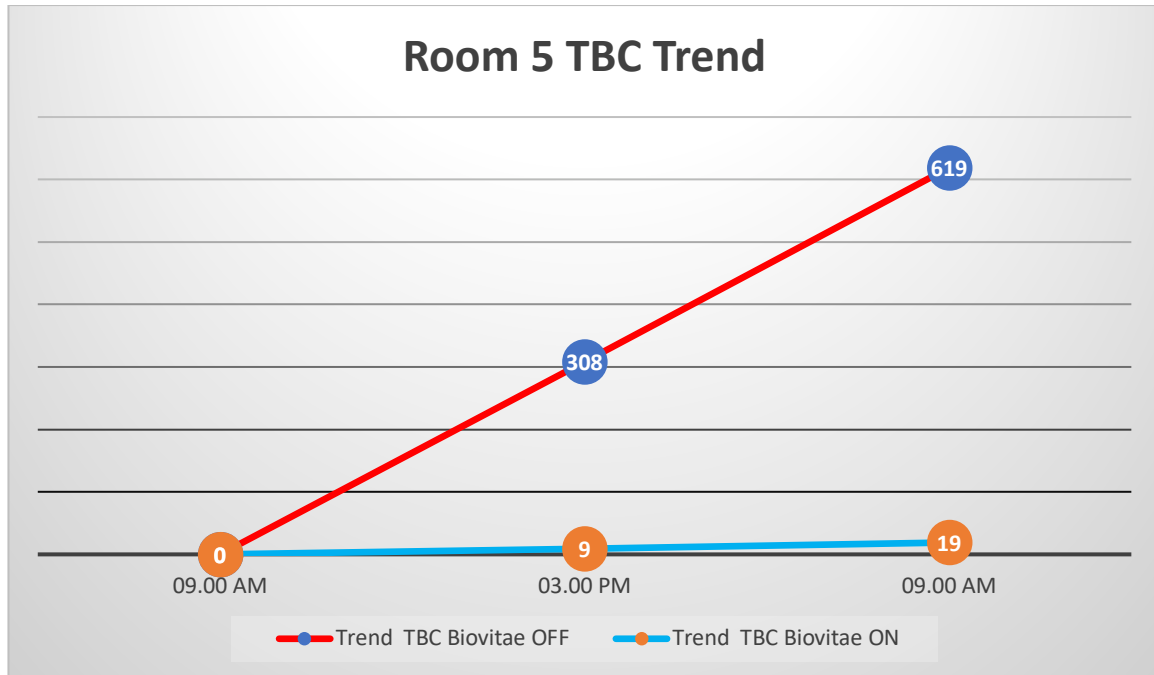


Fig. 11 - ROOM 5, TEST 1 (TBC: -96.30%): comparing of TBC trends in Bathroom 2 (Room 5), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

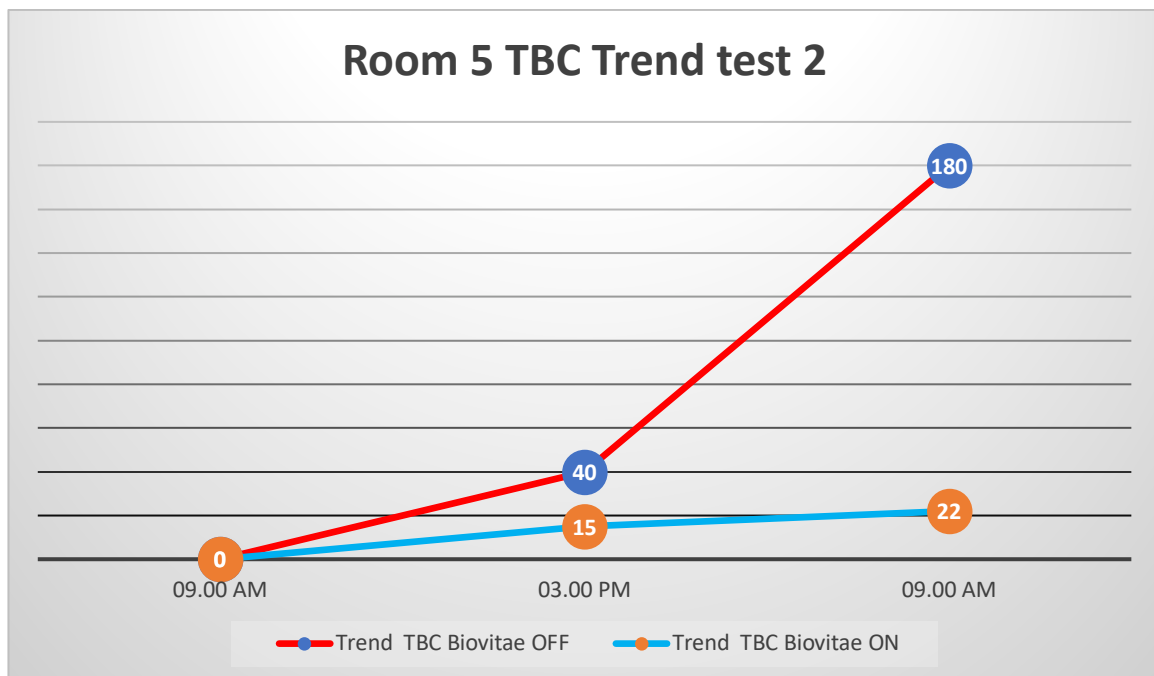


Fig. 12 - ROOM 5, TEST 2 (TBC: -87.77%): comparing of TBC trends in Bathroom 2 (Room 5), before and after installation of Biovitae® light sources. Under standard lighting, the TBC has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, TBC count is always very low and does not present phases of uncontrolled growth.

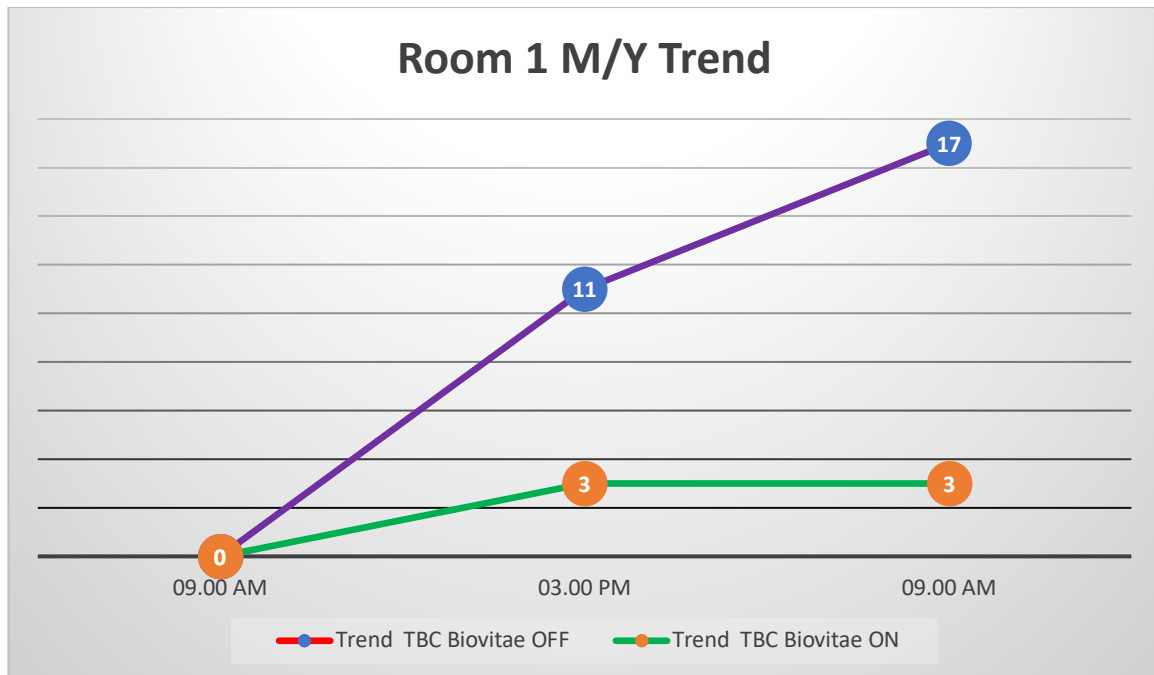


Fig. 13 - ROOM 1, TEST 1 (Y/M: -82.35%): comparing of M/Y trends in Meeting Room 1 (Room 1), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

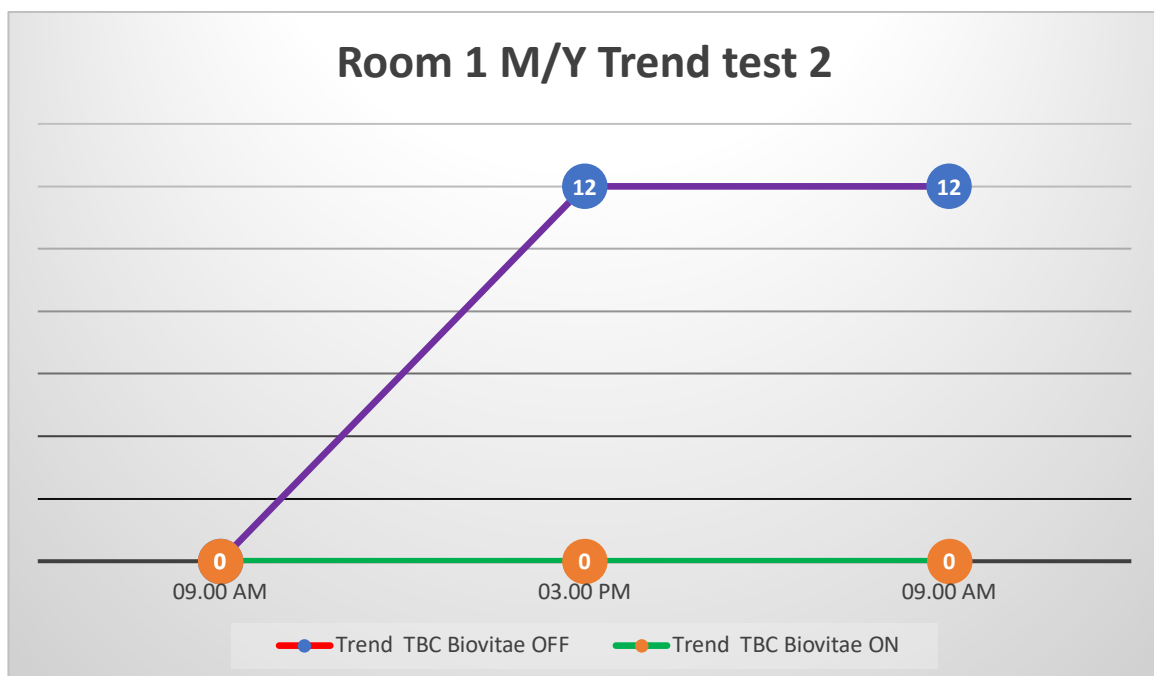


Fig. 14 - ROOM 1, TEST 2 (Y/M: -100.00%): comparing of M/Y trends in Meeting Room 1 (Room 1), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

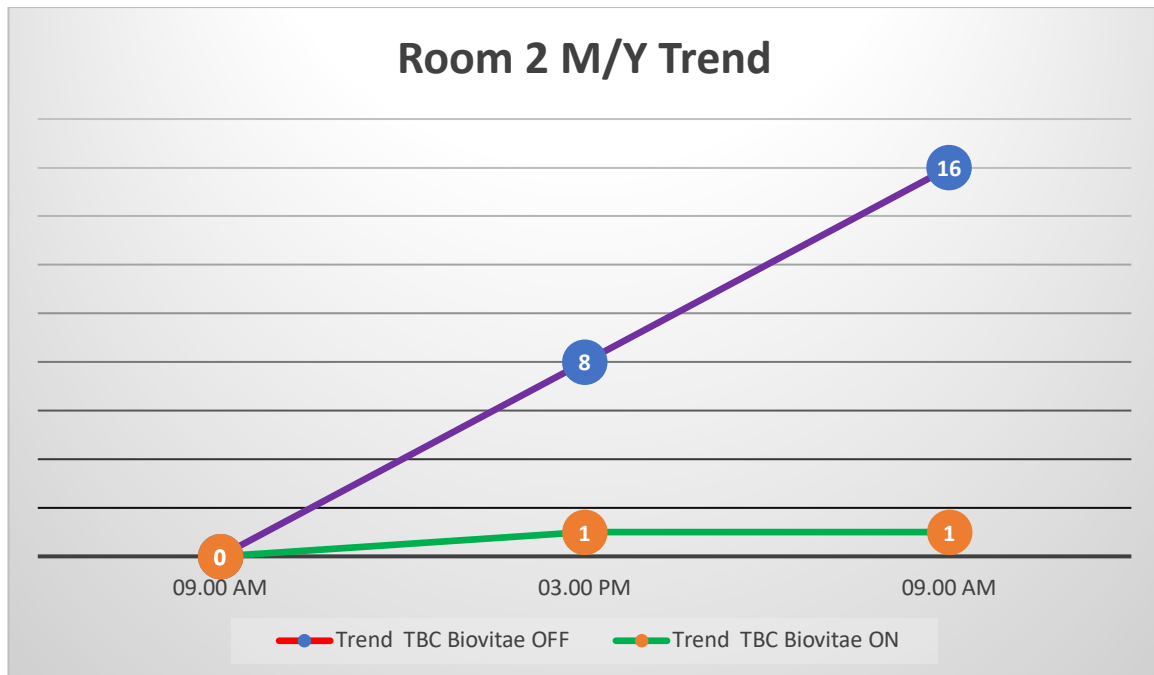


Fig. 15 - ROOM 2, TEST 1 (Y/M: -93.75%): comparing of M/Y trends in Meeting Room 2 (Room 2), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

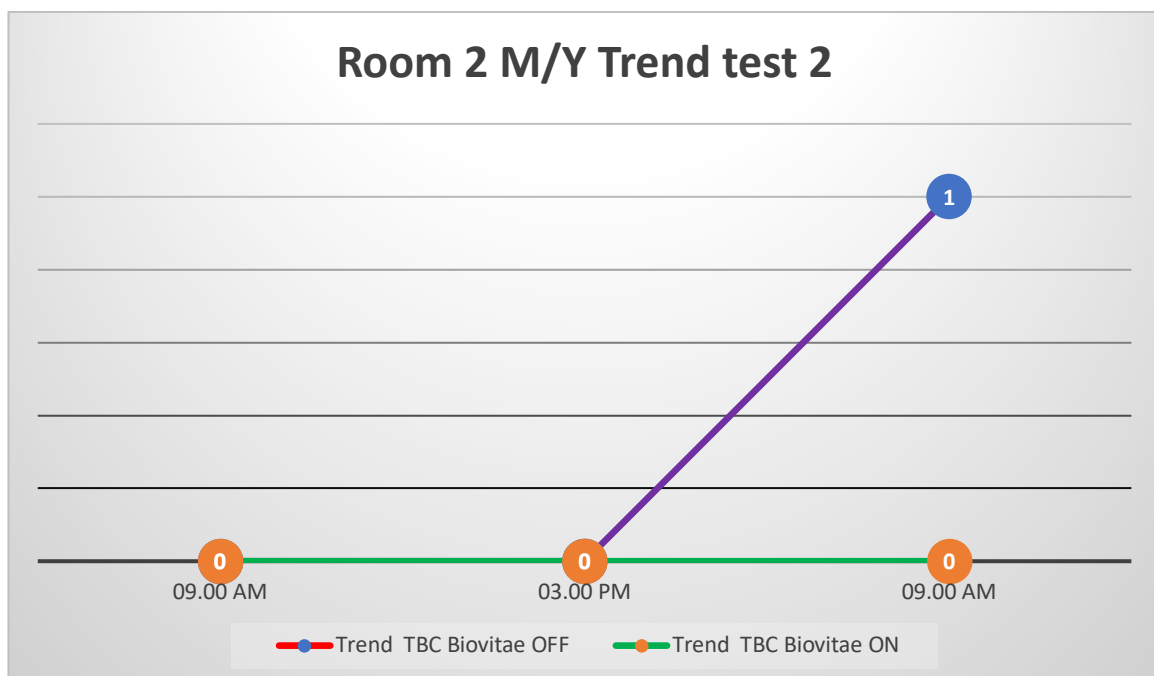


Fig. 16 - ROOM 2, TEST 2 (Y/M: -100.00%): comparing of M/Y trends in Meeting Room 2 (Room 2), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

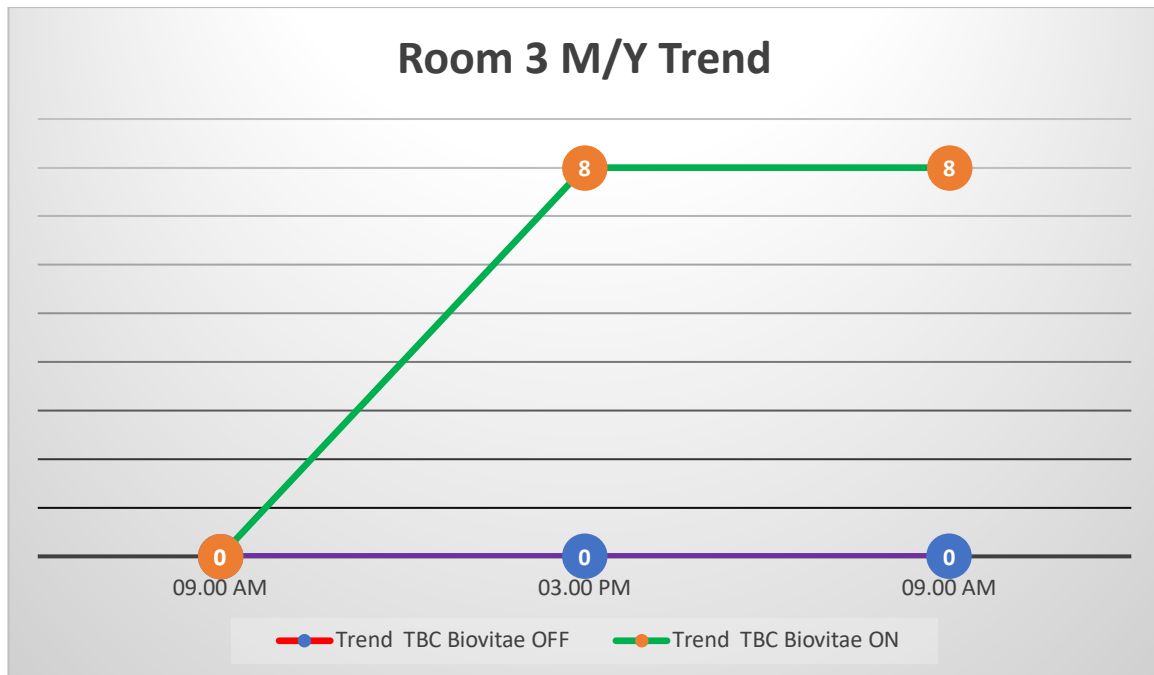


Fig. 17 - ROOM 3, TEST 1 (Y/M: -100.00%): comparing of M/Y trends in the Gym (Room 3), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

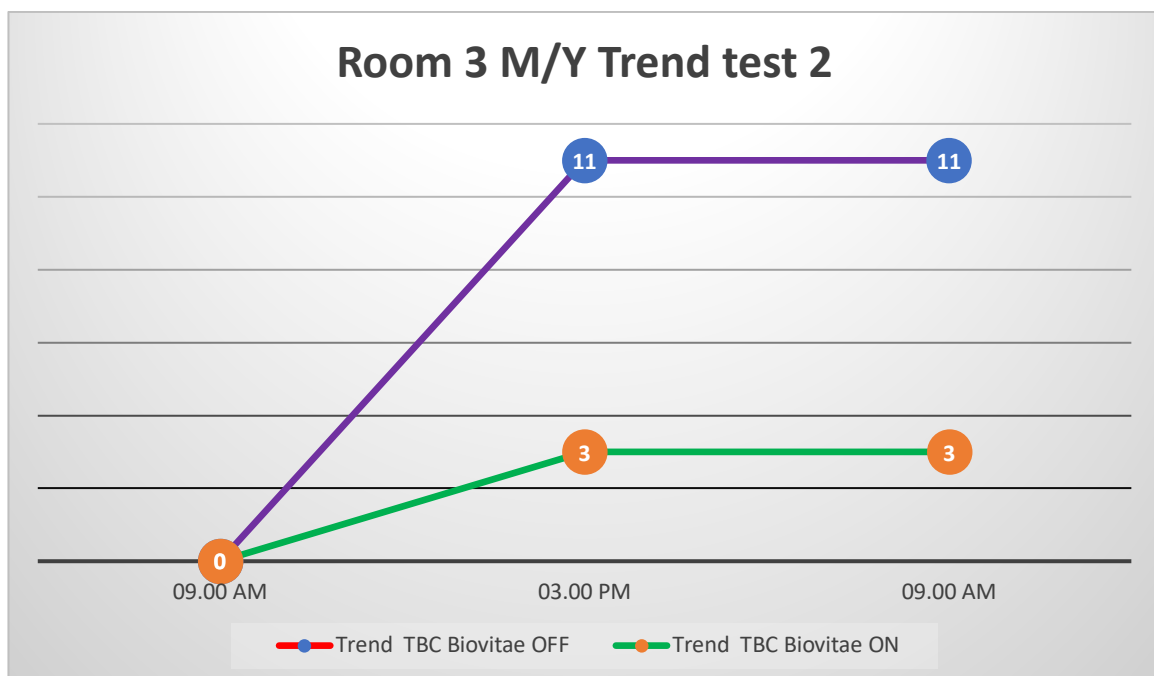


Fig. 18 - ROOM 3, TEST 2 (Y/M: -72.72%): comparing of M/Y trends in the Gym (Room 3), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

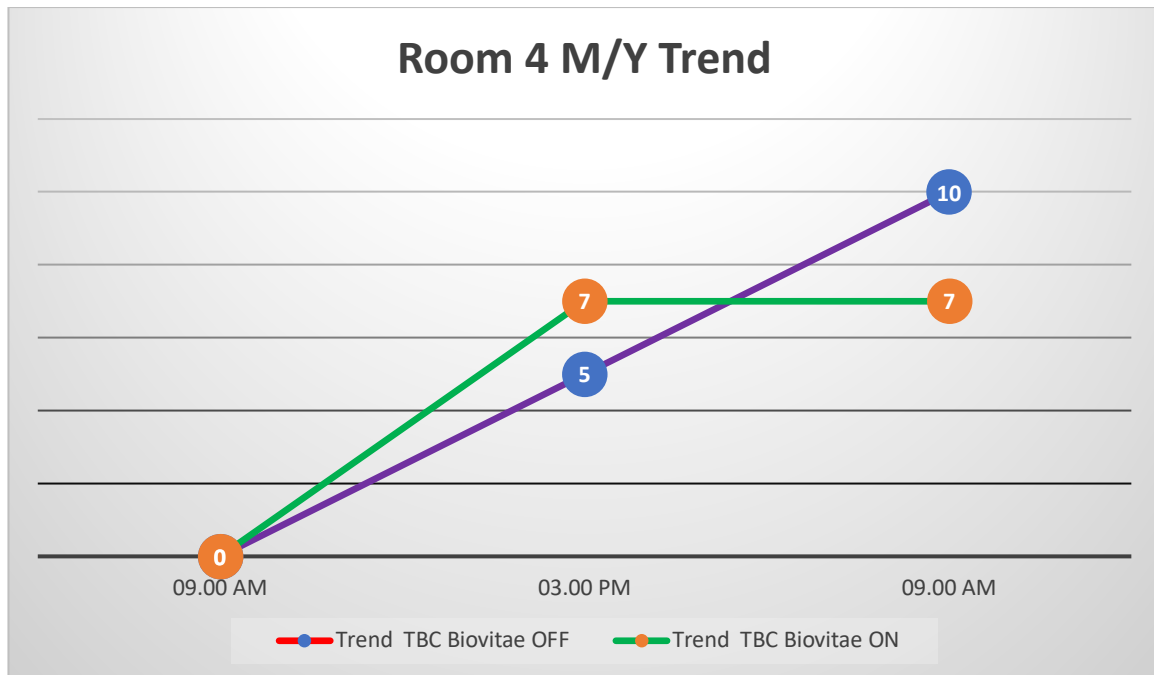


Fig. 19 - ROOM 4, TEST 1 (Y/M: -30.00%): comparing of M/Y trends in Bathroom 1 (Room 4), before and after installation of Biovitae® light sources. In this round the total M/Y count is higher in the immediate after installation, most likely following the technical problems during the assembly of the Biovitae® light sources which required a very long time and the need to remove numerous tiles, resulting in direct contamination of the environment through material precipitated from the ceiling.

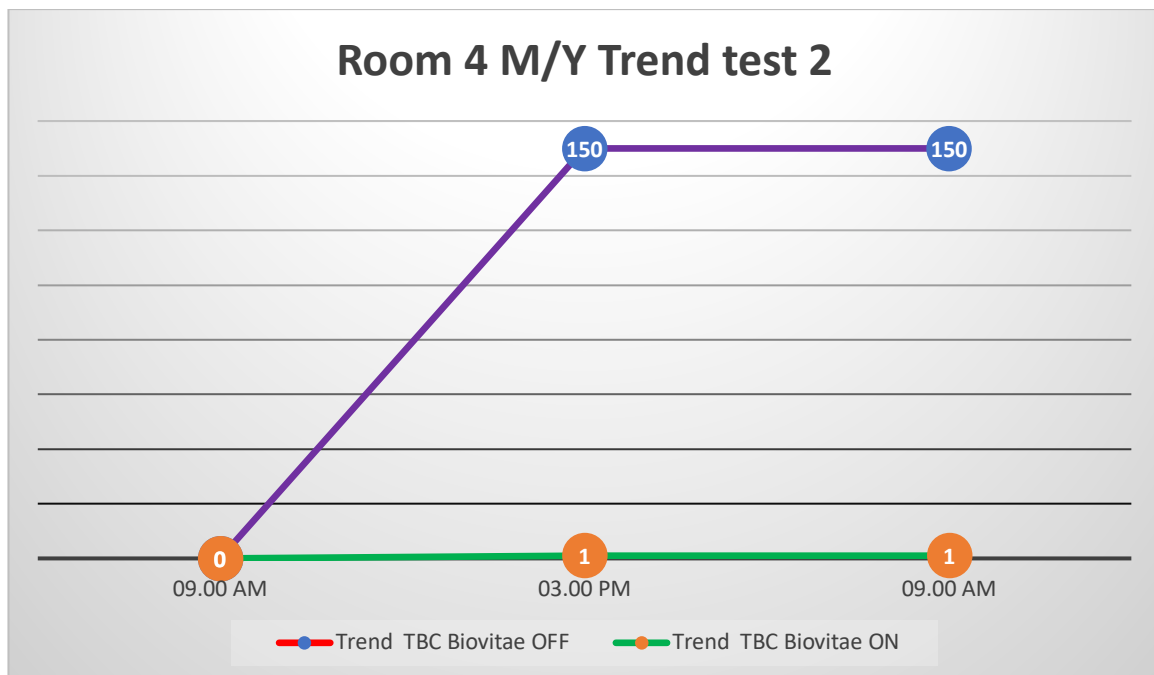


Fig. 20 - ROOM 4, TEST 2 (Y/M: -99.33%): comparing of M/Y trends in Bathroom 1 (Room 4), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

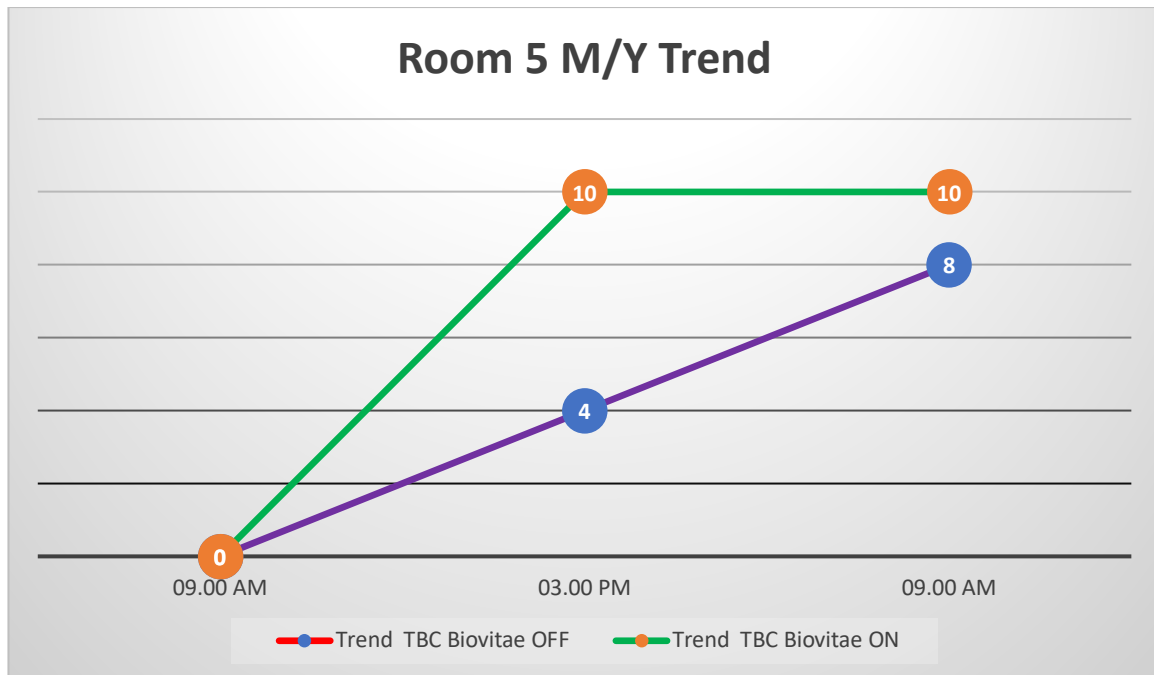


Fig. 21 - ROOM 5, TEST 1 (Y/M: -20.00%): comparing of M/Y trends in Bathroom 2 (Room 5), before and after installation of Biovitae® light sources. Again, in this round the total M/Y count is higher in the immediate after installation, most likely following the technical problems during the assembly of the Biovitae® light sources which required a very long time and the need to remove numerous tiles, resulting in direct contamination of the environment through material precipitated from the ceiling.

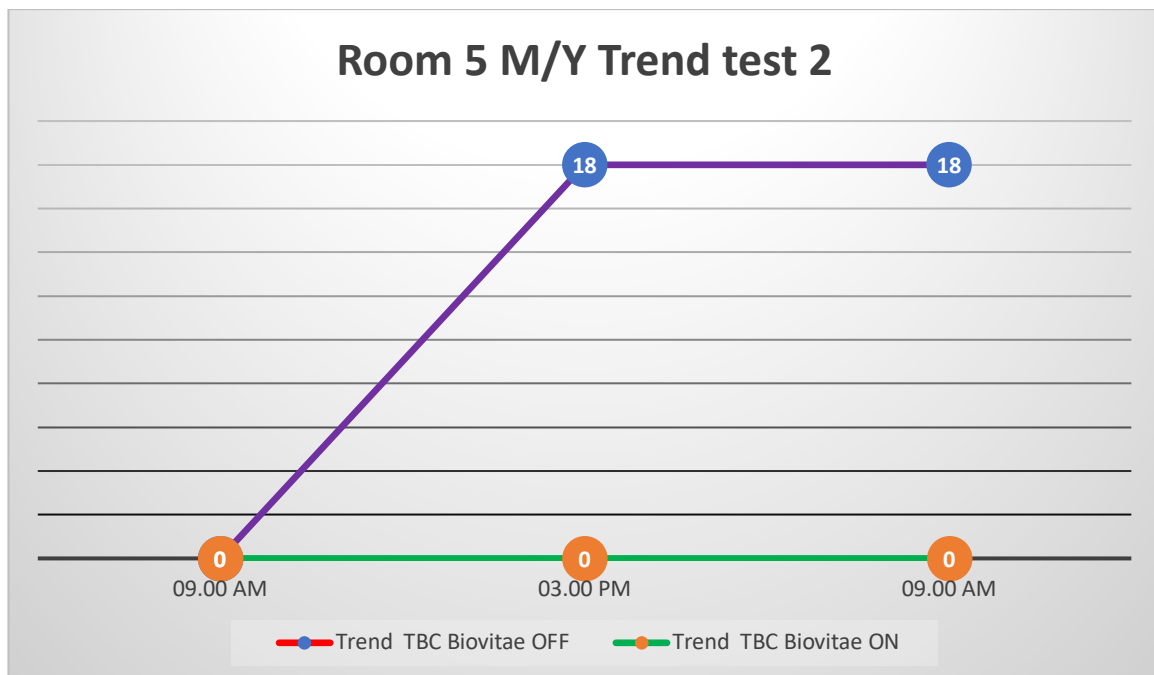


Fig. 22 - ROOM 5, TEST 2 (Y/M: -100.00%): comparing of M/Y trends in Bathroom 2 (Room 5), before and after installation of Biovitae® light sources. Under standard lighting, the Y/M count has an exponential trend in the first hours and then continues to grow. Under Biovitae® lighting, Y/M count is always very low and does not present phases of uncontrolled growth.

Final Thoughts

Varied and dynamic environments such as those present in the workplace represent a daily challenge to ensure the healthiness of these environments and to prevent them from becoming incubators for pathogenic microorganisms.

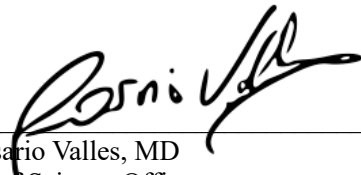
Normal cleaning procedures fail to guarantee the safety of the rooms due to their incorrect execution and duration. And once an environment has been cleaned and disinfected with a chemical agent, the protection offered against pathogenic microorganisms is limited and short-lived: in fact, it is estimated that a disinfectant has the ability to reduce no more than 20% of the total bacterial load and that its effect ceases within 30 minutes of application.

In this study, environments lit by classic lighting systems in which typical daily cleaning routines were performed were compared against the same environments lit by Biovitae® continuous sanitization systems. The total bacterial count (TBC) and Moulds/Yeasts count (M/Y) of five different environments, cleaned and sanitized with chemical biocides and the same environments subjected to the Biovitae® continuous sanitization system was paralleled.

At the end of the tests, the Biovitae® continuous sanitization technology brought the general microbial load to levels much lower than those obtained with the use of chemical biocides. But, above all, it was verified that the TBC remained low for the entire time the rooms were used, generally reducing the TBC by more than 90% and guaranteeing visitors a very low infectious risk.

NEXTSENSE SRL

Report by:



Rosario Valles, MD
Chief Science Officer



ALS Life Sciences Ltd trading as ALS
Carrigeen Business Park, Clonmel, Co. Tipperary
Telephone: +353 (0) 52 617 8100

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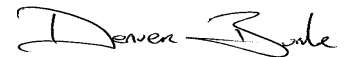
Order N

For the Attention of: Rosario Valles

Sample Reception 10 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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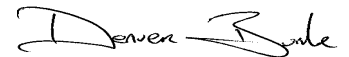
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Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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Monksland Business Park
Athlone
Co. Roscommon

Date S

Date R

Order N

For the Attention of: Rosario Valles

Sample Reception 5 sample(s) received in good condition.

Comments N/A

Report Authorised by:

Olwen Maher

Olwen Maher
Deputy Microbiology Manager

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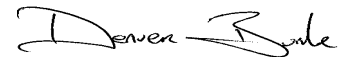
Order N

For the Attention of: Rosario Valles

Sample Reception 5 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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10. Statement of conformity made against the result does not take into account the uncertainty of measurement associated



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Co. Roscommon

Date S

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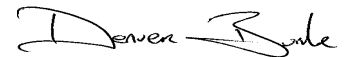
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For the Attention of: Rosario Valles

Sample Reception 10 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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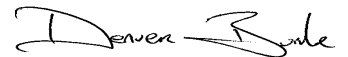
Order N

For the Attention of: Rosario Valles

Sample Reception 9 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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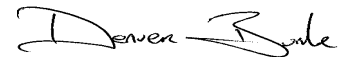
Order N

For the Attention of: Rosario Valles

Sample Reception 8 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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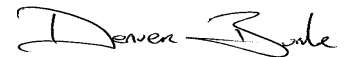
Order N

For the Attention of: Rosario Valles

Sample Reception 10 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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Order N

For the Attention of: Rosario Valles

Sample Reception 5 sample(s) received in good condition.

Comments N/A

Report Authorised by:

Olwen Maher

Olwen Maher
Deputy Microbiology Manager

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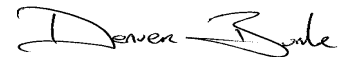
Order N

For the Attention of: Rosario Valles

Sample Reception 1 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Denver Burke
Microbiology Manager

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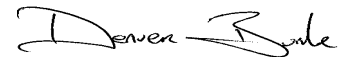
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For the Attention of: Rosario Valles

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Comments N/A

Report Authorised by:



Denver Burke
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Comments N/A

Report Authorised by:



Olwen Maher
Deputy Microbiology Manager

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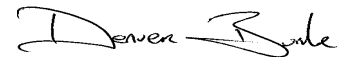
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Comments N/A

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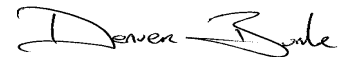
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Order N

For the Attention of: Rosario Valles

Sample Reception 10 sample(s) received in good condition.

Comments N/A

Report Authorised by:



Darren Bray
Microbiology Department Supervisor

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