Decontamination of Building Materials Contaminated with Methamphetamine

By

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Introduction:

Concerns regarding chemical contamination associated with the clandestine production of methamphetamine have been realized for some time. [1 - 10] Work conducted by National Jewish Medical Center Researchers has documented a number of the contaminants generated at clandestine laboratories and the presence of some of these contaminants in actual methamphetamine laboratory investigations.[11]

Research conducted by our group has indicated that the contamination associated with these clandestine methamphetamine laboratories does not end when the laboratory ceases operation.[11] Simulated methamphetamine cooks conducted by our group have demonstrated that a number of compounds may persist after the cook has been completed. Initial testing revealed that shortly after a clandestine cook, levels of iodine, hydrogen chloride, and methamphetamine were found at the site even though the bulk chemicals may have been removed. The largest contaminant was found to be the drug, methamphetamine, itself. Methamphetamine was found to aerosolize during the salting-out phase conducted during all current production methodologies. It is released as an aerosol and can contaminate most surfaces within a structure.[11] Our research also indicated that the methamphetamine continues to be present within the structure for some period of time (months to years).

The levels of methamphetamine found within a structure after clandestine cooks is a factor of the type of cook and the number of cooks conducted. Red phosphorous cooks appear to result in a higher concentration of methamphetamine release than do anhydrous ammonia cooks and multiple cooks will result in a higher contamination level.[11] Surface wipes for methamphetamine were collected at suspected methamphetamine laboratories during law enforcement actions. A total of 14 suspected laboratories were sampled with all of the laboratories having at least one sample positive for methamphetamine. The levels of methamphetamine found ranged from a low of 1.0 µg/sample to a high of 16,000 µg/sample. The overall mean methamphetamine contamination level in these suspected laboratories was 511 µg/sample with a median contamination level of 28 µg/sample.

Further research has indicated that simply by using methamphetamine, the drug will be deposited on surfaces within the structure. We conducted a simulated "smoke" using methamphetamine and found that a significant amount of methamphetamine is released during that process. Depending upon how much methamphetamine is used within a structure the mean level of methamphetamine on the walls may range from less than 0.1 ug/100 cm^2 to as high as 5 ug/100 cm^2. These lower levels of contamination are being more commonly encountered as residences are increasingly monitored for methamphetamine during realty transactions. As low as these levels appear to be, they are normally above the levels that have been promulgated by the states for cleanup.

This study was designed to determine the efficacy by which methamphetamine can be removed from different building materials. The study has application in the methamphetamine remediation business as well as in the regulatory arena.

Methodology:

The initial portion of this study was conducted to determine the impact of washing specific building materials with Simple Green to effect decontamination of those materials. The specific building materials that were utilized were:

- Painted plywood
- Painted drywall (gypsum board)
- Galvanized metal air duct material
- Glass

In the case of the painted materials, the drywall and the plywood were purchased in small panels that were approximately 28" by 28". The drywall was 3/8th inch gypsum board and the plywood was a sanded 28 " by 28" ¼ inch plywood. These materials were painted with a latex enamel paint by painting the surface with two coats of paint, letting the paint dry and then painting it again with the same latex paint. Good coverage was provided and a gallon of paint was found to cover a total of 16 panels. After the painting, the paint was allowed to dry for a period of at least 2 days prior to contaminating the panels with methamphetamine.

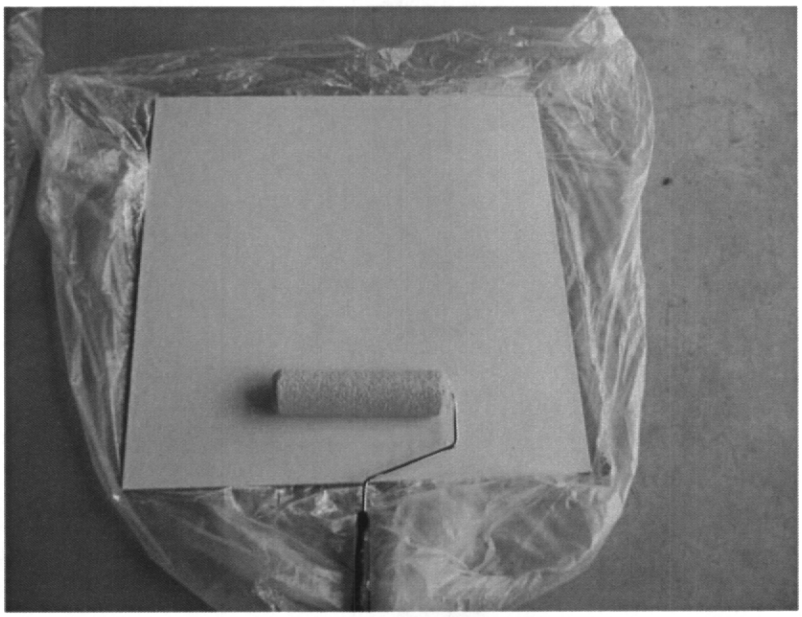

Figure 1. Painting drywall with a base paint prior to contaminating the board in the chamber.

The panels of galvanized duct material were smaller and measured 12" by 24" and the glass panels were 16" by 20". Neither of these materials were painted or treated in any way.

After painting, the plywood panels, the drywall panels, the metal and the glass panels were put into the chamber for contamination. Each of the materials were put into the chamber at different times and using different amounts of methamphetamine (although all were approximately 200 mg). The contamination information is as follows:

Material	*Date of Contamination*	*Meth Amount*	*Start Time*	*Stop Time*	*Fan Stop Time*
Plywood	7/21/08	203 mg	12:49 pm	1:10 pm	2:20 pm
Drywall	7/22/08	209 mg	8:55 am	9:08 am	10:20 am
Metal	8/25/08	203 mg	2:28 pm	2:49 pm	4:00 pm
Glass	9/2/08	214 mg	12:45 pm	1:02 pm	3:50 pm

The methamphetamine utilized for contamination was a street-manufactured methamphetamine provided by the North Metro Task Force in Colorado. The drug was approximately 77% methamphetamine and also contained small amounts of amphetamine, ephedrine, and pseudophedrine. No MDMA or phenylpropanolamine were found to be present. The methamphetamine was put into a beaker and the chamber was sealed and the methamphetamine aerosolized in the chamber. The methamphetamine was completely aerosolized within a short time (listed above) and the beaker heater was turned off. The fans within the chamber were kept running for another period of time to assure even distribution of the methamphetamine. The chamber was then allowed to sit overnight and the material was removed the next day.

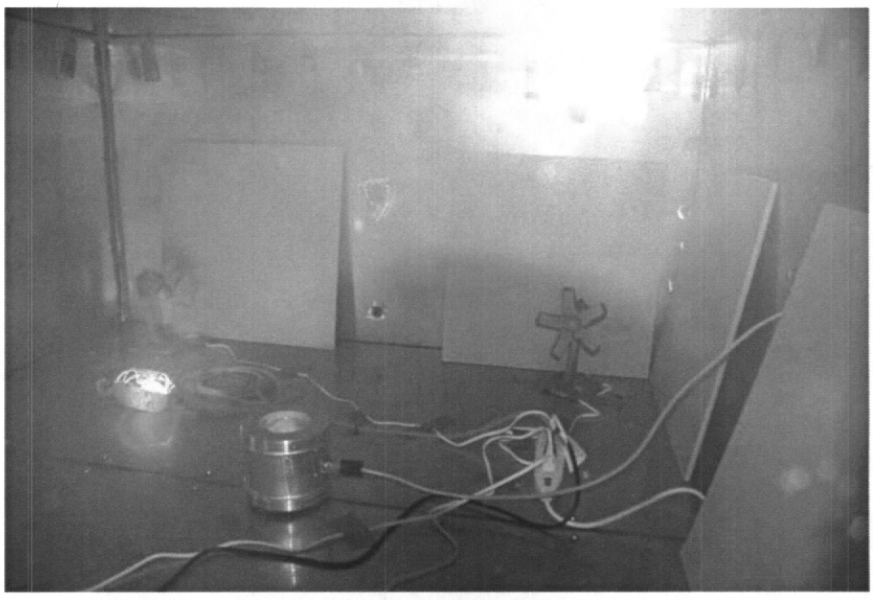

Figure 2. Painted drywall material being contaminated within the chamber.

After the material was removed from the chamber, it was placed in a plastic bag and transported to an area to be pre-sampled, washed, and post sampled.

Figure 3. Drywall being removed for transportation to an area to be sampled and treated.

After being transported, the panels were divided into 5 groups for testing. The groups were as follows:

a. One panel was not washed.
b. One panel was washed 1 time with Simple Green and then tested.
c. One panel was washed 2 times and then tested.
d. One panel was washed 3 times and then tested.

Seven samples were collected prior to treatment and after treatment, resulting in a total of 14 samples being taken from each of the plywood and drywall panels. Each sample consisted of a 100 cm^2 area being sampled from the panel using a 3"x 3" cotton swab to which 3 ml of methanol were added which was then put into a plastic centrifuge tube for analysis.

For each panel, there were a total of 36 potential 100 cm^2 samples available. The squares sampled were determined using random number generator for each panel using numbers from 1 – 36. The two groups of 7 samples were generated with no replicates and the position of the samples were located on the panel using the following template:

i.	1	2	3	4	5	6
ii.	7	8	9	10	11	12
iii.	13	14	15	16	17	18
iv.	19	20	21	22	23	24
v.	25	26	27	28	29	30
vi.	31	32	33	34	35	36

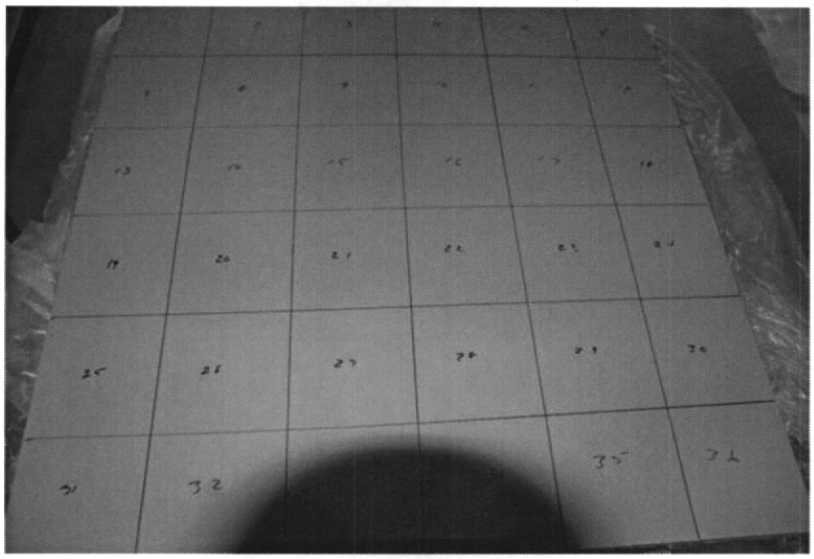

Figure 4. Panel prepared for initial pre-sampling after contamination.

The metal and glass panels were smaller and only 5 pre and post treatment samples were taken from each of these materials. The total number of samples that were possible in the glass panels were 20 and there was a possible 18 samples on the metal.

After the collection of the pre-samples, the panels were then washed for the prescribed number of treatments using Simple Green. The Simple Green was used according to label directions for a maximum degreasing. The cleaner was applied full-strength from a spray bottle onto the surface of the panel. The cleaner was allowed to sit on the panel for approximately 1. 5 minutes and then it was washed off using clean water and a cloth. The surface was not scrubbed hard and no abrasive materials were utilized. After cleaning, the panels were allowed to dry completely before subsequent cleanings or prior to post sampling.

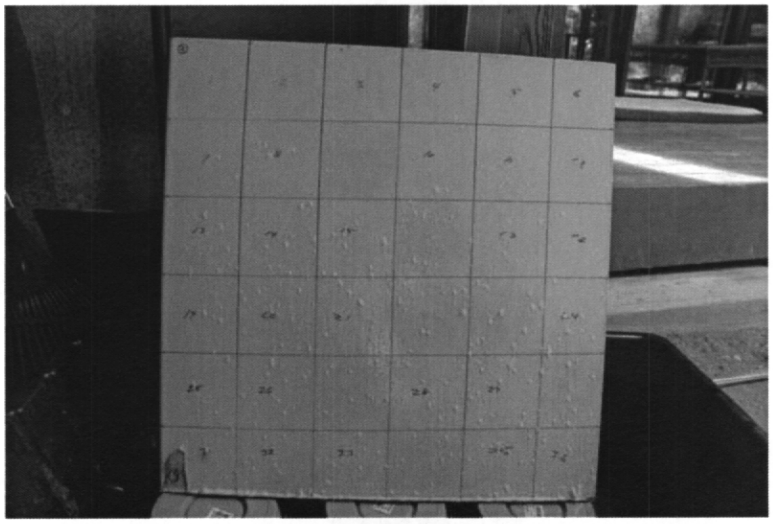

Figure 5. Washing the panel with Simple Green.

After the treatment, the panels were sampled in the same manner as in the pre-sample portion of the project and the samples sent to DataChem laboratories for analysis.

Results:

A total of 28 samples were collected from the plywood and drywall material. For each group of seven samples, a mean, median and percent reduction was calculated. The results for the drywall samples were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	13	13	14	14	-10 %
One Wash	37	30	8.5	8.5	77%
Two Washes	23	24	5.2	4.5	77%
Three Washes	17	16	3.2	3.0	81%

These results indicate that the washing process using Simple Green was able to remove a total of 81% of the methamphetamine contamination using 3 washes. It is interesting to note that the second and third washes did not remove significantly more methamphetamine than did the initial wash. It appears that the initial wash removed the easiest methamphetamine contamination and subsequent washes were not able to remove much more methamphetamine.

The results obtained from the plywood material were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	11	12	13	12	-11 %
One Wash	12	12	5.7	6	53%
Two Washes	11	11	4.2	4.5	63%
Three Washes	18	18	3.6	3.6	80%

Although the initial wash using the Simple Green did not result in quite as large a reduction in the methamphetamine contamination, the initial reduction was still the largest. The total amount of contamination removed was 80% after the three separate washes. Again the 3 washes did not remove all of the methamphetamine but after the initial wash, the remaining methamphetamine was not easily removed.

The results obtained from the sheetmetal were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	3.6	3.7	3.2	2.8	12 %
One Wash	11.4	12	0	0	100%
Two Washes	1	.9	0	0	100%

In the case of sheetmetal, all of the methamphetamine was removed from a single washing with Simple Green. The initial levels of methamphetamine were lower due to a difference in condensation on the sheet metal. Both sheetmetal and glass do not appear to collect as much methamphetamine in the chamber as do most of the other surfaces. The reduction was still 100% even with one metal sheet collecting similar levels of methamphetamine. Only two washes were conducted because of the prediction that methamphetamine would be completely removed with one wash.

The results obtained from the glass were as follows:

Treatment	*Pre-Mean (ug/100 cm^2)*	*Pre-Median (ug/100 cm^2)*	*Post Mean (ug/100 cm^2)*	*Post Median (ug/100 cm^2)*	*Mean % Reduction*
No Treatment	0.1	0.1	0.2	0.2	-50 %
One Wash	0.2	0.2	0	0	100%
Two Washes	12.5	12	0	0	100%

The results of the glass testing were similar to the sheetmetal results in that all of the methamphetamine was removed from a single wash with Simple Green. This was predicted to occur and therefore only two washes were conducted in order to reduce unnecessary costs.

Discussion and Conclusions:

The results of the washing with Simple Green detergent were variable depending upon the surface that was being decontaminated. Surfaces that were smooth and impervious to the methamphetamine were easily cleaned using a single washing with the detergent. Surfaces that were more porous were not as easily cleaned. In the case of both painted wood and painted drywall, more than 50% of the methamphetamine present was removed from a single wash but subsequent washes were able to remove only another 30% of the methamphetamine present. In both cases, the ability to remove more than 80% of the initial methamphetamine contamination was not possible using this technique.

The results of this study suggest that washing porous surfaces that can't be put into a washing machine may be difficult. A study conducted by Minnesota suggested that the methamphetamine becomes absorbed into the paint and that subsequent samplings only remove a portion of the paint and therefore methamphetamine continues to be present.

Future experiments conducted on the materials used in this study will attempt to confirm this observation by testing the amount of methamphetamine removed during sampling compared to the amount still held in the paint.

Although these porous surfaces were not able to be completely cleaned by the use of a detergent, the inability of the detergent to remove methamphetamine after the initial 50% was removed may suggest that the remaining methamphetamine is not completely available for removal. It is possible that after the first 50% is removed, that the remaining methamphetamine may not easily leave the surface of the porous materials simply due to touch or simple cleaning. Exposures therefore, may be significantly reduced after the initial cleaning. Usually a second wash could only remove another 10% or so and the third wash only another 10% of the methamphetamine left.

In the case of smooth surfaces such as metal and glass, as predicted, the use of a detergent will result in a complete removal of the residual methamphetamine. In all cases, a single washing was enough to remove the methamphetamine to undetectable levels (<0.05 ug/100 cm^2). The second washing was not necessary but could be expected to remove any material that was left. These results would also indicate that methamphetamine present on smooth surfaces will readily leave that surface if contacted by skin or clothing.

The results obtained on the metal and glass also indicate that objects that are taken from a home that are smooth and easily cleanable could be easily decontaminated as long as all of the surfaces could be cleaned. Added to the information obtained by testing the efficiency of clothes washing on methamphetamine removal, it could be concluded that items with smooth easily cleanable surfaces or items that could be put into a washing machine could be easily decontaminated. Items that did not meet that criteria could be very difficult to decontaminate.

There are a number of limitation to this study that must be considered. We utilized only latex paint similar to that used in most houses but not all houses. It is possible that a more impervious paint exists that would not absorb the methamphetamine and make decontamination easier. Some painted woods, for instance, may be sealed with a plastic paint (Varathane) or other sealant that may be more easily decontaminated. We also only let the paint cure for a couple of days prior to exposing it in the chamber. Paint that has cured longer may be less permeable to the methamphetamine although Minnesota did not find that to be the case.

In some cases, methamphetamine removal may be even more difficult that we found since we did not apply texturing or any other surface to the wood or drywall prior to painting. Texture could make decontamination even more difficult since the methamphetamine may penetrate even deeper into the surface of the material.

In our study we used Simple Green to determine the ability to remove the methamphetamine. The reason for this procedure was that Simple Green is mentioned in the Utah guidelines and is representative of a detergent that may be used by many

contractors. Other cleaning agents may accomplish decontamination more effectively and we will be testing some of these detergents in the near future. There are many other variables that could be tested such as scrubbing, use of solvents, etc. but the cost of conducting that testing is beyond the scope of this grant. This study does, however, provide an initial look into the decontamination of building materials and the difficulty of decontaminating porous materials.

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Sample #	Cloth Type	Treatment	Meth Conc.	Mean	Median	% reduction Mean	% Reduction Median
1-1	Drywall	pre-treatment	25				
1-2	Drywall	pre-treatment	83				
1-3	Drywall	pre-treatment	36				
1-4	Drywall	pre-treatment	30				
1-5	Drywall	pre-treatment	42				
1-6	Drywall	pre-treatment	29				
1-7	Drywall	pre-treatment	12	36.71429	30		
1-8	Drywall	One Wash	8.5				
1-9	Drywall	One Wash	8.8				
1-10	Drywall	One Wash	7.9				
1-11	Drywall	One Wash	12				
1-12	Drywall	One Wash	9.9				
1-13	Drywall	One Wash	5.5				
1-14	Drywall	One Wash	6.9	8.5	8.5	76.8	71.7
2-1	Drywall	pre-treatment	30				
2-2	Drywall	pre-treatment	19				
2-3	Drywall	pre-treatment	24				
2-4	Drywall	pre-treatment	25				
2-5	Drywall	pre-treatment	16				
2-6	Drywall	pre-treatment	24				
2-7	Drywall	pre-treatment	22	22.85714	24		
2-8	Drywall	Two Wash	3.8				
2-9	Drywall	Two Wash	4.5				
2-10	Drywall	Two Wash	4				
2-11	Drywall	Two Wash	7.2				
2-12	Drywall	Two Wash	6.6				
2-13	Drywall	Two Wash	4.1				
2-14	Drywall	Two Wash	5.9	5.157143	4.5	77.4	81.3
3-1	Drywall	pre-treatment	16				
3-2	Drywall	pre-treatment	19				
3-3	Drywall	pre-treatment	18				
3-4	Drywall	pre-treatment	16				
3-5	Drywall	pre-treatment	21				
3-6	Drywall	pre-treatment	14				
3-7	Drywall	pre-treatment	15	17	16		
3-8	Drywall	Three Washes	3.7				
3-9	Drywall	Three Washes	3				
3-10	Drywall	Three Washes	3.9				
3-11	Drywall	Three Washes	4.2				
3-12	Drywall	Three Washes	2.8				
3-13	Drywall	Three Washes	2.6				
3-14	Drywall	Three Washes	2.5	3.242857	3	80.9	81.3
4-1	Drywall	pre-treatment	13				
4-2	Drywall	pre-treatment	13				

4-3	Drywall	pre-treatment	13				
4-4	Drywall	pre-treatment	14				
4-5	Drywall	pre-treatment	12				
4-6	Drywall	pre-treatment	9.5				
4-7	Drywall	pre-treatment	16	12.92857	13		
4-8	Drywall	No Washes	13				
4-9	Drywall	No Washes	13				
4-10	Drywall	No Washes	14				
4-11	Drywall	No Washes	14				
4-12	Drywall	No Washes	13				
4-13	Drywall	No Washes	16				
4-14	Drywall	No Washes	17	14.28571	14	-10.5	-7.7
5-1	Plywood	pre-treatment	13				
5-2	Plywood	pre-treatment	16				
5-3	Plywood	pre-treatment	13				
5-4	Plywood	pre-treatment	8.5				
5-5	Plywood	pre-treatment	11				
5-6	Plywood	pre-treatment	12				
5-7	Plywood	pre-treatment	11	12.07143	12		
5-8	Plywood	One Wash	4.1				
5-9	Plywood	One Wash	6.2				
5-10	Plywood	One Wash	6.9				
5-11	Plywood	One Wash	7.5				
5-12	Plywood	One Wash	6				
5-13	Plywood	One Wash	5.1				
5-14	Plywood	One Wash	4	5.685714	6	52.9	50.0
6-1	Plywood	pre-treatment	10				
6-2	Plywood	pre-treatment	10				
6-3	Plywood	pre-treatment	10				
6-4	Plywood	pre-treatment	12				
6-5	Plywood	pre-treatment	15				
6-6	Plywood	pre-treatment	11				
6-7	Plywood	pre-treatment	12	11.42857	11		
6-8	Plywood	Two Wash	4.3				
6-9	Plywood	Two Wash	5.7				
6-10	Plywood	Two Wash	4.5				
6-11	Plywood	Two Wash	3				
6-12	Plywood	Two Wash	3				
6-13	Plywood	Two Wash	4.7				
6-14	Plywood	Two Wash	4.5	4.242857	4.5	62.9	59.1
7-1	Plywood	pre-treatment	18				
7-2	Plywood	pre-treatment	20				
7-3	Plywood	pre-treatment	15				

7-4	Plywood	pre-treatment	19				
7-5	Plywood	pre-treatment	18				
7-6	Plywood	pre-treatment	17				
7-7	Plywood	pre-treatment	18	17.85714	18		
7-8	Plywood	Three Washes	4.5				
7-9	Plywood	Three Washes	3.6				
7-10	Plywood	Three Washes	2.4				
7-11	Plywood	Three Washes	4.1				
7-12	Plywood	Three Washes	4.1				
7-13	Plywood	Three Washes	3.3				
7-14	Plywood	Three Washes	3.5	3.642857	3.6	79.6	80.0
8-1	Plywood	pre-treatment	12				
8-2	Plywood	pre-treatment	13				
8-3	Plywood	pre-treatment	15				
8-4	Plywood	pre-treatment	9.1				
8-5	Plywood	pre-treatment	7.7				
8-6	Plywood	pre-treatment	8.6				
8-7	Plywood	pre-treatment	14	11.34286	12		
8-8	Plywood	No Washes	12				
8-9	Plywood	No Washes	9.7				
8-10	Plywood	No Washes	15				
8-11	Plywood	No Washes	11				
8-12	Plywood	No Washes	12				
8-13	Plywood	No Washes	14				
8-14	Plywood	No Washes	14	12.52857	12	-10.5	0.0
MN-1	Metal	pre-treatment	3.2				
MN-2	Metal	pre-treatment	4				
MN-3	Metal	pre-treatment	3.7				
MN-4	Metal	pre-treatment	3.1				
MN-5	Metal	pre-treatment	4.2	3.64	3.7		
MN-6	Metal	No Washes	4.2				
MN-7	Metal	No Washes	2.3				
MN-8	Metal	No Washes	2.6				
MN-9	Metal	No Washes	2.8				
MN-10	Metal	No Washes	4.1	3.2	2.8	12.1	24.3
M1-1	Metal	pre-treatment	12				
M1-2	Metal	pre-treatment	12				
M1-3	Metal	pre-treatment	13				
M1-4	Metal	pre-treatment	10				
M1-5	Metal	pre-treatment	10	11.4	12		
M1-6	Metal	One Wash	0				
M1-7	Metal	One Wash	0				
M1-8	Metal	One Wash	0				

M1-9	Metal	One Wash	0				
M1-10	Metal	One Wash	0	0	0	100.0	100.0
M2-1	Metal	pre-treatment	0.9				
M2-2	Metal	pre-treatment	1.3				
M2-3	Metal	pre-treatment	0.9				
M2-4	Metal	pre-treatment	1.1				
M2-5	Metal	pre-treatment	0.9	1.02	0.9		
M2-6	Metal	Two Wash	0				
M2-7	Metal	Two Wash	0				
M2-8	Metal	Two Wash	0				
M2-9	Metal	Two Wash	0				
M2-10	Metal	Two Wash	0	0	0	100.0	100.0
GN-1	Glass	pre-treatment	0.1				
GN-2	Glass	pre-treatment	0.1				
GN-3	Glass	pre-treatment	0.2				
GN-4	Glass	pre-treatment	0.2				
GN-5	Glass	pre-treatment	0	0.12	0.1		
GN-6	Glass	No Washes	0.3				
GN-7	Glass	No Washes	0.2				
GN-8	Glass	No Washes	0.1				
GN-9	Glass	No Washes	0.2				
GN-10	Glass	No Washes	0.1	0.18	0.2	-50.0	-100.0
G1-1	Glass	pre-treatment	0.1				
G1-2	Glass	pre-treatment	0.3				
G1-3	Glass	pre-treatment	0.2				
G1-4	Glass	pre-treatment	0.2				
G1-5	Glass	pre-treatment	0.4	0.24	0.2		
G1-6	Glass	One Wash	0				
G1-7	Glass	One Wash	0				
G1-8	Glass	One Wash	0				
G1-9	Glass	One Wash	0				
G1-10	Glass	One Wash	0	0	0	100.0	100.0
G2-1	Glass	pre-treatment	6.6				
G2-2	Glass	pre-treatment	11				
G2-3	Glass	pre-treatment	13				
G2-4	Glass	pre-treatment	20				
G2-5	Glass	pre-treatment	12	12.52	12		
G2-6	Glass	Two Wash	0				
G2-7	Glass	Two Wash	0.1				
G2-8	Glass	Two Wash	0				
G2-9	Glass	Two Wash	0				
G2-10	Glass	Two Wash	0	0.02	0	99.8	100.0
8-15	Blank		0				

8-16	Blank		0.096
B1	Blank	<0.05	
B2	Blank	<0.05	
B3	Blank	<0.05	
B4	Blank	<0.05	
B5	Blank	<0.05	
B6	Blank	<0.05	
B7	Blank	<0.05	
B8	Blank	<0.05	
B9	Blank	<0.05	
B10	Blank	<0.05	