Final Report

UV Lights

Australian Meat Group
UV wet conveyor product belt sterilisation

Project Code
2020-1050

Prepared by
Allister Watson
Pasadena Partners Pty Ltd

Published by
AMPC

Date Submitted
08/06/21

Date Published
08/06/21

Contents

1.0 Executive Summary

The purpose of this project is to see if UV light can be introduced to the product conveyor belts and assist in the reduction of water used to clean the belts during production periods, as well as, reducing the microbial counts on the product and therefore giving AMG the ability to increase shelf life.

UV light has proved to be effective in destroying bacteria with thin cell walls such as Salmonella, Listeria and E.coli through the radiation it expels but previous studies have not seen any significant reduction in the E.coli count.

The belts are currently cleaned every 2 hours with a pulsing water system which has proved to reduce the microbial counts and give them a visually cleaner look, however, this means there is a significant amount of water used throughout the day which adds to the cost of processing.

Trials were done with a prototype UV light from Australian Ultraviolet in Brisbane. The results were very conclusive and showed a much reduced microbial count when using the light as opposed to not using it.

The UV lights were purchased from Australian Ultraviolet and modified by the AMG engineering team to ensure the housing was robust and waterproof without exposing the light to the processing workers as it could damage their eyes. At the same time UV lights were also purchased and fitted to the incoming air refrigeration units in the room which created an added benefit of cleaner air entering the room.

The results from using the UV lights were a significant reduction in the total microbial counts as well as a reduction in the E.coli counts. These reductions gave the QA team confidence to start reducing the cleaning cycles while monitoring the results. The initial water savings were 7,000 litres per day but that has now risen to a consistent saving of 22,000 litre per day. Once the cleaning cycle reductions were set and the water savings were established then shelf life testing could be reassessed. The AMG QA team have now extended the product shelf life from 120 days for primal cuts to 130 days, and are evaluating and increased shelf life for the future.

Apart from having to manufacture housing for the lights and adapt them to the individual belts, the only other issue was in the belts themselves. The belts used were the original standard product belts but with the constant UV light on them they started to deteriorate so have had to be replaced with a UV resistant material. This was not considered at the start of the project but should be built into the process from the start with any plant putting in UV lights.

This project has been a success. The original objectives of reducing cleaning cycles and therefore reducing water consumption, as well as being able to increase the product shelf life, have both been met. It is important to note that AMG have also been doing other work in the boning room to help reduce the microbial counts on the product and increase the overall shelf life. Any processing plant adopting UV lights on their product conveyor belts should see the same reduction in microbial counts that AMG has seen which will allow them to make decisions on cleaning and product shelf life.

2.0 Introduction

AMG currently have 12 x 600mm wide product conveyor belts with self-contained head water washing units that are used both during cleaning and systematically during production (i.e. every 2 hours). AMG have obtained increased shelf life pulsing the water cleaning system during production and hence have demonstrated the ability to keep belts microbial and visually cleaner during production runs, however, this has come at a cost of increased water usage and water disposal. In addition, residual water on the belt during processing, if contaminated from a belt source, becomes a microbial carrier in itself.

The purpose of this project is to see if UV light can be introduced to the product conveyor belts and assist in the reduction of water used to clean the belts during production periods, as well as, reducing the microbial counts on the

product and therefore giving AMG the ability to increase shelf life.

UV light has been shown to be effective on most bacterial microorganisms as well as viruses and moulds. Ultraviolet light at wavelengths of 254nm destroys the DNA of all microorganisms so viruses, bacteria, yeasts and fungi are disabled in seconds. Bacteria such as Salmonella, Listeria and E. coli have a comparatively thin cell wall and can only slightly block the UV radiation, therefore, are extremely vulnerable and should be easily destroyed.

AMG are aware of previous work that has been done with the use of UV light and, contrary to a previous report on the use of UV light on product belts as detailed in the AMPC/MLA Processors Guide 3rd edition page 124, where the report detailed a 0.7 log on average reduction in TVC counts on product belts with no significant reduction in E.coli prevalence, they hope to get a reduction in E. coli levels through this project.

There are no limitations in this project and if there is an alternative use for the UV lights found during the process then this will also be considered.

3.0 Project Objectives

This project will evaluate the complementary benefit of UV systems on meat primal belts that are currently installed at the AMG Dandenong facility. The belts at AMG have been previously modified to have an in-situ water wash system that is used during cleaning, but more importantly for this project used in a pulse program to 'freshen up' the belts during production runs, i.e. every two hours.

This during product water wash introduced by AMG has increased shelf life / reduced microbial contamination, however, has come at the result of increased water consumption and resulting treatment costs. The introduced water during production can also be a source of microbiological contamination.

This project will evaluate if UV systems can (1) increase shelf life and (2) reduce water usage during production periods.

AMG do not want to lose the benefits they have achieved with periodic water washing of belts during production but at the same time want to reduce the water use and potential for any residual water to be a micro carrier in its own right.

UV light is used for a large variety of applications in the food industry. With high-performance UV light sources and equipment, water, air and surfaces can be reliably disinfected, cleaned and treated. The use of chemicals can be reduced or even avoided in an economical and environmentally friendly way.

On surfaces such as conveyor belts, particularly in the meat and meat processing areas, UV light can be used to provide continuous decontamination in the form of a module designed to expose the belt to UV as it passes. The module is completely watertight and can be incorporated into CIP best practices. The intense germicidal action of UV light acts on microorganisms on the belt surface, rendering them inactive. This treatment can reduce the number of complete washdowns required during processing, thereby saving resources such as water and energy costs.

As such AMG want to experiment with a combination of inline production run washing and UV systems working in tandem.

4.0 Methodology

A number of options were available to purchase UV lights from, but Australian Ultraviolet from Brisbane was chosen by AMG as they wanted to support an Australian business that would also be on hand to support them. They were able to meet with the AMG team at Dandenong, prior to lockdowns, showing all the information and some of the

overseas installations they had been involved with.

Another reason they were chosen was that they provided examples of proven trials they had done and provided a prototype lamp that AMG could trial for a month.

The QA team are able to take swab samples during the trial and this has shown such promising results that orders were placed for the UV light system for all belts. The UV light continually disinfects the conveyor belt to ensure hygienic contact surfaces, reducing microbial spikes, reduced risk from cross contamination and manual cleaning issues.

It was also decided to apply the UV light to the refrigeration units as well as the belts. This will greatly reduce the risk of cross contamination from fouled cooling coils into the processing room.

The initial trials had been done with a UV light prototype that was given to AMG for trials. The trial results were excellent and the micro counts when using the UV lights on the belt were greatly reduced compared with not using the UV light.

There was also evidence that having the UV lights on the room refrigeration system reduced the amount of bacteria in the air in the room. This was extremely important with the onset of COVID19 as the cleaner the air then the less risk of airborne transmission of any bacteria. It was decided to add UV lights to all the refrigeration units (Air con units) as well as the 11 belts originally identified in the project.

The belts had to be modified to have the UV lights in place over them and the lights had to also have a compliant guard to secure the lights and ensure that the people in the room weren't able to look at it directly as it may cause damage to their eyes.

The guards and screens were made on site by the engineers at AMG and they had to be fitted in the weekend when the plant was shut down.

The first lights were fitted and commissioned on 26th July 2020 to the refrigeration units.

The lights for the belts were fitted and commissioned on 2nd August 2020.

The UV light unit was installed underneath the product conveyor belt and housed so there was no radiance to the outside or risk of direct exposure to people or product (see Appendix 1). The UV lamps are run within the C wavelength spectrum, i.e. 185mn to 254mn, and are within a few mm of the product belt.

The belts are cleaned with water and sanitisers after each 2 hours of a production shift. The QA and Laboratory teams validated the UV lights continued performance of sterilizing belts by counting bacteria on the belt surfaces.

The introduction of UV lights has allowed one of the cleaning cycles to be removed and the other cleaning cycles will continue to be assessed based on the micro counts on the belts and products.

Contrary to a previous report in the AMPC/MLA Processors Guide 3rd edition page 124, where the report detailed a 0.7 log on average reduction in TVC counts on product belts with no significant reduction in E.coli prevalence, AMG validations in contrast have shown significant reductions in E.coli prevalence on belts.

The conventional trim belts used in the boning room were found to break up with the constant exposure to the UV light which was not expected. This meant the belts had to be changed to a UV rated belt which works well.

5.0 Project Outcomes

The results from this project were that the use of UV lights on the Product conveyor belts has reduced the overall microbial counts, and the E.coli counts, on the products as shown in Appendix 2. This reduction in counts initially has led to the reduction in cleaning cycles by AMG to maintain the same shelf life on the product that they have previously declared – 120 days on most primals.

The initial water saving from reducing the cleaning the cycles was 7000 litres per day but now after months of trials to determine the right number of cycles required and the water requirement per cycle, AMG have reduced the cleaning water by 22000 litres per day.

The second outcome after months of validation is that the shelf life on the primals has now been increased to 130 days. This is not necessarily only due to the introduction in UV lights but it is the single biggest change that has been made in the room. There are thoughts that the shelf life may be able to be extended further to 150 days but that is still being validated and AMG will be very cautious in moving to that level at this stage.

The addition of UV lights to the refrigeration units also would have assisted in the reduction of airborne bacteria and would contribute to the reduction in overall microbial counts and the increased product shelf life.

The project met the objectives that it set out to achieve in both reducing the water usage in the cleaning cycles and increasing the product shelf life.

6.0 Discussion

The UV light on the product conveyor belt has had a significant effect on the total microbial count and the E.coli levels detected. There was not expected to be a difference in the E.coli count as was previously recorded in the report in the AMPC/MLA Processors Guide 3rd edition page 124, however the reduction has been significant in the AMG plant.

This reduction has allowed the cleaning cycles in the plant to be reduced on these belts resulting in a water usage of 22,000 litres less per day than was previously used. It was originally thought that the savings would be approximately 7,000 litres per day but this has been exceeded due to the consistently lower counts.

UV lights were also put on the incoming refrigeration units which wud have contributed to cleaner air entering the boning room but the impact of this on the overall microbial counts on the product conveyor belts couldn't be measured.

The reduced microbial counts when the cleaning cycles were reduced has also enabled AMG to increase the product shelf life by 10 days from 120 days to 130 days. Whilst there is a possibility that the shelf life could be extended even further, the 130 days is what the plant is comfortable to apply at present.

7.0 Conclusions / Recommendations

It is evident from this project that the use of UV lights on the conveyor belts in the production areas help reduce the microbial counts. This then allows the plant to make a decision on whether they reduce the cleaning times of the belts, eliminate cleaning cycles, or just continue with the same cycles and lower counts.

AMG also applied the UV lights to the incoming refrigeration units as a way of ensuring 'cleaner' air was entering the processing room. Whilst this was done through the onset of COVID19 in Australia and there was a desire to ensure airflow in the plant was as clean as possible, it also would have contributed to the lower microbial counts in the room and therefore on the product conveyor belts as well.

The aim of this project was to see if the use of UV lights on the conveyor belts would allow AMG to reduce the cleaning cycles used and therefore reduce the amount of water used in cleaning the belts, and, to also look at increasing the

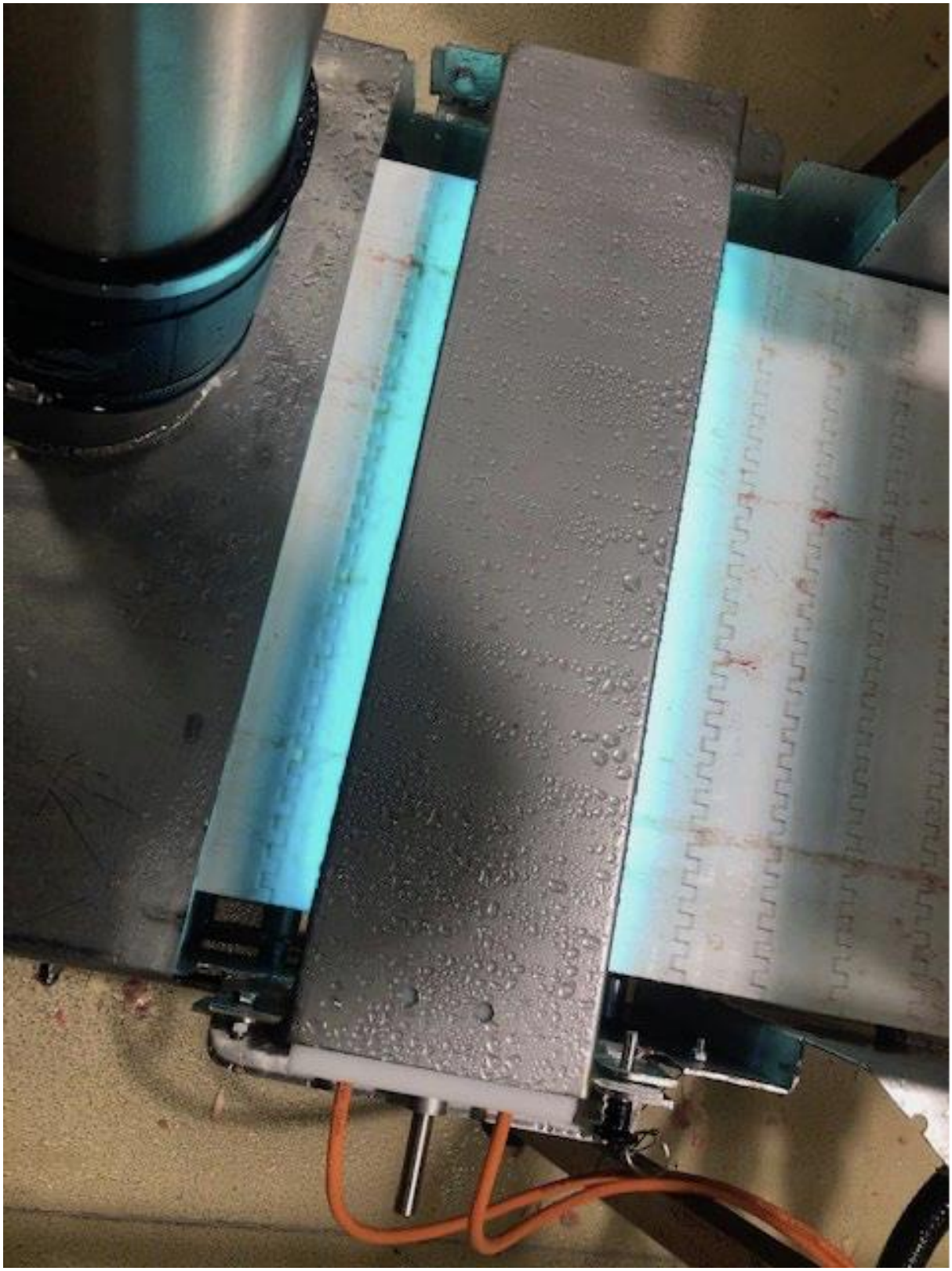
shelf life on the product itself from using the UV lights.

AMG have been able to achieve both of these objectives through the use of UV lights primarily, although there have also been other improvements in the room. The daily reduction of 22000 litres of water used for cleaning and the extension of the shelf life from 120 days to 130 days are great results.

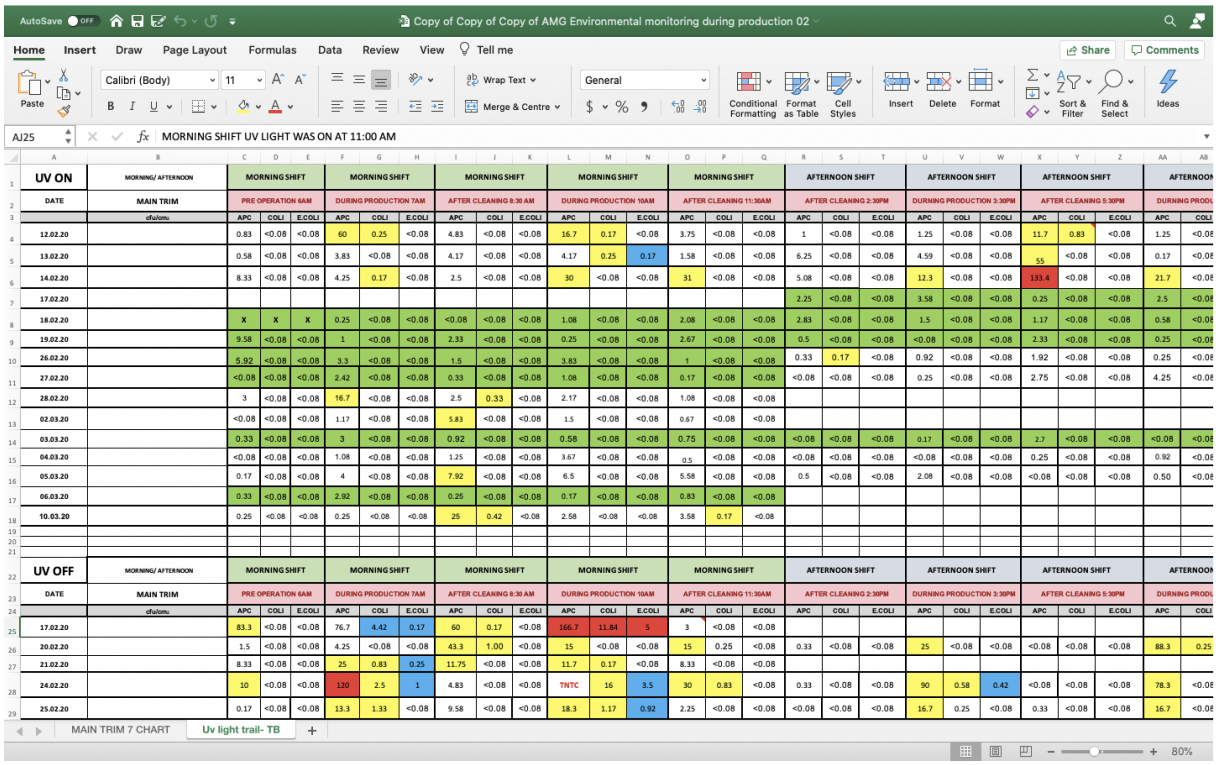
It is recommended that UV lights are applied to wet conveyor product belts as they assist in reducing total microbial counts and E.coli counts. This will allow a reduction of cleaning water used on the belts and give confidence to any shelf life extension that is sought. The correct UV rated belts will need to be used otherwise the UV light will have a detrimental effect on the life of the belt itself.

8.0 Appendices

8.1 Appendix 1



8.2 Appendix 2



Copy of Copy of Copy of AMG Environmental monitoring during production 02

AJ25 MORNING SHIFT UV LIGHT WAS ON AT 11:00 AM

UV ON	MORNING/ AFTERNOON	MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			AFTERNOON SHIFT			AFTERNOON SHIFT			AFTERNOON SHIFT			AFTERNOON
DATE	MAIN TRIM	PRE OPERATION 6AM			DURING PRODUCTION 7AM			AFTER CLEANING 8:30 AM			DURING PRODUCTION 10AM			AFTER CLEANING 11:30AM			AFTER CLEANING 2:30PM			DURNING PRODUCTION 3:30PM			AFTER CLEANING 5:30PM			DURNING PRODU
	cfu/cm2	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI
12.02.20		0.83	<0.08	<0.08	60	0.25	<0.08	4.83	<0.08	<0.08	16.7	0.17	<0.08	3.75	<0.08	<0.08	1	<0.08	<0.08	1.25	<0.08	<0.08	11.7	0.83	<0.08	1.25	<0.08
13.02.20		0.58	<0.08	<0.08	3.83	<0.08	<0.08	4.17	<0.08	<0.08	4.17	0.25	0.17	1.58	<0.08	<0.08	6.25	<0.08	<0.08	4.59	<0.08	<0.08	55	<0.08	<0.08	0.17	<0.08
14.02.20		8.33	<0.08	<0.08	4.25	0.17	<0.08	2.5	<0.08	<0.08	30	<0.08	<0.08	31	<0.08	<0.08	5.08	<0.08	<0.08	12.3	<0.08	<0.08	133.4	<0.08	<0.08	21.7	<0.08
17.02.20																	2.25	<0.08	<0.08	3.58	<0.08	<0.08	0.25	<0.08	<0.08	2.5	<0.08
18.02.20		X	X	X	0.25	<0.08	<0.08	<0.08	<0.08	<0.08	1.08	<0.08	<0.08	2.08	<0.08	<0.08	2.83	<0.08	<0.08	1.5	<0.08	<0.08	1.17	<0.08	<0.08	0.58	<0.08
19.02.20		9.58	<0.08	<0.08	1	<0.08	<0.08	2.33	<0.08	<0.08	0.25	<0.08	<0.08	2.67	<0.08	<0.08	0.5	<0.08	<0.08	<0.08	<0.08	<0.08	2.33	<0.08	<0.08	0.25	<0.08
26.02.20		5.92	<0.08	<0.08	3.3	<0.08	<0.08	1.5	<0.08	<0.08	3.83	<0.08	<0.08	1	<0.08	<0.08	0.33	0.17	<0.08	0.92	<0.08	<0.08	1.92	<0.08	<0.08	0.25	<0.08
27.02.20		<0.08	<0.08	<0.08	2.42	<0.08	<0.08	0.33	<0.08	<0.08	1.08	<0.08	<0.08	0.17	<0.08	<0.08	<0.08	<0.08	<0.08	0.25	<0.08	<0.08	2.75	<0.08	<0.08	4.25	<0.08
28.02.20		3	<0.08	<0.08	16.7	<0.08	<0.08	2.5	0.33	<0.08	2.17	<0.08	<0.08	1.08	<0.08	<0.08											
02.03.20		<0.08	<0.08	<0.08	1.17	<0.08	<0.08	5.83	<0.08	<0.08	1.5	<0.08	<0.08	0.67	<0.08	<0.08											
03.03.20		0.33	<0.08	<0.08	3	<0.08	<0.08	0.92	<0.08	<0.08	0.58	<0.08	<0.08	0.75	<0.08	<0.08	<0.08	<0.08	<0.08	0.17	<0.08	<0.08	2.7	<0.08	<0.08	<0.08	<0.08
04.03.20		<0.08	<0.08	<0.08	1.08	<0.08	<0.08	1.25	<0.08	<0.08	3.67	<0.08	<0.08	0.5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.25	<0.08	<0.08	0.92	<0.08
05.03.20		0.17	<0.08	<0.08	4	<0.08	<0.08	7.92	<0.08	<0.08	6.5	<0.08	<0.08	5.58	<0.08	<0.08	0.5	<0.08	<0.08	2.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.50	<0.08
06.03.20		0.33	<0.08	<0.08	2.92	<0.08	<0.08	0.25	<0.08	<0.08	0.17	<0.08	<0.08	0.83	<0.08	<0.08											
10.03.20		0.25	<0.08	<0.08	0.25	<0.08	<0.08	25	0.42	<0.08	2.58	<0.08	<0.08	3.58	0.17	<0.08											

UV OFF	MORNING/ AFTERNOON	MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			MORNING SHIFT			AFTERNOON SHIFT			AFTERNOON SHIFT			AFTERNOON SHIFT			AFTERNOON
DATE	MAIN TRIM	PRE OPERATION 6AM			DURING PRODUCTION 7AM			AFTER CLEANING 8:30 AM			DURING PRODUCTION 10AM			AFTER CLEANING 11:30AM			AFTER CLEANING 2:30PM			DURNING PRODUCTION 3:30PM			AFTER CLEANING 5:30PM			DURNING PRODU
	cfu/cm2	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI	E.COLI	APC	COLI
17.02.20		83.3	<0.08	<0.08	76.7	4.42	0.17	60	0.17	<0.08	166.7	11.84	5	3	<0.08	<0.08											
20.02.20		1.5	<0.08	<0.08	4.25	<0.08	<0.08	43.3	1.00	<0.08	15	<0.08	<0.08	15	0.25	<0.08	0.33	<0.08	<0.08	25	<0.08	<0.08	<0.08	<0.08	<0.08	88.3	0.25
21.02.20		8.33	<0.08	<0.08	25	0.83	0.25	11.75	<0.08	<0.08	11.7	0.17	<0.08	8.33	<0.08	<0.08											
24.02.20		10	<0.08	<0.08	120	2.5	1	4.83	<0.08	<0.08	TNTC	16	3.5	30	0.83	<0.08	0.33	<0.08	<0.08	90	0.58	0.42	<0.08	<0.08	<0.08	78.3	<0.08
25.02.20		0.17	<0.08	<0.08	13.3	1.33	<0.08	9.58	<0.08	<0.08	18.3	1.17	0.92	2.25	<0.08	<0.08	<0.08	<0.08	<0.08	16.7	0.25	<0.08	0.33	<0.08	<0.08	16.7	<0.08

MAIN TRIM 7 CHART | Uv light trail- TB