ASSESSMENT OF A DECONTAMINATION PROCEDURE FOR THE 'HYGENIUS' HANDWASHING UNIT

TEAL HAND WASH SYSTEMS

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JANUARY 2008

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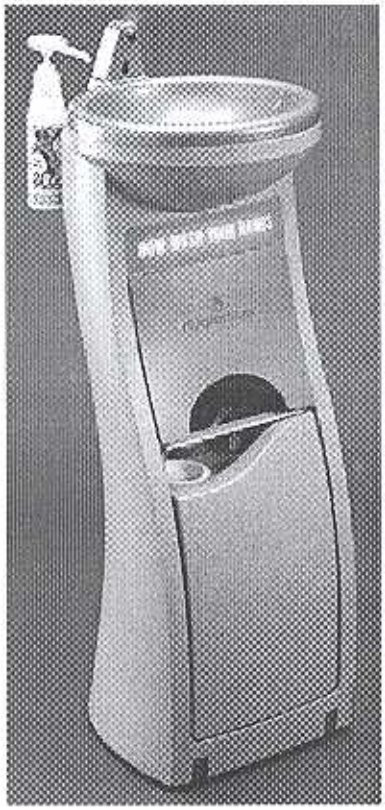
EQUIPMENT TESTED

Hygenius Hand Wash Unit
Machine 1 Serial Number 1214
Machine 2 Serial Number 1221



OBJECTIVE

To devise and evaluate an effective disinfection procedure for the Hygenius Hand Wash Unit.

INTRODUCTION

The Hygenius Hand Wash Unit consists of a waist high portable hand-washing unit that is connected to a power supply. The unit supplies heated water for up to 50 washes per 10 litres of water used. The tank or 'TEALtainer', which holds both fresh and wastewater, is located underneath the washbasin and is connected to the unit via a 'click lock' connector. Two separate plastic bags are located in the tank; one accommodates fresh water, the other waste. A waste pipe is positioned between the washbasin and the waste bag. Fresh water is pumped through the heater when the sensor on the water outlet is activated. The heater raises the water to approx 35°C.

When the fresh water has been depleted, the unit is disconnected from the power supply. The 'TEALtainer' is removed from the unit, and the wastewater, and any residual fresh water, is discarded. The fresh water bag is then filled with fresh tap water, the 'TEALtainer' is reconnected to the unit, and the unit is reconnected to the power supply.

If water is left for periods of time then contamination, particularly with *Pseudomonas spp* can occur. These tests were designed to assess the time period before contamination could occur and a simple method for maintaining the units in a bacteria free state.

TEST METHODS

To establish the base level of contamination, water samples were taken from the Hygenius Hand Wash Units on the day they were installed. The water samples were collected from the nozzles of the machines (during operation) and from the fresh water bags of the 'TEALtainers' / tanks (when not in

operation). The water samples were plated out onto Tryptone Soy Agar (TSA) and incubated at 37°C for approximately 24 hours. Thereafter, water from the nozzles and tanks were sampled prior to disinfection (at about 9.00am), immediately after disinfection (at about 9.20am), and at 3.00pm.

The disinfection routine tested on the Hygenius Hand Wash Units was as follows:

1. Disconnect the unit from the power supply.
2. Disconnect the 'TEALtainer' from the unit.
3. Discard wastewater and any remaining fresh water.
4. Replenish the fresh water bag with approximately 10 litres of tap water.
5. Add sodium dichloroisocyanurate (a chlorine releasing agent) tablets to the water, giving a final concentration 500 ppm av. Cl.
6. Allow tablets to dissolve.
7. Reconnect the 'TEALtainer' to the unit, and the unit to the power supply.
8. Run the 'purge function' for 5 minutes.
9. Repeat steps 1-3.
10. Thoroughly rinse the fresh water bag with tap water.
11. Replenish the fresh water bag with approximately 10 litres of tap water.
12. Reconnect the 'TEALtainer' to the unit, and the unit to the power supply.
13. Run the 'purge function' for 2 minutes.

The project was conducted over 31 days. On days 2-5, 8, 15, 19 and 29, both machines were disinfected and sampled. Days 6-7, 13-14, 20-21 and 27-28 were on a weekend, and days 23, 24 and 30 were bank holidays; the machines were not disinfected or sampled on these days. On days 9-12, 22, 25, 26 and 31, machine 1 was disinfected but machine 2 was not. However, both machines were sampled. On days 17 and 18, machine 2 was disinfected but machine 1 was not. As before, both machines were sampled. On days 16 and 26, neither machine was disinfected, but both were sampled. The omissions were designed to ascertain the optimum frequency of disinfection.

On all days when sampling took place, the machines were regularly activated by placing hands under the sensors. This was to replicate expected operational conditions.

RESULTS

Table 1 displays the Total Viable Counts (TVC's) obtained from the water samples.

The samples taken on day 1 (the day the machines were installed) show that the nozzle of machine 2 was contaminated with *Pseudomonas* spp. By the morning of day 2, the pre-disinfection samples show that the contamination had increased substantially. The nozzles of machines 1 and 2 yielded *Pseudomonas spp* at the levels of 10^5 and 10^6 CFU's per ml, respectively. The tank of machine 1 also contained *Pseudomonas spp*, albeit at much lower levels. Both machines were disinfected daily using the method previously described for the next 4 days. This routine daily disinfection reduced the recovery of *Pseudomonas spp* to very low levels, with none isolated on day 5.

After the first weekend (days 6 and 7), *Pseudomonas spp* was present, at a level of 10^2 CFU's per ml, in the pre-disinfection samples from the nozzles of both machines. Machine 1 was then disinfected *per diem* for the next 5 days, with no *Pseudomonas spp* isolated from the water samples. Machine 2 was disinfected on day 8, which removed any traces of *Pseudomonas spp*. Thereafter, machine 2 was not disinfected for 4 days, with *Pseudomonas spp* at the level of 10^2 CFU's per ml isolated from both the tank and the nozzle by the 4^{th} day (day 12).

After the second weekend (days 13 and 14), *Pseudomonas spp* was present, at a level of 10^5 CFU's per ml, in the pre-disinfection sample from the nozzle of machine 2 (the tank sample was omitted accidentally). By this point, machine 2 had not been disinfected for 6 days. Machine 1 was free of any contamination. Both machines were disinfected on day 15.

Neither machine was disinfected on day 16; by day 17, the nozzle of machine 1 was contaminated with low levels of *Pseudomonas spp*, whilst machine 2 was clean. Also, machine 1 was not disinfected on days 17 and 18, producing *Pseudomonas spp* at a level of 10^2 CFU's per ml in the nozzle by day 18, and *Pseudomonas spp* at levels of 10^2 CFU's per ml and 10^3 CFU's per ml in the tank and nozzle, respectively, by day 19. Machine 2 was disinfected on days 17, 18 and 19, remaining free from contamination. Machine 1 was also disinfected on day 19.

After the third weekend (days 20 and 21), both machines were free of *Pseudomonas spp*. On day 22 (Christmas Eve), only machine 1 was disinfected. The machines were not disinfected or used over the Christmas period (days 23 and 24). On day 25, only machine 1 was disinfected; on day 26, neither machine was disinfected. Both machines were free of *Pseudomonas spp* on days 25 and 26.

After the fourth weekend (days 27 and 28), machine 1 was contaminated with *Pseudomonas spp* at a magnitude of 10^4 CFU's per ml in the nozzle, although machine 2 was free from *Pseudomonas spp*. Both machines were disinfected on day 29. The machines were not disinfected or used on New Year's Day (day 30). On day 31, the nozzle of machine 1 contained *Pseudomonas spp* to a level of 10^2 CFU's per ml, while machine 2's nozzle contained *Pseudomonas spp* to a level of 10^3 CFU's per ml.

The samples of both machines were occasionally contaminated with very low levels of skin flora and aerobic spore-bearing bacilli. These most likely originated from accidental contamination of the samples during processing, and so have been discounted from the analysis of the results.

Table 2 shows the mean TVC's of *Pseudomonas spp* from both machines compared with the number of days since the unit was last disinfected and the start contamination (pre-disinfection count one day after installation – 'Start') and the post-disinfection count (0). For the purposes of this analysis, only the pre-disinfect counts were used (e.g. if machine 1 was disinfected on day 25,

then the pre-disinfect sample for day 26 would count as 1 day since disinfection). The 3pm counts were not used, as they tended to be much lower than the pre-disinfection counts and may be due to residual chlorine or insufficient time for contamination to be detectable. Irrespective of the counts obtained pre disinfection, no contamination was detected after using 500 ppm chlorine releasing agent for a 5 minute contact time.

Table 1

Day / Date		Total Viable Count (CFU / ml)	
		Machine 1	**Machine 2**
Day 1 (03.12.07)	Tank	0	0
	Nozzle	0	554 *Pseudomonas* spp.
Day 2 (04.12.07) Pre-Disinfect	Tank	900 *Pseudomonas* spp.	0
	Nozzle	3.1×10^5 *Pseudomonas* spp.	1.34×10^6 *Pseudomonas* spp.
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	6 *Pseudomonas* spp.	0
	Nozzle	0	0
Day 3 (05.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	2 *Pseudomonas* spp.	0
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	0	0
Day 4 (06.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	4 *Pseudomonas* spp.
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	1 ASB	1 *Pseudomonas* spp.

Day 5 (07.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	0
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	0	0
Day 8 (10.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	225 *Pseudomonas* spp.	450 *Pseudomonas* spp.
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	0	0
Day 9 (11.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	0
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	0	0
	Nozzle	0	0
Day 10 (12.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	1 ASB; 2 SKF	2 *Pseudomonas* spp.
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	0	0
	Nozzle	0	2 *Pseudomonas* spp.

Day 11 (13.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	1 SKF	394 *Pseudomonas* spp.
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	1 SKF	0
	Nozzle	0	81 *Pseudomonas* spp.
Day 12 (14.12.07) Pre-Disinfect	Tank	0	175 *Pseudomonas* spp.
	Nozzle	0	800 *Pseudomonas* spp.
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	2 SKF	0
	Nozzle	0	275 *Pseudomonas* spp.
Day 15 (17.12.07) Pre-Disinfect	Tank	0	NOT PERFORMED
	Nozzle	0	4×10^5 *Pseudomonas* spp.
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	0	0
Day 16 (18.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	0
Post-Disinfect	Tank	NOT DISINFECTED	NOT DISINFECTED
	Nozzle	NOT DISINFECTED	NOT DISINFECTED
3pm	Tank	0	0
	Nozzle	1 ASB	1 SKF

Day 17 (19.12.07) Pre-Disinfect	Tank	0	1 SKF
	Nozzle	8 *Pseudomonas* spp.	0
Post-Disinfect	Tank	NOT DISINFECTED	0
	Nozzle	NOT DISINFECTED	0
3pm	Tank	0	0
	Nozzle	1 SKF; 13 *Pseudomonas* spp.	1 SKF
Day 18 (20.12.07) Pre-Disinfect	Tank	2 SKF	1 ASB
	Nozzle	198 *Pseudomonas* spp.	0
Post-Disinfect	Tank	NOT DISINFECTED	0
	Nozzle	NOT DISINFECTED	0
3pm	Tank	0	0
	Nozzle	137 *Pseudomonas* spp.	0
Day 19 (21.12.07) Pre-Disinfect	Tank	270 *Pseudomonas* spp.	0
	Nozzle	8000 *Pseudomonas aeruginosa*	0
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	1 SKF	2 SKF
	Nozzle	0	0
Day 22 (24.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	1 SKF
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	NOT PERFORMED	NOT PERFORMED
	Nozzle	NOT PERFORMED	NOT PERFORMED

Day 25 (27.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	0
Post-Disinfect	Tank	1 SKF	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	0	0
	Nozzle	0	0
Day 26 (28.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	0	0
Post-Disinfect	Tank	NOT DISINFECTED	NOT DISINFECTED
	Nozzle	NOT DISINFECTED	NOT DISINFECTED
3pm	Tank	0	0
	Nozzle	0	0
Day 29 (31.12.07) Pre-Disinfect	Tank	0	0
	Nozzle	3 x 10^4 *Pseudomonas* spp.	0
Post-Disinfect	Tank	0	0
	Nozzle	0	0
3pm	Tank	0	0
	Nozzle	0	0
Day 31 (02.01.08) Pre-Disinfect	Tank	0	0
	Nozzle	195 *Pseudomonas* spp.	2370 *Pseudomonas* spp.
Post-Disinfect	Tank	0	NOT DISINFECTED
	Nozzle	0	NOT DISINFECTED
3pm	Tank	15 SKF	0
	Nozzle	1 SKF	220 *Pseudomonas* spp.

SKF = Skin Flora
ASB – Aerobic Spore-bearing Bacilli

Table 2

Days post disinfection		Mean Count (CFU / ml) / Number of samples (n)			
		Pre-disinfect	n	Post-disinfect	n
Start	Tank	450	2	0	2
	Nozzle	8.25×10^5	2	0	2
1	Tank	0	16	0	12
	Nozzle	0.38	16	0	12
2	Tank	0	5	0	2
	Nozzle	515	5	0	2
3	Tank	0	8	0	5
	Nozzle	158.38	8	0	5
4	Tank	148.33	3	0	2
	Nozzle	1.29×10^4	3	0	2
6	Tank	0	1	NOT DISINFECTED	-
	Nozzle	0	1	NOT DISINFECTED	-
7	Tank	0	1	0	1
	Nozzle	2×10^5	2	0	1
10	Tank	0	1	0	1
	Nozzle	0	1	0	1

Table 2 demonstrates that after 2 days without disinfection, the amount of *Pseudomonas spp* recovered from the nozzles of the units begins to increase appreciably. The tanks did not begin to grow *Pseudomonas spp* until about 4 days post-disinfection. The units occasionally remained contamination free for a long time after disinfection, even up to 10 days. This may have been due to residual chlorine in the system, or the drying of nozzles over weekends/bank holidays through lack of usage.

CONCLUSION

Upon installation of the Hygenius Hand Wash Unit, it is recommended that the unit be disinfected daily with 500 ppm chlorine for 5 minutes to remove any residual contamination that occurred during storage. Thereafter, the results of the tests carried out suggest that for routine disinfection, 500ppm chlorine for 5 minutes once every other day in these tests appears to be sufficient to maintain a negligible level of contamination. If the unit is not used for an extended period of time, it may be necessary to resume daily disinfection for the first few days of its reuse.

SUMMARY

The results of these tests suggest that for routine disinfection, 500ppm chlorine with a 5 minute contact time once every other day is sufficient to maintain a negligible level of contamination.

This Laboratory holds full CPA (UK) accreditation status for NHS Trusts

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