Holchem Technical Centre Report

Summary of Trials to Investigate the Potential Value of the Bactiscan in the Food Industry.

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Background

Holchem were introduced to a technology produced by EIT International in late 2011. In brief, the technology consists of a lamp using light sources at three wave lengths. By use of these wavelengths independently or in different combinations, it is claimed that microbial contamination on surfaces can be visualised. There is also a facility to use a variable flicker rate for the light sources to enhance the revealing of organisms. Figure One is a picture of the lamp.

EIT International have previously commissioned a study by Campden BRI to assess the properties of the Bactiscan. This study was restricted to a laboratory environment with controlled inoculation of surfaces. The report is attached as Appendix One, it concluded that *"the Bactiscan lamp is a robust device that is easy to use, needs little operator training and is portable so that it can be used wherever required in the manufacturing environment. Some training/ experience would be required for the interpretation of the fluorescence produced from investigated surfaces as reflected light may be misinterpreted. In terms of detection of microorganisms, the lamp will clearly highlight a high concentration of bacteria/yeast cells as would occur in a fully developed biofilm. Early stages of biofilm formation on surfaces are more difficult to detect as the fluorescence produced is not as intense as seen in some of the cases in this study".* (Campden BRI January 2012, courtesy of EIT International).

Holchem briefly tested the lamp in late 2011 in the EV area of a Chicken Processing Plant and in the Slaughter area of a Red Meat Abattoir. In both cases, the unit appeared to be able to rapidly identify the presence of material invisible to the eye.

In 2012, Holchem undertook a longer field assessment of the unit, with the objectives of understanding the following:-

1) The Influence of ambient light on the instruments response.
2) Does the lamp reveal the presence of micro-organisms?
3) What level of micro-organisms will the lamp detect?
4) Is the instrument more useful/cost effective than swab data?

Throughout this report the term Fluorescence is used to describe the phenomena revealed by the light. Technically we are not sure if it really is Fluorescence, Luminescence or simply a wave length shift caused by absorption.

A number of case studies are highlighted in the report and findings are complied in the Summary.

Over six months, eighteen studies have been performed using the help of customers from the Brewing, Food Process and Hospitality Industries. Much of the data that has been collected has been repetitive, not all has been listed in this report. All data was however used to compile the analysis in Figure Four. All data reported here is blind and cannot readily be used to identify accounts. However, all customers that have helped us with trials will receive a copy of data collected on their site by way of Annexed attachment.

Figure One

The Bactiscan Unit

Investigation

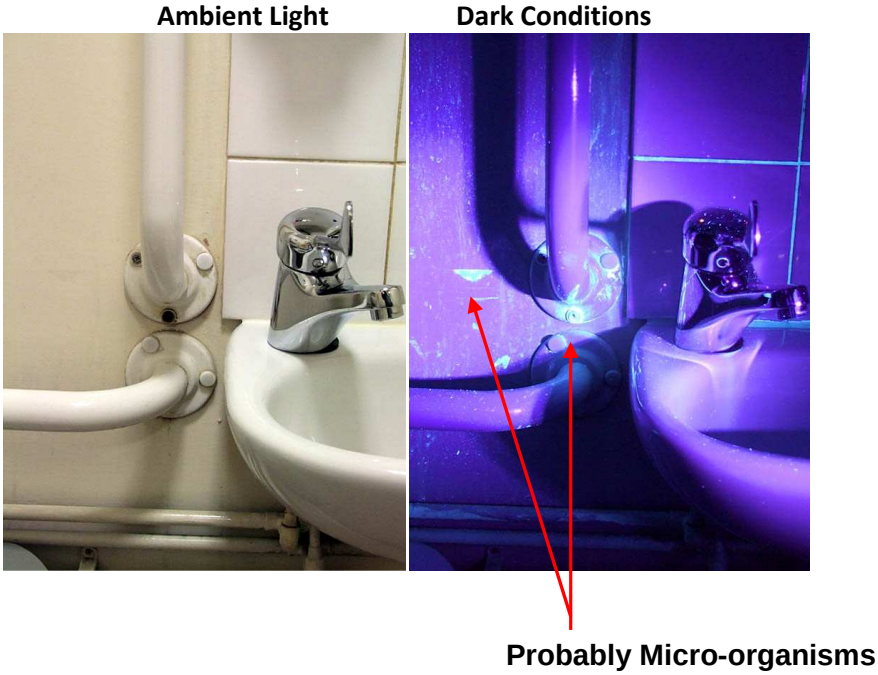
1.0) What is the Influence of Ambient Light on the Instruments Response?

We understand from EIT International that the Bactiscan is not yet capable of distinguishing between different types of micro-organisms. Our understanding is that the light source of the device causes a green fluorescence/luminescence reaction from organisms.

The instrument is quite bulky and the light sources are dim. In full day light or under normal office/production lighting, we found it very difficult to see "fluorescence" on surfaces. Figure Two A shows the difference seen in ambient light and dark conditions, this data was collected in the bathroom area of a hospitality site.

Figure Two A

Bactiscan Fluorescence in Ambient Light and Dark Conditions.



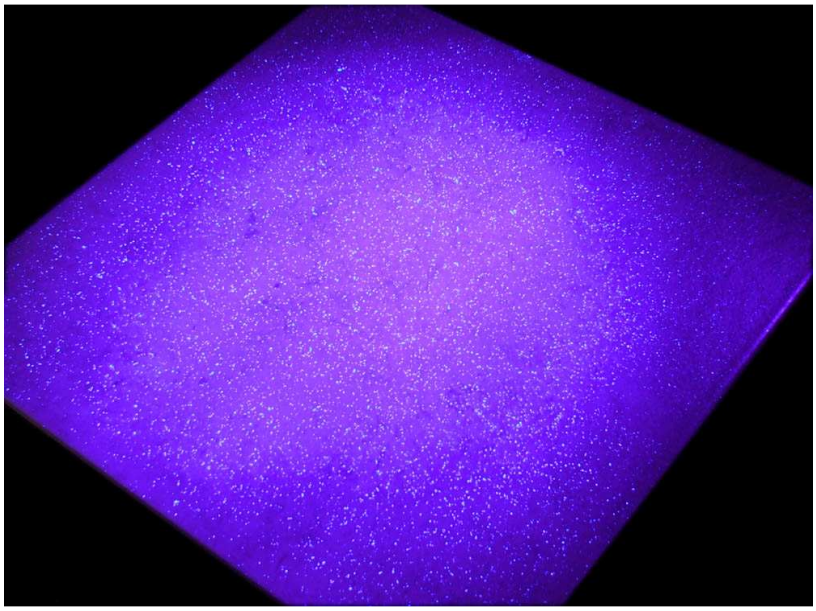
In the above example, lights were very bright and no revealing of micro-organisms was possible, but in dark conditions there is clearly some form of contamination on surfaces.
In general, although dark conditions always gave the best results, where there was a significant loading of non-microbial material we were still able to obtain a visualisation under dim lighting.

We have experimented with a number of different ways of creating shrouds for the lamp with varying degrees of success. In a Food Factory environment lighting tends to be all or nothing. During our assessment trials, one account that had a particular problem was able to turn off all the lights for us. In most plants this was not possible. If the device is to have value as an auditing tool in the Food Industry an effective shroud needs to be developed. We would also recommend replacing one of the lamps with a normal white light source, this would be particularly useful for the occasions when lights can be turned off.

2.0) Does the Bactiscan Reveal the Presence of Micro-Organisms?

During this study it rapidly became apparent that the Bactiscan readily reveals the presence of non-microbial particles on surfaces. Typically these are revealed as blue specs. Figure Three shows this as dust fibres on a clean ceramic tile.

Figure Three
Dust Fibres on a Clean Ceramic Tile



On certain surfaces, the Bactiscan is also capable of illuminating selective components of the surface matrix, for example Titanium Dioxide whitening agents in plastic and paints. Hard water scale also shows up as a blue – green colouration. Also optical brighteners used in papers and fabrics appear to fluoresce but at a different wavelength to micro-organisms.

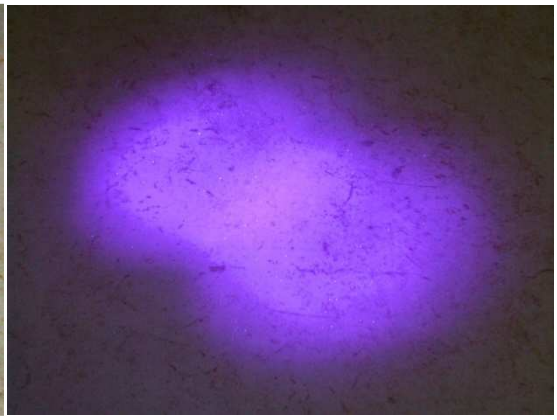
In Figures Four A and F we see the effect of shining the Bactiscan onto a clean tile coated with Fat and Milk. The Fat is almost invisible to the light and has a negligible ATP count. However, the Milk is very apparent under the Bactiscan light as a green fluorescence, this is accompanied by a high ATP count.

Note:- Photography under dull/dark slightly changes the colour appearance of the fluorescence from Green to Blue, this is evident throughout this report.

Figures Four

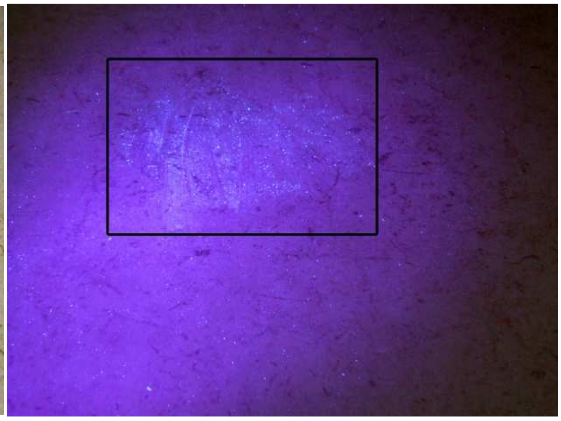
Four A
Clean Tile Natural Light

Four B
Bactiscan Light



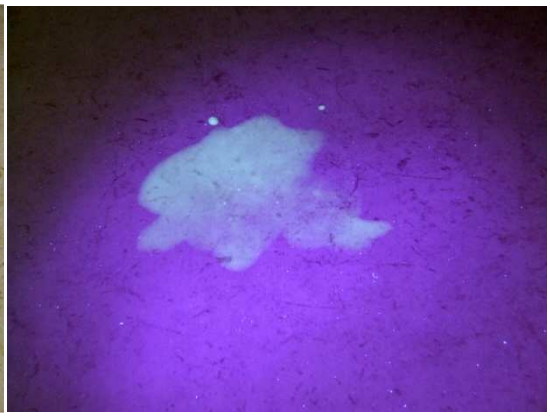
Four C
Lard Fat Under Natural Light

Four D
Lard Under Bactiscan Light
ATP Reading = 51 RLU's



Four E
Milk Under Natural Light

Four F
Milk Under Bactiscan
ATP Reading = 17,023 RLU's



The appearance of green fluorescence appears to be associated with micro-organisms. Table One shows example data taken from a Brewery. In this and subsequent studies, ATP measurements have been used as a quick indicator for the presence of micro-organisms. ATP measurements have been backed up by traditional swabs taken from an area of approximately 5*5cm and plated out as **A**erobic **C**olony **C**ounts at three temperatures, 22^0C (5 day incubation), 32^0C (3 day incubation) and 37^0C (24hour incubation,) using Agar plating medium. This technique is expected to reveal the presence of bacteria. We have not specifically looked for the presence of yeasts and molds.

The example data shows three distinct sets.

Set 1 (samples 1-3)
Zero ACC and Zero ATP, here no visualisation was observed.

Set 2 (samples 4-5)
Zero or very low ACC with low ATP, here visualisation was apparent.

Set 3 (samples 5-8)
Very high ACC with significant ATP counts, again here visualisation is apparent.

The data sets in Table One suggest that even at very low densities of micro-organisms, the Bactiscan is giving a true positive result and may therefore be a useful tool for auditing or for tracking down elusive but persistent sources of bacterial contamination.

Note:- *Data set for the FV valve plate initially appears odd as there is visualisation with ATP, but no counts from plating out swabs. This may indicate that both the lamp and ATP are revealing dead organisms. This is discussed later.*

Although the Bactiscan lamp may be useful for identifying areas of microbial contamination, experience has taught us to ignore reflectance or florescence that appears blue. These are generally false positives. It would be very easy to use false positives from dust or components of construction materials as a way of convincing a prospect account that they had a serious problem. This would be wrong and Holchem would not do this. It is essential that any suggested areas of microbial contamination are confirmed by the use of an appropriate swabbing process.

Table One
Data Set Taken from a Brewing Account

Data Set`	Location	ACC 22^{0}C Cfu/swab	ACC 32^{0}C Cfu/swab	ACC 37^{0}C Cfu/swab	APT/ RLU's	Visualisation
1	FV26 Lid	0	0	0	None	None
1	FV26 Seal on lid	0	0	0	None	None
1	FV Tank Roof Underside	0	0	0	None	None
2	FV5 behind seal	3	4	0	95	Positive
2	*FV Valve Plate*	*0*	*0*	*0*	*140*	*Positive*
3	Conical Yard Drain	TNTC	TNTC	TNTC	2182	Positive
3	Yard drain after Caustak 30	TNTC	TNTC	TNTC	3752	Positive
3	Yard drain after PAA	TNTC	TNTC	60	1106	Positive

3.0) What Level of Micro-Organism Population will the Bactiscan Detect?

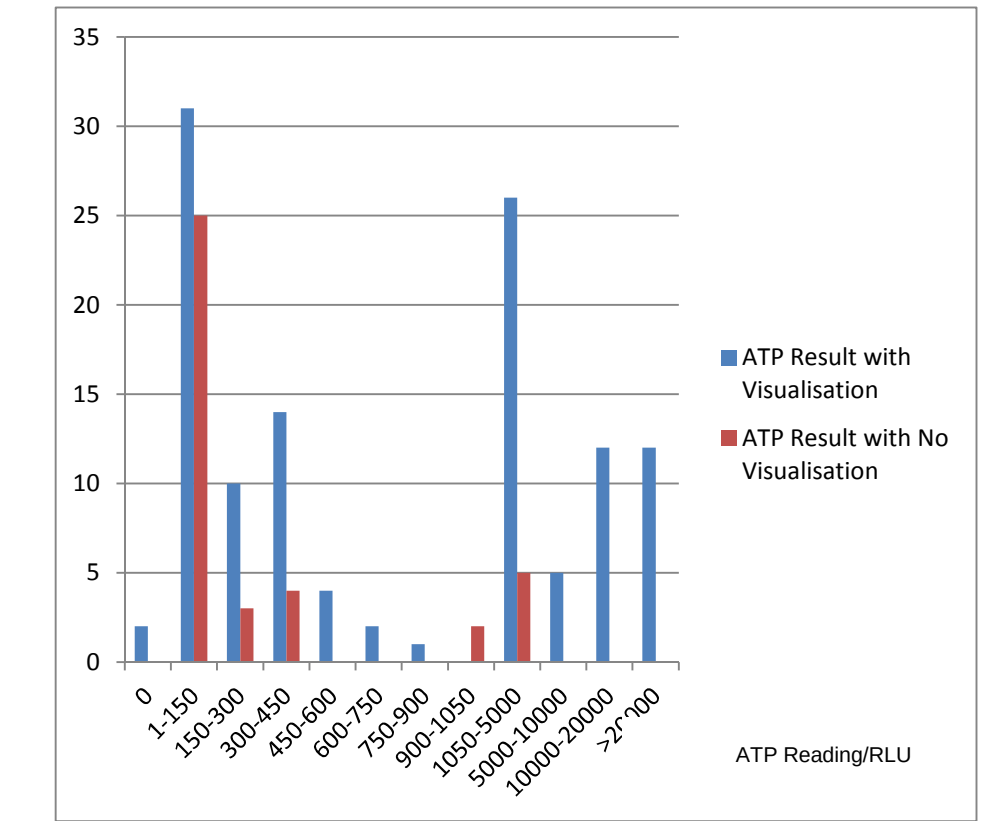
We have attempted to reveal known populations of micro-organisms grown on agar plates. This however provided very little useful information.

Figure Five compiles data from all studies and ranks numbers of visualisations against ATP counts. Two data sets are shown.

1. Number of ATP results for which visualisation was achieved.
2. Number of ATP results for which there was no apparent visualisation.

The data would seem to suggest that the Bactiscan can reveal micro-organisms down to very low ATP levels. Referring back to Table Two, it also appears to correlate to very low ACC data.

Figure Five
Visualisations vs ATP Readings.



It is curious that at ATP readings of around 150RLU's and lower, it is possible to get significant apparent positive ATP results with no visualisation. However, within this region many ACC swabs came back as 0 or <10 Cfu/swab. This suggests that at low population densities the Bactiscan correlates well with conventional swabbing and plating, but less well with ATP data. As a control, we selected three clean un-used ATP swabs and observed apparent RLU reading between 50 and 150! Typically, readings at this level would not cause concern in high or low care environments, but it is perhaps indicative of the level of reliability of ATP technology.

In our complete data set there was one discrepancy where a low ATP reading combined with no visualisation that gave a Too Numerous To Count result when plated out at 22 and 32 Degrees C. This swab came from a Dicer Blade after two cleans in a Raw Chicken Plant. Looking at this data set (referred to later in Table Six) in more detail; after the plant clean using **Maxifoam Plus** there was a positive visualisation on the blade, the ATP reading was 3381 and at all three ACC temperatures counts were TNTC Cfu/swab. This area was then spot re-foamed and re-swabbed to give the anomalous result. In this plant ambient light level was high making it difficult to see colouration.

It is not possible to easily link the intensity of visualisation to ATP counts, background light has a massive affect on the amount of colouration seen. However, within any given data set there is evidence to suggest that at a given ambient light intensity colouration becomes fainter as ATP reduces on cleaning. However, development of a suitable shrouding device would significantly improve the instrument.

4.0 Case Study 1.

Environment:-	**High Care Ready (Deli) Meals.**
Status:	**Pre-Clean**
Site Detergent:-	**Maxifoam.**
Site Disinfectant:-	**Holquat.**

Numerous swabs and visualisations were taken on this visit. Table Two picks out three clean/disinfection sequences.

i Depositor Chute No.1.
ii Depositor Chute No.2.
iii A Multi-Vac that had not been used but was located clean at the back of the production area.

Both of the Chutes appeared to be free of gross debris. ATP results prior to cleaning were high and visualisation of the surfaces revealed a strong green colouration. On sequential cleaning and disinfection, the colouration became fainter and both ATP and ACC readings fall.

More interesting is the Multi-Vac. This appeared to be clean.
Examination of the Aluminium surface revealed a strong green colouration. ATP results were very high as were ACC swabs results. There was no intention to clean this equipment. Sequential cleaning with **Maxifoam** and disinfection with **Holquat** and **Perbac** reached the point where visualisation became very faint and ACC results fell to zero. ATP results were less useful, possibly a failing of ATP where at very clean levels random noise from clean swabs is significant (see section 3.0). However, here was a clear example of the Bactiscan showing up an area of micro-organisms that were not obviously dirty to the eye and where there was no intention to clean.

Table Two
High Care Ready (Deli) Meals Pre-Clean

Location	ACC 22^0C Cfu/swab	ACC 32^0C Cfu/swab	ACC 37^0C Cfu/swab	APT/ RLU's	Visualisation
Depositor Chute Visually Clean	17	33	13	4037	Positive
Cleaned with Maxifoam (5%v/v)	0	3	0	228	Faint
Disinfected with Perbac OPD (1%)	0	0	0	90	Faint
Depositor Chute No 2 Visually Clean	48	41	3	1761	Positive
Cleaned with Maxifoam	5	4	0	1521	Faint
Disinfected with Perbac OPD (1%)	1	0	0	371	Faint
2nd Disinfection with Perbac OPD (1%)	0	3	0	109	Very Faint
Multi Vac Pre Clean	TNTC	TNTC	TNTC	18331	Strong Positive
Multi Vac Post Clean with Maxifoam (5%)	12	11	6	99	Faint
Multi Vac Post Second Clean (padded with Maxifoam)	0	0	0	92	Faint
Multi vac (half) after Disinfection with Holquat (1%)	0	0	0	129	Faint
Multi vac (half) after Disinfection with Perbac OPD (1%)	1	0	0	30	Very Faint

4.1 Case Study 2.

Environment:-	**High Care Ready (Deli) Meals.**
Status:-	**Post-Clean**
Site Detergent:-	**Maxifoam.**
Site Disinfectant:-	**Holquat.**

This data set was collected towards the end of a hygiene shift. Numerous swabs and visualisations were taken on this visit. Table Three picks out four clean/disinfection sequences. All of these were undertaken after the plant had been cleaned.

A Stainless Steel Table appeared clean. Using the Bactiscan we revealed an area of contamination on the under-surface. The area was cleaned with **Maxifoam** and on re-inspection there was no visualisation from the Bactiscan. Possibly this data set is over extreme, the ACC counts were very low and the area was not a food contact surface. However, it is demonstration that the device does reveal poor or incomplete cleaning.

A series of plastic drain covers were lifted. The ends of these appeared to be pink, whereas the upper and lower surfaces were dark grey. Under the Bactiscan light, the pink ends showed as bright blue with green specs (Figure Four). Neither ATP nor the subsequent ACC results were particularly high, but the cover ends were slightly porous/rough and it was difficult to swab into crevices. Sequential cleaning and disinfection reduced the degree of visualisation. It is unclear what we were seeing here, the low swab results may indicate poor swabbing. As a control, the Bactiscan light source was used to illuminate the main food source in the plant (Olives). These reflected as red suggesting the fluorescence seen on the drain covers was not food soiling. The fluorescence was not seen on the smooth upper or lower surfaces.

A section of floor where it curved up against a wall was illuminated and shown to have a strong green fluorescence. Subsequent ACC swabs produced very high numbers. Cleaning with **Maxifoam** reduced the counts to negligible levels. This data was taken at the end of the clean, the floor would not have been re-cleaned.

Figure Four
Drain Cover Ends

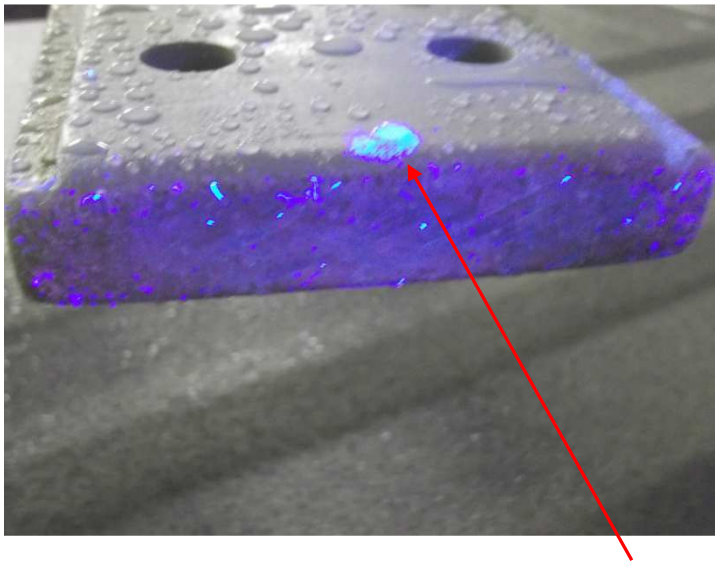


Table Three
High Care Ready (Deli) Meals Post-Clean

Location	ACC 22^{0}C Cfu/swab	ACC 32^{0}C Cfu/swab	ACC 37^{0}C Cfu/swab	APT/ RLU's	Visualisation
Under Table	39	80	12	4765	Positive
Under table end of clean (Maxifoam)	0	1	0	49	Negative
Grid Cover	9	10	8	167	Positive but note Pink in normal light
Grid Cover after Clean (Maxifoam)	2	1	1	60	Positive
Grid Cover Second Clean (Maxifoam and PAD)	3	0	8	211	Faint
Floor Pre-clean (lip by wall	54	TNTC	200	4437	Positive
Floor Post Clean Maxifoam	0	0	0	68	Positive

4.2 Case Study 3.

Environment:- **Low Care Fish Processing.**
Status:- **Pre and Post-Clean**.
Site Detergent:- **Chlorfoam Plus.**
Site Disinfectant:- **Terminol, Perbac OPD**

In this plant, the overall level of hygiene appeared very good. However, using the Bactiscan as an investigative audit tool indicated several areas of microbial contamination. Data is presented in Table Four.

Pre Plant Clean:-

i) On the line for gutting larger fish there were a number of circular "V" clamps holding sections of drain pipe together. These were not routinely removed during cleaning. Removing one of these clamps and inspecting under the lamp gave a positive visualisation together with very high ATP and ACC results.

ii) An extrusion machine appeared to be clean. However, a seam between plastic and metal components gave a visualisation. ATP and ACC swabs gave high results. Sequential spot cleaning (**Maxichlor**) and disinfection (**Perbac OPD**) resulted in sequentially fainter visualisations. However, this result was misleading, the ACC swabs remained very high as did the final ATP swab. In all likelihood debris was being washed out of the seam. Although the Bactiscan had been useful to identify the area of concern, it failed to indicate that cleaning was not successful.

iii) A number of tables (Prawn Line) were found with Stainless Steel Chutes on the side. In all of these an area of staining was visible without the Bactiscan. Under illumination from the Bactiscan, a strong green colouration was observed. Cleaning with **Chlorfoam Plus** failed to remove the colouration or visible stain, although ATP results were reduced and ACC counts fell to zero. Secondary cleaning with **Revive** (acid) removed the staining. ATP results fell to virtually zero and no subsequent visualisation was given by the Bactiscan. This suggests it was probably a hard water stain that became a matrix from the growth of micro-organisms. That ACC data fell to zero after cleaning with **Chlorfoam Plus** probably indicates that bacterial cells at or near the surface of the scale were killed. However, at this point the Bactiscan still indicated the presence of micro-organisms within the scale matrix suggesting that the area needed further attention.

Post Plant Clean:-

iv) In the Fish Gutting Area, a number of racks were investigated. The first of these had been cleaned by the hygiene team with **Chlorfoam Plus**. Under the Bactiscan these appeared to give a positive result for the presence of micro-organisms, this was confirmed by an ATP reading of 1400 RLU's. Subsequent disinfection with **Perbac OPD** reduced this to 14 RLU's. However, none of the ACC swabs for either post clean or post disinfection indicated the presence of micro-organisms. Either the ATP and Bactiscan were both giving a false positive result, or more likely the both are responding to dead cells or non cellular material. Given that the main clean used a chlorinated detergent, the presence of dead cells is not an un-reasonable assumption.

v) A similar response to dead cells appears to be happening on the small fish auto gutting line. This had already been cleaned with **Chlorfoam Plus**. However, on the shoe for holding the fish body, strong green fluorescence was observed, again this was backed up by ATP data whereas ACC swabs indicate no viable micro-organisms. Cleaning with an oxidising disinfectant (**Perbac OPD**) removed the green fluorescence and reduced the ATP results to a negligible number.

vi) A mincer that appeared to be of rusty Mild Steel construction was located in a wash-down area. This had previously been cleaned with **Chlorfoam Plus**. Using the Bactiscan to illuminate the outlet resulted in a strong green fluorescence and a very high ATP result. Spot cleaning with **Maxichlor** resulted in no subsequent visualisation, but the ATP reading was still high. Ambient light levels here were very high. The mincer outlet was approximately 10cm in diameter, it is highly likely that in dark conditions clearer visualisation would have been obtained. Subsequent disinfection with **Perbac OPD** reduced the ATP and ACC readings to very low numbers. So the question is, "did the Bactiscan have any value over simple ATP swabs in this area". The answer must be yes. Swabbing would have revealed the problem, but at this point in the trial we were simply walking around the plant taking random visualisations, this could be done very quickly whereas random swabbing would have been a slow process.

Table Four
Low Care Fish Processing Pre and Post-Clean.

Location	ACC 22^{0}C Cfu/swab	ACC 32^{0}C Cfu/swab	ACC 37^{0}C Cfu/swab	ATP/ RLU	Visualisation
Pre Plant Clean					
Large Gutting line Clamp on Waste Liquid Line	TNTC	TNTC	0	12187	Positive
Gutting Line Drain Clamp	TNTC	TNTC	5	12500	Positive
Extrusion Head Plastic and Seam to Metal	TNTC	TNTC	TNTC	167,647	Positive
Extrusion Head Plastic and seam to metal (Post spot clean Maxichlor 5%)	TNTC	TNTC	TNTC	41,481	Positive but reduced
Extrusion Head Plastic and seam to metal (Post 2nd spot clean Maxichlor 2nd)	TNTC	TNTC	TNTC	14,998	Positive but reduced
Extrusion Head Plastic and seam to metal (Post Spot Disinfection with Perbac OPD 1%)	TNTC	TNTC	TNTC	40,804	Positive but very faint
Chute on side of Prawn Line	50	20	0	2096	Positive
Chute after Chlorfoam Plus	0	0	0	304	Positive
Chute after Revive	0	0	0	8	None
Post Plant Clean with Chlorfoam Plus					
Gutting Line Rack	0	0	0	1400	Positive
Gutting line rack after disinfection with Perbac OPD	0	0	0	14	None
Gutting Line Fish holding shoe (Aluminium)	0	0	0	1442	Positive
Gutting Line Shoe after disinfection with Perbac OPD	0	0	0	27	Positive
Mincer Outlet Steel rusty)	30	40	50	19046	Positive
Mincer after spot cleaning with Maxichlor	20	10	0	2430	None (high ambient light)
Mincer after disinfection with Perbac OPD (1%)	0	0	0	386	None
Mincer 2nd after disinfection with Perbac OPD (1%)	0	0	0	323	None

4.3 Case Study 4.

Environment:-	**Low Care Fruit Processing.**
Status:-	**Pre and Post-Clean**.
Site Detergent:-	**Maxichlor**
Site Disinfectant:-	**Bioactive**

In this site there was a known Listeria problem related to Peelers used for Melons and Pineapples. It was accepted that the Peelers were very poorly designed consisting of numerous mixed metals, gears, drives and crevices. In this plant we were able turn off the main lights and use the Bactiscan to reveal significant areas of green fluorescence. However, it is questionable whether this was really useful, certainly the device showed many areas of fluorescence, but the equipment was so badly designed it was clear that areas would not be well cleaned and become points of bacterial contamination. In this example the usefulness of the device would have been to reveal areas of that needed re-cleaning, but this would represent significant investment to overcome poor equipment design.

Table Five shows the sequential results for a number of areas that were cleaned and disinfected. Each of the sections described in the table showed a graduation in visualisation as they were cleaned and disinfected, this was backed up by falling ATP and ACC counts. One exception was for swabs taken from under the Assembly of Peeler No.2 (see Table Five) Here, after cleaning with **Maxichlor** no visualisation was observed, but counts remained very high. This was with ideal dark conditions.

During this trial it was noted that both fruits when sliced strongly reacted to the Bactiscan light source. Swabbing the inside of the two fruits produced massive ATP numbers. For the Melon, ACC data was **T**oo **N**umerous **T**o **C**ount. Conceivably, the ATP and Bactiscan were inducing reactions from plant cellular material. However, given that both fruits are acidic, we would not have expected high bacterial readings from conventional swabs. This does suggest that for this plant the continual low level Listeria problem is related to the incoming produce.

Table 5
Low Care Fruit Processing Pre and Post-Clean

Location	ACC 22^0C Cfu/swab	ACC 32^0C Cfu/swab	ACC 37^0C Cfu/swab	ATP/ RLU	Visualisation
Bearing above Orbital Peeler	TNTC	TNTC	TNTC	1062	Positive
Bearing above Orbital Peeler Post cleaning with Maxichlor	17	TNTC	0	1259	Patchy
Bearing above Orbital Peeler Post Bioactive	7	3	0	428	None
Peeler Actuator	TNTC	TNTC	TNTC	14064	Positive
Peeler Actuator post Maxichlor	TNTC	TNTC	50	256	Patchy
Peeler Actuator post Bioactive	38	65	30	276	None
Inside Roof of Peeler No 1	0	0	0	9333	Positive
Inside Roof of Peeler No 1 Post cleaning with Maxichlor	0	0	0	20	None
Inside Roof of Peeler No 1	7	38	10	66	None
Under Peeler Assembly No 2	TNTC	TNTC	TNTC	26424	Positive
Under Peeler Assembly No 2 Post spot clean with Maxichlor	TNTC	TNTC	150	1200	None
Peeler No 2 mild steel Bracket	TNTC	TNTC	TNTC	10256	Positive
Peeler No 2 mild steel Bracket Post spot clean with Maxichlor	9	12	0	143	None
Peeler No 2 mild steel Bracket Post disinfection with Bioactive	3	25	0	------	None
Under Peeler housing Peeler No 2	42	65	0	373	Positive
Under Peeler housing Peeler No 2 Post spot clean with Maxichlor	TNTC	TNTC	100	247	None
Under Peeler housing Peeler No 2 post disinfection with Bioactive	100	100	9	------	None
Inside Melon	TNTC	TNTC	TNTC	997500	Red
Inside Pineapple	40	50	60	750000	------

4.4 Case Study 5.

Environment:- **Low Care Chicken Processing**
Status:- **Pre Plant Clean**.
Site Detergent:- **Maxichlor, Maxifoam Plus.**
Site Disinfectant:- **Terminol**

Around a dirty EV line the Bactiscan performed as expected, that is it showed positive visualisation in locations where we expect high bacterial counts (Table Six and Figures Six A and B). Although spot cleaning with a chlorinated detergent reduces ATP readings, the soil loading is so high that the oxidising ability of the detergent does little to reduce ACC swab counts, although ATP data does fall. After destroying residual micro-organisms with **Perbac OPD**, bacterial population measured by swabs falls to zero, but both ATP and the Bactiscan continue to indicate a presence, presumably dead cells. There is anomalous data on a Dicer blade where there is no visualisation, with high bacterial loading we should see a positive result (lighting was dull).

Table Six
Low Care Chicken Processing Pre Plant Clean.

Location	ACC 22^0C Cfu/swab	ACC 32^0C Cfu/swab	ACC 37^0C Cfu/swab	ATP/ RLU	Visualisation
EV Line	TNTC	TNTC	TNTC	21303	Positive
EV Line Post spot clean with Maxichlor	TNTC	TNTC	TNTC	6223	Positive
EV Line Post Padding with Maxichlor	*TNTC*	*TNTC*	*TNTC*	*1387*	*None*
EV Line Post spot disinfection with Perbac OPD (1%)	0	0	0	22	None
F1 Cutting Board (Filleting) Wet Plastic no apparent soil	TNTC	TNTC	TNTC	43660	Positive
F1 Cutting Board (Filleting) Wet Plastic post spot cleaning with Maxichlor (5%)	TNTC	TNTC	0	6994	Positive
F1 Cutting Board (Filleting) Wet Plastic post spot disinfection with OPD (1%)	4	0	0	7836	Positive
Line G Belt intralox belt no Visual soil	TNTC	TNTC	TNTC	66964	Positive
Line G Belt intralox belt Post spot cleaning with Maxichlor (5%)	TNTC	TNTC	TNTC	888	Positive
Line G Belt intralox belt Post spot disinfection with Perbac OPD	0	0	0	2275	Positive
Dicer Blade after clean	TNTC	TNTC	TNTC	3381	Positive
Dicer Blade after 2nd clean with Maxifoam Plus	TNTC	TNTC	50	64	None

Figures Six A
EV Area Showing Visualisation of Soil

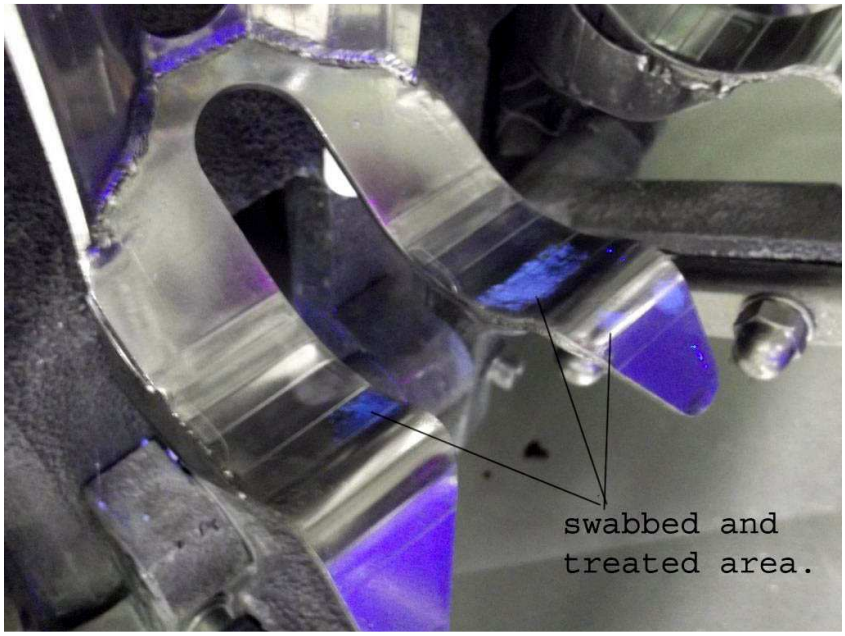
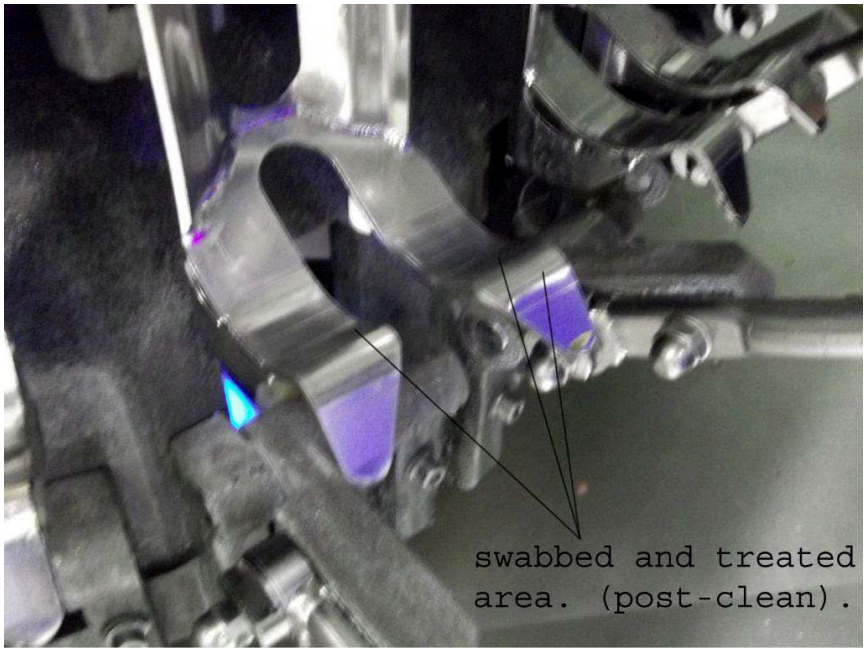


Figure Six B
No Visualisation after Perbac OPD



4.5 Case Study 6.

Environment:- **Low Care Chicken Processing**
Status:- **Pre Plant Clean**.
Site Detergent:- **Maxichlor**
Site Disinfectant:- **Holquat, Terminol**

Several areas were examined and are reported in Table Seven. These are areas not routinely cleaned. However, all showed positive very high results by all three test methods. Clearly swabbing is not used to decide whether these areas should be cleaned or not. Swabbing would be cheap and effective. However here we see the benefit of the Bactiscan as potential audit tool to highlight areas that should be cleaned.

Table Seven
Infrequently Cleaned Areas

Location	Comment	ACC 22°C Cfu/swab	ACC 32°C Cfu/swab	ACC 37°C Cfu/swab	ATP/ RLU	Visualisation
Pre Chill Bird Wash	No daily Clean	TNTC	TNTC	TNTC	21,027	Visualisation
Bird Wash cabinet	No Daily Clean	TNTC	TNTC	TNTC	184,513/ 600,000	Visualisation
Pre Chill Roof Fan	No Daily Clean	TNTC	TNTC	TNTC	102,172	Visualisation

4.6 Catering – Hospitality Studies

Generally in catering kitchens we do not expect to see high microbial or soil loadings on surfaces and utensils. As an audit tool the Bactiscan turned up an interesting result showing a very high microbial loading on the inner surface of the base of a Cooking Vessel (Kitchen One Table Eight). To the naked eye the pan was clean. Running the pot through the washer for a second time reduced the ACC results to zero, but the ATP reading was still high and the Bactiscan still visualised something. Here we assume that the second pass through the Pot Wash thermally killed the cells, but left a biofilm in place that ATP and the Bactiscan revealed.

In Kitchens Two and Three we examined washers directly. In both instances we obtained positive results with the Bactiscan and ATP. In Kitchen Three, ACC counts were very high. High levels of viable bacterial contamination in a Dishwasher/Pot Wash where there may be no subsequent disinfection of Pots, Crockery, Utensils etc is worrying. The Bactiscan device has potential for a "shock effect" training tool.

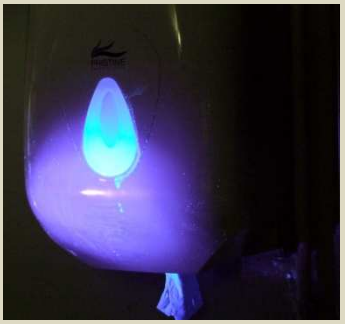
Data given in Table Nine shows a Towel Dispenser. Here the Bactiscan is we suspect creating a false impression. When initially inspected the unit appeared clean, but a positive hit was given under the Bactiscan light. ATP data was low, and subsequent swab data was insignificant. Sequential cleaning with **K1 Multi Purpose Cleaner** and **K2 Sanitiser** reduced the visualisation and indeed the apparent ATP and swab data. We think in this instance much of the material revealed by the Bactiscan was physical soiling and the low bacterial counts pose little health risk. However, there is clearly potential here for bacterial growth and in a high care environment such as a Care Home or Hospital, the Bactiscan may have benefit as an audit tool.

Table Eight
Collated Kitchen Data

Location	ACC 22°C Cfu/swab	ACC 32°C Cfu/swab	ACC 37°C Cfu/swab	ATP/ RLU	Visualisation
Kitchen One					
Stainless Steel Cooking Pan after clean. This stacked on other pans no visually apparent soil	TNTC	TNTC	45	19350 (ring around base and side wall)	Positive
Cooking pan after 2nd clean through Pot Wash	0	0	0	66929	Positive But reduced
Kitchen Two					
Cabinet Pot/Dishwasher	35	2	0	23804	Positive
Cooking Pan	1	4	0	1054	Positive
Galvanised Steel around Serving Area	9	16	0	5288	Positive
Kitchen Three					
Pot Wash	TNTC	TNTC	TNTC	58951	Positive

Table Nine

Towel Dispenser

Location	ACC 22°C Cfu/swab	ACC 32°C Cfu/swab	ACC 37°C Cfu/swab	ATP/ RLU	Visualisation	
Hospitality Area						
Towel Dispenser Pre Clean Plastic surface No visible soil	0	1	0	440	Positive	
Towel Dispenser Cleaned with K1 (Multipurpose Cleaner)	0	0	0	78	Positive	
Towel Dispenser Cleaned with K2 Sanitiser (QAC Disinfectant)	0	0	0	51	Reduced	

Summary

Over six months, eighteen studies have been completed, not all of the data has been included in the body of the report as much of it is repetitive.

The Bactiscan is capable of indicating the presence of microbial contamination on surfaces even down to very low population densities (as enumerated by swabs). At low population densities (<100cfu/swab) the Bactiscan correlates better with conventional swabbing and plating than with ATP. The instrument does not allow for estimation of population density, but the fluorescent like light does become less intense as densities drop.

No attempt has been made to see if the Bactiscan can identify different species of organism. However, the field data we have collected suggest that with the current unit this is unlikely.

It is unclear if the instrument reveals just cellular material. Certainly fat appears to be almost invisible, while general environmental dust shows up very brightly as blue specs. These bright blue specs can be alarming and misleading. With experience it is possible to distinguish between the bright blue specs and the duller green light of viable micro-organisms. However, evidence suggests that non-viable organisms are also visible. It is essential that any suggested areas of microbial contamination are confirmed by the use of an appropriate swabbing process.

The Bactiscan's usefulness is reduced in high ambient light conditions. Outside in daylight we found it unusable, however with experience we were able to use it in production areas operating under normal strip lighting. In reality we feel that if the device is to have value as an auditing tool in the Food Industry an effective shroud needs to be developed. Also we are not entirely sure of the benefit of three light sources. A smaller unit offering just a visible white light and either light source or two would be more practical. Also the an ability to use the device through an endoscope would be useful, we found it particularly difficult to use the device through the man way of tanks.

Is the Bactiscan of Value to the Food Industry?

In general we found the Bactiscan to be effective as a means of rapidly identifying areas of potential micro-organisms. Often the same results could have been obtained with ATP swabs, but the Bactiscan allows for larger areas of plant to be inspected rapidly so that swabbing can be targeted to highlighted areas. As a post hygiene QA tool this would seem to be very advantageous, but the instrument is very expensive. Within a small-medium food producing organisation, use of the equipment through a hire arrangement prior to a major audit is conceivable. However, the usefulness of the device does depend a lot on the experience of the user. Within large groups, purchase of an instrument by a central QA or Technical function as an auditing device for a number of sites is more likely.

The Bactiscan would be a good training device to show operatives that apparently clean areas are actually very dirty with invisible soiling. However, the comments above in relation to cost apply.

Appendix One

Previous Campden BRI Report