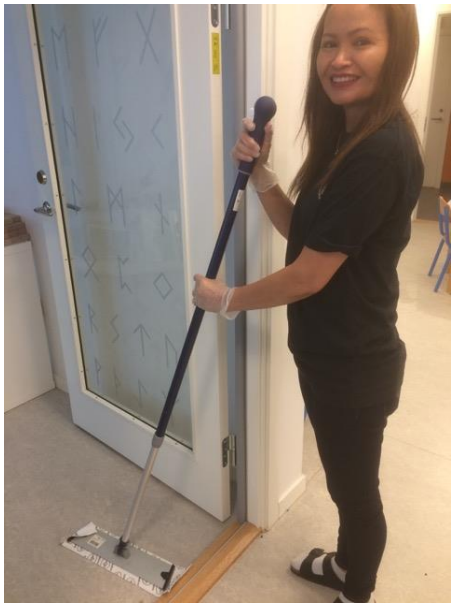
NYNÄSHAMN

For information contact:
Nynäshamn, Environment and Public Building Management
Cleaning; Real Estate Department, www.nynashamn.se
Anette Pettersson, Service Manager

Better Indoor Environment Using Less Cleaning Chemicals

Hygiene monitoring results from a pilot project at Midgård`s Primary School in Nynäshamn, Sweden



HYGIENE diagnostics

17th april 2017

Frank Axelsson, Hygiene Diagnostics AB,
www.hygiene-diagnostics.se

Better Indoor Environment Using Less Cleaning Chemicals

Hygiene monitoring results from a pilot project at Midgård`s Primary School in Nynäshamn, Sweden

Background

The background to this report is a pilot project, which began in the autumn of 2016 as part of long-term work regarding the reduction of chemical usage in the cleaning process in Nynäshamn´s municipality. The initiators were Nynäshamn´s municipal service manager, Annette Petterson, together with the group managers for the cleaning process, Annika Ryd and Stefan Hjort. The intention being that both staff and children at primary and comprehensive schools will have fewer residual chemicals in their indoor environment after cleaning.

In recent years, cleaning techniques have developed toward more efficient and environment friendly cleaning methods. A recent French study in Toulon´s hospital has shown that cleaning only with microfibre and water functions just as well when compared to a chemically-based cleaning method.[1] During 2016 a cleaning project was completed at a primary school in Håbo municipality, where the amount of cleaning chemicals was successfully reduced. This was carried out by an effective mechanical cleaning method using different microfibres together with deionized and filtered water, so-called particle-free water.[2] This cleaning method was developed by Ergoinvent AB in collaboration with Orbotech AB.

The Project

In the Nynäshamn´s pilot project cleaning with microfibre and particle-free water has been evaluated over time with ATP measurements and microbiological tests. The results taken on different measurements dates have been utilized to optimize the new cleaning method and choice of microfibres. The measurements during the project period were carried out by Hygiene Diagnostics AB together with group manager Annika Ryd. Midgård´s primary school was selected for the trial site because not only is it a relatively new school, but also there is a general interest to achieve a more “toxin-free” primary school environment within the municipality. This primary school was totally renovated in 2015 and teaching in the renovated building began in August 2015.

The project´s overall aim is that all primary schools within the municipality can be cleaned using this new cleaning method. Moreover, this new cleaning method will lead altogether to a reduced level of chemical usage for the cleaning group and, hopefully, healthier children and adults. This report combines the measurement results together with a discussion and conclusion.

[1] Hospital Partenaires no. 33/34. Toulon Hospital: biological cleaning of floors with water and microfibres 2015.

[2] Report by Hygiene Diagnostics AB/Håbo municipality. Clean in primary school without chemicals – Result from ATP measurements at Råbydal´s primary school in Håbo. April 2016.

The Question at Issue

The question at issue in this report is subject to:

- Is it possible to achieve an equally good or better cleanliness level by replacing the traditional cleaning method, which uses an all-round cleaning detergent, with a new optimized cleaning method using microfibre and particle-free water?

Description of Cleaning Method and Cleaning Chemicals

Cleaning Routines and Definitions

The cleaning routine in Nynäshamn´s primary schools, including Midgård, is shown in Appendix 1.

The responsibility for cleaning is divided between cleaners and primary school staff. The cleaners clean floors, toilets and empty spaces, whereas the staff cleans the kitchen, tables, chairs, changing table, toys and acute spillage. Thanks to the voluntary participation of the staff, the cleaning process in the project also included the changing table, tables and chairs. The staff´s routines for disinfection of surfaces as well as cleaning the kitchen, acute spillage (vomit and faeces) and toys (for example the slide) were not included in the project´s monitoring.

Cleaning Method and Materials Used

The cleaning material and cleaning method are shown in Appendices 2 and 3. All textiles were washed and handled in accordance with existing instructions before they were used.

On measurement dates 1 and 2 (2016-10-07 respectively 2016-10-19), a chemically-based cleaning method was used. A microfibre of good quality was used for floors, furniture and fixtures (Nline Micro Power respectively Brighton). Firstly, the floors were dry-mopped then a new mop was soaked in a solution of detergent and tap-water. For toilets, cloths with an alkaline sanitary detergent were used. The primary school staff used Wettex cloths soaked in detergent when wiping tables and chairs. The changing table was cleaned and dried with paper soaked in disinfectant.

The chemical-free cleaning method used Decitex™ microfibre together with particle-free so-called ultraclean water (UltraH20™). The water was produced on site with filter equipment installed by the company Orbotech Sweden AB. On measurement dates 3 and 4 (2016-11-16 respectively 2016-12-07), combination mops Ultimate Duo were used for cleaning floors. For dry mopping, Ultimate Duo 60cm Grey was used and for damp mopping, Ultimate Duo 40cm White. A damp mop (MOPV200) was used for all flat surfaces, such as benches, tables and glass sections. For other furniture and fixtures a damp Mini320, a closely-woven cleaning cloth, was used. The changing table was cleaned first with damp microfibre and then disinfected in the usual way with disinfectant. On measurement dates 5 and 6 (2017-01-18 respectively 2017-02-22), the damp mop Ultimate Duo 40cm White was exchanged for Ultimate 3D^{+}, which is a thinner and more compact damp mop.

Decitex microfibre cloths and microfibre mops were supplied by Ergoinvent AB. Manufacture of these products takes place in France and fulfill all environmental requirements in accordance with existing European legislation. Decitex microfibre material is tested and approved in accordance with EN13697,

and its cleaning effect has been validated with ATP measurements according to the hygiene requirements stated in Danish Hygiene Standard DS2451-10.[3]

Measurement Equipment

ATP meter Clean-Trace NG was used together with ATP swab test Clean-Trace™. For the microbiological analyses of total number Petrifilm™ was used. Measurement equipment and reagents are manufactured by 3M™ and distributed in Sweden by Hygiene Diagnostics AB.

Measurement Method

ATP Measurement

Evaluation of the cleaning result has mainly been carried out with so-called ATP measurement (see figure 1). The measurement value is expressed in relative light units (RLU) and in a test gives a measurement of the cell-organic level of impurities. ATP is found in all types of living cells and occurs, for example, in micro-organisms, rejected skin cells, blood and foodstuff residue. ATP measurement is not a microbiological method but, as a rule, low RLU values signify a low bacteria count.

ATP measurements prior to and after cleaning make it possible to determine the effect of the cleaning process, i.e., how much of the cell-organic impurities on surfaces are removed.

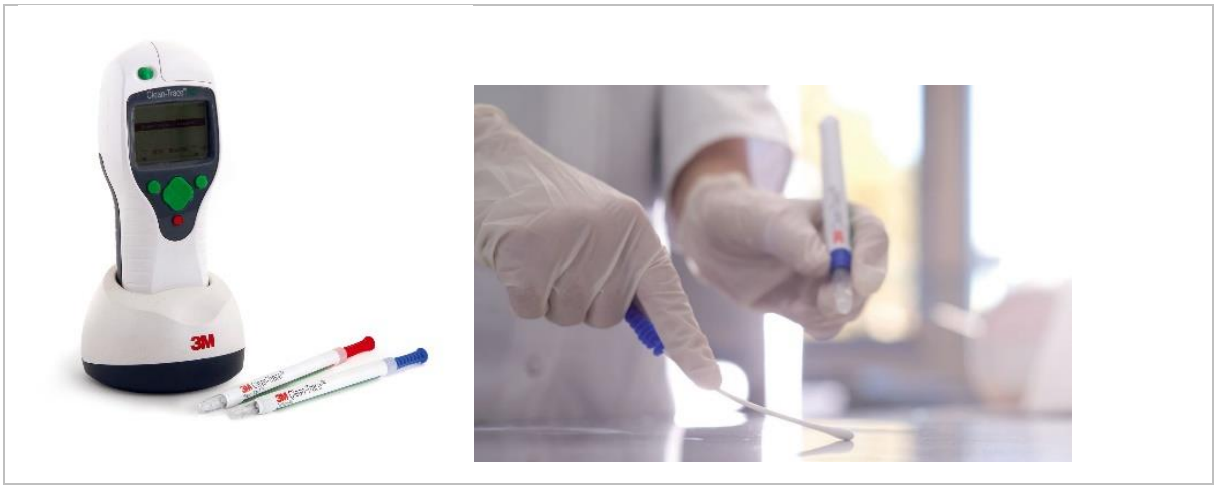


Figure 1. ATP meter Clean-Trace™ NG. Tests on surfaces are carried out with an ATP swab test containing a damp swab and liquid reagents. A 10 x 10cm control point swabs. The swab is returned to the test tube and the test is activated when the swab is pressed down in the tube. The test is then loaded into the ATP meter and the measurement value is shown on the screen after a few seconds.

[3] Validation documentation Ergoinvent AB

ATP Threshold for Cleanliness

ATP measurements are used among others in health care in order to quantifiably evaluate cleaning levels associated with different hygiene demands. A bottom limit for health care locations is 50 fmole ATP per 100cm^2. [4] Converted to the Clean-Trace meter scale the limit value will then be 500 RLU (relative light units). There is even a top limit value of 1000 RLU. The limit value applies to a cleaning level that should be achieved with efficient cleaning of surfaces (including toilets) in the patient´s immediate vicinity. There is no stipulated limit for floors, walls and ceilings. In this report, the ATP limit value is used as a technical cleaning guide line.

In this report, an approved cleaning result is construed as less than 500 RLU (green). Between 500-1000 RLU the result is approved, but with remarks (yellow). If the result is higher than 1000 RLU, the result is not approved (red).

Microbiological Measurements

Microbiological swab tests and agar plates are used to measure the quantity of cultivable micro-organisms (Figure 2). An abnormally high number of aerobic micro-organisms (total viable count number) on cleaned surfaces is an indication that the cleaning and disinfection does not function optimally.

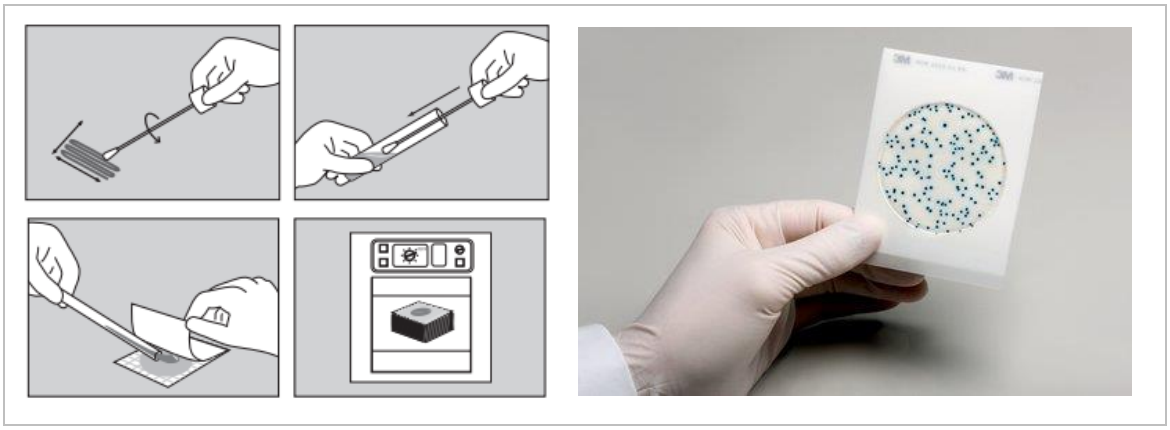


Figure 2. Microbiological total viable number 3M Petrifilm™. Swab tests on surfaces are carried out with swab samples. The swab is placed in the test tube, which is shaken to release the bacteria into the liquid. The test is then poured onto the Petrifilm total number test, which consists of a bottom plate and a top film with a jelly-like agar culture medium. When the top film is rolled down over the test, this will then "jelly" together the top film with the nutritive substance on the bottom plate. The test is then kept for one day in a warming cupboard. The colonies are counted and the result is determined per cm^2 (the number is divided with the plate surface of 20 cm^2).

[4] Danish Hygiene Standard DS 2451-10 (normative standard to Nordic cleaning standard INSTA 800).

NB. RLU scale for Clean-Trace is 1mole = 10 RLU.

Microbiological Threshold for Cleanliness

A microbiological limit value for health-care hygiene has been proposed on similar lines as the ATP limit value[5]. The calculated unit for microbiological analyses is colony-formed units abbreviated to CFU or cfu. In this report, an approved cleaning result is construed as less than 2.5 CFU/cm^2 (green). Between 2.5-5 CFU/cm^2 the result is approved with remarks (yellow). If the result is higher than 5 CFU/cm^2 after cleaning, the result is not approved (red).

Implementation

Sixteen control points were chosen as representative of the cleaning process and relevant from the perspective of hygiene (Appendix 4). ATP measurements were carried out at the control points just before and after the cleaning process, in order to assess the efficiency of the cleaning. Reduction is calculated as $\%(ATP_{before} - ATP_{after})/ATP_{before}$. Microbiological swab tests were taken only after cleaning as a complementary test. As far as possible, the microbiological tests were carried out at the side of surfaces that were ATP swab-tested, so that the swabbed surfaces did not overlap each other. Both cleaners and staff were informed that measurement monitoring was in progress. At every measurement monitoring, the cleaning process was carried out by the same cleaners.

ATP measurements were carried out on six different occasions over a period that extended from October 2016 until February 2017. On the first two dates the effect of the original cleaning method using chemical detergents was scrutinized. On the other four dates, the effect of cleaning with microfibre and particle-free water was scrutinized. Microbiological measurements were commenced on the second date (2016-10-19) and, after cleaning, these microbiological measurements were carried out on all the remaining dates.

The results were evaluated during the project after every measurement monitoring. Different steps were later proposed which aimed at optimizing the new cleaning method, i.e., to reduce ATP and bacteria levels.

Hypothetical testing with t-test analyzed if the new optimized cleaning method had a positive effect of statistical significance. In this test, the mean ATP and CFU values were compared after cleaning with chemicals at the first measurement on (2016-10-07), with corresponding values at the last measurement on (2017-02-22).

Result

All of the measurement results before and after the cleaning of the monitored surfaces are shown in Appendix 5, together with comments and deviations. In Appendices 6 and 7, all the results of the individual control points are compared to the recommended hygiene limit values and presented in the form of visual "hygiene maps".

The cleaning effect (ATP reduction), expressed as a percentage for furniture and fixtures and floors, is shown in Table 1. Trend charts showing ATP measurements and microbiological tests are presented in Tables 2 and 3.

[5] Danish Hygiene Standard DS 2451-10.

The result from the statistical analysis reveals that a reduction in the mean ATP and bacteria levels is statistically significant at 99.95%.

Table 1. Mean ATP reductions

Measurement date	**Cleaning method**	**Furniture & fixtures** ATP reduction*	**Floors** ATP reduction	**All surfaces** ATP reduction
2016-10-07	Cleaning with chemicals	24% (n=16)	24% (n=6)	24% (n=22)
2016-10-19	Cleaning with chemicals	45% (n=20)	-59% (n=12)	6% (n=32)
2016-11-16	Microfibre with particle-free water	58% (n=20)	44% (n=12)	53% (n=32)
2016-12-07	Microfibre with particle-free water	51% (n=20)	26% (n=12)	42% (n=32)
2017-01-18	Microfibre with particle-free water	74% (n=20)	74% (n=12)	74% (n=32)
2017-02-22	Microfibre with particle-free water	92% (n=20)	66% (n=12)	82% (n=32)

* Wettex cloths with chemicals were used for tables and chairs in the dining-room. If the ATP measurement results for these surfaces are omitted from the study, the mean ATP reduction for all furniture and fixtures would be: 72% (2016-10-07), 71% (2016-10-19), 80% (2016-11-16), 76% (2016-12-07), 63% (2017-01-18, 98% (2017-02-22).

Table 2. Chart showing mean ATP amounts on monitored surfaces immediately after cleaning on six different measurement dates. The surfaces are divided into furniture and fixtures (tables, chairs, touch surfaces in toilets), floors and all surfaces in total. On the first two measurement dates, the cleaning method with chemicals was scrutinized (microfibre was used, apart from two measurement dates when Wettex was used on the furniture and fixtures as well as on the changing table when, on the second measurement date, paper with disinfectant was used). On the other four measurement dates, the cleaning method with microfibre and particle-free water was scrutinized. The upper and lower hygiene thresholds of 1000 RLU (dotted red line) and 500 RLU (dotted green line) respectively can by comparison be perceived as an aim of quality. The ATP-scale applies to the ATP meter Clean-Trace™.

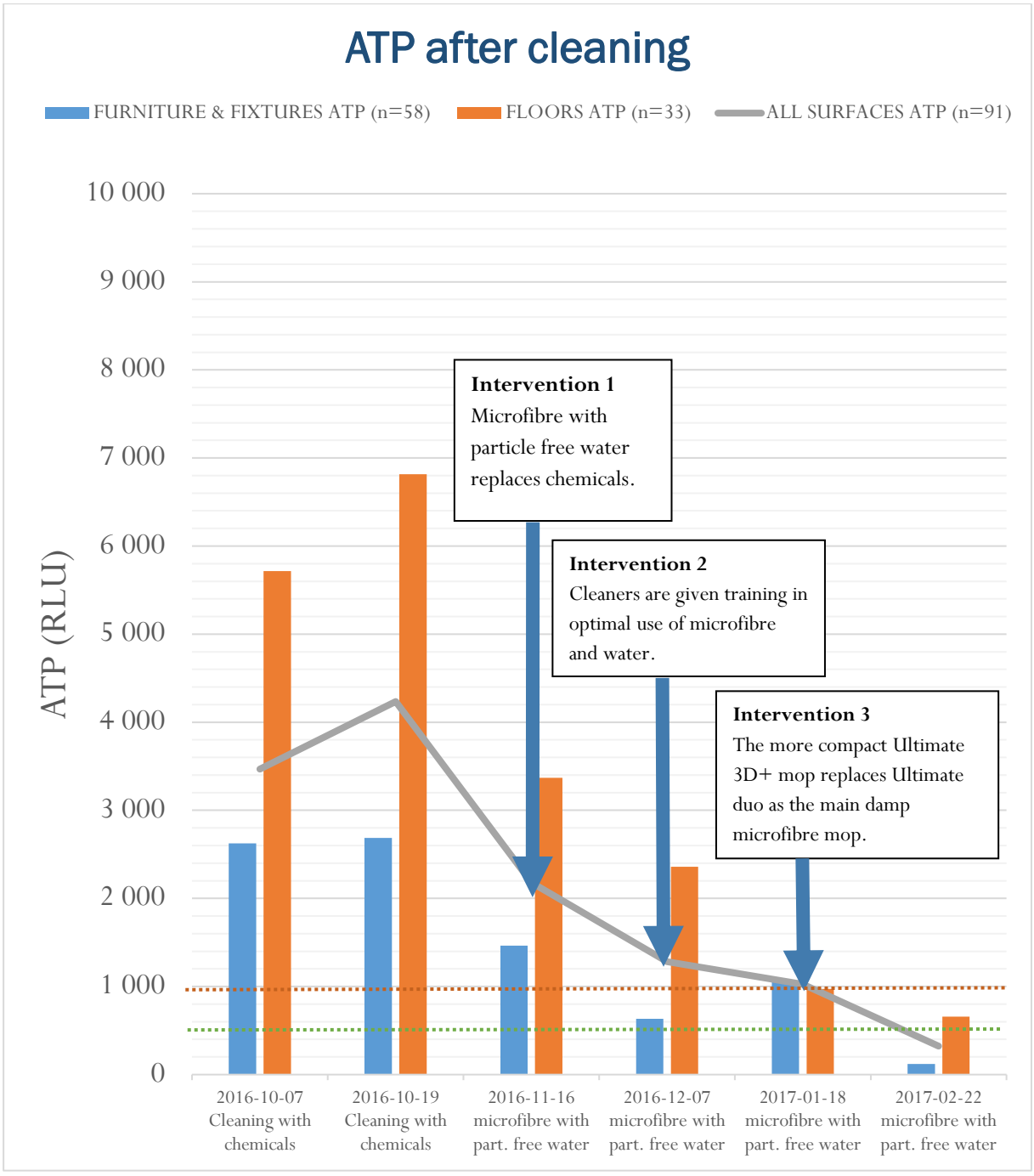
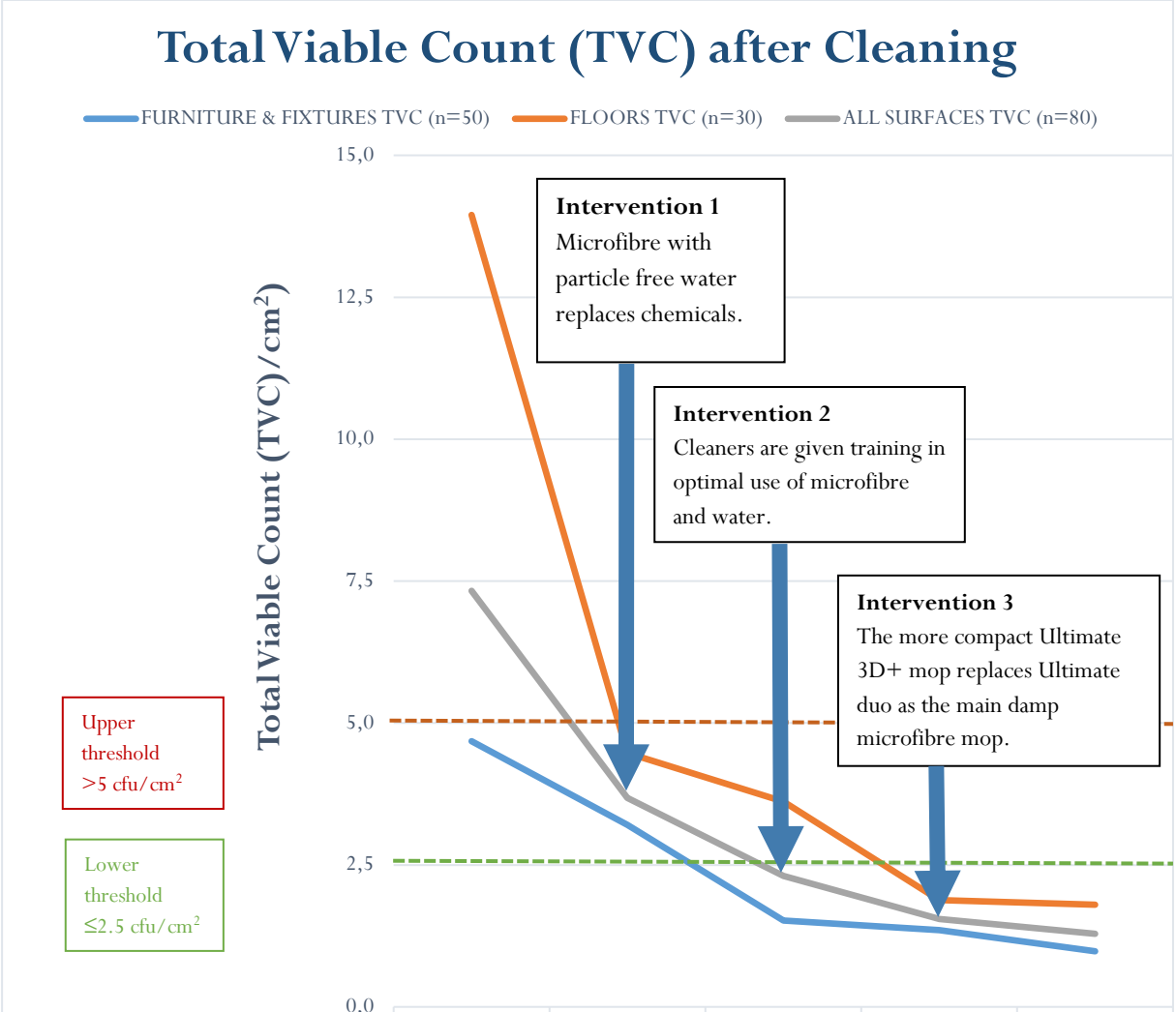


Table 3. Chart showing mean total viable count number of monitored surfaces immediately after cleaning on five different dates. The surfaces are divided into furniture and fittings (tables, chairs, touch surfaces in toilets), floors and all surfaces in total. On the first measurement date, the cleaning method with chemicals was scrutinized (microfibre was used on the furniture and fittings, apart from two measurement dates when Wettex was used as well as paper with disinfectant on the changing table. On the four other measurement dates, the cleaning method with microfibre and particle-free water was scrutinized. The upper and lower hygiene thresholds of 5 CFU/cm² (red dotted line) and 2.5 CFU/cm² (green dotted line) respectively can by comparison be perceived as an aim of quality.



	2016-10-19 Cleaning with chemicals	2016-11-16 Microfibre with part.free water	2016-12-07 Microfibre with part.free watern	2017-01-18 Microfibre with part.free water	2017-02-22 Microfibre with part.free water
FURNITURE & FIXTURES TVC (n=50)	4,7	3,2	1,5	1,4	1,0
FLOORS TVC (n=30)	14,0	4,5	3,6	1,9	1,8
ALL SURFACES TVC (n=80)	7,3	3,7	2,3	1,6	1,3

Discussion

In this project, the results from the measurements confirm similar results from Motala and Håbo municipalities.[6, 7] The new optimized cleaning method with microfibre and particle-free water is at least as effective as traditional cleaning with chemicals. Reduction of ATP values and bacteria levels when compared to the first and last measurements show a statistical significance. ATP reduction (the cleaning effect) at the last measurement was on mean 82% (Table 1). The ATP value of 390 RLU was clearly under the limit value (<1000 RLU). The effect applies to all surfaces with the lowest ATP value for furniture and fixtures (Table 2). Even the mean total number (CFU values) is reduced after changing the cleaning method and damp-optimizing the floor mopping (Table 3). In the long term, this can mean less absenteeism through illness and considerable cost-saving for the municipality.

Cleaning with microfibre and chemicals showed a cleaning effect for furniture and fixtures of, at best, 72%. This percentage applies if the measurement values are deducted for the tables and chairs in the dining-room where Wettex cloths were used. However, when these control points are included, the mean effect decreases to 24%. The deterioration does not however appear to be due to the cleaning material itself, but mostly because the surfaces were sticky and difficult to wipe away, irrespective of the cleaning method. For floors the reduction was 45%, but only at the first measurement. At the second measurement, the effect of cleaning floors with chemicals was negative (-59%), despite being visually clean. This signifies that the cleaning was not sufficiently effective with regard to the hygiene limits and that on this occasion the cleaning spread organic cell material all around.

As was also the case in Håbo, the project´s measurement results revealed considerable variation on both floors and furniture and fixtures. In the main, this is due to the fact that impurities are haphazardly dispersed and at variance with the swab tests. Therefore, there is a necessity for more measurement opportunities and measurement values over a long period of time, so that a trend can be discerned with greater certainty. In this report we have carried out both ATP measurements and microbiological analyses in order to reinforce the assessments. ATP and CFU values to not correlate directly with each other, which is normal, but the hygiene maps (Appendices 6 and 7) show with both measurements a successively better hygiene result.

Håbo used another older model of ATP meter (SystemSure), which has been reported to have a variation of up to +-35%. The ATP meter used in this project (Clean-Trace™), has a better precision and less variation +-10%.[8] When comparing different reports, it is also important to note what scale is being used for measurements. For the Clean-Trace meter the analysis is 10 times higher than the ATP scale in the Håbo report. The limit values in this report are therefore 10 times higher.

[6] Report Hygiene Diagnostics AB 2016. Clean in the primary school.

[7] Magazine *Clean* no.4, Purified water gives cleaner floors.

[8] Repeatability Study of ATP Hygiene Monitoring Systems in 77 Food and Beverage Manufactory Sites in the United States. L. Ruiz, E. Morales et al., 2009

The Håbo report was criticized both for its ATP measurements on floors, which were not considered reliable, and that the comparison between cleaning materials was not considered just.[9] As was the case with the Håbo report, this project does not intend to prove the effects of particle-free water, but instead chooses to evaluate the end results of the cleaning methods' different measures as a whole. It is therefore not possible to maintain if it is the microfibre that in the main cleans and if in such case it is of minor importance what water is used. The particle-free water in this study is the same sort that was used in the Håbo municipality. The water has therefore not contributed to any variation in the effect of the cleaning method, which had been the case if a different tap-water had been used.

The project shows that in order to attain a balanced and good level of cleaning quality in primary schools, it is important that routines are controlled, material tested, improvements measured and objective feedback given to the cleaners. Monitoring with a rapid ATP meter is in this situation an invaluable tool for quality assurance.

Conclusion

The measurement results show that a routine cleaning of floors and furniture and fixtures with microfibre and particle-free water can replace cleaning with all-round chemicals.

- The ATP levels and total number of bacteria were gradually reduced concurrently with the change in the cleaning method, damp optimizing, clearer instructions to cleaners and change of floor mop to a more effective variant (Ultimate $3D^{+}$).
- The cleaning effect (reduction of ATP levels) with the new cleaning method after the last measurement date reached on mean 82% for all the monitored surfaces (furniture and fixtures 92%, floors 66%). By comparison, the chemically-based cleaning method (excluding the Wettex cloths), at best reached on mean 72% for furniture and fixtures. For floors, the chemically-based cleaning at best reached a cleaning effect of 24% (first measurement date).
- The bacteria levels dropped down on mean to 82% (78% for furniture and fixtures and 87% for floors); calculated in total number from 7.3cfu/cm^2 for chemically-based cleaning to 1.3cfu/cm^2 for cleaning with microfibre and particle-free water.

The project concluded that the indoor environment is better with the new cleaning method. The project has also shown that with the aid of the ATP meter one can rapidly and easily measure the result of cleaning and, moreover, that the measurement method can be used for continual improvements.

[9] Magnus Rönnmark´s debate contribution in the Magazine *Clean* no.5

Appendix 1. Cleaning routine Nynäshamn´s primary schools

LOCATION	ACTIVITY	FREQUENCY		
		per week	per month	when needed
Toilets and changing room				
	Clean sanitary units and mirrors	5		
	Remove stains on doors, door frames, on and round light switches	At least 1 time per week		X
	Replenish consumable articles	5		
	Empty waste-paper baskets	5		
	Clean floors	5		
	Ventilation device under 2.5 m	1		X
	Clean floor drain	1		
Entrance/Stairs				
	Damp mop alt. damp-dry floors	5		
	Wet-dry floors			X
	Remove stains on doors, door frames, on and round light switches	At least 1 time per week		X
	Vacuum clean mats at entrance			X
Dining-room				
	Damp-mop, alt. damp-dry floors	5		
	Wet-dry floors			X
	Dust free spaces	1		
	Dust low-hung lamps	1		
	Empty waste-paper baskets	5		
	Ventilation device under 2.5 m	1		X
	Remove stains on doors, door frames, on and round light switches	At least 1 time per week		X
Playroom/living room				
	Damp mop alt. damp-dry floor	5		
	Wet-dry floor			X
	Dust free spaces	1		
	Vacuum-clean upholstery		1	X
	Empty waste-paper baskets	5		
	Ventilation device under 2.5 m	1		X
	Exterior cleaning of kitchenette equipment	1		X
	Remove stains on doors, door frames, on and round light switches	At least 1 time per week		X
Painting room/carpentry room				
	Damp mop alt. damp-dry floor	1		
	Wet-dry floors			X
	Empty waste-paper baskets	5		
Staff room				
	Damp mop alt. damp-dry floor	2		
	Wet-dry floor			X
	Empty waste-paper baskets	5		
	Dust free spaces	1		
Office				
	Damp mop alt. damp-dry floor	1		
	Dust free spaces	1		
	Empty waste-paper baskets	1		

Other
Dust skirting boards once every quarter.
Dust/vacuum clean radiators when necessary.
*Remaining carpets tended to by primary school staff.
Chairs lifted up/down by primary school staff/cleaners move out/in chairs.

Appendix 2. Material

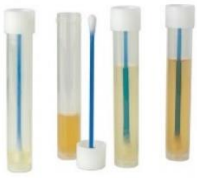
A. Cleaning method with chemicals

- Saniren A (no.101778) alkaline all-round scented cleaning detergent for sanitary surfaces
- Allotol (no.1100590) unscented cleaning detergent for floors
- Ajax Crystal Clear Spray (no.137730) cleaning product containing ammonia for windows, mirrors
- Dax Surface Disinfectant Plus (no.1534486) for disinfecting flat surfaces
- Nline Micro Power (no.132021) microfibre mop for wet, damp and dry cleaning
- Brighton Cleaning Cloth (134399) microfibre cloth for dry, wet or porous surfaces
- Wettex for drying

B. Chemical-free cleaning method

		
Decitex Ultimate Duo 60cm, high mechanical effect dry (grey no.100 646)	Decitex Ultimate Duo 40cm, high mechanical effect dry/damp (white no. 100 837)	Decitex microfibre cloth mini 320 high absorption, no fibre loss (blue no.100 588)
		
Decitex mop V200 for furniture and fixtures, high finish, for flat surfaces (no. 100 870)	Decitex Ultimate 3D^{+} low weight 22 grams, high efficiency (blue no.101 065)	Unit for particle-free water Ultra H20^{TM}(ultra-clean). Filling with spray atomizer

C. Analysis material for monitoring of cleaning method

		
3M^{TM} Clean-Trace NG^{TM} ATP meter with ATP swab tests	3M^{TM} Petrifilm rapid aerobic agar plate (total number). Cultivation of tests takes place in warming cupboard	3M^{TM} Swab samples for Petrifilm environment tests

Appendix 3. Cleaning method with microfibre and water

Floors

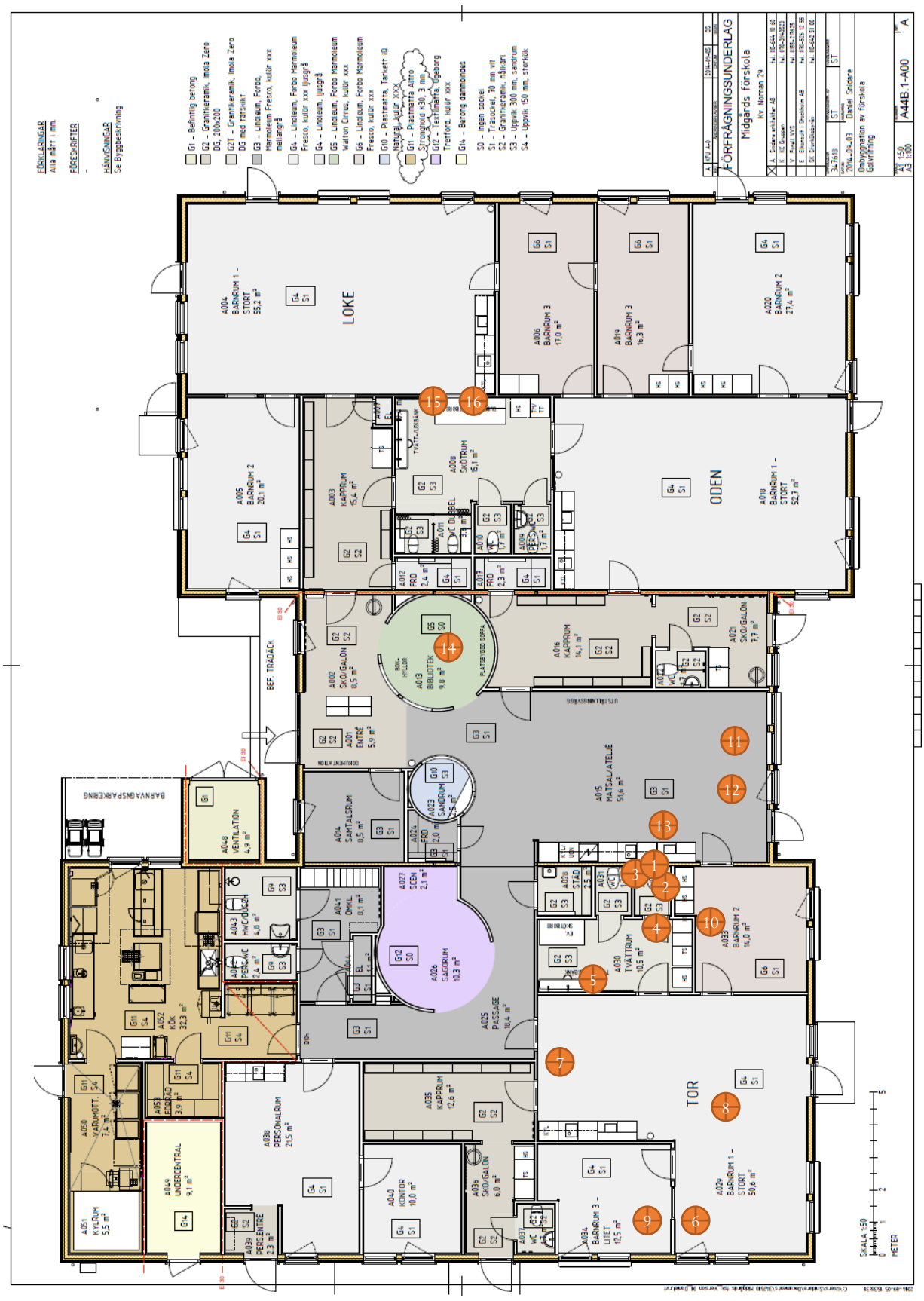
	
Dry-mop floor. Adjustable stave used for cleaning surfaces a vacuum cleaner cannot reach. Vacuum-clean carpets.	Damp-mopping floor. Damp mop with 5 sprays of particle-free water.

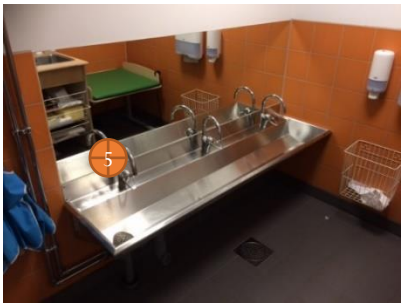
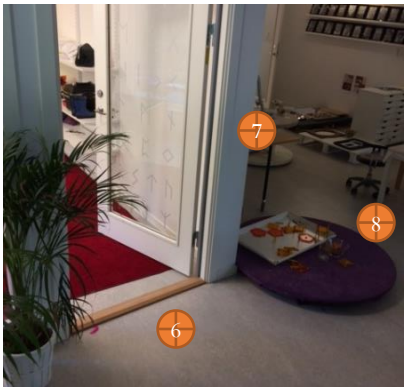
Furniture and fixtures

		
Fold cloth twice. Clean sides against hand and cleaning surface.	Fold cloth so that dirt particles end up in the cloth. Use 4 sides.	Loose dirt particles – dry cloth Stain remover – damp cloth

Appendix 4. Control points

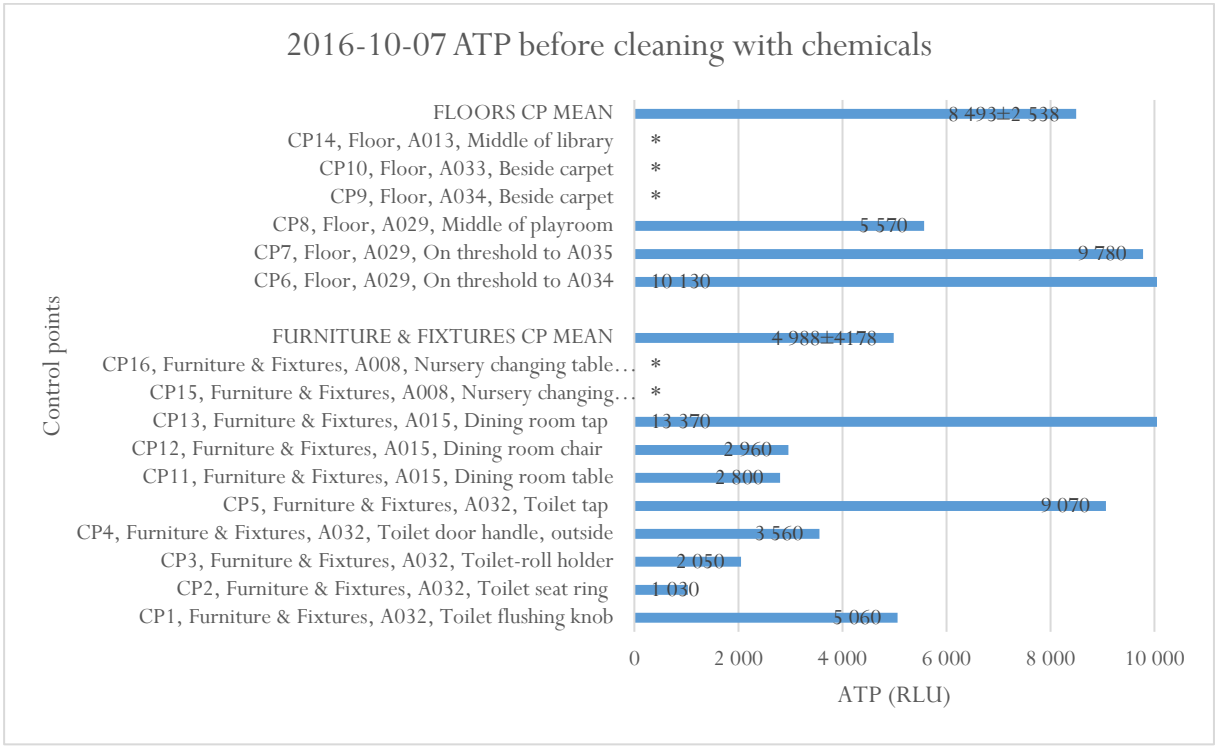
Control points: cp



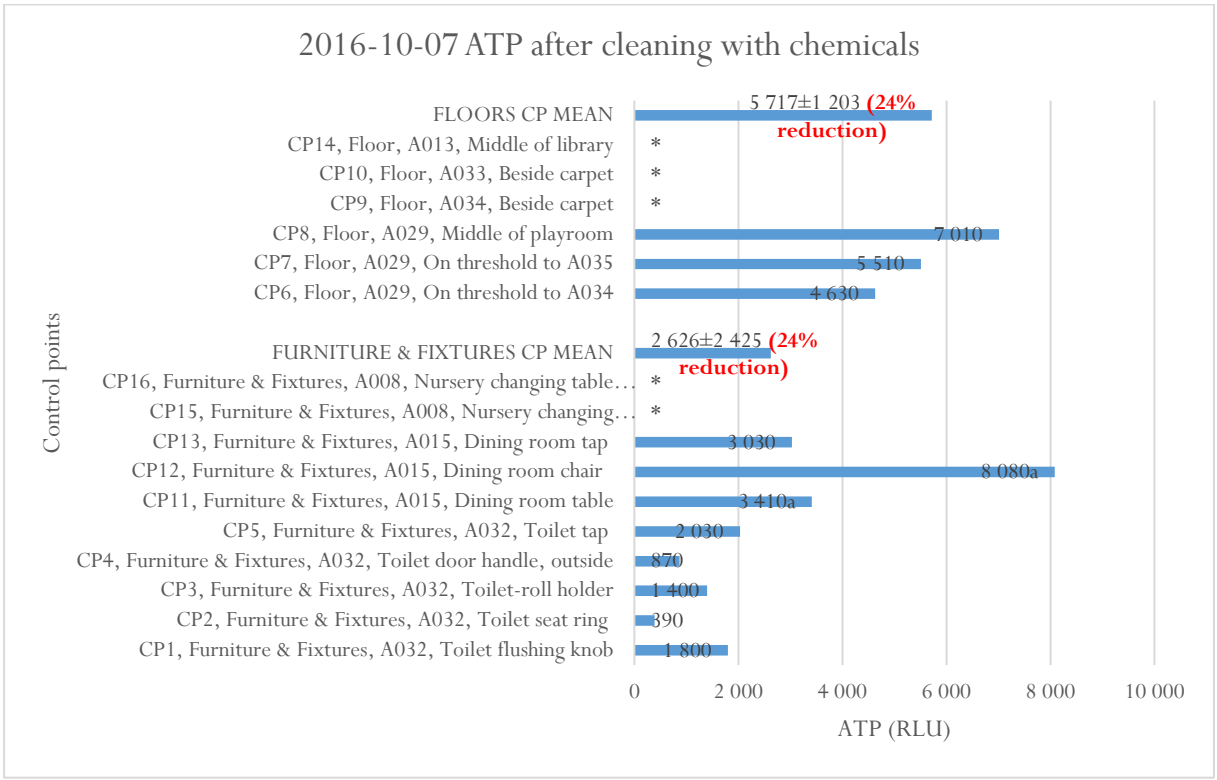
Department/room	Control points (CP)
TOR/A032  	Touch surfaces in toilets: 1. Flushing knob 2. Seat ring, top side 3. Toilet-roll holder 4. Door handle, outside (not in illustration)
TOR/A030  	Taps: 5. Tap on left
TOR/A029  	Floor spaces for play: 6. Floor space on threshold to A034 7. Floor space on threshold to A035 (not in illustration) 8. Floor space, middle of room
TOR/A034  	9. Floor space beside carpet A034 10. Floor space beside carpet A033 (room not shown)

Department/room	Control points (CP)
A015  	Dining room : 11. Table at window 12. Chair at window
 	13. Tap at children´s wash basin
A013  	Library: 14. Middle of floor
A008  	Nursery room, changing table: 15. Wooden side on left 16. Changing table mattress

Appendix 5. ATP test results before and after cleaning

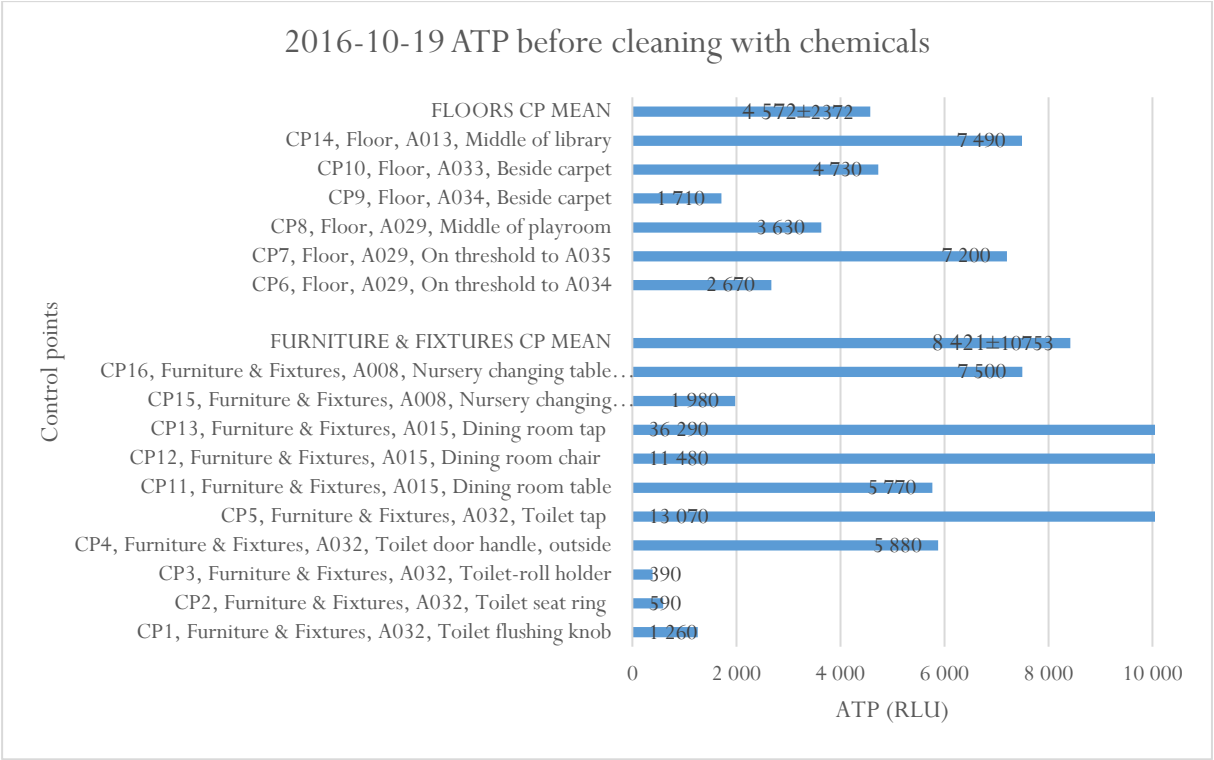


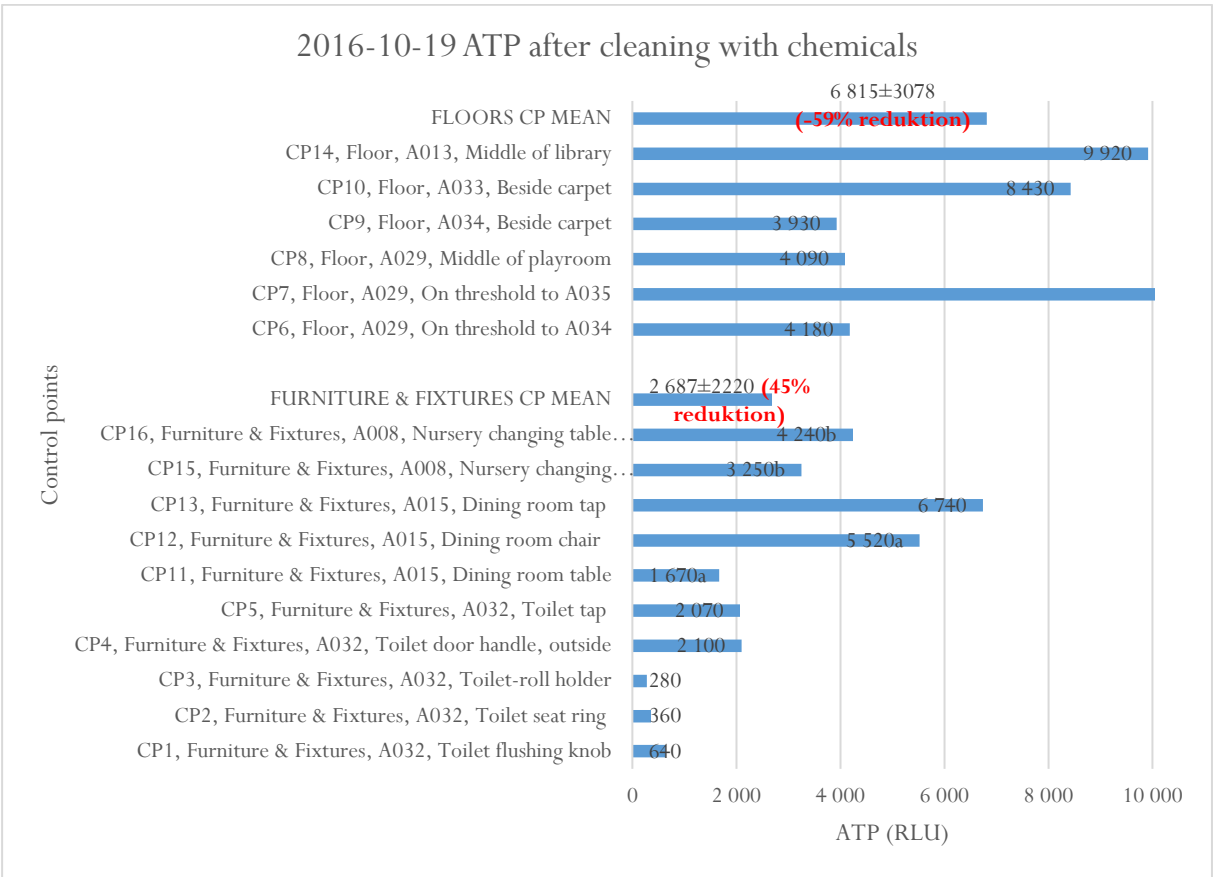
* CP 9,10,14-16 not tested.



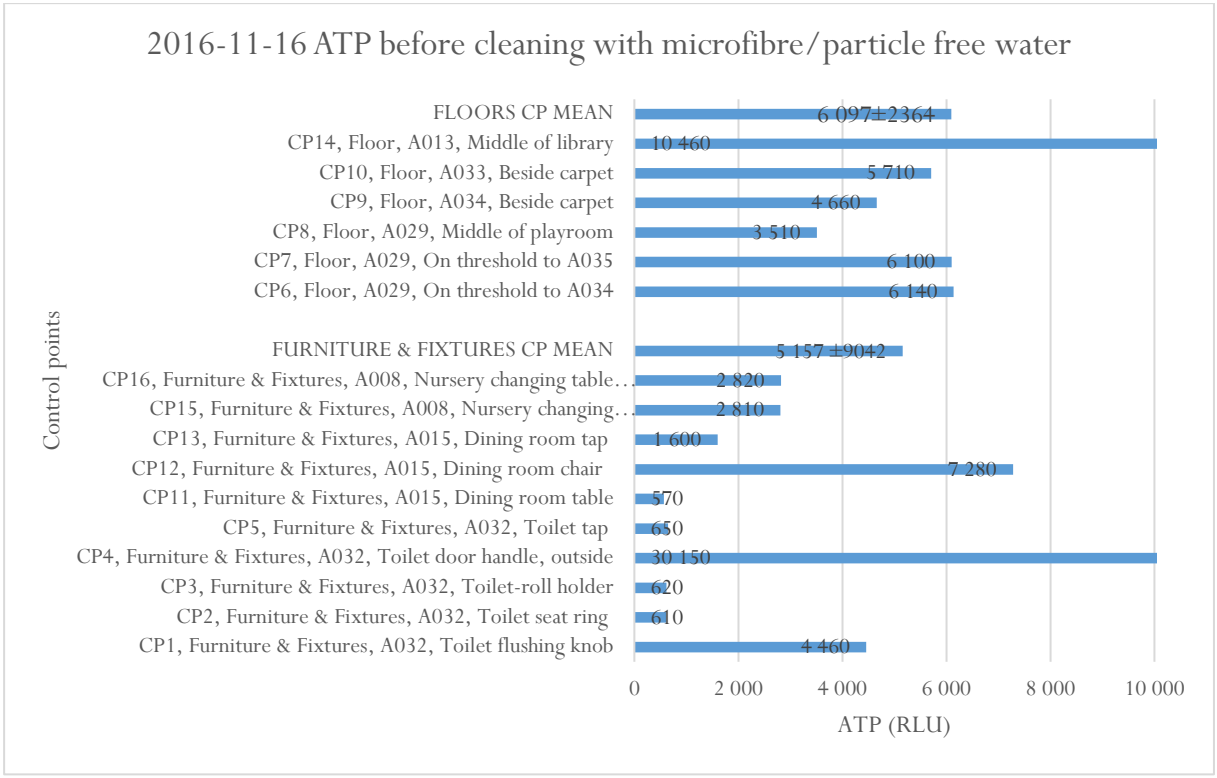
* CP 9,10,14-16 Not tested. (a) CP11, 12; Wettex™ was used

Note. All CP were visibly clean before sampling

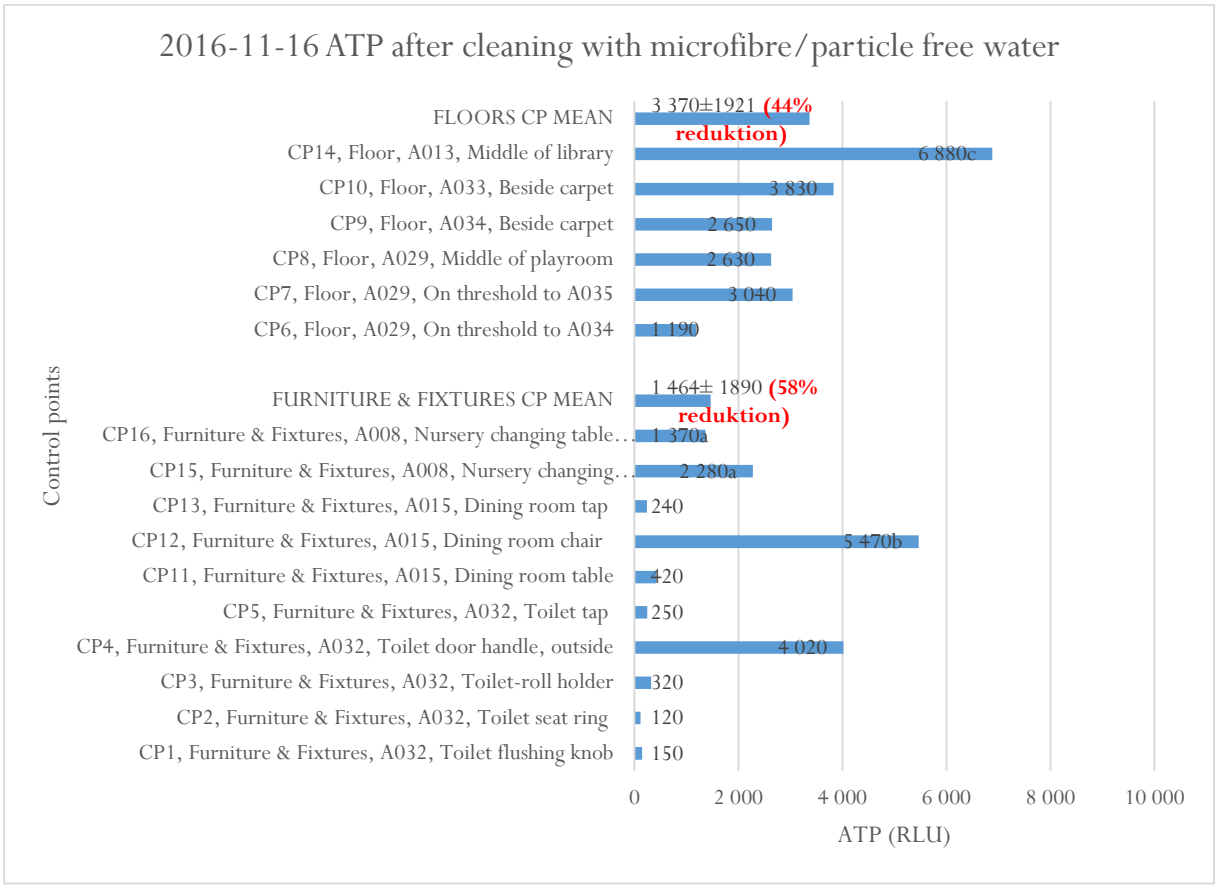




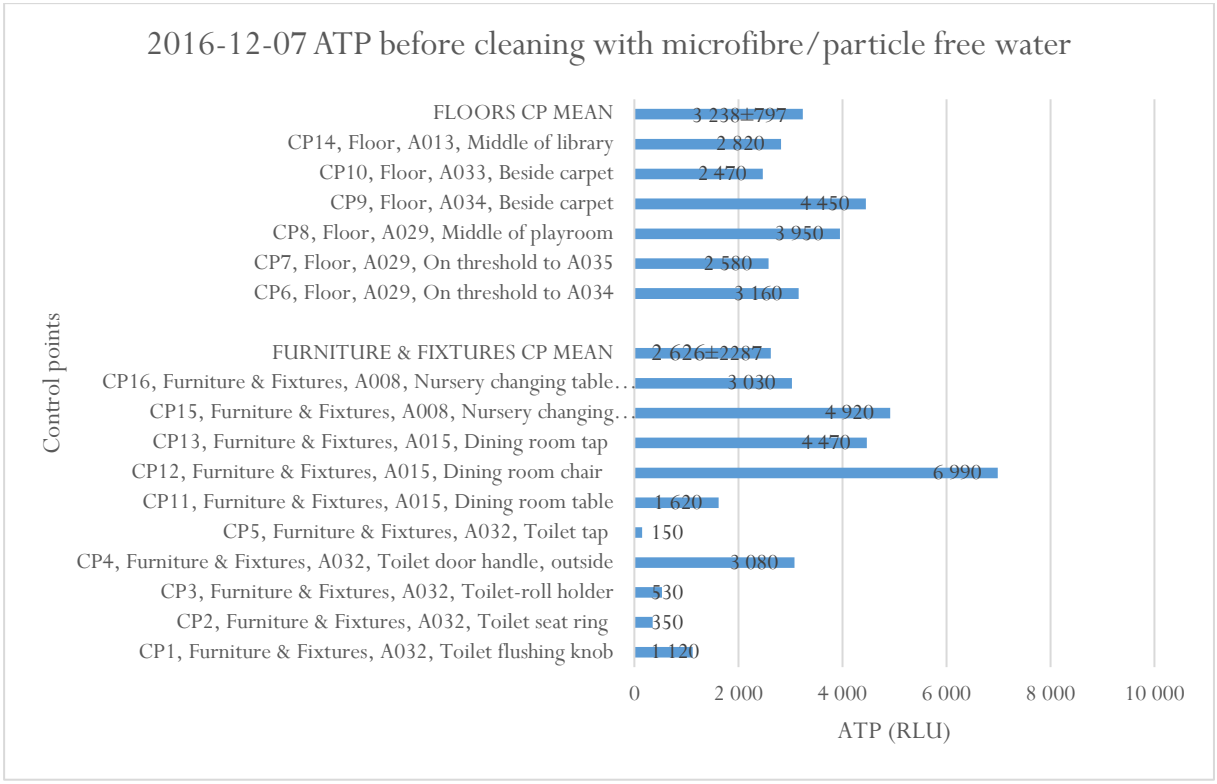
(a) CP11, 12; new Wettex™ cloths was used (b) Cleaning/disinfection was done with alcohol and paper
Note. All CP were visibly clean before sampling

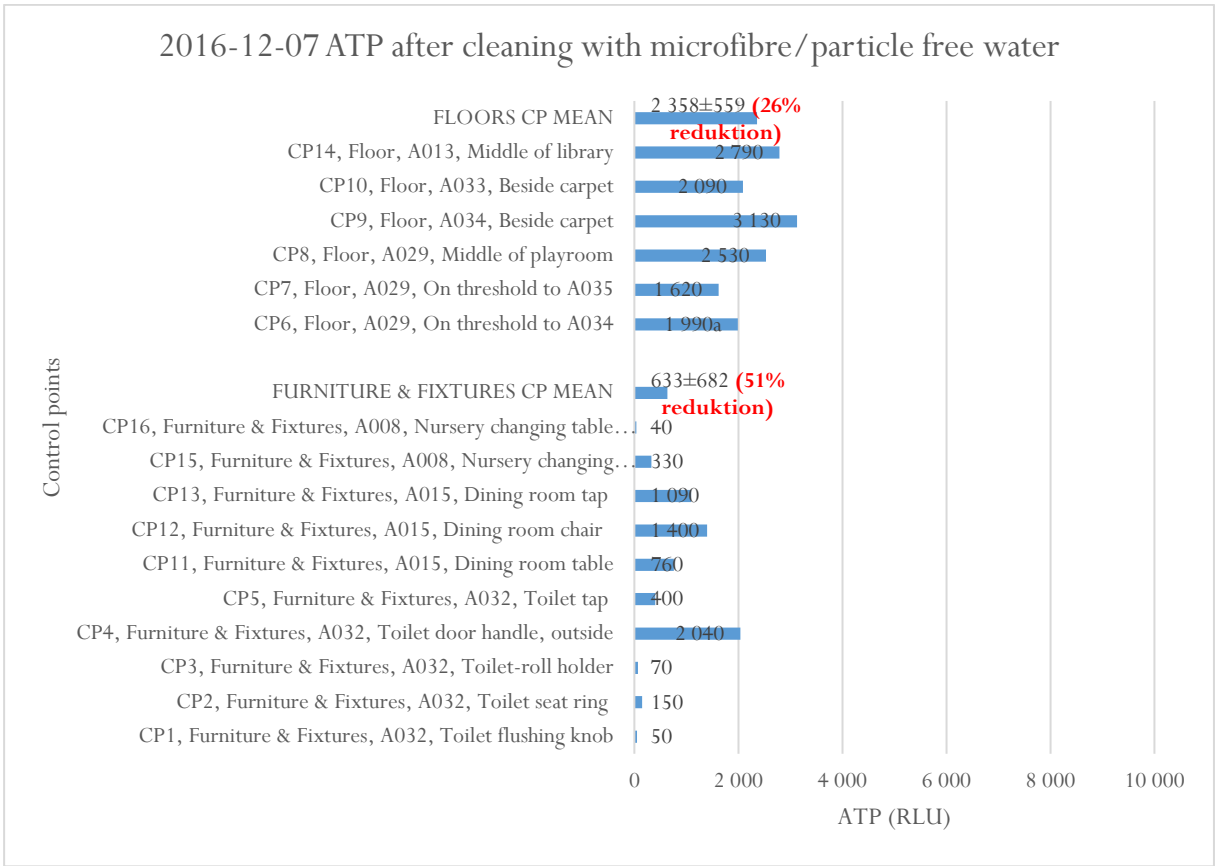


Note. All CP were visibly clean before sampling except for CP12.



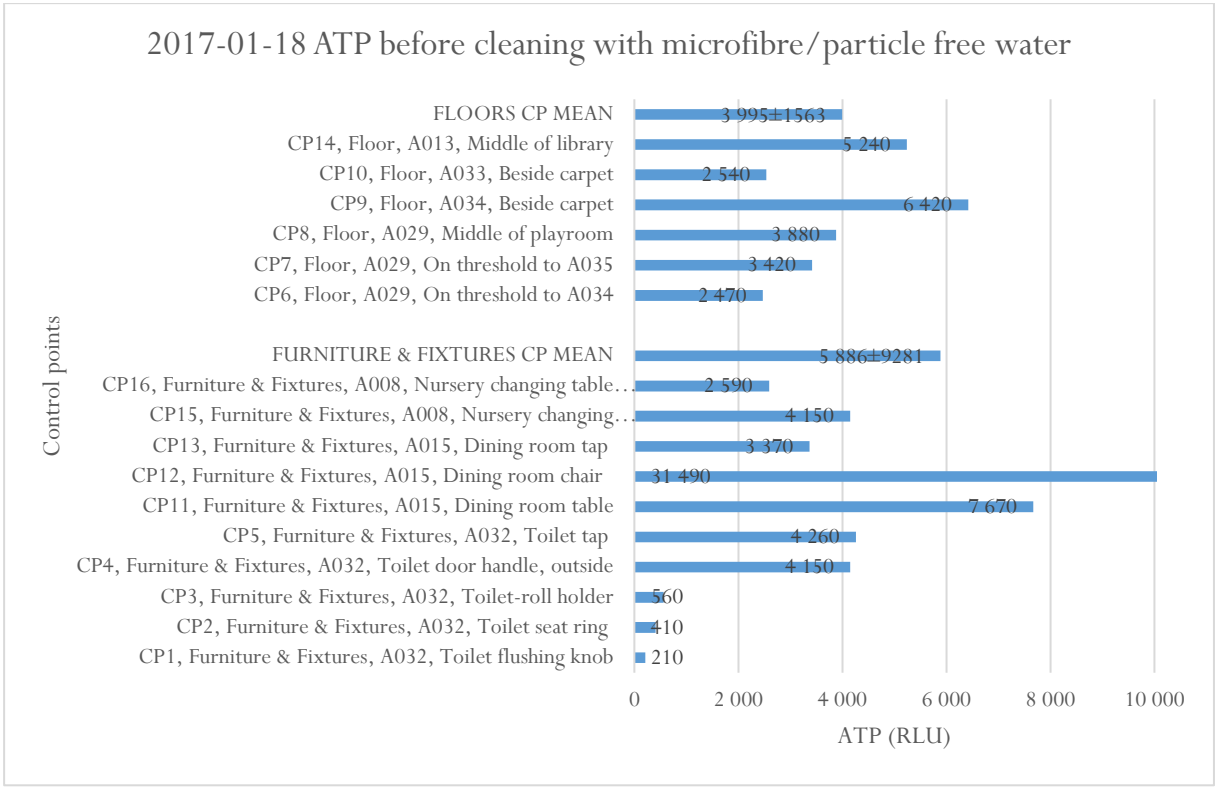
(a) Cleaning with mikrofiber/part. free water followed by disinfection with paper. Before sampling the table had been used. (b) visible food residues (c) Surface was wet, retest after waiting for surface to dry



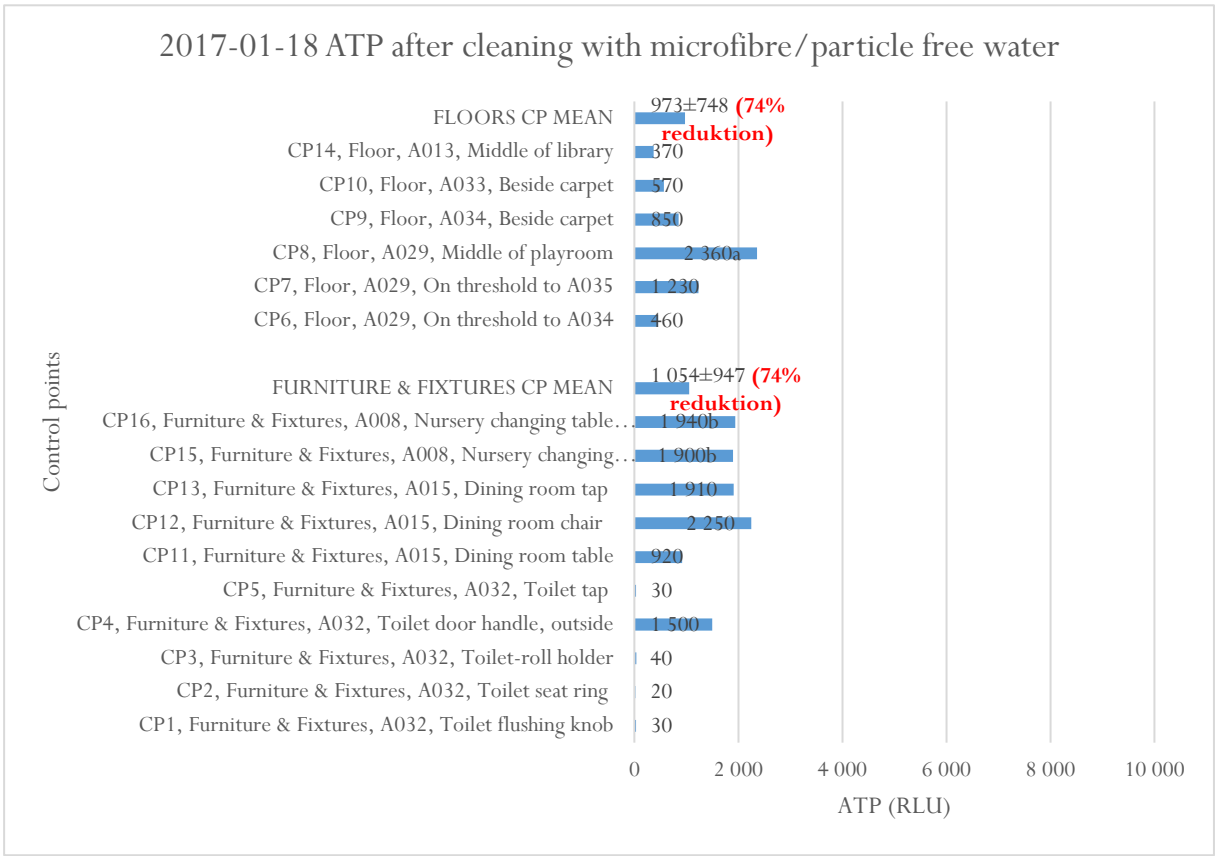


(a) re-cleaned and re-tested after surface was used

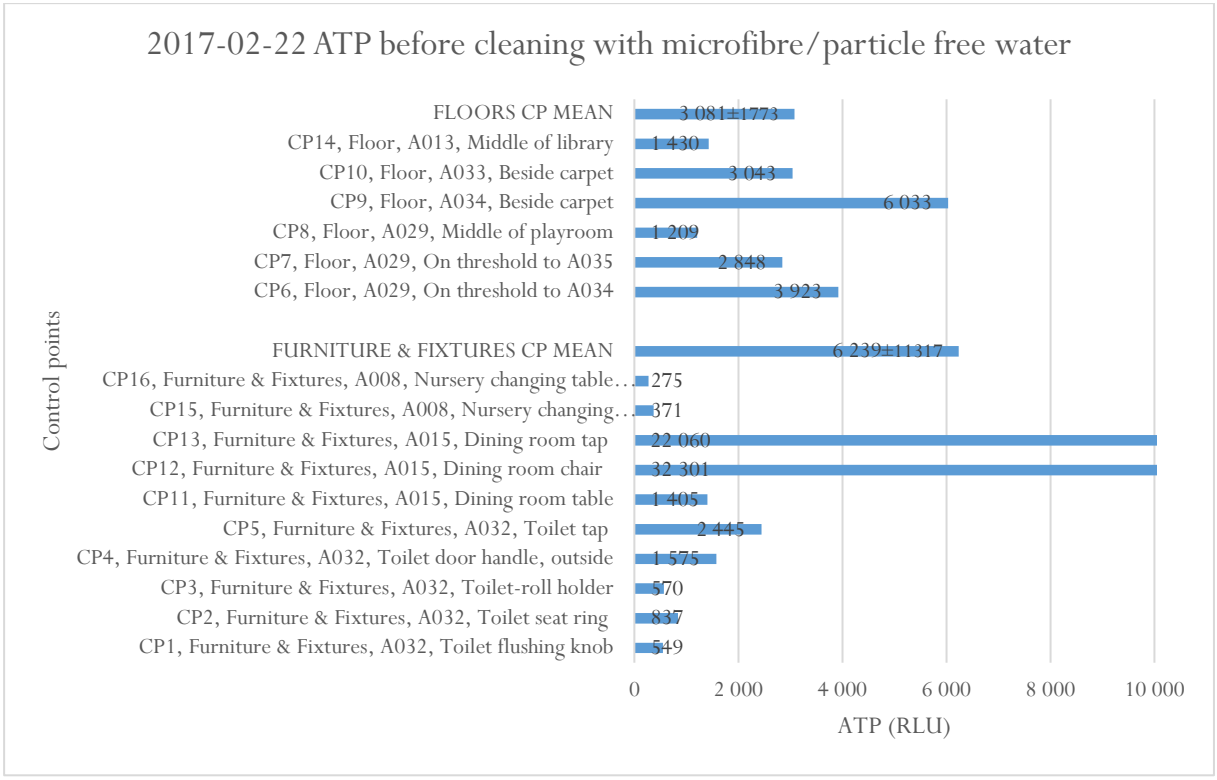
Note. All CP were visibly clean before sampling



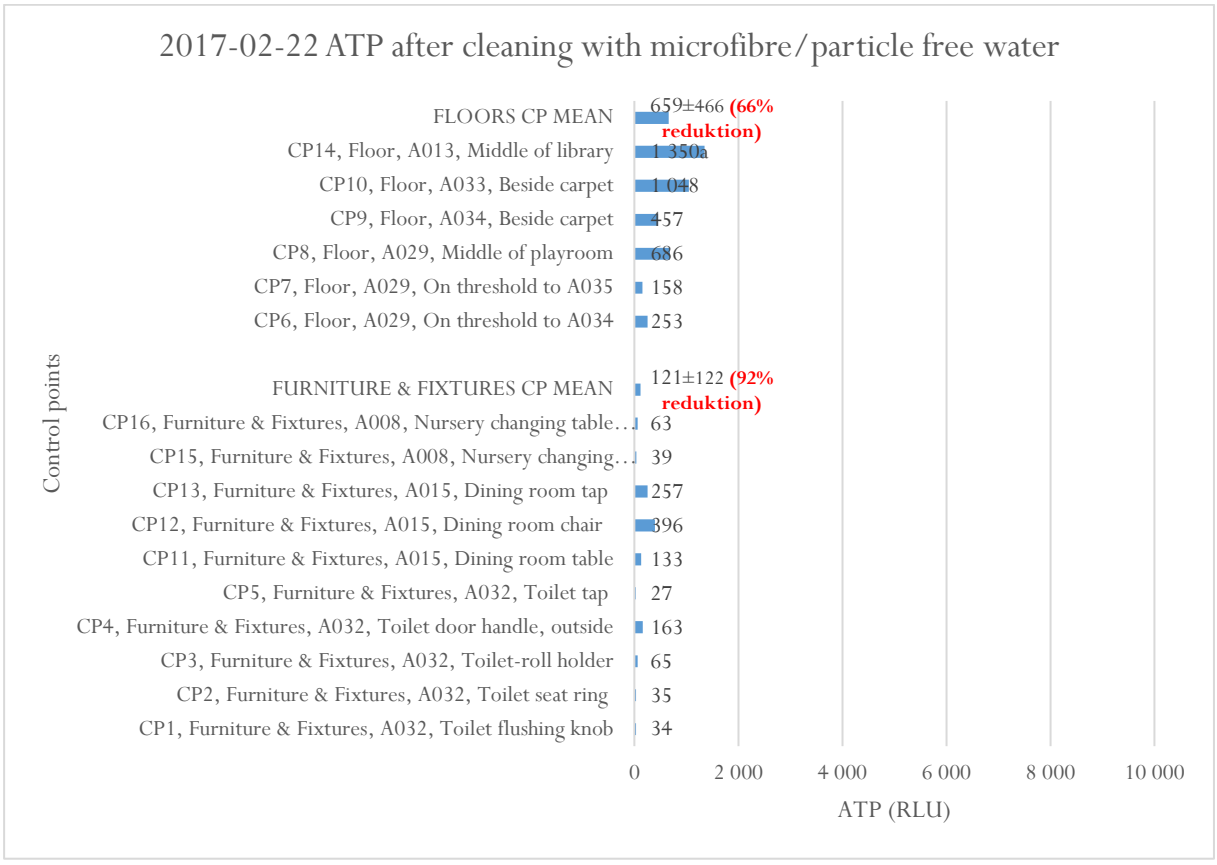
Note. All CP were visibly clean before sampling except for CP5 thad had some paint on it



(a) Dispomop was used the wrong way round. (b) Surface was probably used (soiled) before sampling.



Note. All CP were visibly clean before sampling



(a) CP14 was re-cleaned and re-tested. This control point did not improve after re-cleaning.

NYNÄSHAMN

Appendix 6. Hygiene Map for ATP Test Results

ATP values (RLU/100 cm^2) after cleaning

	After cleaning with chemicals	After cleaning with chemicals	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water
Midgårds Primary School	1	2	3	4	5	6
Control Points (CP)	**2016-10-07**	**2016-10-19**	**2016-11-16**	**2016-12-07**	**2017-01-18**	**2017-02-22**
CP1, Furniture & Fixtures, A032, Toilet flushing knob	1 800	640	150	50	30	34
CP2, Furniture & Fixtures, A032, Toilet seat ring	390	360	120	150	20	35
CP3, Furniture & Fixtures, A032, Toilet-roll holder	1 400	280	320	70	40	65
CP4, Furniture & Fixtures, A032, Toilet door handle, outside	870	2 100	4 020	2 040	1500	163
CP5, Furniture & Fixtures, A032, Toilet tap	2 030	2 070	250	400	30	27
CP11, Furniture & Fixtures, A015, Dining room table	3 410	1 670	420	760	920	133
CP12, Furniture & Fixtures, A015, Dining room chair	8 080	5 520	5 470	1 400	2250	396
CP13, Furniture & Fixtures, A015, Dining room tap	3 030	6 740	240	1 090	1910	257
CP15, Furniture & Fixtures, A008, Nursery changing table, left side	*	3 250	2 280	330	1900	39
CP16, Furniture & Fixtures, A008, Nursery changing table mattress	*	4 240	1 370	40	1940	63
CP6, Floor, A029, On threshold to A034	4 630	4 180	1 190	1 990	460	253
CP7, Floor, A029, On threshold to A035	5 510	10 340	3 040	1 620	1230	158
CP8, Floor, A029, Middle of playroom	7 010	4 090	2 630	2 530	2360	686
CP9, Floor, A034, Beside carpet	*	3 930	2 650	3 130	850	457
CP10, Floor, A033, Beside carpet	*	8 430	3 830	2 090	570	1 048
CP14, Floor, A013, Middle of library	*	9 920	6 880	2 790	370	1 350
Mean value +/- Standard deviation	**3469±2547**	**4235±3221**	**2179±2069**	**1280±1062**	**1024±852**	**323±392**

*Not tested

Cleanliness threshold

> 1 000 RLU	Fail
501–1 000 RLU	Caution
≤ 500 RLU	Pass

NYNÄSHAMN

Appendix 7. Hygiene Map for Total Viable Count

Total Viable Count (CFU/cm²) after cleaning

	After cleaning with chemicals	After cleaning with chemicals	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water	After cleaning with microfibre and part.free water
Midgårds Primary School	1	2	3	4	5	6
Control Points	**2016-10-07**	**2016-10-19**	**2016-11-16**	**2016-12-07**	**2017-01-18**	**2017-02-22**
CP1, Furniture & Fixtures, A032, Toilet flushing knob	*	1.6	0.25	0.2	0.6	0.6
CP2, Furniture & Fixtures, A032, Toilet seat ring	*	0.6	0	0.5	0.8	0.9
CP3, Furniture & Fixtures, A032, Toilet-roll holder	*	0.5	0.3	2.1	1	2.9
CP4, Furniture & Fixtures, A032, Toilet door handle, outside	*	0.6	1.6	7	4.5	0.7
CP5, Furniture & Fixtures, A032, Toilet tap	*	18	2.0	0.2	2.8	0.6
CP11, Furniture & Fixtures, A015, Dining room table	*	1.8	0.3	2.2	0.6	0.4
CP12, Furniture & Fixtures, A015, Dining room chair	*	3.0	18	0.8	0	1.0
CP13, Furniture & Fixtures, A015, Dining room tap	*	19	0.9	0.9	2.6	0.4
CP15, Furniture & Fixtures, A008, Nursery changing table, left side	*	0.9	0	0	0	0.8
CP16, Furniture & Fixtures, A008, Nursery changing table mattress	*	0.8	8.7	1.3	0.6	1.5
CP6, Floor, A029, On threshold to A034	*	6.2	4	1.6	2.5	0.8
CP7, Floor, A029, On threshold to A035	*	22	12	3.6	2.8	0.8
CP8, Floor, A029, Middle of playroom	*	23	2.25	3.1	2.2	1.0
CP9, Floor, A034, Beside carpet	*	5.8	3.4	4.1	0.9	0.8
CP10, Floor, A033, Beside carpet	*	7.7	3.0	1.8	1.9	5.4
CP14, Floor, A013, Middle of library	*	3.1	2.2	7.5	1	2.0
Mean value +/- Standard deviation	*	**7.3 ± 8.9**	**3.7 ± 5.0**	**2.3 ± 2.3**	**1.6 ± 1.3**	**1.3 ± 1.3**

*Not tested

Cleanliness threshold

> 5 cfu per cm²	Fail
2.5–5 per cm²	Caution
≤ 2.5 per cm²	Pass