Methamphetamine Aerosolization in an Exposure Chamber

Results of Initial Testing

By

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Introduction:

A major concern regarding decontamination of materials at the scene of a clandestine methamphetamine laboratory is how well different materials can be decontaminated. Typically law enforcement has restricted the removal of clothing and other materials from methamphetamine laboratories until the materials are tested by some entity and allowed to be re-used. In addition, the decontamination of construction materials in a structure that has been used for the clandestine production of methamphetamine has also been difficult to study. In most homes it is unknown as to how much methamphetamine is present in the home and in what areas it was manufactured or used. It is also unknown as to how easily methamphetamine is removed from different surfaces using varying techniques.

There have been some efforts to determine how easily methamphetamine contamination can be removed from the protective equipment of emergency services personnel and a number of documents report that a number of cleanings may be necessary to completely remove methamphetamine from clothing, etc. In one of our previous studies we attempted to determine how easily materials could be tested using solvent wipes on different surfaces, however, we had not studied surface decontamination.

The testing of different surfaces to determine the efficiency of decontamination is difficult. It is necessary to be able to contaminate a large surface area with a relatively uniform amount of methamphetamine in order to test decontamination methods. In addition, the method of contamination should be similar to actual methods observed in the field. In other words, although we could apply methamphetamine to a surface using a micro-pipette, the material applied may adhere to the surface differently than methamphetamine applied by smoking or manufacturing methamphetamine. These differences may result in different decontamination efficiencies using different methods.

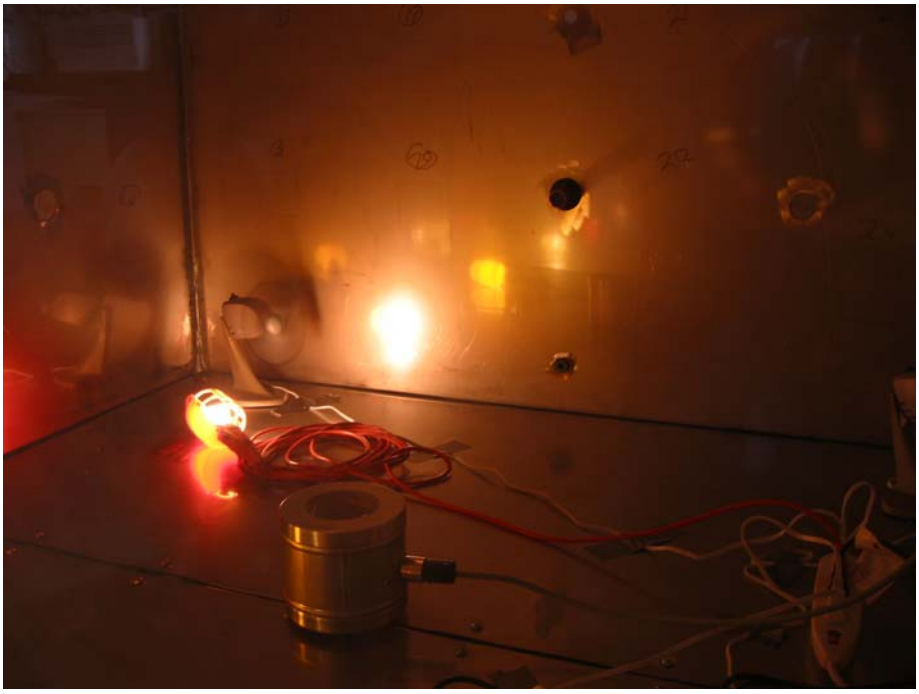
This project was designed to construct and test a chamber that was capable of generating an airborne methamphetamine aerosol that could be naturally deposited on surfaces and in clothing contained inside the chamber.

Methodology:

This project utilized a stainless steel chamber that had been constructed to document airborne concentrations of beryllium for a previous project. The chamber is completely stainless steel and measures 2 meters wide x 2 meters long x 1 meter high. The chamber has a small window at one end in order to view the internal portion of the chamber but the rest of the chamber does not have windows.(Figure 1.) The chamber includes a number of sampling ports and it is portable in that it can be broken down and stored for some time. The chamber is contained in a special room in the research area of National Jewish Medical Center that is equipped with a hood for effluent evacuation purposes.

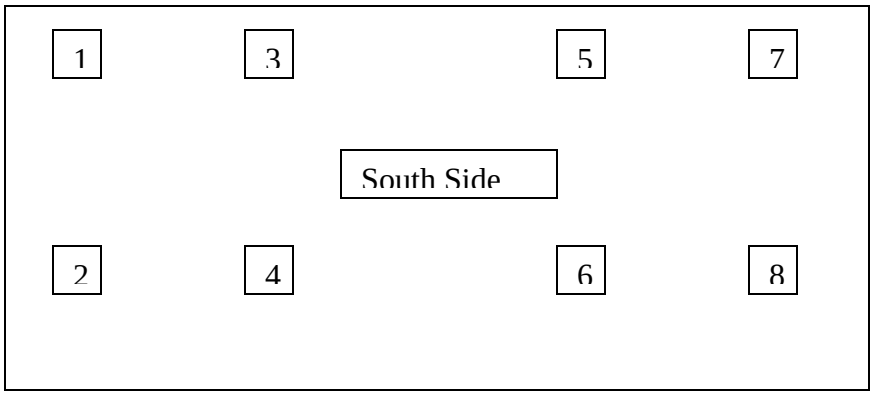
Figure 1. Stainless steel chamber utilized to aerosolize methamphetamine with sampling pumps attached for initial testing.

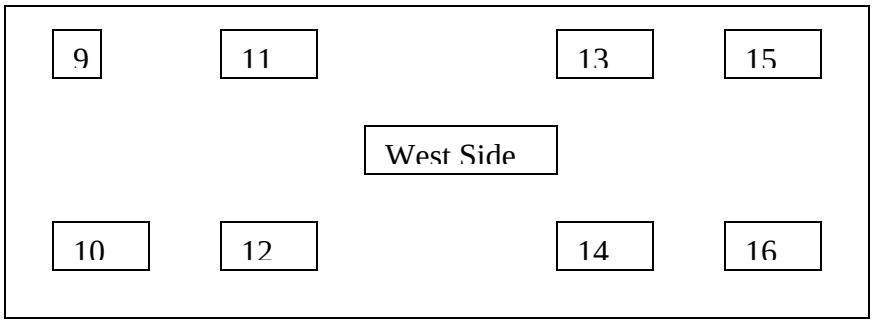
The inside of the chamber includes four fans that are utilized to ensure that the air inside of the chamber is kept in a turbulent state in order to adequately mix the aerosolized methamphetamine in the chamber. The fans are located at each corner of the chamber and pointed into the center of the chamber. (Figure #2.)

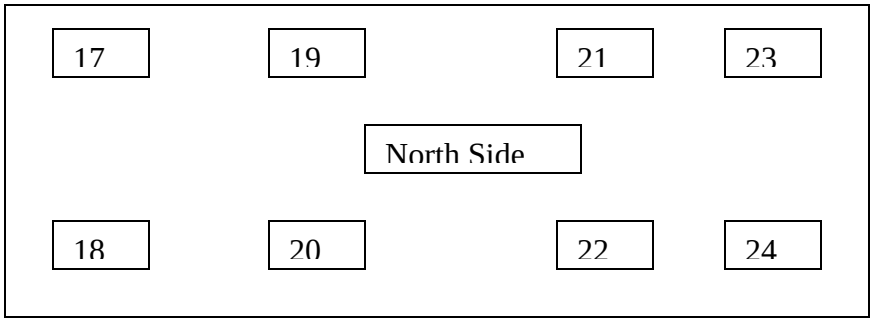


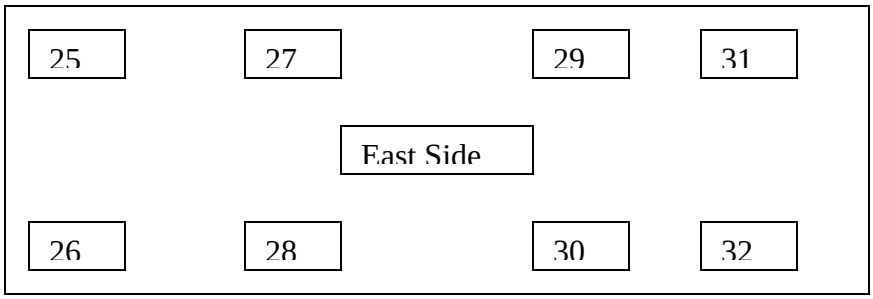
Illumination in the chamber is provided by two droplights that are located on the floor of the chamber. The methamphetamine is aerosolized by putting methamphetamine into a 400 ml beaker and inserting the beaker into a 325 watt Griffin Beaker Heating Mantle (Cole Palmer Catalogue # K36235-00) which has a maximum temperature of 450 degrees Celsius. All of the power cords exit the chamber on the east side and power can be applied from the outside of the chamber. Methamphetamine is aerosolized by plugging in the heating mantle until a sizable vapor is observed leaving the beaker and then it is turned off for a few minutes. It is then restarted and run for about 5 minutes and then unplugged again. A third cycle is also conducted. At the end of all three cycles, the methamphetamine has been completely aerosolized. This operation usually takes less than ½ hour to conduct.

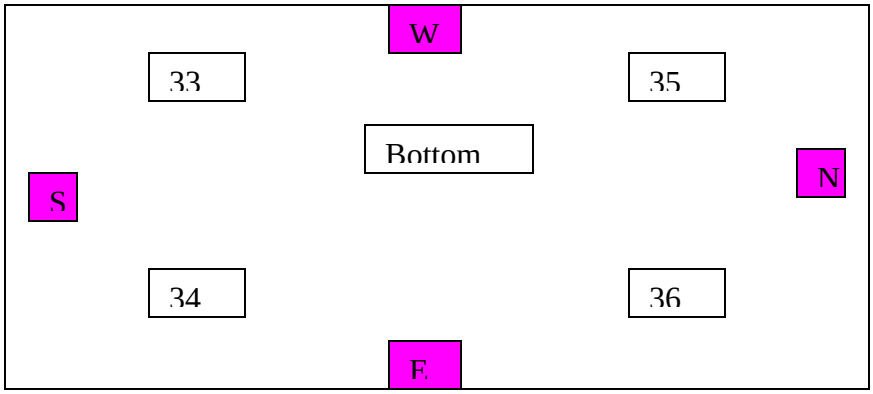
For this initial testing, the inside of the chamber was marked with a total of 36 – 100 cm^2 templates to be tested after the aerosolization had been conducted. The chamber was labeled as follows:











The initial testing was conducted on 6/23/2008 at 10:19 am. The methamphetamine used was a clean crystalline street methamphetamine provided by the North Metro Task Force. The amount of methamphetamine utilized was 208 mg. The experiment was completed at 1:00 pm when the fans were turned off.

During this initial run, a total of 6 air samples were collected with two of the samples using two inline filters to determine if all of the methamphetamine was captured in the initial filter. The samples were taken using SKC personal sampling pumps at a flow rate of 2.0 liters/min for a period of 159 minutes using an acid-treated fiberglass filter in a open 37 mm cassette. The air samples taken and their locations were as follows:

Sample #	***Sample Location***	***Liters Sampled***
1	Inside South Side of Chamber	159
2A	Inside East Side of Chamber	159
2B	Inside East Side of Chamber (2nd filter)	159
3	Inside North Side of Chamber	159
4A	Inside West Side of Chamber	159
4B	Inside West Side of Chamber (2nd Filter)	159
5	Outside of East Side of Chamber	159
6	Outside of West Side of Chamber	159
7	Blank	
8	Blank	

Wipe samples were taken using a 3 x 3 cotton wipe supplied by DataChem laboratories. The wipes were wetted with 2 ml of methanol prior to taking the sample and afterwards were put into a centrifuge tube for analysis. The samples were taken by wiping the

template area in an up and down and side to side pattern for 4 times each way and then folded and wiped again for 4 times before packaging in the centrifuge tube. Both air and wipe samples were sent to DataChem Laboratories in Salt Lake City by overnight mail and were analyzed using LC/MS.

Results:

Air Sample Results:

A total of 8 air samples were collected during this initial testing period. Four samples were collected from inside of the chamber and 2 samples were collected from outside of the chamber. The final two samples were blank samples that were not exposed to the air. Two of the interior samples were collected using two filters to assure that all of the methamphetamine was collected on the initial filter. The outside samples were collected to assure that the methamphetamine was contained within the chamber during the aerosolization process.

The air sample results were as follows:

Sample #	***Location***	***Result ug/m^3***
1	South side interior sample	10,000
2A	East side interior sample – 1st filter	12,000
2B	East side interior sample – 2nd filter	ND
3	North side interior sample	15,000
4A	West side interior sample – 1st filter	16,000
4B	West side interior sample – 2nd filter	ND
5	East side exterior sample	ND
6	West side exterior sample	ND
7	Blank	ND
8	Blank	ND

ND = Not Detected

These data indicate that the interior of the chamber had an average methamphetamine concentration of 13,250 ug/m^3 during the testing period. The median level of contamination was 13,500 ug/m^3. The samples collected from outside of the chamber did not show any detected methamphetamine suggesting that all of the methamphetamine was contained within the chamber. The second filter for air samples #2 and #4 did not have any detectable methamphetamine indicating that the use of a single acid-treated fiberglass filter collects all of the methamphetamine that can be collected using that methodology.

The methamphetamine measured was collected from 10:20 am to 1:00 pm and as such is an average over that entire time period. Since the actual aerosolization ended at approximately 11:00 am, the peak interior concentration was likely higher than the results

presented. Generally, the interior concentration only varied by +/- 25% from the average level present within the chamber.

Wipe Sample Results:

A total of 36 individual wipes were collected from the sides and floor of the chamber. the mean level of methamphetamine found was 25.8 ug/100 cm^2 with a median of 10.5 ug/100 cm^2. The lowest level found was 5 ug/100 cm^2 and the highest level was 120 ug/100 cm^2. The results by surface were as follows:

Location/Side	*Sample #s*	*Mean ug/100 cm^2*	*Median ug/100 cm^2*
Southeast panel / South	1 – 4	11.9	11.7
Southwest panel / South	5 – 8	7.2	6.8
West south panel / West	9 – 12	12.0	6.0
West north panel / West	13 – 16	9.4	8.2
Northwest panel / North	17 – 20	8.7	8.5
Northeast panel / North	21 – 24	13.4	11.8
East north panel / East	25 – 28	42.0	34.5
East south panel / East	29 – 32	12.5	13
Floor	33 – 36	115	120

These data show that the sides of the chamber became contaminated with methamphetamine that ranged from a mean of 7.2 ug/100 cm^2 to a mean of 42 ug/100 cm^2. The highest levels of methamphetamine were observed on the north side of the east panel. A reason for this higher contamination level is not known. The rest of the panel areas had mean contamination levels that ranged from 7.2 ug/100 cm^2 to 13.4 ug/100 cm^2. These levels are similar and represent a relatively uniform spread across the surfaces of the chamber.

We also compared the values obtained for the upper and lower portions of the panel. The results were as follows:

	Upper Panel	*Lower Panel*
Mean (ug/100 cm^2)	9.4	19.6
Median (ug/100 cm^2)	9.0	12
Minimum (ug/100 cm^2)	5	5.7
Maximum (ug/100 $cm^{2)}$	16	85

The methamphetamine levels for the upper panels were lower than the levels observed in the lower panels. The lower panels included the highest levels on the east panel. The fact that the lower level had the higher contamination levels corresponds with the fact that the highest levels were found on the floor of the chamber. These data suggest that the generated aerosol has a tendency towards a particle size that will settle out on the lower areas of the chamber. It appears that the chamber is relatively uniform since the

concentrations observed on the panels are not orders of magnitude different, and with the exception of the east panel, the results were very similar ranging from a mean of 7.2 ug/100 cm^2 to a mean of 13.4 ug/100 cm^2, a difference of only 6.2 ug/100 cm^2.

Conclusions:

Based upon our testing, the following conclusions can be made:

1. The chamber allows for the generation of a significant amount of airborne methamphetamine. Using approximately 200 mg of crystal methamphetamine, the internal concentrations averaged over a period of approximately 2.5 hours were 13,250 ug/m^3. These levels are higher than those normally observed during either a cook or a use scenario but allow for a significant contamination level on articles within the chamber in a short period of time.

2. The generation of methamphetamine using the beaker heater results in a relatively uniform contamination of materials inside of the chamber with a slight increase in the concentration on the lower portion of the panels and on the floor.

3. The methamphetamine generated is easily collected on the acid treated glass fiber filters and no methamphetamine was found to penetrate the initial collection filter.

4. The chamber was found to contain all of the methamphetamine that was generated and no airborne methamphetamine was released into the general room air.

5. This chamber allows for the testing of methamphetamine decontamination methodologies on articles that have been contaminated in a realistic manner. Simply dripping a methamphetamine-methanol mixture on a surface may not duplicate the application that occurs during cooking or use under normal conditions. This testing realistically mimics a methamphetamine use situation and possibly a manufacturing scenario.