Dallas-Ft. Worth Airport ATP Results Summary

The following is the summary of a 4 week study conducted at DFW Airport in Dallas, TX from 9/2018 to 10/2018.

Challenge:
The airport had long recognized the high volumes of traffic through their facility and in particular the impact of that volume of people on the conditions in their rest rooms. Odor was also a persistent reminder of the environmental conditions. Their best efforts to clean and sanitize were felt to be insufficient to adequately handle the volume of use and they were in search of new practical solutions.

The Zoono technology offers a practical, technological solution to their challenge in that the persistently active microbial barrier this technology affords mitigates both microbial loads and odors, yielding a more hygienic rest room environment with minimal change or challenge to existing sanitation protocols.

Purpose of Test:
Execute a test vs. control environmental testing using ATP to measure the ability of Zoono to preserve the hygienic state of restroom surfaces over under normal use conditions. If the Zoono technology in the restroom test environment, which is deemed to be one of the most challenging, can deliver a meaningfully quantitative benefit as compared to current sanitation best practices, the facility will consider the use of this technology and a large scale basis for the benefit of their customers and staff.

Test Hypothesis:
Treatment of hard surfaces with Zoono will result in a measurable sustained hygienic environmental state as compared to surfaces under similar conditions, not treated with Zoono.

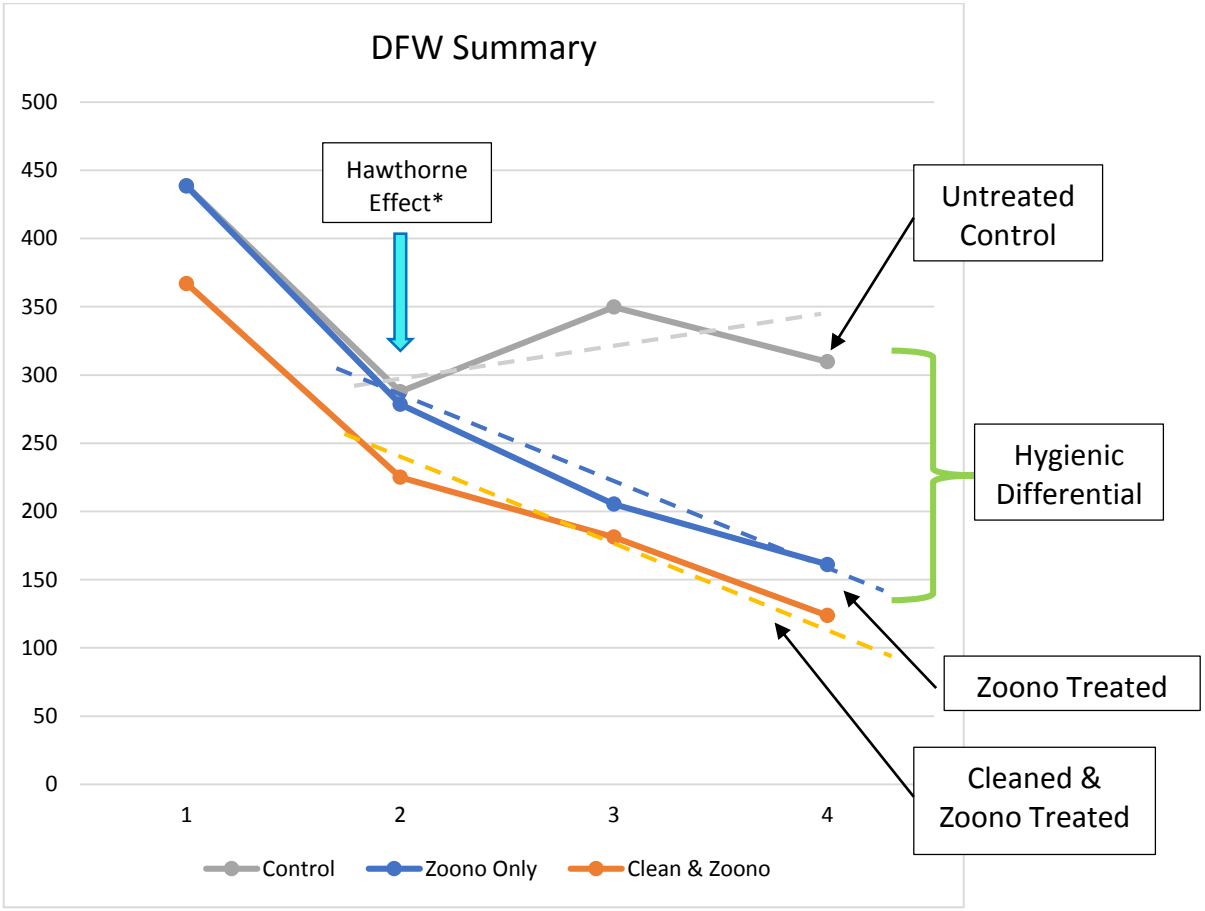
Testing Protocol:
Three rest rooms were selected for the test. One rest room was used as control to observe hygienic conditions during the test period as representative of “Business As Usual”. In one of the other restrooms Zoono was applied “in addition to” / on top of current sanitation best practices and the other, target areas in that restroom were additionally cleaned with alcohol and then treated with Zoono. The results of these areas is to be compared and the variance in ATP measurements will document any changes in hygienic conditions.

The initial testing was conducted on 9/11/2018 to secure a baseline of surface / environmental hygiene that represented the current ‘normal’ conditions. Three additional ATP samples were taken at weekly intervals for 4 weeks. Within each rest room, ATP test locations in both test and control locations were a variety of high-touch locations assessed to be cleaned regularly on a routine basis. They were selected in each location to be as comparable in each environment as possible to not introduce variability due to test location selection.

Test and control locations were sampled and the specific area recorded and photographed to ensure accurate measurement of the same area in the follow-up swab testing.

This protocol was followed weekly for a period of 4 weeks.

Results Summary:
In the chart below, a summary of the results of each location in the test are presented. These results reflected in the chart are the average of the 11 readings taken in each test location with high and low anomalies removed to mitigate the distortion of the data by random variances[1].



* The Hawthorne Effect is a well documented phenomenon that is characterized by the alteration of behavior by the subjects of a study due to their awareness of being observed. In this case, the housekeeping personnel were present at the time of the initial data collection and highly cognizant of their performance subject to evaluation. The additional effort applied during the first week of the trial subsided and more normative practices resumed and more characteristic results reemerged.

As is apparent from this chart, the untreated control room maintained with current normal cleaning protocols exhibited an initial decrease in bio-load but then a more normal course of contamination followed.

Note: all test scenarios showed initial improvement between initial baseline data collection and the first test interval. Some of this improvement can be attributed to the Hawthorne Effect (the alteration of behavior by the subjects of a study due to their awareness of being observed). There was high interest and awareness of the cleaning crews on site during the initial testing and their attention to detail was likely heightened for the ensuing week. However, as the housekeeping staff was less aware of being observed, normal practices resumed and contamination levels returned.

Both Zoono test areas also benefitted from the greater level of detail in maintenance initially but continued to show consistent improvement in recorded bio-loads while exposed to the same regular cleaning protocols. Specifically, the area where Zoono was added on top of existing cleaning activity the bio-load reduction was 63% whereas, the areas that received an additional measure of cleaning prior to Zoono application saw approximately the same pattern of bio-load reduction, 66%. Both Zoono treated areas showed strong decreases in contamination that were sustained / compounded throughout the course of this study.

Net: if the period impacted by the Hawthorne effect is removed and a trend is established after the first week of the test, it is possible to see the impact of Zoono vs. current best practices in the hygienic differential, a variance

of over 100% (see dotted line trend). In other words after 4 weeks, the control area was twice as contaminated as the test areas.

Conclusion:
The performance of Zoono in this study showed that not only would the addition of Zoono Microbe Shield improve the overall level of sanitation in treated areas, the product shows that bio-loads are reduced, the evidence supports continuing mitigation of contamination over time, improving the overall sustained hygienic state of treated environments.

Recommendations:

- To improve environmental hygiene of the facility, it is recommended that a broader deployment of Zoono be considered. This additional deployment may begin as a strategic targeting of presumed high contamination areas which may include the airport security lines and trays used for personal belongings, ticket counters and eating areas or terminal by terminal as makes sense. (International arrivals may be a high opportunity area to mitigate the transmission on microorganisms which may have been imported from international destinations).
- Regardless of continued use of Zoono, the facility may want to consider adopting a regular program of ATP testing to ensure cleaning is done to a satisfactory standard. This protocol is a standard practice in healthcare, food service and other commercial settings to ensure efficient cleaning is delivered.
- Surface and environmental hygiene is an important piece in maintaining a healthy, sanitary environment. However, as the CDC reports hands are the number one vector of germ transmission with 80% of germs that make people sick are attributable to hand hygiene. Healthy hands combined with sanitary surfaces is the best combination of practices to break the cycle of infection and ensure healthy populations, in particular employees so as to mitigate illness related absenteeism.

Footnote [1]: The results in the chart above are the average of the readings taken in the test and control environments. Individual data points for each surface tracked are available and are helpful in identifying specific areas which require more rigorous attention but the average is used as a measure to show overall hygiene performance trends. Moreover, overly high or low data is also removed as they can unreasonably skew the average when only a few data points constitute the sample. Such anomaly's are noted and in general do not represent the general state of hygiene on surfaces.

Appendix

Data for Summary chart

Dallas-Ft. Worth Airport ATP Test Summary

	Baseline	Interval 1	Interval 2	Interval 3				
	9/11/18	9/20/18	9/25/18	10/2/18	Pt Chg Base to Last	% Chg base to last	Pt Chg 1st Interval to Last	% Chg 1st Interval to last
Control								
Total Raw Average	657	386	393	339	-318	-48%	-48	-12%
Average /w High removed	440	289	351	311	-129	-29%	22	8%
Average with High and Low removed	439	288	350	310	-129	-29%	22	8%
Zoono ONLY								
Total Raw Average	554	307	228	183	-371	-67%	-124	-40%
Average /w High removed	458	281	208	162	-295	-65%	-119	-42%
Average with High and Low removed	438	279	205	161	-277	-63%	-117	-42%
Cleaned and Treated with Zoono								
Total Raw Average	481	242	188	137	-344	-72%	-105	-43%
Average /w High removed	342	210	166	113	-229	-67%	-97	-46%
Average with High and Low removed	367	225	181	124	-243	-66%	-101	-45%

Observations:

- The considerable reduction in contamination between the Baseline and Interval 1 in all scenarios is in large part attributable to the Hawthorne Effect – all scenarios benefited from this additional level of effort.
- Control area showed a gradual ATP increase following Interval 1 – a slower contamination rate than would normally be expected but even after 4 weeks, ATP readings remain high and in the 'contaminated' range.
- "Zoono Only" showed a notable 63% reduction over the entire period, but slightly less if comparing to data beginning after Interval 1, of 43%. ATP results trending positively and on track to yield 'clean' status with regular Zoono use.
- "Clean and Zoono" showed a precipitous decline between baseline and interval 1 and continued to improve with each interval. ATP results trending positively and on track to yield 'clean' status with regular Zoono use.
- Comparing ATP results in either Zoono setting vs control shows a 2-3 X improvement vs. control

Note about ATP Readings:

ATP is a measure of general contamination and does not identify any specific pathogen. Environmental contamination is measured through the detection of **Adenosine triphosphate** - (ATP). ATP is found in the cellular make-up of living organisms. Therefore, the amount of ATP present is a widely accepted gauge of microbial / bacterial **contamination.**

- Below 100 are considered "Clean" – a generally acceptable reading
- 100-200 indicate additional attention is required
- Above 200 are contaminated

ATP Test Result Scale

0 - 30	Considered Food Safe
31 - 100	Considered clean
101 - 200	Caution!
201 - 500	Contaminated
501 - 1000	High Risk of Infection
1000 +	Extreme Risk of Infection

Specific Data by Test area

Dallas-Ft. Worth Airport ATP Test

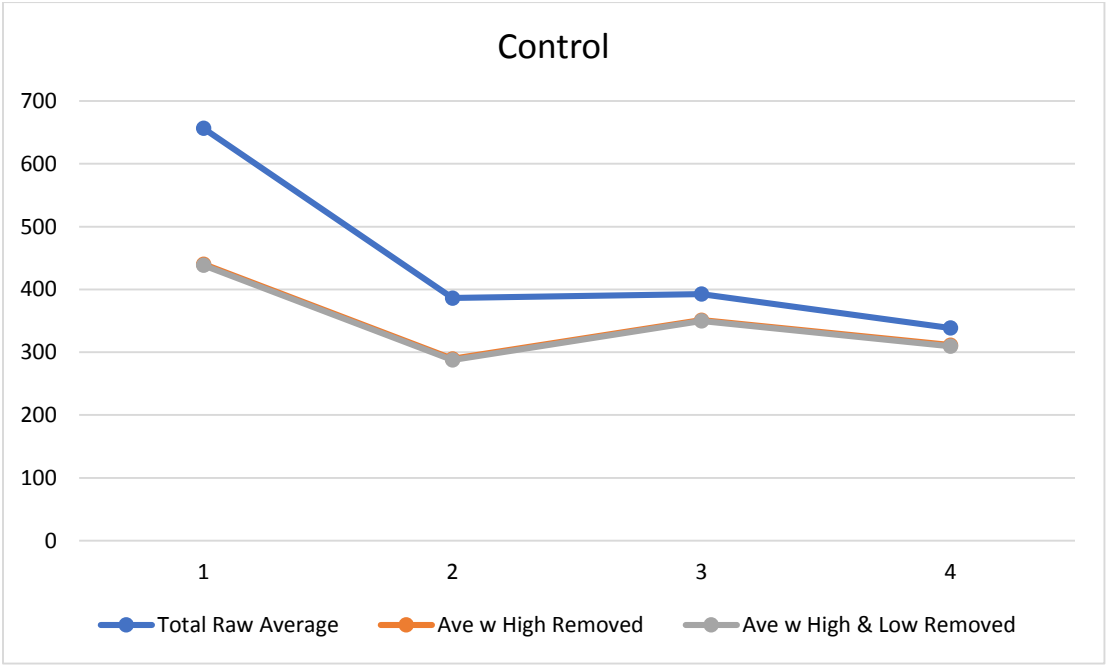
CONTROL No Clean / ATP ONLY

DFW — Mens restroom swabing C-19a
Mens restroom Terminal C C19 — ATP test only
J Espinosa

Location where ATP readings were completed	Baseline 9/11/18	Interval 1 9/18/18	Interval 2 9/25/18	Interval 3 10/2/18		
Janitor door handle	501	666	581	565		
Stall #14 outside door	19	18	16	19		
Stall # 14 insdie door latch	688	438	451	639		
Stall # 14 inside dispenser top	445	298	298	387		
Stall # 14 toilet seat	345	218	214	214		
Urinal # 3 Rt side	479	311	368	298		
ADA # 8 Grab rail bar	3035	596	632	582		
Child Changing board handle	110	87	185	134		
Child changinboard	40	192	183	116		
Soap dispenser sink # 5	92	68	65	60		
Paper towel dispenser	1691	1451	871	617		
Customer experience screen	434	292	848	434		
					Pt Chg Base to Last	% Chg base to last
Total Raw Average	657	386	393	339	318	48%
Average /w High removed	440	289	351	311	129	29%
Average with High and Low removed	439	288	350	310	129	29%

Observations:

- 88% increase in bio-load in 4 weeks
- High touch areas = high contamination as expected
- Forced Air hand dryer concentrates airborne microbes onto adjacent surfaces



Dallas-Ft. Worth Airport ATP Test

Zoono / No Clean

DFW
Mens restroom Terminal c C27a
J Espinosa

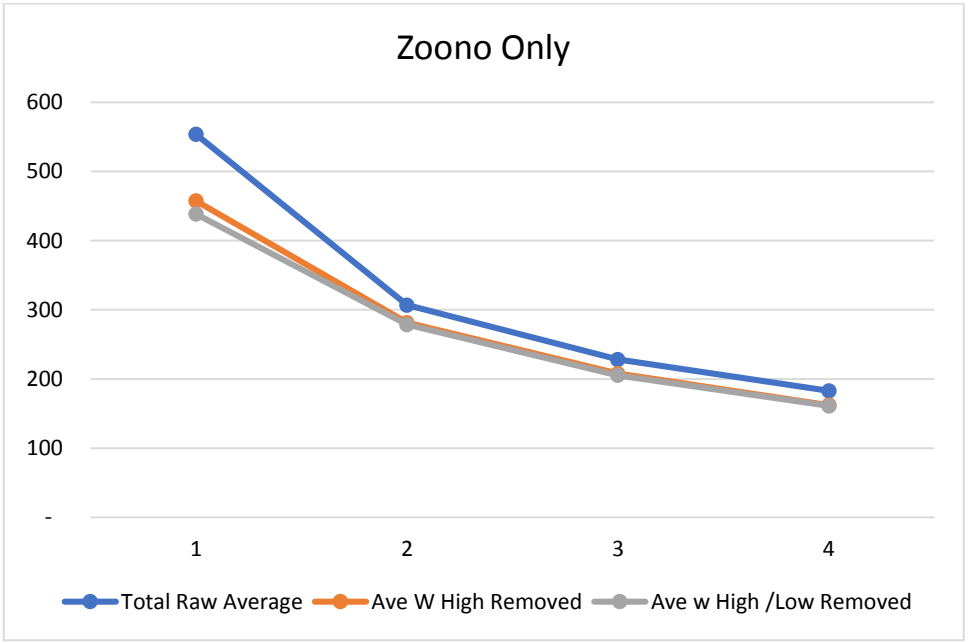
Mens restroom swabing C-27a
ATP test and Applied Zoono Only no Cleaning

	Baseline 9/11/18	Interval 1 9/18/18	Interval 2 9/25/18	Interval 3 10/2/18
Location where ATP readings were completed				
Janitor door handle	450	368	357	206
Stall # 4 outside door	332	29	24	16
Stall # 4 inside door latch	879	477	432	389
Stall # 4 inside dispenser top	379	211	210	207
Stall # 1 toilet seat	296	188	132	118
Urinal # 3 Rt side wall	270	146	136	132
ADA grab bar rail	658	540	350	199
Child changingboard handle	191	82	57	11
Child changingboard	442	239	110	92
Soap Dispenser sink # 2	678	562	314	297
Paper towel dispenser	1516	534	387	344

					Pt Chg Base to Last	% Chg base to last
Total Raw Average	554	307	228	183	371	67%
Average /w High removed	458	281	208	162	295	65%
Average with High and Low removed	438	279	205	161	277	63%

Observations:

- 71% increase in bio-load in 4 weeks
- High touch areas = high contamination as expected
- Forced Air hand dryer concentrates airborne microbes onto adjacent surfaces



Specific Data by Test area

Dallas-Ft. Worth Airport ATP Test

Clean + Zoono

DFW
Mesns restroom Terminal C C07a
J Espinosa

Mens restroom swabing C-07a
ATP Test, Clean with Cloroxwipes and apply Zoono

Location where ATP readings were com	Baseline 9/11/18	Interval 1 9/18/18	Interval 2 9/25/18	Interval 3 10/2/18	Pt Chg Base to Last	% Chg base to last
Janitor door handle	**972**	499	435	400		
Stall #14 outside door	102	15	10	5		
Stall # 14 insdie door latch	896	587	371	256		
Stall # 14 inside dispenser top	286	90	98	68		
Stall # 14 toilet seat	399	354	221	145		
Urinal # 8 lower Rt side	237	207	156	120		
Last Stall ADA grab rail	188	169	293	84		
Child changing board handle	92	62	60	59		
Child changing board	154	84	99	89		
soap dispenser sink #5	139	119	98	68		
Paper Towel Dispenser	2004	384	228	187		
Water Fountain outside entryv	298	329	188	161		
Total Raw Average	481	242	188	137	344	72%
Average /w High removed	342	210	166	113	229	67%
Average with High and Low re	367	225	181	124	243	66%

Observations:

- 27% decrease in bio-load over 4 weeks
- High touch areas = high contamination as expected
- Forced Air hand dryer concentrates airborne microbes onto adjacent surfaces – treating with Zoono mitigates contamination