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**TRIALS AND DEVELOPMENT TEAM**



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**LONDON UNDERGROUND - ZOONO ANTIMICROBIAL TREATMENTS  
TRIAL REPORT**

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Report Number: 02/15

17 September 2015

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**LONDON UNDERGROUND ZOONO ANTIMICROBIAL TREATMENTS TRIAL**

**Zoono UK Limited TRIAL REPORT No: 02/15**

**CONCLUSIONS AND RECOMMENDATIONS**

Conclusions and recommendations of a practical nature in this report reflect the views of the Zoono UK Limited. Recommendations regarding acceptance into service or scales of issue, however, reflect only the views of the Zoono UK Limited Trials and Development Unit, and are subject to confirmation by the Trail Sponsor.

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TRIALS UNIT	:	Zoono UK Limited
SPONSOR	:	London Underground Ltd
AUTHORITY	:	London Underground
DATES	:	27 August – 21 September 2015
LOCATION	:	Central Line Depot

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Date: 7 October 2015

Distribution:

Action:

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- b. **London Underground Rolling Stock.** The train stock used on the Central Line are of 1992 stock vintage. The dimensions of the carriages are: Length 16.25m, Width 2.62m, Height 2.87m.



4. **Trial Staff.** The trials staffs were drawn from Zoono UK Limited Technical Expert Support Team (TEST) pool.

5. **Climatic Conditions.**

- a. **London Central Line Depot.** The User Trial phase was conducted over 21 days from 27 August – 21 Sept 2015. Weather information was gathered from Zoono UK Limited Metrological equipment. Temperatures ranged from 14°C to 27°C during the day and at night highs of 14°C and lows of 6°C.

**Limitations**

6. **Environment.** The following limitations are associated with the trial environments:

- a. There were no limitations to the trial environments.

7. **Locations.** The locations/touch points for the trail were chosen in order that a varied yet fair representation of the rolling stock was tested. Moreover, the locations identified were those most likely to be touched by both staff and travellers.

**Swab Testing**

8. EU Legislation states “Sampling of the environment can be a useful tool to identify and prevent the presence of pathogenic microorganisms”. The environment can be contaminated with a variety of micro-organisms derived from various sources. Estimation of the overall numbers of bacteria (Aerobic Colony Count) present can provide useful information when assessing general hygiene. Environmental monitoring can also be used as part of routine inspections of premises or in an investigation of a suspected viral outbreak where surfaces are thought to be likely vehicles of cross-contamination. Determination of the number of aerobic viable micro-organisms and the number of Enterobacteriaceae on a specified area of a surface can provide an indication of the cleanliness and allows monitoring of cleaning procedures over time.

9. The main value of determining the colony counts on a surface is to assess the cleanliness of that surface. A Detection and enumeration of bacteria in swab samples with a high count can be an early warning of inadequate cleaning practices.

10. Results:

Ser	CFU Count	Result
1	<10	Clean
2	10-160	Contaminated
3	>160	Gross Contamination

## Trial Conduct

### 11. Scope and Method.

- a. **Objectives.** The trial objectives were to:
  - (1) Assess the performance of the Zoono Antimicrobial product over a minimum of a 21-day period. The 21-day period was chosen as this matched the current cleaning cycle of the carriages.
  - (2) Create a baseline of sample results in order to score the Zoono product against.
- b. **Scope.** The scope of the trial was to assess and test the Zoono Antimicrobial Product and provide user feedback and comment.
- c. **Method/Concept.** The method employed was to split the trial into two parts:
  - (1) **Baseline Tests.** This phase was conducted by Zoono UK Limited's trials team at the London Underground Central Line depot. Two 'double-cab' carriages were selected by the London underground staff. The team identified 'touch points'/sampling locations within each cab. It was agreed that sampling would take place before the regular cleaning process was undertaken and then again after the cleaning process and the application of Zoono to two of the carriages. This would provide an initial data set of 40 samples. The samples were then sent to an independent lab for analysis. Each of the touch points were swabbed and recorded in accordance with the data sheets.



Figure 1 – Touch Point Sampling

- (2) **21-Day Trial Point.** This phase was planned to be conducted at the 21-day point as the carriages were returned to the depot as part of cleaning cycle. However, due to circumstances outside of reasonable control the carriages could not be returned to the depot at the 21-day point. This portion of the trial was subsequently undertaken at the 25-day point. Each of the 40 identified sampling locations were sampled again and the samples sent to the independent laboratory for testing.



Figure 2 – Zoono UK Limited Trials Team Trials

d. **Measures of Effectiveness/Performance.** Data was collected, collated and assessed and then each data set was compared in order to see the effectiveness of Zoono. The results of which are shown at Annex A.

## Results

12. The results section will be split into 3 separate sections to correspond with each Sample Set.

a. **Baseline Test – Pre Cleaning:**



Figure 3 – Application of Zoono

(1) **Objective and Test Methodology.** The plan was to test the carriages prior to cleaning in order to establish a baseline. Once tested Zoono was applied to the drivers cabs and two of the carriages. The agreed methodology is at Annex B.

(2) **Results.**

(a) The results showed that prior to the application of Zoono and after a 21-day's 'in service' and prior to cleaning 27.5% of the carriages were clean and 72.5% were contaminated Figure 4 (32.5% were contaminated and 40% were Grossly Contaminated – Figure 5).

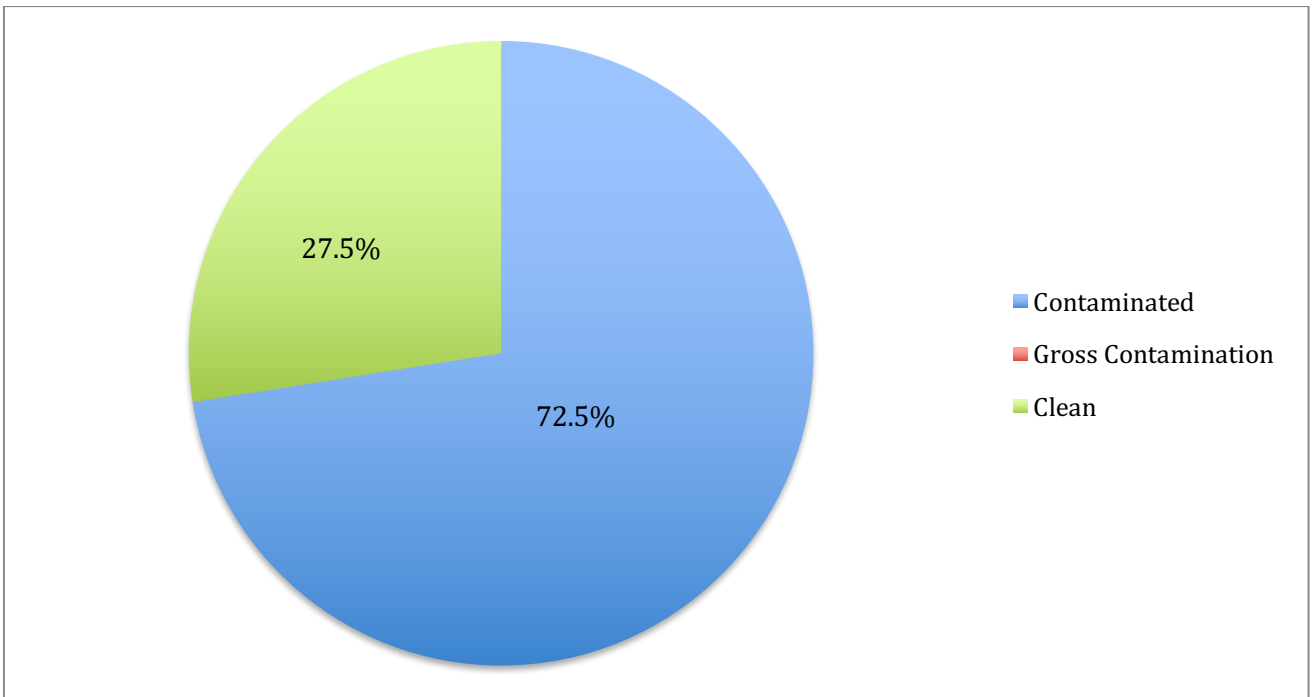


Figure 4 – 27 August - Overall Conatmination

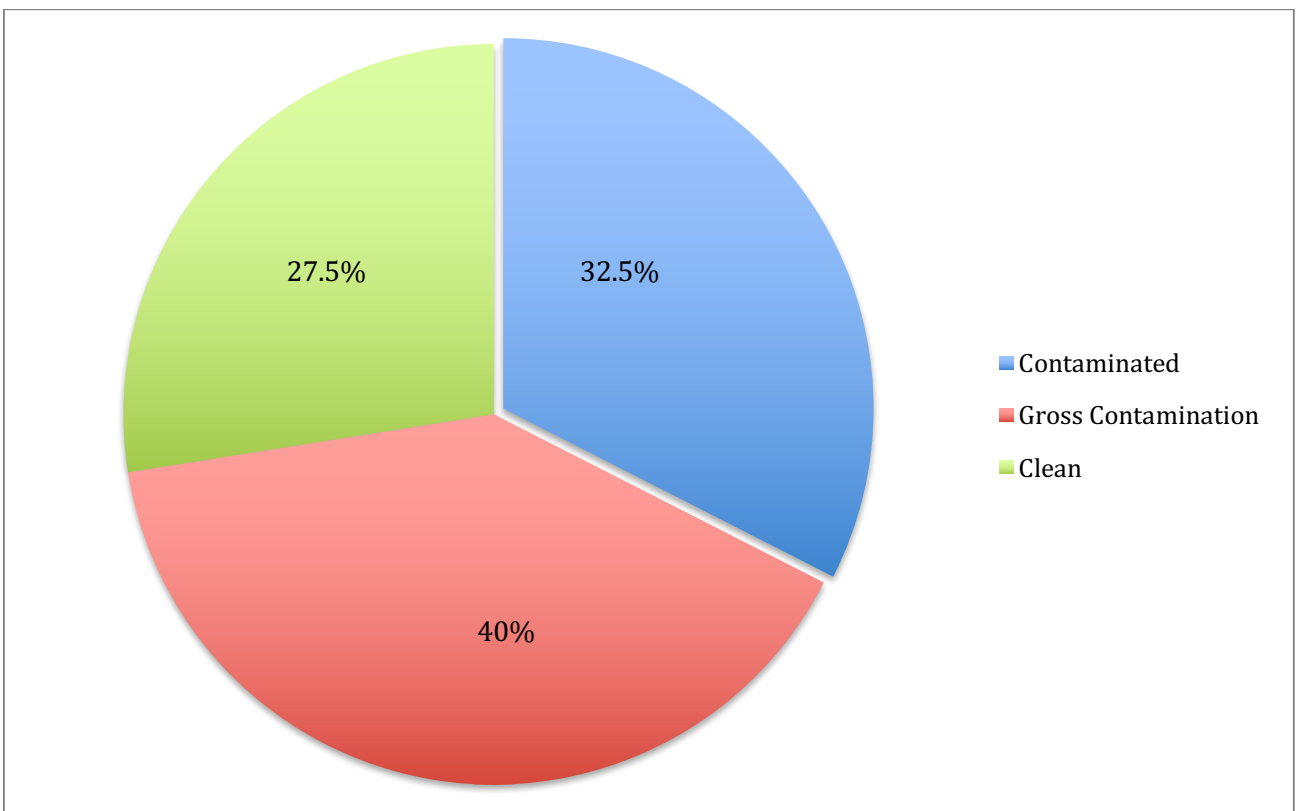


Figure 5 – 27 August – Contamination Breakdown

**Comment.**

(b) The surfaces swabbed are not considered as surfaces that would naturally harbour bacteria and therefore any positive results are mean that bacteria has been 'placed' on the surface by contact and cross contamination. Results by swab location - Figure 6 Overall Results, Figure 7 <10000 Results, Figure 8 <500 Results.

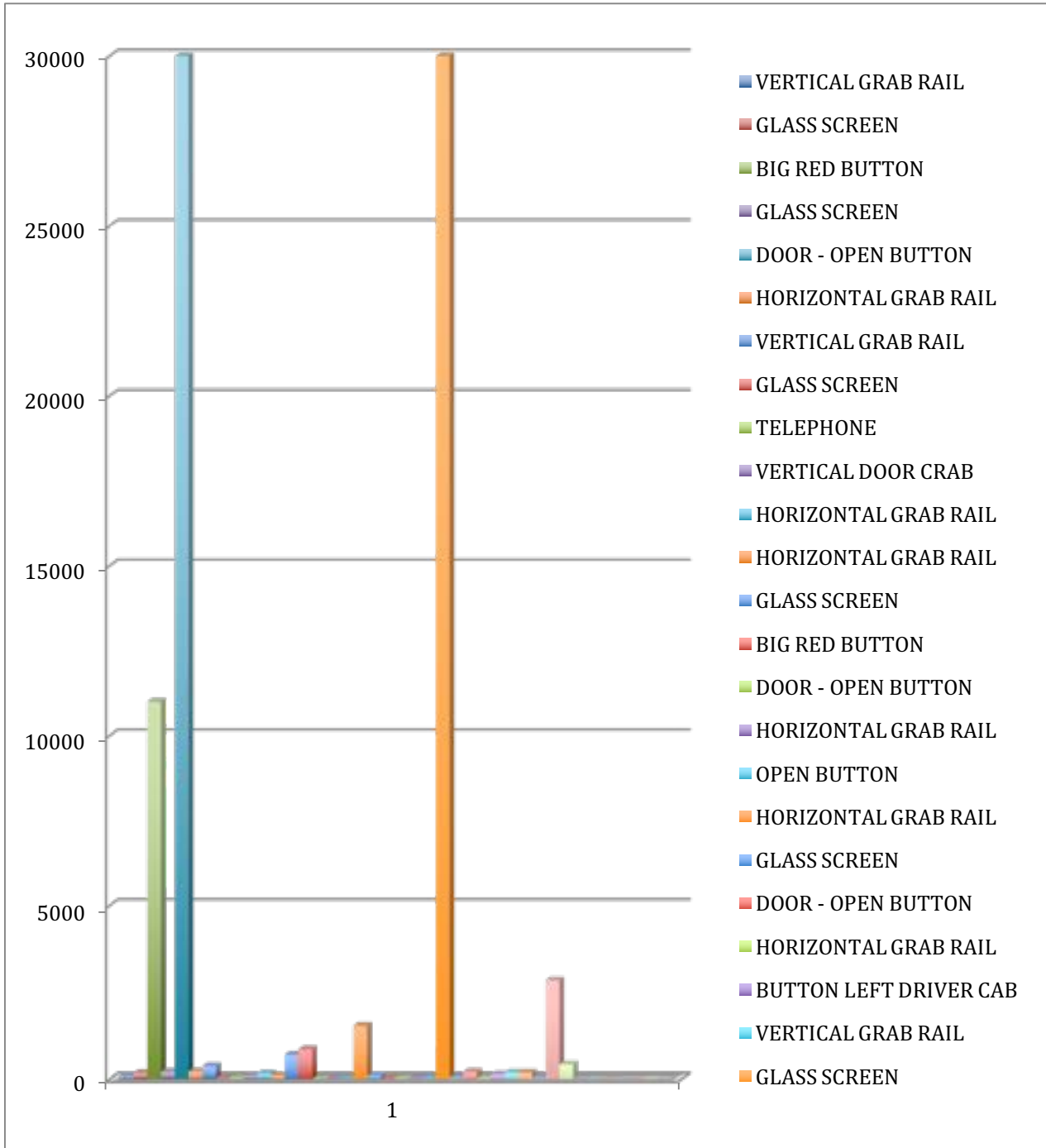


Figure 6 – Overall Results

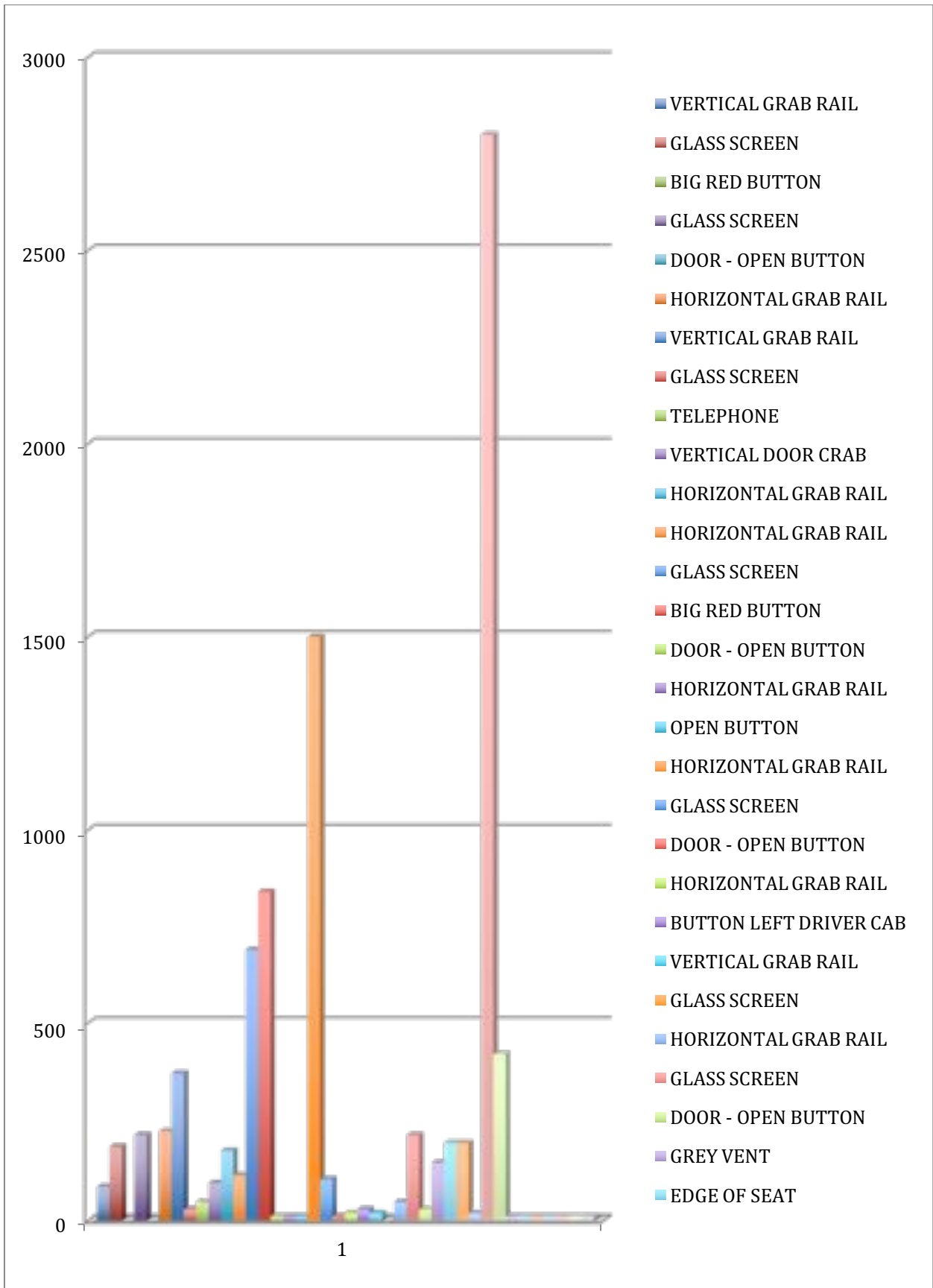


Figure 8 <10,000 Results

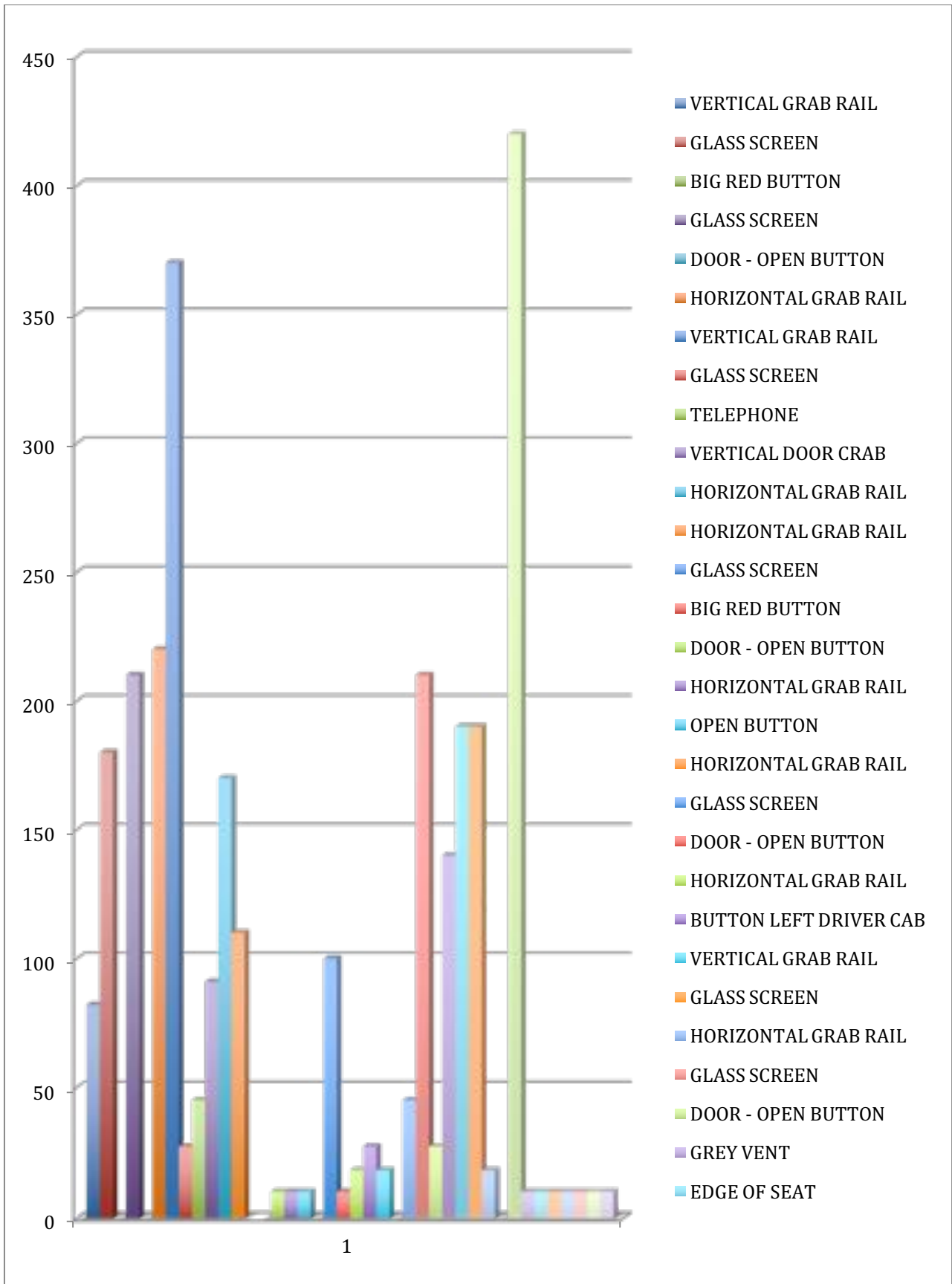


Figure 9 - <500 Results

**Comment.**

(c) Whilst there were nil results on the presence of Coagulase Positive Staphylococcus and Enterobacteriaceae the high results would suggest that there is a very high probability of other pathogenic bacteria being present.

b. **21 Day Tests:**

(1) **Objective and Test Methodology.** The plan was to take a set of 40 samples 20 from the Zoono carriages and 20 from the non-Zoono carriages. This would demonstrate the effectiveness or not of the Zoono product.

(2) **Results.**

(a) **Zoono.** The results showed that after the application of Zoono and the stack being in service for 25 days the Zoono swabbed areas indicated <10 score which is considered clean – Figure 10.

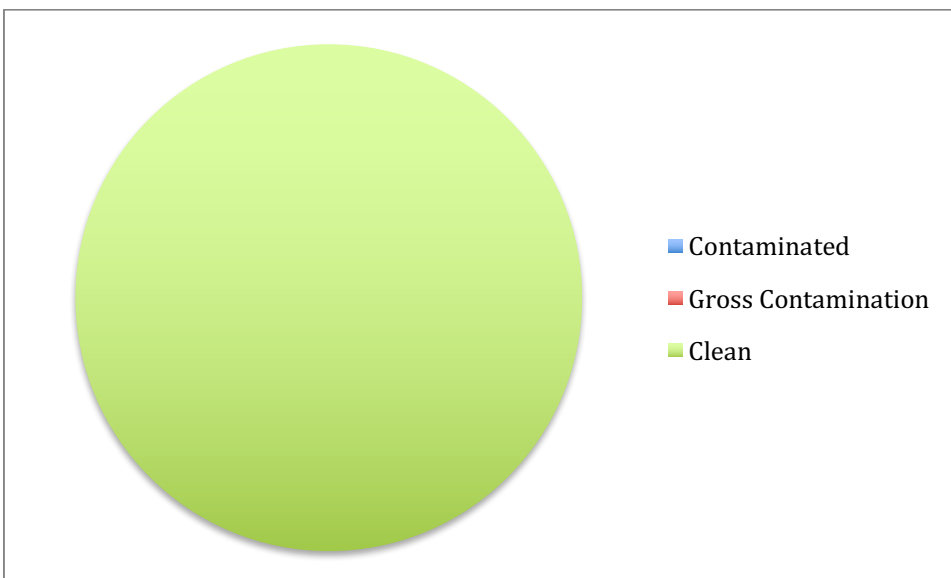


Figure 10 – Zoono Results

**Comment.** Zoono performed as expected.



(b) **Non-Zoono.** The results from the Non-Zoono swabs indicated that the carriages remained significantly contaminated with 35% being clean and 65% considered contaminated - Figure 11 Overall Results, (45% contamination 20% Gross Contamination) Figure 12 – Contamination Breakdown.

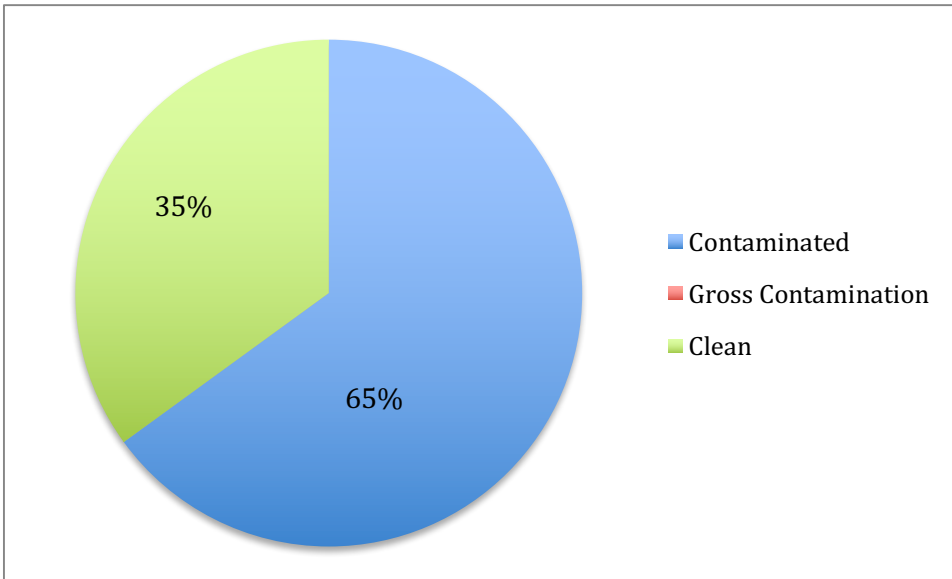


Figure 11 – Overall Contamination

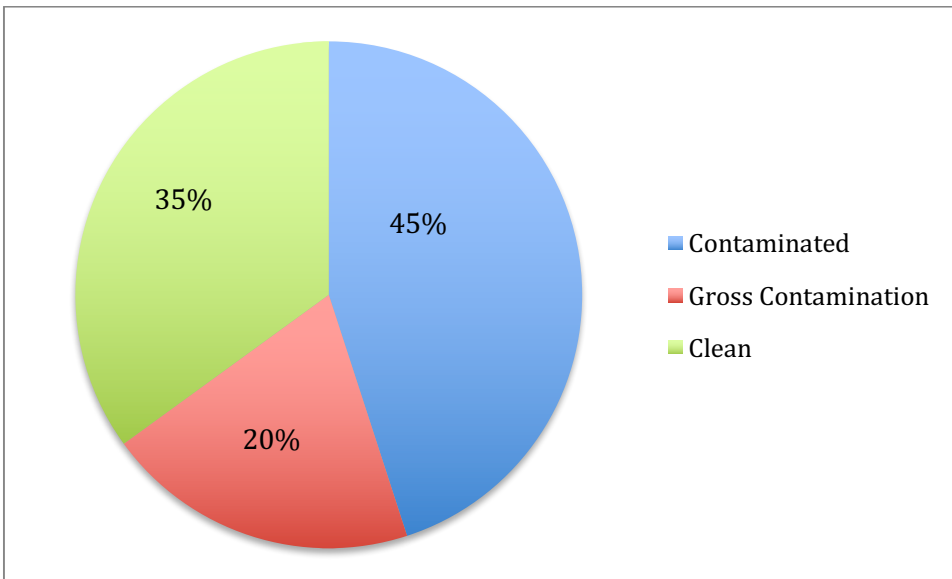


Figure 12 – Contamination Breakdown

**Comment.** The surfaces swabbed are not considered as surfaces that would naturally harbour bacteria and therefore any positive results are mean that bacteria has been 'placed' on the surface by contact and cross contamination. Results by swab location - Figure 13 Overall Results, Figure 14 <10000 Results, Figure 15 <600 Results.

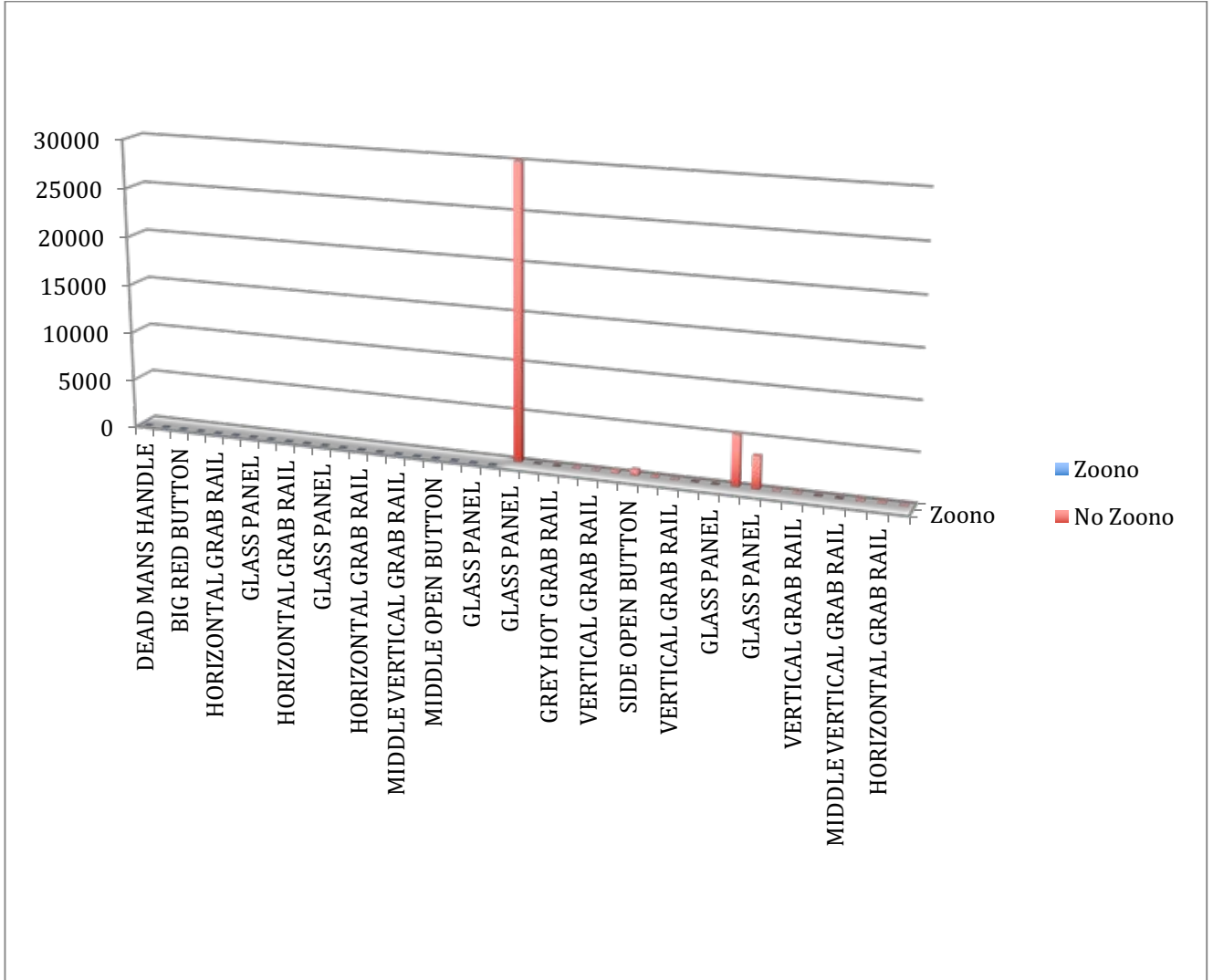


Figure 13 - Overall Results 21 September

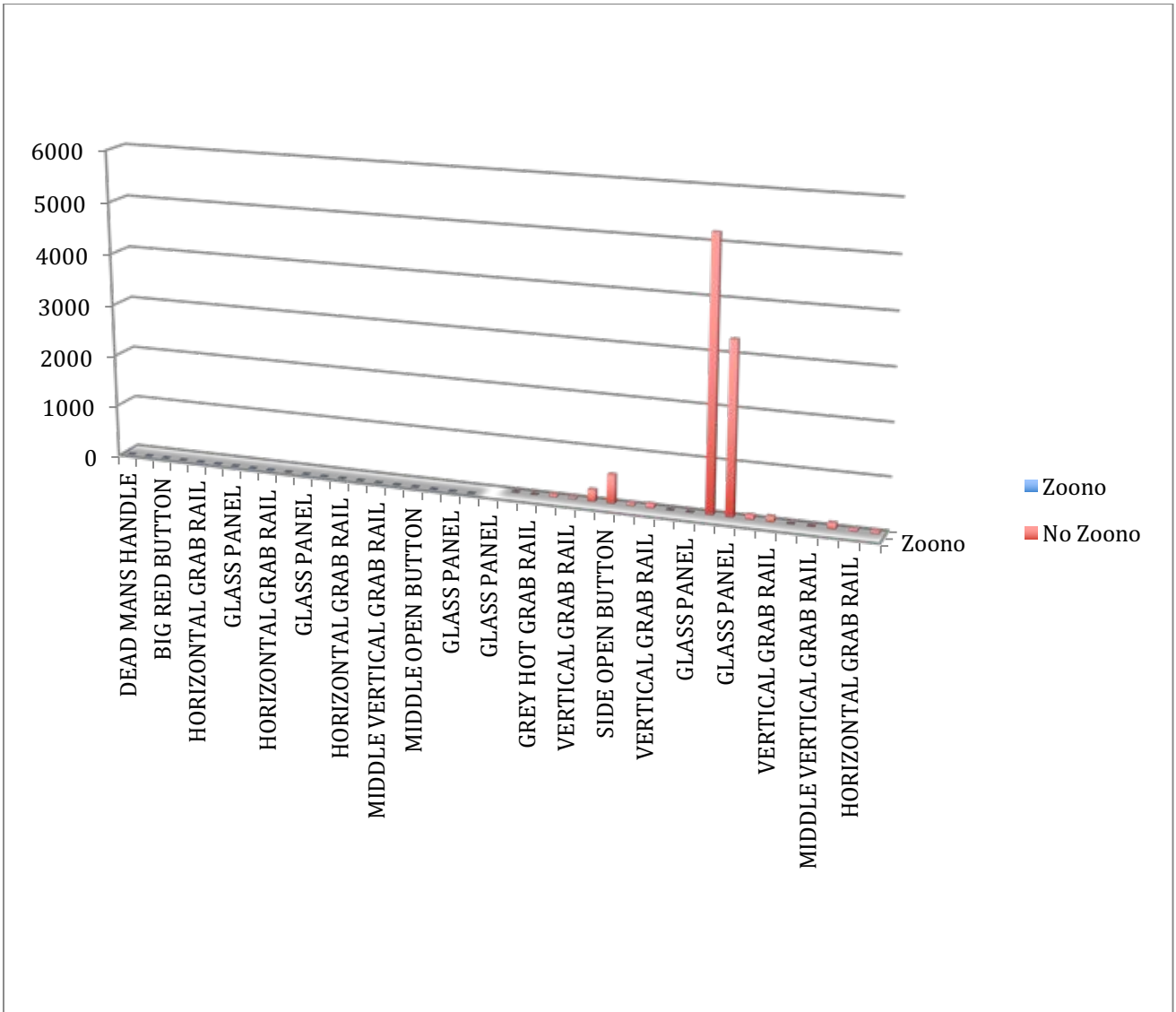


Figure 14 - <6000 Results

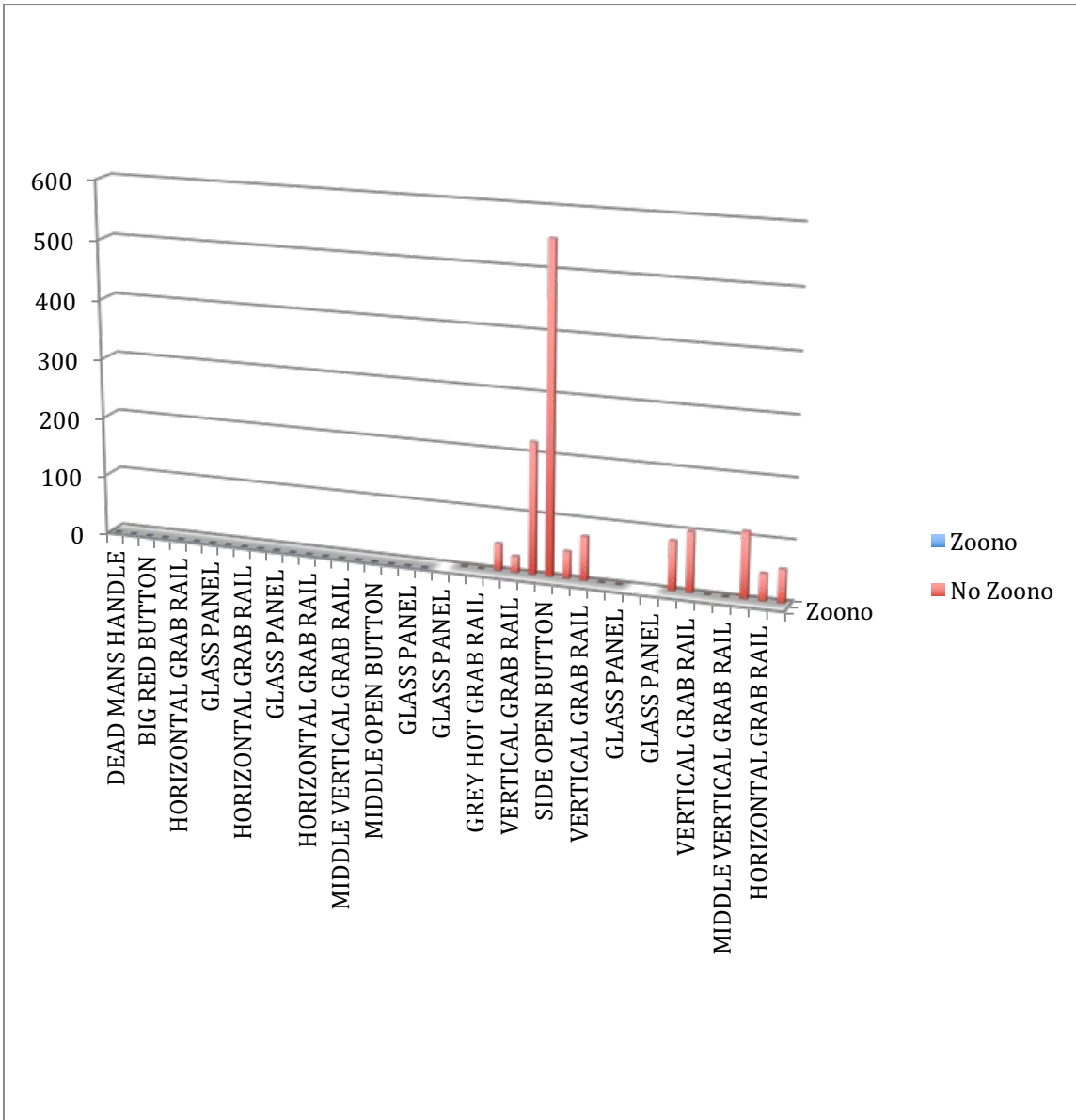


Figure 15 – <600 results

13. **Comments.** The following general comments were made about the performance of the Zoono product:

- a. Where Zoono was applied the results prove that Zoono remains an effective barrier against bacteria for over 21 days.
- b. The application of Zoono will significantly enhance the cleanliness of carriages and working environments.

14. **Conclusion**

- a. The trial was successful in testing fully the requirements detailed by the London Underground and ensured that areas of interest from the client were addressed, namely effectiveness of Zoono and duration of effectiveness.

b. In summary, the trial can recommend that Zoono would meet the user expectations and has exceeded the specified requirements. If brought into service, Zoono would provide the protection levels required on the London Underground for protecting staff and travellers.

15. **Recommendations.** It is recommended that further consideration is now given to the implementation of a Zoono cleaning regime on the London Underground Rolling Stock, Stations and support infrastructure.

**DETAILED TEST RESULTS – 27 AUGUST 2015**

Analytical Report Code	Lab. Sample Number	Client code	Client Reference	Aerobic Plate Count	Coagulase Positive Staphylococcus	Enterobacteriaceae
AR-15-UD-301084-01	400-2015-60236300	1.1.1	HORIZONTAL GRAB RAIL	1500	<10	<10
AR-15-UD-301090-01	400-2015-60236309	1.10.1	TELEPHONE	<10	<10	<10
AR-15-UD-301091-01	400-2015-60236310	1.11.1	BUTTON LEFT DRIVER CAB	27	<10	<10
AR-15-UD-302475-01	400-2015-60236311	1.12.1	BIG RED BUTTON	11000	<10	<10
AR-15-UD-302472-01	400-2015-60236301	1.2.1	VERTICAL GRAB RAIL	82	<10	<10
AR-15-UD-301085-01	400-2015-60236302	1.3.1	GLASS SCREEN	100	<10	<10
AR-15-UD-301086-01	400-2015-60236303	1.4.1	DOOR - OPEN BUTTON	<10	<10	<10
AR-15-UD-301087-01	400-2015-60236304	1.5.1	HORIZONTAL GRAB RAIL	18	<10	<10
AR-15-UD-301088-01	400-2015-60236305	1.6.1	VERTICAL GRAB RAIL	<10	<10	<10
AR-15-UD-302473-01	400-2015-60236306	1.7.1	GLASS SCREEN	180	<10	<10
AR-15-UD-302474-01	400-2015-60236307	1.8.1	DOOR - OPEN BUTTON	<10	<10	<10
AR-15-UD-301089-01	400-2015-60236308	1.9.1	DEAD MANS HANDLE	<10	<10	<10
AR-15-UD-302476-01	400-2015-60236312	2.1.1	HORIZONTAL GRAB RAIL	<10	<10	<10
AR-15-UD-301092-01	400-2015-60236313	2.2.1	VERTICAL GRAB RAIL	18	<10	<10
AR-15-UD-302477-01	400-2015-60236314	2.3.1	GLASS SCREEN	210	<10	<10
AR-15-UD-302478-01	400-2015-60236315	2.4.1	DOOR - OPEN BUTTON	>30000	<10	<10
AR-15-UD-302479-01	400-2015-60236316	2.5.1	HORIZONTAL GRAB RAIL	220	<10	<10
AR-15-UD-302480-01	400-2015-60236317	2.6.1	VERTICAL GRAB RAIL	370	<10	<10
AR-15-UD-301093-01	400-2015-60236318	2.7.1	GLASS SCREEN	>30000	<10	<10
AR-15-UD-301094-01	400-2015-60236319	2.8.1	DOOR - OPEN BUTTON	<10	<10	<10
AR-15-UD-302482-01	400-2015-60236329	3.10.1	TELEPHONE	45	<10	<10
AR-15-UD-301095-01	400-2015-60236320	3.1.1	HORIZONTAL GRAB RAIL	45	<10	<10
AR-15-UD-302540-01	400-2015-60236330	3.11.1	BIG RED BUTTON	840	<10	<10
AR-15-UD-301103-01	400-2015-60236331	3.12.1	BUTTON CLOSE SALOON	<10	<10	<10
AR-15-UD-301096-01	400-2015-60236321	3.2.1	VERTICAL GRAB RAIL	<10	<10	<10
AR-15-UD-301097-01	400-2015-60236322	3.3.1	GLASS SCREEN	210	<10	<10
AR-15-UD-301098-01	400-2015-60236323	3.4.1	DOOR - OPEN BUTTON	27	<10	<10
AR-15-UD-301099-01	400-2015-60236324	3.5.1	GREY VENT	140	<10	<10
AR-15-UD-301100-01	400-2015-60236325	3.6.1	EDGE OF SEAT	190	<10	<10
AR-15-UD-302481-01	400-2015-60236326	3.7.1	GLASS SCREEN	27	<10	<10
AR-15-UD-301101-01	400-2015-60236327	3.8.1	OPEN DOOR BUTTON	190	<10	<10
AR-15-UD-301102-01	400-2015-60236328	3.9.1	DEAD MANS HANDLE	18	<10	<10
AR-15-UD-302483-01	400-2015-60236332	4.1.1	VERTICAL DOOR GRAB	91	<10	<10
AR-15-UD-302484-01	400-2015-60236333	4.2.1	HORIZONTAL GRAB RAIL	170	<10	<10
AR-15-UD-301104-01	400-2015-60236334	4.3.1	GLASS SCREEN	<10	<10	<10
AR-15-UD-301105-01	400-2015-60236335	4.4.1	OPEN BUTTON	2800	<10	<10
AR-15-UD-302485-01	400-2015-60236336	4.5.1	HORIZONTAL GRAB RAIL	110	<10	<10
AR-15-UD-301106-01	400-2015-60236337	4.6.1	VERTICAL GRAB RAIL	420	<10	<10
AR-15-UD-302486-01	400-2015-60236338	4.7.1	GLASS SCREEN	690	<10	<10
AR-15-UD-302487-01	400-2015-60236339	4.8.1	OPEN BUTTON	<10	<10	<10

**DETAILED TEST RESULTS – NON-ZOONO – 21 SEPTEMBER 2015**

Analytical Report Code	Lab. Sample Number	Client code	Client Reference	Aerobic Plate Count	Coagulase Positive Staphylococcus	Enterobacteriaceae
PR-15-UD-001899-01	400-2015-60257183	01	GLASS PANEL	30000	<10	<10
PR-15-UD-001900-01	400-2015-60257184	02	MIDDLE VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001901-01	400-2015-60257185	03	GREY HOT GRAB RAIL	<10	<10	<10
PR-15-UD-001902-01	400-2015-60257186	04	MIDDLE OPEN BUTTON	45	<10	<10
PR-15-UD-001903-01	400-2015-60257187	05	VERTICAL GRAB RAIL	27	<10	<10
PR-15-UD-001904-01	400-2015-60257188	06	HORIZONTAL GRAB RAIL	220	<10	<10
PR-15-UD-001905-01	400-2015-60257189	07	SIDE OPEN BUTTON	550	<10	<10
PR-15-UD-001906-01	400-2015-60257190	08	HORIZONTAL GRAB RAIL	45	<10	<10
PR-15-UD-001907-01	400-2015-60257191	09	VERTICAL GRAB RAIL	73	<10	<10
PR-15-UD-001908-01	400-2015-60257192	10	VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001909-01	400-2015-60257193	11	GLASS PANEL	<10	<10	<10
PR-15-UD-001910-01	400-2015-60257194	12	VERTICAL GRAB RAIL	5200	<10	<10
PR-15-UD-001911-01	400-2015-60257195	13	GLASS PANEL	3300	<10	<10
PR-15-UD-001912-01	400-2015-60257196	14	HORIZONTAL GRAB RAIL	82	<10	<10
PR-15-UD-001913-01	400-2015-60257197	15	VERTICAL GRAB RAIL	100	<10	<10
PR-15-UD-001914-01	400-2015-60257198	16	GLASS PANEL	<10	<10	<10
PR-15-UD-001915-01	400-2015-60257199	17	MIDDLE VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001916-01	400-2015-60257200	18	VERTICAL GRAB RAIL	110	<10	<10
PR-15-UD-001917-01	400-2015-60257201	19	HORIZONTAL GRAB RAIL	45	<10	<10
PR-15-UD-001918-01	400-2015-60257202	20	GREY HORIZONTAL GRAB RAIL	55	<10	<10

**DETAILED TEST RESULTS – ZOONO TREATED – 21 SEPTEMBER 2015**

Analytical Report Code	Lab. Sample Number	Client code	Client Reference	Aerobic Plate Count	Coagulase Positive Staphylococcus	Enterobacteriaceae
PR-15-UD-001919-01	400-2015-60257203	Z1	DEAD MANS HANDLE	<10	<10	<10
PR-15-UD-001920-01	400-2015-60257204	Z2	DRIVER SIDE BUTTON	<10	<10	<10
PR-15-UD-001921-01	400-2015-60257205	Z3	BIG RED BUTTON	<10	<10	<10
PR-15-UD-001922-01	400-2015-60257206	Z4	TELEPHONE	<10	<10	<10
PR-15-UD-001923-01	400-2015-60257207	Z5	HORIZONTAL GRAB RAIL	<10	<10	<10
PR-15-UD-001924-01	400-2015-60257208	Z6	VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001925-01	400-2015-60257209	Z7	GLASS PANEL	<10	<10	<10
PR-15-UD-001926-01	400-2015-60257210	Z8	OPEN BUTTON	<10	<10	<10
PR-15-UD-001927-01	400-2015-60257211	Z9	HORIZONTAL GRAB RAIL	<10	<10	<10
PR-15-UD-001928-01	400-2015-60257212	Z10	MIDDLE OPEN BUTTON	<10	<10	<10
PR-15-UD-001929-01	400-2015-60257213	Z11	GLASS PANEL	<10	<10	<10
PR-15-UD-001930-01	400-2015-60257214	Z12	MIDDLE VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001931-01	400-2015-60257215	Z13	HORIZONTAL GRAB RAIL	<10	<10	<10
PR-15-UD-001932-01	400-2015-60257216	Z14	VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001933-01	400-2015-60257217	Z15	MIDDLE VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001934-01	400-2015-60257218	Z16	GLASS PANEL	<10	<10	<10
PR-15-UD-001935-01	400-2015-60257219	Z17	MIDDLE OPEN BUTTON	<10	<10	<10
PR-15-UD-001936-01	400-2015-60257220	Z18	VERTICAL GRAB RAIL	<10	<10	<10
PR-15-UD-001937-01	400-2015-60257221	Z19	GLASS PANEL	<10	<10	<10
PR-15-UD-001938-01	400-2015-60257222	Z20	VERTICAL GRAB RAIL	<10	<10	<10