Contract No. SPO900-94-D-0002
CBIAC Task No. 491

Test Report for the System Effectiveness Test of Home/Commercial Portable Room Air Cleaners

To

U.S. Army Soldier, Biological Chemical Command (SBCCOM)

27 April, 2000

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TEST REPORT

SYSTEM EFFECTIVENESS TEST OF HOME/COMMERCIAL PORTABLE ROOM AIR CLEANERS

To

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By

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Executive Summary

The objective of this test was to determine the relative effectiveness of a number of previously-selected, commercially-available recirculating home air filtration units at removing contaminant vapor (simulant) from a sealed room. In this test, a simulant vapor was introduced directly inside a test room, in a controlled and reproducible manner, so that the dosage reduction due to each of the air purifiers could be measured.

The test room was constructed to represent a sealed interior room. It was approximately 5 ½ ft. wide, 7 ½ ft. long, and 8 ft. high, made of wood, caulked, sealed, and epoxy painted. The room was instrumented and controlled from a computer console outside.

In the test, a filter unit was placed in the test room, and methyl salicylate vapor was generated. When the vapor concentration reached approximately 0.1 mg/m^3, the filter unit was activated, and the vapor concentration reduction measured and recorded for one hour. This process was repeated three times for each of 9 filter unit designs, three times with no filter unit present (to establish a baseline), and three times using a U.S. Army standard M20AI recirculation filter unit. One of the filter units was tested two additional times, but with it relocated to different places within the test room.

The filter units were effective in removing the simulant vapor from the test room. Most of the units reduced the vapor concentration by more than 90% during the first hour of operation. The most effective units, however, accomplished the 90% reduction in less than 35 minutes, and reduced the 1-hour dosage (concentration × time) in the room from 5.0 mg·min/m^3 to approximately 1.5 mg·min/m^3.

The Honeywell 11200, the Austin HM 400, AllerAir 4000 and the Dust Free were the most effective of the commercial filter units in reducing the simulant vapor dosage within the test room. It was found that its vapor reduction effectiveness was not appreciably influenced by its location in the test room.

Acknowledgments

The authors gratefully acknowledge Mr. Victor Arca, SBCCOM, for his contributions to the test facilities and instrumentation used in this test. Mr. Robert Rudolph, BEO, contributed valuable technical and organizational guidance. Ms. Debbie Mioduszewski and Mr. Kevin Kraft, BEO, contributed the graphic art essential to the clear presentation of technical material.

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1. INTRODUCTION

1.1. Background

Sheltering in place (SIP) is a means of protecting the off-post community from a chemical stockpile accident or incident. SIP is a process that reduces the infiltration of hazardous chemicals into a shelter by closing windows, vents, and doors and turning off heating, ventilating, and air conditioning (HVAC) systems. Additional protection can be achieved by applying tape around doors and placing plastic sheeting over windows and HVAC registers (enhanced SIP). Procedures for SIP have been published and implemented by several organizations in the U.S. and have also been reviewed in past CSEPP documents.[1]

SIP provides temporary protection from chemical hazards. When a building or room is tightly sealed, contaminated outside air will still enter very slowly through unintentional openings. Chemical agent is adsorbed and desorbed from building materials as it infiltrates and thereby remains for a time within the shelter after the hazardous vapors outside have passed. Because of this delayed response, the procedure for attaining maximum protection is to ventilate the shelter and exit the building as soon as the outside air is less hazardous than the inside air. Exiting the shelter at the appropriate time is unfortunately difficult due to the fact that reliable detection and monitoring of the cloud at the shelter location is required.

A number of studies have been conducted to help improve the protection afforded by SIP. In a previous series of tests[2], it was found that the protection afforded by SIP could be improved by the use of recirculation filtering. In those tests, simulant vapor was allowed to infiltrate the test structure from a surrounding high-concentration atmosphere, and then the surrounding atmosphere was cleared, simulating the conditions of a passing contaminant cloud. Based upon the positive initial results, it was decided to conduct the current comprehensive study of home/commercial portable room air cleaners (referred to in this report as filter units). The study was conducted in two phases. The first phase included a market survey[3] to identify potential filter units that met predefined criteria and the second phase involved simulant testing to determine the relative effectiveness of the units.

As part of phase 1 over 100 different filter units were examined. Applicability to CSEPP was based upon factors such as filtration efficiency, cost, size, weight, power, flow design, flow rate, and bypass ratio. A variety of tools were utilized to select applicable units, including past market investigations, Internet searches, database searches, trade shows, and industrial and Government contacts. The following requirements were used as a guide to downselect the filters for testing.

Filtration – can remove low volatility vapors
Size – one-person portable
Weight – less than 40 lbs
Power – 110 VAC
Flow Design – maximize mixing
Cost – less than $400
Flow rate – greater than 100 cfm
Bypass ratio - minimal

[1] Blewett, W.K., et al, "Sheltering in Place: An Evaluation for the Chemical Stockpile Emergency Preparedness Program." U.S Army Edgewood Research, Development and Engineering Center, Aberdeen Proving Ground, MD, May 1996.
[2] Blewett, William K. and Arca, Victor J, "Experiments in Sheltering in Place: How Filtering Affects Protection Against Sarin and Mustard Vapor," June 1999, U.S. Army SBCCOM, Aberdeen Proving Ground, MD.
[3] Janney, Charles, "Market Survey on Home/Commercial Portable Room Air Cleaners," October 1999, Battelle Memorial Institute, Bel Air, MD.

Based upon the results of the market survey, nine filter units were selected and procured for testing during the second phase. The following report describes the results of the phase 2 effort.

1.2. Objective

The objective of this test series is to determine the relative effectiveness of the selected filter units at removing contaminant vapor (simulant) from a sealed room. Relative effectiveness of each filter unit is calculated from the time dependent decay of contaminant vapor, measured *in situ* during the operation of each filter unit. The initial challenge concentration in the test chamber was selected based on the results from previous shelter in place testing.[4]

1.3. Scope of Test

This testing was designed to determine the relative effectiveness of the filter units and was not intended to simulate an actual chemical accident or incident. This test primarily addressed a single condition, where the values of the following essential parameters were fixed:

- Initial Peak Vapor Concentration
- Room Size and Shape
- Room Ventilation
- Simulant Vapor Composition
- Test Item
- Filter Unit Location in Test Room
- Test Room Temperature and Relative Humidity

The test room was prepared, and preliminary instrument checks were conducted. Baseline tests were conducted, and then the same conditions were duplicated, but with a filter unit activated 20 to 25 minutes after the methyl salicylate (MeS) vapor was introduced (when the MeS vapor concentration reached the peak value). The decay in MeS vapor concentration can then be compared to the baseline decay.

The test procedure was performed 3 times for each of the selected test items and 3 times for the baseline condition with no filter unit. Then one filter unit was selected for two additional trials with the filter unit located in different places within the room.

The MeS vapor concentration in the test room was measured with a MINICAMS® (an air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas-chromatography column for separation, and detects the compounds with a flame-ionization detector) and the test room dosage (concentration integrated over time) for each 20-minute interval was measured using Tenax sorbent tubes (in sets of 3 each). Each tube was analyzed with a gas chromatograph to determine its MeS content.

2. TEST FACILITIES AND INSTRUMENTATION

2.1. Test Room

The test room is illustrated in the drawings and pictures that follow. Figure 1. Test Room Drawing, Doorway View, and

[4] Blewett, William K. and Arca, Victor J, "Experiments in Sheltering in Place: How Filtering Affects Protection Against Sarin and Mustard Vapor," June 1999, U.S. Army SBCCOM, Aberdeen Proving Ground, MD.

Figure 2. Test Room Drawing, Cutaway View, depict the test room layout. These diagrams indicate the relative locations of each item inside the room.

2.2. Test Room Characteristics

a. The test room was constructed from plywood and framing lumber, with the framing on the outside, and the inside coated with epoxy paint.

b. The inside dimensions, width, length, and height, of the test room were 68" × 92" × 96".

c. All seams and penetrations were sealed with silicone caulk, and the door was equipped with a semi-pneumatic rubber sealing strip.

d. Figures 1-6 contains pictures and drawings of the test room indicating the approximate locations of the vapor sampler inlets and the filter unit. The vapor generator was positioned on the floor, as far away from the vapor sampler inlets as practical.

e. The test room was located in the high-bay area of building E5354 on Aberdeen Proving Ground. The high-bay area was maintained at moderate temperature and protected the test room from wind and direct sunlight.

f. A MINICAMS® was used to measure the MeS vapor concentration in the test room during the test. The sample line was divided into three inlet locations as shown in Appendix A.

g. An electric heater and a cool-air humidifier were placed on the floor of the test room and controlled from the outside. Temperature and humidity sensors inside the test room were used to regulate and record those conditions during the test.

h. The MeS vapor was generated by dispensing a measured quantity (1.8 microliter) of liquid MeS onto an electrically-heated surface under an air-circulation fan, directed upward.

2.3. Test Room Instrumentation

The test room contained the following items during testing:

a. Recirculating filter unit system, the test item. It was positioned on the floor, near the center of the room, initially. After all the filter units had been tested 3 times, two additional tests were conducted with a filter unit in alternate locations within the test room. The first alternate location was on the floor, against the front wall, to the right of the entrance doorway. The second alternate location was in the junction of the far end and left side walls, 5 ½ feet above the floor.

b. Vapor generator system. It consisted of an electric hotplate and a small iron skillet. It was positioned along the left side wall, underneath the mixing fans.

c. Syringe pump. An accessory for the vapor generator, it enabled a predetermined volume of MeS to be introduced by activating a switch outside the test room.

d. Mixing fans. This was a compact unit with two electrically-powered ducted fans, side-by-side, directed upward, fastened to the left side wall, 56 inches from the floor, 45 inches from the door-end wall.

e. Electric heater. It was a compact unit with integral fan, operating at 1500 watts input, controlled by the computer system to maintain 90°F, ± 0.1°F. It was positioned near the back end wall.

f. Cool-air humidifier. It was positioned along the back end wall and controlled by the computer to introduce moisture as required to maintain the RH near 35%. No means of removing moisture from the air was provided, other than ventilating the test room.

g. Temperature and humidity control sensors. These were mounted along the right side wall, 43 inches from the floor, 52 inches from the door-end wall.

h. Sorbent tubes and manifold controller. These were fastened to the back-end wall, 69 inches from the floor, centered, and operated electrically from outside the test room.

i. MIRAN infrared air sampling unit. It was initially positioned on the floor along the right side wall, to be used as a backup to the MINICAMS® and sorbent tubes. After the first few tests it was removed.

j. Three MINICAMS® sampling lines were positioned so that their inlets were approximately:

(1) One foot from the walls at the upper left front corner and 16 inches from the ceiling.
(2) One foot from the lower right rear corner walls and 16 inches from the floor.
(3) At the geometric center of the test room but 31 inches from the ceiling.

2.4. Operational Concept

The three MINICAMS® sampling lines were joined into a single heated sample line connected to the MINICAMS® inlet. The MINICAMS® location was approximately 70 feet from the test room, so heated lines were used to prevent condensation of vapor in the lines. The flow rate in the inlet line was approximately 0.8 liters/minute, resulting in a negligible loss of test room atmosphere during the test, as the test room volume is over 9,800 liters.

The sorbent tubes were connected in sets of three, in parallel, to a vacuum pump outside the test room. They were mounted in a manifold that allowed each set to be selected in sequence from outside the room. Sorbent tubes are used to measure dosage, i.e., concentration integrated over time, so they can be compared with the integrated MINICAMS® concentration data. The sorbent tube vacuum pump draws approximately 800 ml/minute, and this loss of test room atmosphere was also considered negligible.

2.5. Test Room Layout

Figure 3. Test Room, Door End View, and Figure 5. Test Room, Three-Quarter View, show the outside configuration of the test room. The control console is shown alongside the test room. The sorbent tube sampler pump is visible in Figure 3, on the floor, between the test room and the control console. The main MINICAMS® sampler line appears in Figure 4, exiting near the top of the test room and routed overhead to the instrument. This picture also shows the electric power switches, mounted on the side of the test room.

Figure 4 and Figure 6 show aspects of the interior of the test room. The ducted fans and the sorbent tube manifold can be seen in Figure 4. Also visible is the central MINICAMS® sample line inlet. The temperature and humidity sensors, the sorbent tube manifold, and one of the filter units appear in Figure 6. The cool-air humidifier is also partially visible in this view. Both interior views show the glossy epoxy coating on the interior walls. All electric power and controller wires are fully exposed inside the test room, but the boxes and pass-throughs to which they connect are all sealed and caulked to minimize vapor leakage.

Figure 1. Test Room Drawing, Doorway View

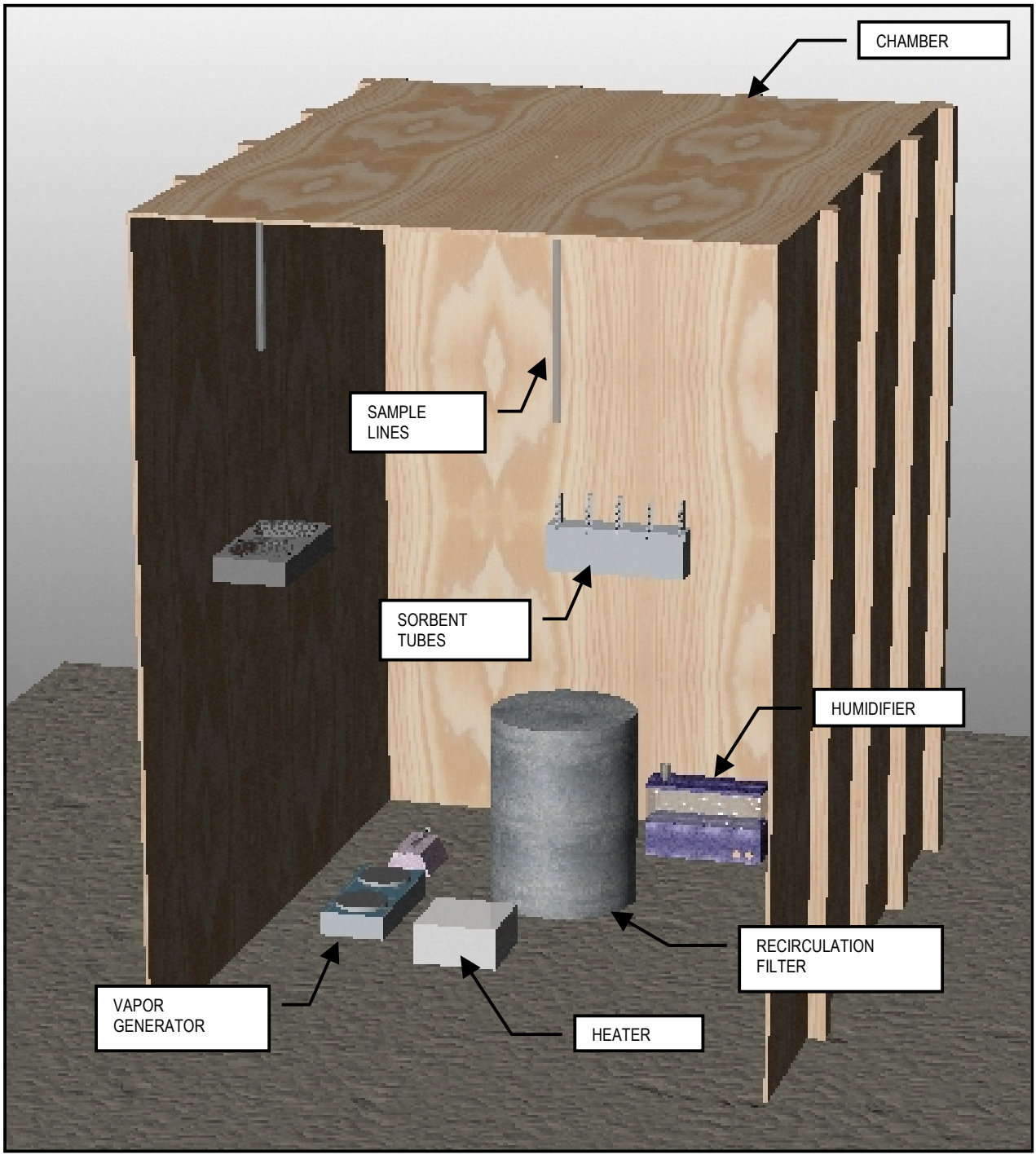

Figure 2. Test Room Drawing, Cutaway View

Figure 3. Test Room, Door End View

Figure 5. Test Room, Three-Quarter View

Figure 4. Test Room, Showing Interior

Figure 6. Test Room, Showing Interior

3. TEST PROCEDURE

3.1. Pretest Test Room Setup Procedures

a. With the test room MeS concentration, measured with the MINICAMS®, below 0.020 mg/m^3, enter the test room, close the door, and load the 15 Tenax sorbent tubes into the sorbent tube sampler manifold.

b. Select each set of sorbent tubes in turn and use a flow meter to measure the airflow through each tube with the sorbent tube sampler vacuum pump running.

c. After measuring and recording the flow rates through each set of tubes place a cap on their exposed end.

d. Leave the power to the Tenax sampler manifold and pump on, but set the manifold to the 0 position (no tubes sampling).

e. Draw 1.8 µl of MeS into a 10-µl syringe, then draw the plunger back to the 5 µl position, to draw an 3.2-µl air bubble in the syringe.

f. Place the syringe in the syringe pump such that the end of the needle is pressed against the surface of a cast iron frying pan on a 1,100 watt heating element.

g. Position the plunger of the syringe pump such that 43 seconds of operation are required to expel the 1.8 µl held within the syringe.

h. Remove the caps from the ends of the Tenax tubes, exit the room and seal the door closed.

3.2. Detailed Test Operating Procedures

With the test room sealed, the mixing fan running, the temperature and humidity stabilized at 90^o F and 35% relative humidity, begin the test. {Time references are to the elapsed time).

a. Set the computer to automatically start logging MINICAMS®, temperature and relative humidity data at a predetermined time on the computer clock. At the auto start time manually toggle the power to the Tenax sampler manifold (this begins airflow to sampler set 1).

b. At 15 minutes turn on the hot plate.

c. At 20 minutes toggle the power to the Tenax sampler manifold (this stops the airflow to sampler set 1 and starts set 2), and turn on the syringe pump for 44 seconds to dispense the 1.8 :l sample of MeS.

d. At 25 minutes turn off the hotplate.

e. At 40 minutes (later changed to 45 minutes to assure complete volatilization of MeS) toggle the power to the Tenax sampler manifold (this stops the airflow to sampler set 2 and starts set 3), turn on the power to the filter unit, if one is being evaluated.

f. At 60 (later changed to 65) minutes toggle the power to the Tenax sampler manifold (this stops the airflow to sampler set 3 and starts set 4).

g. At 80 (later changed to 85) minutes toggle the power to the Tenax sampler (this stops the airflow to sampler set 4 and starts set 5).

h. At 100 (later changed to 105) minutes toggle the power to the Tenax sampler manifold (this stops the airflow to all sample tubes), and turn off Tenax sampler vacuum pump. After the next concentration measurement by the MINICAMS® discontinue the logging of data.

i. Enter the test room, close the door, remove the Tenax tubes from the sampler, and seal their ends with the Teflon caps.

j. Clear down the room by operating one or two of the test filter units simultaneously. Monitor the room concentration with the MINICAMS®.

4. TEST RESULTS

4.1. Initial Inspection and Measurements

4.1.1. Objective

To record the essential details that characterize the test items.

4.1.2. Test Item Descriptions

The filter units tested are identified in Table 1. Pictures of each recirculation unit tested are in Appendix B.

Table 1. Recirculating Filter Systems Tested

Manufacturer	Model No.	Serial No.	Dimensions, in.	Wt., lb.	Power, W*	Approx. Price, $
Hunter Fan Co.	30375	VO902539	9½ × 20 × 17½	14½	220	195
Bionaire, Inc.	LC-1060	XSL0274	15½ × 7½ × 12½	7½	75	215
Aller Air	4000	12182	18 dia. × 18 H	35	134	300
Honeywell	63500	F113A	18 dia. × 17 H	15½	165	225
Holmes	HAP 240	DHX 10-99	11½ × 10 × 6½	6	45	90
Honeywell	11200	F112C	16 dia. × 10 H	17	200	255
Austin	HM 400	00010872	14½ × 14½ × 20½	42	115	395
Electrocorp	224C4	8007	10 × 10 × 12	16	250	295
Dust Free Inc.	None	022456	15½ × 12½ × 13	20½	n/a	399

* According to motor specification plate.

4.2. Vapor Concentration Decay Baseline

4.2.1. Objective

To measure and record the initial vapor concentration and the rate at which it declines in the test room when no filter unit is used.

4.2.2. Summary of Baseline Test Results

Detailed baseline data is contained in Appendix A.

The peak MeS concentrations measured in the test room in the three baseline trials ranged from 0.130 to 0.138 mg/m^3. After 60 minutes, they ranged from 0.092 to 0.100. The baseline concentration decay, due to the imperfect sealing of the structure and the natural absorption of vapors by the materials in the test room, was about 10% each 20 minutes.

4.3. Filtration System Effectiveness

4.3.1. Objective

To measure the effectiveness of the test items for reducing the vapor concentration in the test room.

4.3.2. Summary of Filter Unit System Test Results

The vapor concentrations in the test room measured with the MINICAMS® and the vapor dosages collected by sorbent tubes during the tests of each filter unit are presented in Appendix A.

The MINICAMS® vapor concentration data, averaged and normalized to compensate for the variations in initial concentration (by calculating the fractional concentration vs. time), are illustrated in Figure 7 and tabulated in Appendix A, Table A- 24.

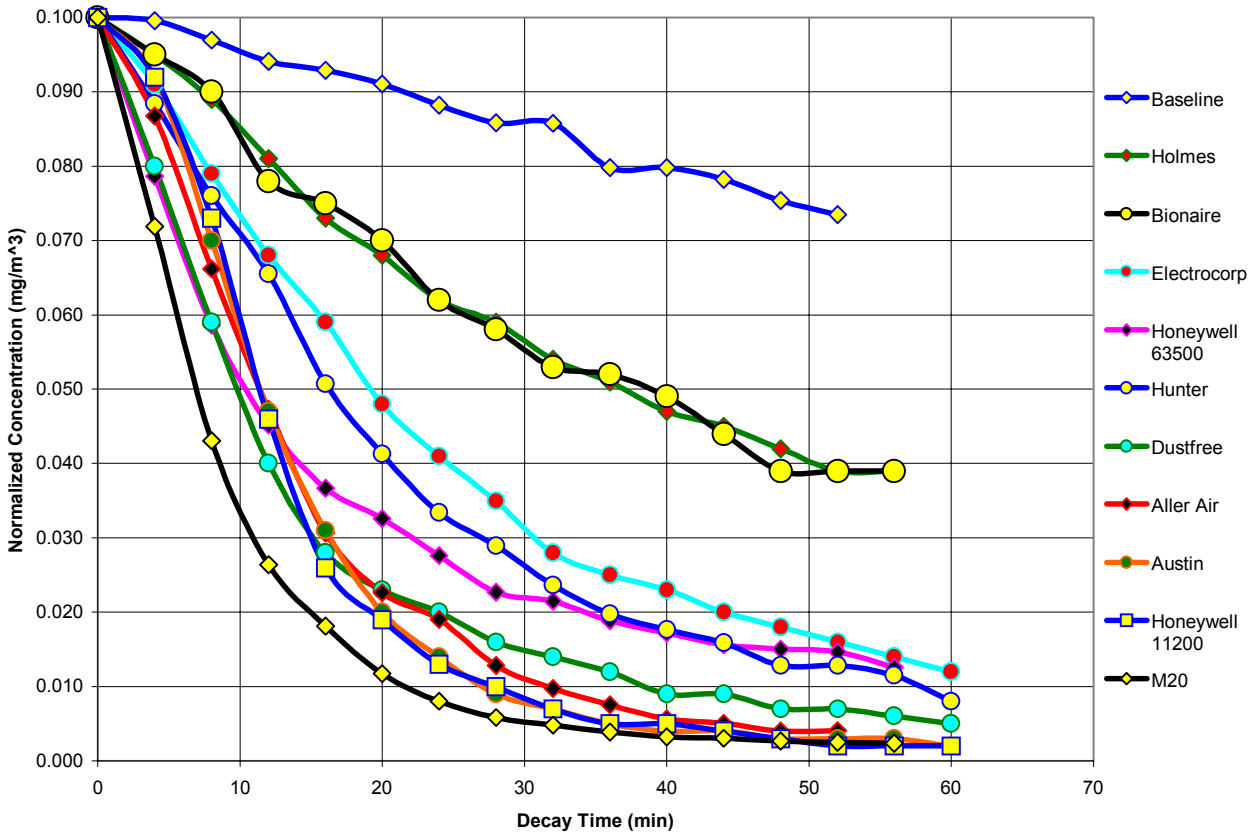

Figure 7. Normalized Average Concentration vs. Time, MINICAMS® Data

The average logarithmic reduction in MeS vapor concentration (MINICAMS® data) for each filter unit design was also calculated from the MINICAMS® data. It is illustrated in Figure 8, and tabulated in Appendix A, Table A- 25. Logarithmic reduction is often used to express the effectiveness of filtration systems. It is the negative logarithm (base 10) of the vapor concentration divided by the initial vapor concentration. Hence, a "one log" reduction means the vapor concentration has been reduced to 10% of its initial value, a "two log" reduction means it has been reduced to 1%, and "three log" to 0.1%.

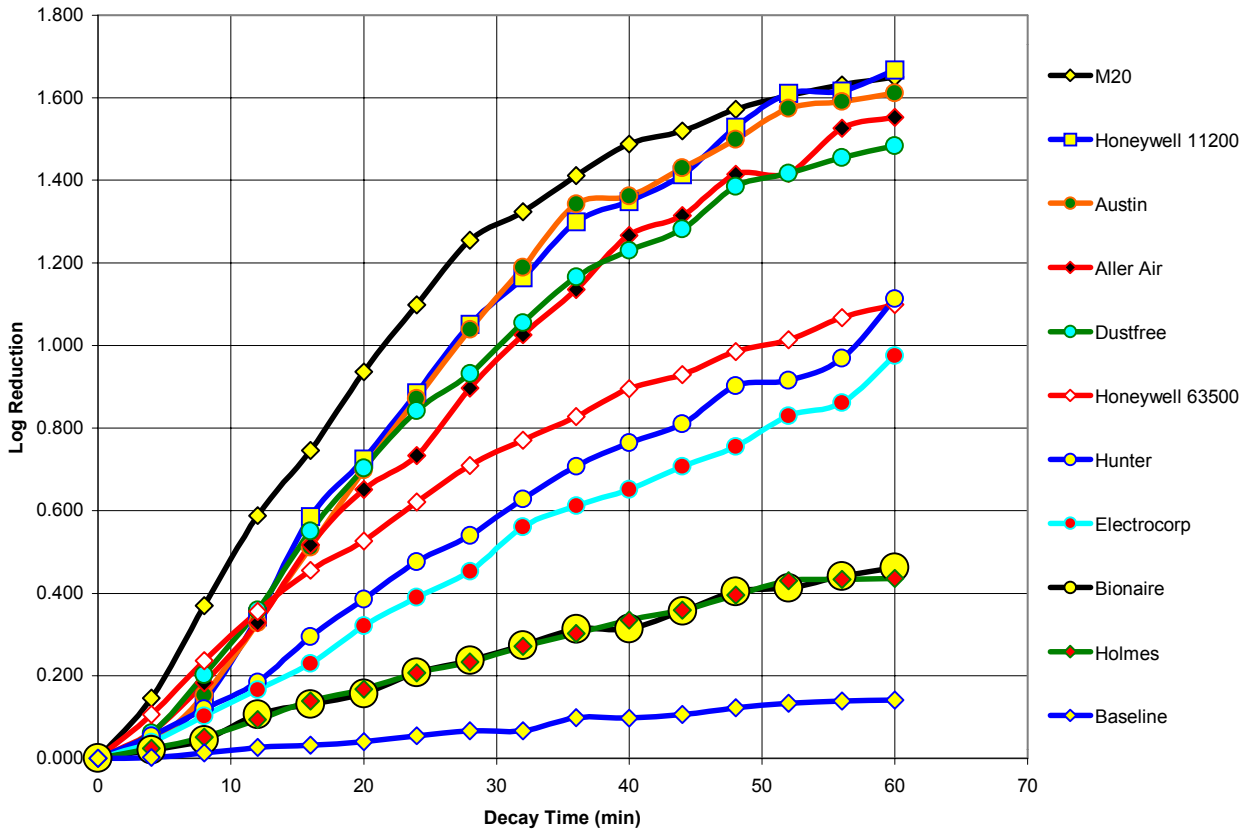

Figure 8. Logarithmic Reduction of Vapor Concentration

The integral of concentration over time, called dosage, is often used in assessments of aerosol and vapor hazards. The normalized dosages (for an initial concentration of 0.1 mg/m^3), within the test room were calculated from the MINICAMS® test data. They are illustrated in Figure 9 and tabulated in Appendix A, Table A- 26.

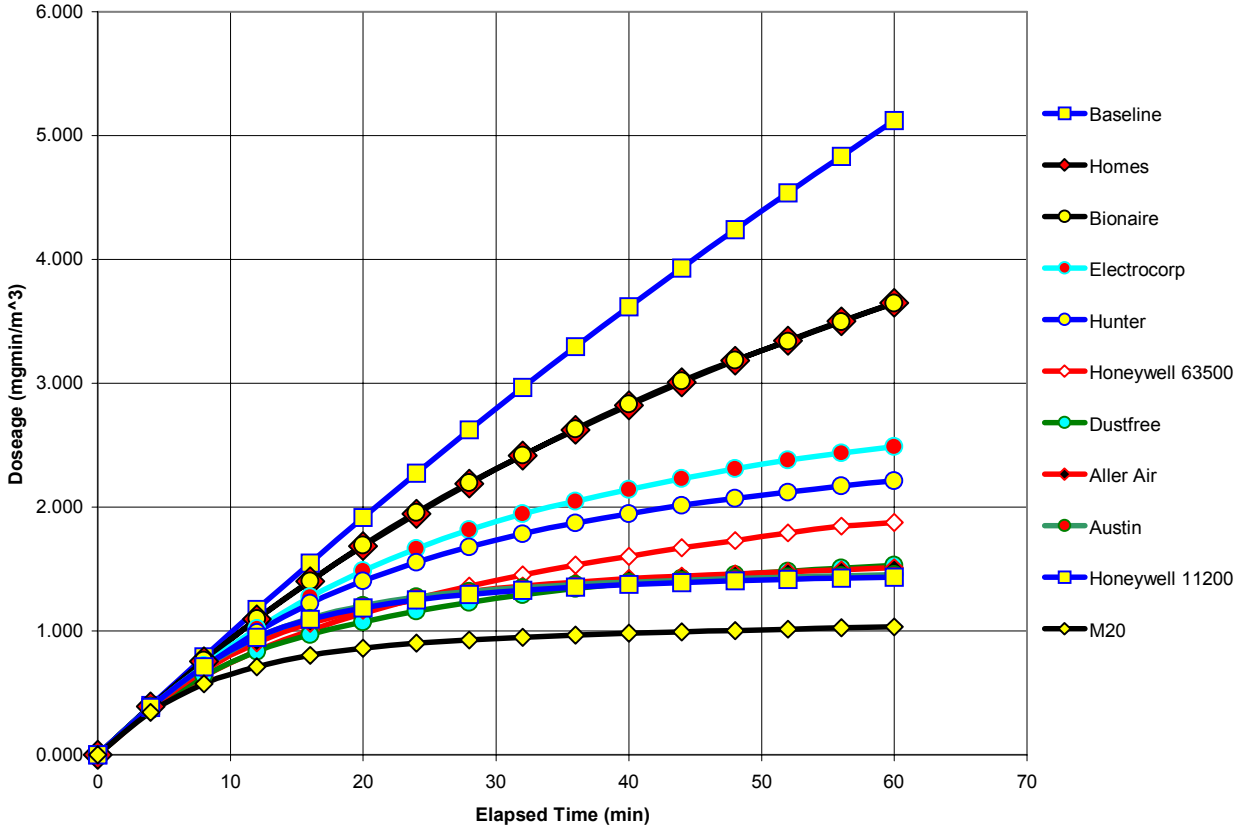

Figure 9. Normalized Dosages Inside Test Room

5. ANALYSIS OF RESULTS

5.1. Discussion

The sorbent tube data, presented in Table A-23, Appendix A, correlates well with the MINICAMS® data.

The dosage calculations are informative, but it should be noted that this test was designed to begin with the dosage at a peak value before the filters were turned on, so that the effectiveness in reducing existing vapor concentrations could be compared. In actual practice, it is hoped that the filters would be turned on before the vapor concentration began to rise in the shelter room. Then, if the vapor infiltration rate were as low as the baseline decay rate observed in this test, the filters would likely prevent the concentration from rising to the peak levels selected for this test.

This test was not designed to assess the capacity of the filters, i.e., the total amount of contaminant vapor they could remove before it would be necessary to replace the filter media. Examination of the units revealed that the most effective designs contained carbon beds large enough to

remove over ten thousand times as much MeS as was used in this test.

The initial concentration of MeS measured during the M20 filter test was lower than that measured during the trials of the other filters, but the M20 nevertheless reduced the concentration most effectively. The M20 filter unit was tested with a previously-used filter (no new replacement filter was available).

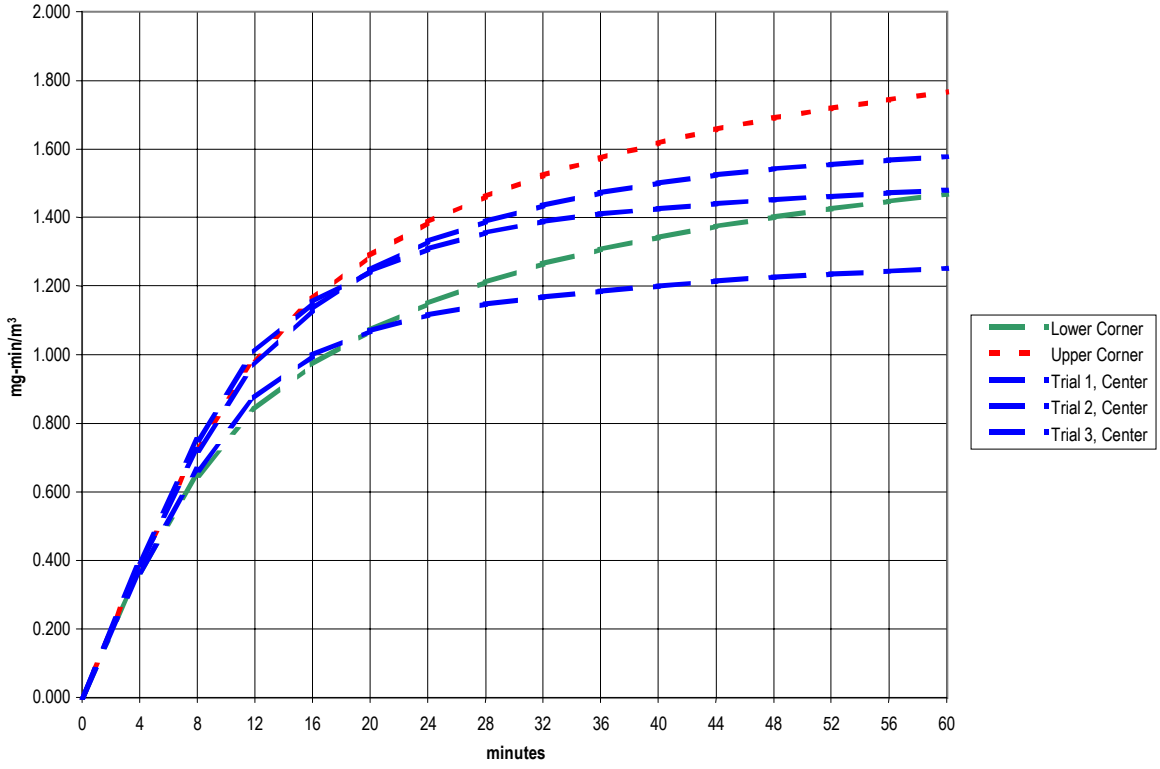

Figure 10. Comparison of Alternate Filter Unit Locations

The single trials run with the Honeywell 11200 in alternate locations (see Appendix A) are compared to the three trials with the filter unit in its initial location (center of the floor) in Figure 10. It is apparent that the location of the filter unit in the room affected its reduction of simulant vapor concentration slightly in these tests. This is likely the result of the air circulation characteristics and the sampling inlet locations within the test room. It would not be expected that the location would have large effects because the filter units tested had flow rates ranging from 250 to 400 cfm, and the test room volume was only about 350 ft^3. This means that the air volume passing through the filter unit each minute was about equal to the entire volume of the test room.

The effectiveness of the filter units as tested is summarized in Table 2.

Table 2. Filter Unit Effectiveness

Filter Unit	Price, $	Weight, lbs.	Effective-ness*	Observations and Remarks
Honeywell 11200	255	17	1.61	Easy to replace filter units. Comes with handle attached for transportability. Manual fan speed control.
Austin HM 400	395	42	1.57	Filter change requires the use of a screwdriver. Comes with wheels attached to roll the unit around. Manual fan speed control.
Aller Air 4000	300	35	1.42	Filter Change requires the use of a screwdriver. Comes with wheels attached to roll the unit around. Manual fan speed control.
Dust Free	399	20 ½	1.42	Easy to replace filter units. Comes with handle attached for transportability. Possibility of replacing media in the wrong order. Manual fan speed control.
Honeywell 63500	225	15 ½	1.01	Easy to replace filter units. Comes with handle attached for transportability. Manual fan speed control.
Hunter 30375	195	14 ½	0.92	Easy to replace filter units. Electronic fan speed control.
Electrocorp 224C4	295	16	0.83	Easy to replace filter units. Manual fan speed control.
Holmes HAP 240	90	6	0.43	Easy to replace filter units. Manual fan speed control.
Bionaire LC-1060	215	7 ½	0.41	Easy to replace filter units. Manual fan speed control.

*Logarithmic Reduction of Vapor Concentration at 52 minutes.

5.2. Conclusions

a. All the filter units tested significantly reduced the MeS concentration inside the test room. Of the commercial filters, the Honeywell 11200, the Austin HM 400, the AllerAir 4000, and the Dust Free removed the simulant vapor from the air most effectively.

b. The most effective of the filter units were able to reduce the MeS vapor concentration in the room by 90% (a "one-log" reduction) within 35 minutes.

c. The expected one-hour dosage inside the test room, 5.0 mg·min/m^3 with no filter, was reduced to 1.5 mg·min/m^3 or less by the most effective filter units.

d. Changing the location of the filter unit within the test room will change its effectiveness by a small but noticeable amount. This may be an artifact of the room and sample line geometry, but the data suggests that the filter unit should be located on the floor.

e. Operational and maintenance characteristics of the filters, i.e., controls, filter change procedures, adjustments, etc., were not so different among any of the filter units tested to be discriminating factors under the circumstances of this test.

APPENDIX A.
Detailed Test Data

Table A- 1. Baseline MINICAMS® Test Data

Date	Time	Elapsed Time, minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
02-Feb-00	14:03:04	3	0.033	90.2	35.9
	14:07:04	7	0.030	89.3	36.7
	14:11:04	11	0.030	89.5	36.9
	14:15:04	15	0.032	90.1	36.0
	14:19:04	19	0.033	90.3	35.9
	14:23:04	23	0.031	89.8	35.9
	14:27:04	27	0.059	89.9	36.0
	14:31:04	31	0.112	89.9	35.9
	14:35:04	35	0.133	90.5	34.9
	14:39:04	39	0.133	89.9	36.0
	14:43:04	43	0.132	89.6	35.9
	14:47:04	47	0.128	90.3	35.9
	14:51:04	51	0.132	90.2	35.9
	14:55:04	55	0.127	89.5	36.0
	14:59:04	59	0.119	90.0	35.9
	15:03:04	63	0.119	90.3	35.9
	15:07:04	67	0.118	89.5	36.0
	15:11:04	71	0.109	89.6	35.9
	15:15:04	75	0.112	90.2	35.9
	15:19:04	79	0.109	90.2	36.0
	15:23:04	83	0.099	89.4	35.9
	15:27:04	87	0.100	89.7	36.9
	15:31:04	91	0.098	90.3	35.9
	15:35:04	95	0.095	90.0	35.9
	15:39:04	99	0.094	89.5	36.9
07-Feb-00	13:16:59	2	0.010	89.8	37.8
	13:20:59	6	0.010	90.3	36.9
	13:24:59	10	0.013	90.6	36.9
	13:28:59	14	0.012	90.5	36.0
	13:32:59	18	0.012	90.1	35.9
	13:36:59	22	0.015	90.4	35.9
	13:40:59	26	0.047	90.5	36.0
	13:44:59	30	0.104	90.7	35.9
	13:48:59	34	0.126	90.0	35.9
	13:52:59	38	0.138	89.9	36.9
	13:56:59	42	0.138	89.9	36.9
	14:00:59	46	0.135	90.0	35.9
	14:04:59	50	0.132	89.9	35.9
	14:08:59	54	0.133	90.0	36.0
	14:12:59	58	0.129	90.0	35.9
	14:16:59	62	0.124	89.9	35.9

Date	Time	Elapsed Time, minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:20:59	66	0.122	89.8	37.0
	14:24:59	70	0.120	90.2	35.9
	14:28:59	74	0.113	90.6	35.9
	14:32:59	78	0.116	90.5	36.0
	14:36:59	82	0.107	90.0	35.9
	14:40:59	86	0.108	89.7	35.9
	14:44:59	90	0.108	90.2	35.9
	14:48:59	94	0.101	90.6	36.0
	14:52:59	98	0.097	90.2	35.9
	14:56:59	102	0.100	89.9	35.9
23-Feb-00	6:33:00	3	0.010	88.7	37.5
	6:37:00	7	0.010	88.8	36.3
	6:41:00	11	0.010	89.6	35.2
	6:45:00	15	0.010	88.7	36.9
	6:49:00	19	0.010	89.5	36.9
	6:53:00	23	0.010	89.6	35.2
	6:57:00	27	0.038	91.4	35.7
	7:01:00	31	0.094	92.8	36.3
	7:05:00	35	0.122	90.1	39.9
	7:09:00	39	0.124	90.3	38.8
	7:13:00	43	0.130	89.5	41.1
	7:17:00	47	0.128	90.2	39.9
	7:21:00	51	0.125	90.2	38.7
	7:25:00	55	0.120	90.2	38.7
	7:29:00	59	0.120	90.2	38.7
	7:33:00	63	0.120	88.9	37.6
	7:37:00	67	0.116	88.9	37.5
	7:41:00	71	0.117	89.0	38.2
	7:45:00	75	0.110	89.6	37.6
	7:49:00	79	0.111	88.8	36.9
	7:53:00	83	0.106	88.3	37.6
	7:57:00	87	0.105	88.2	36.9
	8:01:00	91	0.100	89.6	35.2
	8:05:00	95	0.099	90.2	36.9
	8:09:00	99	0.097	89.5	36.3

Table A- 2. Baseline Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
2-Feb-00	1133.97	835	0-20	0.068	20	
	1193.78	860	0-20	0.069	20	
	1108.97	800	0-20	0.069	20	0.069
	4110.90	890	20-40	0.231	40	
	4186.52	850	20-40	0.246	40	
	3629.13	740	20-40	0.245	40	0.155
	3208.94	840	40-60	0.191	60	

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	3231.14	850	40-60	0.190	60	
	3105.67	825	40-60	0.188	60	0.190
	2844.80	860	60-80	0.165	80	
	2569.12	800	60-80	0.161	80	
	2759.95	850	60-80	0.162	80	0.163
	2265.15	750	80-100	0.151	100	
	2523.37	870	80-100	0.145	100	
	2317.39	840	80-100	0.138	100	0.145
7-Feb-00	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
	3675.61	910	20-40	0.202	40	
	3649.88	875	20-40	0.209	40	
	3183.92	750	20-40	0.212	40	0.208
	3036.49	860	40-60	0.177	60	
	2954.44	930	40-60	0.159	60	
	3139.27	890	40-60	0.176	60	0.171
	8522.28	840	60-80	0.507	80	
	8610.30	850	60-80	0.506	80	
	8625.31	860	60-80	0.501	80	0.505**
	2163.90	840	80-100	0.129	100	
	2218.01	875	80-100	0.127	100	
	2154.82	875	80-100	0.123	100	0.126
23-Feb-00	475.99	910	0-20	0.026	20	
	533.44	940	0-20	0.028	20	
	510.29	920	0-20	0.028	20	0.027
	3715.01	910	20-40	0.204	40	
	3661.24	930	20-40	0.197	40	
	3907.30	910	20-40	0.215	40	0.116
	2795.73	940	40-60	0.149	60	
	2974.81	825	40-60	0.180	60	
	2890.67	900	40-60	0.161	60	0.163
	2244.81	910	60-80	0.123	80	
	2300.54	930	60-80	0.124	80	
	2488.06	940	60-80	0.132	80	0.126
	2155.38	910	80-100	0.118	100	
	2205.34	925	80-100	0.119	100	
	1858.81	800	80-100	0.116	100	0.118

*Note that the sorbent tube data from the 0-20 minute interval for the 7 Feb 00 Baseline was not taken because insufficient sorbent tubes were available at the time the test was conducted.

**Valve stuck? Data not used in averages.

Table A- 3. BionAire LC1060 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
3-Feb-00*	10:40	0	0.016	90	35
	11:00	20	0.020	90	35
	11:20	40	0.134	90	35
	11:26	46	0.129	90	35
	11:40	60	0.099	90	35
	12:00	80	0.077	90	35
	12:20	100	0.056	90	35
25-Feb-00	14:21:00	1	0.002	88.0	49.0
	14:25:00	5	0.002	89.4	47.8
	14:29:00	9	0.002	92.2	42.9
	14:33:00	13	0.002	90.0	47.1
	14:37:00	17	0.002	89.3	48.4
	14:41:00	21	0.003	94.2	42.3
	14:45:00	25	0.004	92.3	44.2
	14:49:00	29	0.060	93.7	44.2
	14:53:00	33	0.101	95.1	44.8
	14:57:00	37	0.118	94.9	47.1
	15:01:00	41	0.113	93.5	46.5
	15:05:00	45	0.117	92.8	47.1
	15:09:00	49	0.112	91.4	49.6
	15:09:00	49	0.112	91.4	49.6
	15:13:00	53	0.108	90.7	49.6
	15:17:00	57	0.103	90.7	50.8
	15:21:00	61	0.086	88.7	49.6
	15:25:00	65	0.083	94.9	41.1
	15:29:00	69	0.080	90.1	45.9
	15:33:00	73	0.071	90.1	48.4
	15:37:00	77	0.063	92.2	45.3
	15:41:00	81	0.058	89.4	47.8
	15:45:00	85	0.051	92.2	44.1
	15:49:00	89	0.053	91.5	45.3
	15:53:00	93	0.047	90.1	46.6
	15:57:00	97	0.042	90.0	46.5
	16:01:00	101	0.041	92.1	43.5
	16:05:00	105	0.038	89.3	46.5
25-Feb-00	16:09:00	109	0.035	93.5	40.4
10-Apr-00	15:02:00	2	0.008	88.1	39.3
	15:06:00	6	0.013	90.8	36.3
	15:10:00	10	0.016	90.8	35.7
	15:14:00	14	0.017	89.4	41.7
	15:18:00	18	0.017	91.5	39.9
	15:22:00	22	0.020	92.9	36.9
	15:26:00	26	0.023	92.3	37.5

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	15:30:00	30	0.069	94.3	36.9
	15:34:00	34	0.130	96.4	37.5
	15:38:00	38	0.152	95.1	36.9
	15:42:00	42	0.161	95.8	38.1
	15:46:00	46	0.165	94.4	38.7
	15:50:00	50	0.167	93.1	40.0
	15:54:00	54	0.157	93.8	41.2
	15:58:00	58	0.148	92.4	41.2
	16:02:00	62	0.133	92.2	41.7
	16:06:00	66	0.124	90.1	41.7
	16:10:00	70	0.113	90.1	42.3
	16:14:00	74	0.102	90.1	40.5
	16:18:00	78	0.099	90.8	41.7
	16:22:00	82	0.091	90.8	40.5
	16:26:00	86	0.086	90.2	38.1
	16:30:00	90	0.083	90.2	39.3
	16:34:00	94	0.077	91.6	36.3
	16:38:00	98	0.069	89.4	44.1
	16:42:00	102	0.069	92.2	39.3
	16:46:00	106	0.065	90.1	43.5

*Automatic Data Recorder Failed. Selected Values Read From Screen.

Table A- 4. BionAire LC1060 Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
3-Feb-00	1046.86	840	0-20	0.062	20	
	1085.21	860	0-20	0.063	20	
	1079.69	760	0-20	0.071	20	0.065
	3778.50	850	20-45	0.222	45	
	3872.33	840	20-45	0.230	45	
	3476.34	740	20-45	0.235	45	0.229
	2679.12	890	45-65	0.151	65	
	2487.15	840	45-65	0.148	65	
	2262.54	780	45-65	0.145	65	0.148
	1695.65	850	65-85	0.100	85	
	1468.75	875	65-85	0.084	85	
	1783.24	890	65-85	0.100	85	0.095
	1355.55	910	85-105	0.074	105	
	1438.84	900	85-105	0.080	105	
	1501.35	890	85-105	0.084	105	0.080
25 Feb 00	371.01	925	0-20	0.020	20	
	347.01	940	0-20	0.018	20	
	302.26	860	0-20	0.018	20	0.019
	4282.94	835	20-45	0.256	45	
	3658.06	740	20-45	0.247	45	

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	4734.67	850	20-45	0.279	45	0.261
	2044.82	850	45-65	0.120	65	
	1721.22	660	45-65	0.130	65	
	1888.48	810	45-65	0.117	65	0.122
	1143.99	900	65-85	0.064	85	
	1147.47	900	65-85	0.064	85	
	1276.65	880	65-85	0.073	85	0.067
	895.24	830	85-105	0.054	105	
	965.25	900	85-105	0.054	105	
	795.05	730	85-105	0.054	105	0.054
10-Apr-00	788.48	925	0-20	0.043	20	
	775.90	940	0-20	0.041	20	
	818.04	900	0-20	0.045	20	0.043
	6299.31	875	20-45	0.360	45	
	6540.07	925	20-45	0.354	45	
	6662.16	925	20-45	0.360	45	0.358
	3149.96	910	45-65	0.173	65	
	3123.07	925	45-65	0.169	65	
	2824.61	940	45-65	0.150	65	0.164
	441.50	225	65-85	0.098	85	
	1720.58	890	65-85	0.097	85	
	1497.82	800	65-85	0.094	85	0.096
	1087.29	750	85-105	0.072	105	
	1319.14	940	85-105	0.070	105	
	1277.49	890	85-105	0.072	105	0.071

Table A- 5. Aller Air 4000 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
3-Feb-00	13:41:59	2	0.024	90.6	35.9
	13:45:59	6	0.024	90.4	35.9
	13:49:59	10	0.025	89.7	36.9
	13:53:59	14	0.027	90.3	35.9
	13:57:59	18	0.029	90.6	34.9
	14:01:59	22	0.028	90.8	35.9
	14:05:59	26	0.069	90.8	35.2
	14:09:59	30	0.131	90.5	35.9
	14:13:59	34	0.153	90.1	35.9
	14:17:59	38	0.155	90.3	36.0
	14:21:59	42	0.165	90.5	34.9
3-Feb-00	14:25:59	46	0.151	90.2	35.9
	14:29:59	50	0.118	90.0	37.0
	14:33:59	54	0.083	89.8	36.9
	14:37:59	58	0.063	90.0	35.9
	14:41:59	62	0.044	90.6	35.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:45:59	66	0.034	90.6	36.0
	14:49:59	70	0.027	90.4	35.9
	14:53:59	74	0.022	90.1	35.9
	14:57:59	78	0.019	89.8	36.0
	15:01:59	82	0.015	90.1	35.9
	15:05:59	86	0.012	90.6	35.9
	15:09:59	90	0.011	90.6	36.0
	15:13:59	94	0.009	90.4	35.9
3-Feb-00	15:17:59	98	0.009	90.2	36.0
28-Feb-00	10:22:02	2	0.004	84.1	46.6
	10:26:02	6	0.011	86.8	44.8
	10:30:02	10	0.003	89.5	39.9
	10:34:02	14	0.002	90.8	39.3
	10:38:02	18	0.008	87.3	43.5
	10:42:02	22	0.003	91.5	37.5
	10:46:02	26	0.045	91.5	39.3
	10:50:02	30	0.103	92.8	39.3
	10:54:02	34	0.120	92.8	41.1
	10:58:02	38	0.126	90.8	42.3
	11:02:02	42	0.123	89.4	43.5
	11:06:02	46	0.126	92.8	40.5
	11:10:02	50	0.117	90.8	39.9
	11:14:02	54	0.097	90.1	39.9
	11:18:02	58	0.068	89.4	37.5
	11:22:02	62	0.045	90.0	36.8
	11:26:02	66	0.034	90.7	36.2
	11:30:02	70	0.032	88.0	38.0
	11:34:02	74	0.017	90.8	33.9
	11:38:02	78	0.013	87.3	42.3
	11:42:02	82	0.009	91.5	38.1
	11:46:02	86	0.006	89.4	39.3
	11:50:02	90	0.006	90.1	38.1
	11:54:02	94	0.004	90.1	37.5
	11:58:02	98	0.004	88.0	39.3
	12:02:02	102	0.004	92.2	36.3
	12:06:02	106	0.003	89.4	38.7
	12:10:02	110	0.003	90.7	38.0
10-Mar-00	14:00:00	0	0.001	90.0	38.0
	14:04:00	4	0.002	89.4	38.1
	14:08:00	8	0.002	93.5	33.3
	14:12:00	12	0.003	91.0	42.4
	14:16:00	16	0.003	91.0	43.0
	14:20:00	20	0.003	93.0	39.3
	14:24:00	24	0.003	93.5	41.0
	14:28:00	28	0.027	94.2	39.8
	14:32:01	32	0.074	96.3	39.8

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:36:00	36	0.094	95.6	39.2
	14:40:01	40	0.101	96.3	39.8
	14:44:01	44	0.101	95.6	41.0
	14:48:00	48	0.101	94.3	39.9
	14:52:01	52	0.101	94.3	39.3
	14:56:01	56	0.091	94.3	38.7
	15:00:00	60	0.068	92.8	38.6
	15:04:01	64	0.047	92.8	38.6
	15:08:01	68	0.028	92.1	38.6
	15:12:01	72	0.019	91.4	38.6
	15:16:01	76	0.014	91.4	38.6
	15:20:01	80	0.010	91.4	38.6
	15:24:01	84	0.007	90.2	38.7
	15:28:01	88	0.006	90.2	38.1
	15:32:01	92	0.004	90.2	38.1
	15:36:01	96	0.004	90.2	38.7
	15:40:01	100	0.003	92.3	35.1
	15:44:01	104	0.003	90.9	39.3
	15:48:01	108	0.003	90.6	39.8

Table A- 6. Aller Air 4000 Sorbent Tube Test Data

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
3-Feb-00	848.63	800	0-20	0.0530	20	
	884.07	810	0-20	0.0546	20	
	858.00	840	0-20	0.0511	20	0.0529
	4134.18	835	20-40	0.2476	40	
	4194.29	825	20-40	0.2542	40	
	3609.52	725	20-40	0.2489	40	0.2502
	1030.69	840	40-60	0.0614	60	
	948.24	840	40-60	0.0564	60	
	928.80	810	40-60	0.0573	60	0.0584
	262.01	860	60-80	0.0152	80	
	249.41	825	60-80	0.0151	80	
	265.70	840	60-80	0.0158	80	0.0154
	189.06	840	80-100	0.0113	100	
	188.54	860	80-100	0.0110	100	
	186.73	825	80-100	0.0113	100	0.0112
28 Feb 00	462.49	910	0-20	0.025	20	
	453.98	895	0-20	0.025	20	
	436.94	860	0-20	0.025	20	0.025
	4794.16	870	20-45	0.276	45	
	5014.52	890	20-45	0.282	45	
	4627.96	840	20-45	0.275	45	0.278
	712.13	825	45-65	0.043	65	

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	730.71	860	45-65	0.042	65	
	675.75	900	45-65	0.038	65	0.041
	175.64	900	65-85	0.010	85	
	195.19	910	65-85	0.011	85	
	155.56	900	65-85	0.009	85	0.010
	110.13	890	85-105	0.006	105	
	124.96	875	85-105	0.007	105	
	102.09	760	85-105	0.007	105	0.007
10-Mar-00	343.42	910	0-20	0.019	20	
	341.26	895	0-20	0.019	20	
	326.96	860	0-20	0.019	20	0.019
	4397.33	870	20-45	0.253	45	
	4380.29	890	20-45	0.246	45	
	4276.40	840	20-45	0.255	45	0.251
	708.67	825	45-65	0.043	65	
	715.89	860	45-65	0.042	65	
	686.67	900	45-65	0.038	65	0.041
	135.56	900	65-85	0.008	85	
	135.32	910	65-85	0.007	85	
	115.26	900	65-85	0.006	85	0.007
	79.38	890	85-105	0.004	105	
	78.61	875	85-105	0.004	105	
	108.46	760	85-105	0.007	105	0.005

Table A- 7. Honeywell 63500 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
4-Feb-00	10:48:03	3	0.004	89.7	37.0
	10:52:03	7	0.006	90.3	36.3
	10:56:03	11	0.005	90.5	35.9
	11:00:03	15	0.006	90.0	36.0
	11:04:03	19	0.007	90.0	36.9
	11:08:03	23	0.009	90.9	35.9
	11:12:03	27	0.036	91.2	35.9
	11:16:03	31	0.088	91.0	35.9
	11:20:03	35	0.112	90.2	37.0
	11:24:03	39	0.114	90.1	35.9
	11:28:03	43	0.110	90.0	36.9
	11:32:03	47	0.104	90.2	36.0
	11:36:03	51	0.085	90.1	35.9
	11:40:03	55	0.071	89.9	35.9
	11:44:03	59	0.062	90.0	35.9
	11:48:03	63	0.055	90.0	36.0
	11:52:03	67	0.055	90.2	35.9
	11:56:03	71	0.051	90.4	35.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	12:00:03	75	0.043	90.3	36.0
	12:04:03	79	0.044	90.1	35.9
	12:08:03	83	0.039	90.1	35.9
	12:12:03	87	0.037	90.2	36.0
	12:16:03	91	0.033	90.4	35.9
	12:20:03	95	0.034	90.5	35.9
	12:24:03	99	0.034	89.9	35.9
	12:28:03	103	0.029	90.0	35.9
3-Mar-00	11:26:00	1	0.001	86.6	37.5
	11:30:00	5	0.001	86.0	39.3
	11:34:00	9	0.001	88.7	35.7
	11:38:00	13	0.001	90.3	34.5
	11:42:00	17	0.001	85.5	46.0
	11:46:00	21	0.001	90.3	41.8
	11:50:00	25	0.002	90.9	39.3
	11:54:00	29	0.050	90.2	42.3
	11:58:00	33	0.092	92.2	39.3
	12:02:00	37	0.104	89.6	43.0
	12:06:00	41	0.107	92.4	39.4
	12:10:00	45	0.114	90.3	40.0
	12:14:00	49	0.101	89.6	43.6
	12:18:00	53	0.087	90.3	40.5
	12:22:00	57	0.061	88.2	42.4
	12:26:00	61	0.040	90.2	39.3
	12:30:00	65	0.031	88.8	39.3
	12:34:00	69	0.023	88.8	39.3
	12:38:00	73	0.017	91.0	38.1
	12:42:00	77	0.013	88.9	39.3
	12:46:00	81	0.010	89.6	38.1
	12:50:00	85	0.008	90.9	36.9
	12:54:00	89	0.006	88.8	37.5
	12:58:00	93	0.005	89.5	37.5
	13:02:00	97	0.004	90.9	33.9
	13:06:00	101	0.004	88.1	39.3
	13:10:00	105	0.004	90.2	37.5
	13:14:00	109	0.003	89.5	37.5
	13:18:00	113	0.003	88.8	33.3
7-Apr-00	1:44:30	4	0.022	90.1	41.1
	1:48:30	8	0.027	90.1	41.1
	1:52:30	12	0.032	91.4	41.0
	1:56:30	16	0.033	91.4	41.7
	2:00:30	20	0.036	92.1	40.4
	2:04:30	24	0.042	93.5	38.6
	2:08:30	28	0.084	96.3	38.0
	2:12:30	32	0.152	99.8	36.8
	2:16:30	36	0.169	98.4	37.4

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m³	Temp., °F	Relative Humidity, Percent
	2:20:30	40	0.173	100.5	38.0
	2:24:30	44	0.170	99.8	38.0
	2:28:30	48	0.165	98.5	38.1
	2:32:30	52	0.168	95.7	38.7
	2:36:30	56	0.114	95.0	37.5
	2:40:30	60	0.079	94.9	37.4
	2:44:30	64	0.062	93.5	37.4
	2:48:30	68	0.045	92.8	37.4
	2:52:30	72	0.037	92.8	37.4
	2:56:30	76	0.028	92.8	38.0
	3:00:30	80	0.023	92.1	38.0
	3:04:30	84	0.020	92.3	37.5
	3:08:30	88	0.019	92.3	36.9
	3:12:30	92	0.016	91.7	37.5
	3:16:30	96	0.016	92.1	36.8
	3:20:30	100	0.013	92.1	36.2
	3:24:30	104	0.012	92.8	36.8
	3:28:30	108	0.010	92.9	36.9
	3:32:30	112	0.010	92.2	36.9

Table A- 8. Honeywell 63500 Sorbent Tube Test Data

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m³	Elapsed Time At End of Sample, minutes	Set Average, mg/m³
4-Feb-00	880.56	875	0-20	0.050	20	
	856.13	860	0-20	0.050	20	
	804.59	850	0-20	0.047	20	0.049
	4419.96	850	20-45	0.260	45	
	4217.92	840	20-45	0.251	45	
	3673.90	740	20-45	0.248	45	0.253
	1926.73	875	45-65	0.110	65	
	1718.23	840	45-65	0.102	65	
	1838.26	890	45-65	0.103	65	0.105
	1223.94	910	65-85	0.067	85	
	1210.29	905	65-85	0.067	85	
	1072.57	900	65-85	0.060	85	0.065
	986.47	890	85-105	0.055	105	
	1222.11	940	85-105	0.065	105	
	790.01	740	85-105	0.053	105	0.058
3-Mar-00	312.10	900	0-20	0.017	20	
	306.79	860	0-20	0.018	20	
	278.43	825	0-20	0.017	20	0.017
	4709.70	860	20-45	0.274	45	
	4904.23	870	20-45	0.282	45	
	4781.20	840	20-45	0.285	45	0.280
	546.46	875	45-65	0.031	65	

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	327.38	640	45-65	0.026	65	
	514.14	870	45-65	0.030	65	0.029
	155.28	800	65-85	0.010	85	
	121.45	760	65-85	0.008	85	
	143.29	840	65-85	0.009	85	0.009
	131.19	890	85-105	0.007	105	
	120.66	900	85-105	0.007	105	
	128.77	860	85-105	0.007	105	0.007
7-Apr-00	1201.15	840	0-20	0.071	20	
	1280.11	935	0-20	0.068	20	
	1293.22	935	0-20	0.069	20	0.070
	8282.00	910	20-45	0.455	45	
	8622.41	940	20-45	0.459	45	
	8707.55	900	20-45	0.484	45	0.466
	908.64	935	45-65	0.049	65	
	903.33	925	45-65	0.049	65	
	917.88	940	45-65	0.049	65	0.049
	225.44	840	65-85	0.013	85	
	244.74	925	65-85	0.013	85	
	216.62	800	65-85	0.014	85	0.013
	223.77	940	85-105	0.012	105	
	198.37	940	85-105	0.011	105	
	163.18	875	85-105	0.009	105	0.011

Table A- 9. Holmes HAP 240 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
4-Feb-00	13:28:59	4	0.009	89.9	35.9
	13:32:59	8	0.014	89.9	35.9
	13:36:59	12	0.013	89.7	36.0
	13:40:59	16	0.015	90.2	35.9
	13:44:59	20	0.015	90.8	35.9
	13:48:59	24	0.018	90.7	36.0
	13:52:59	28	0.053	91.1	35.9
	13:56:59	32	0.115	90.8	35.9
	14:00:59	36	0.134	90.2	35.9
	14:04:59	40	0.144	90.6	36.0
	14:08:59	44	0.142	90.7	34.9
	14:12:59	48	0.139	90.4	35.9
	14:16:59	52	0.129	89.9	36.0
	14:20:59	56	0.121	90.0	35.9
	14:24:59	60	0.118	90.7	35.9
	14:28:59	64	0.111	90.6	35.0
	14:32:59	68	0.102	90.5	35.9
	14:36:59	72	0.097	90.3	35.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:40:59	76	0.096	90.3	35.9
	14:44:59	80	0.094	90.1	35.9
	14:48:59	84	0.088	89.7	35.9
	14:52:59	88	0.087	90.4	35.9
	14:56:59	92	0.085	90.7	35.0
	15:00:59	96	0.084	90.3	35.9
	15:04:59	100	0.078	90.0	35.9
3-Mar-00	13:42:00	2	0.002	86.6	40.5
	13:46:00	6	0.002	89.4	37.5
	13:50:00	10	0.003	91.4	34.5
	13:54:00	14	0.003	88.2	43.6
	13:58:00	18	0.003	91.0	39.3
	14:02:00	22	0.003	90.3	39.9
	14:06:00	26	0.027	90.3	40.5
	14:10:00	30	0.093	95.1	36.3
	14:14:00	34	0.116	93.0	39.3
	14:18:00	38	0.121	92.3	40.5
	14:22:00	42	0.119	90.9	42.4
	14:26:00	46	0.121	90.2	42.4
	14:30:00	50	0.121	91.0	42.4
	14:34:00	54	0.120	88.9	43.0
	14:38:00	58	0.110	93.7	36.3
	14:42:00	62	0.098	90.3	40.5
	14:46:00	66	0.086	89.6	41.8
	14:50:00	70	0.075	92.3	36.3
	14:54:00	74	0.072	88.8	39.3
	14:58:00	78	0.063	90.9	36.9
	15:02:00	82	0.053	89.5	37.5
	15:06:00	86	0.050	90.2	39.3
	15:10:00	90	0.045	91.5	37.5
	15:13:59	94	0.043	88.1	39.9
	15:17:59	98	0.035	91.5	35.1
	15:21:59	102	0.032	88.8	39.3
	15:25:59	106	0.031	89.5	39.3
23-Mar-00	15:21:18	1	0.004	82.6	42.3
	15:25:18	5	0.004	83.9	41.1
	15:29:18	9	0.006	87.3	36.3
	15:33:19	13	0.006	90.9	34.5
	15:37:19	17	0.007	88.1	39.9
	15:41:19	21	0.008	90.2	38.1
	15:45:19	25	0.014	91.6	34.5
	15:49:19	29	0.091	91.6	41.7
	15:53:19	33	0.126	93.7	39.9
	15:57:19	37	0.135	91.6	43.6
	16:01:19	41	0.143	90.9	44.2
	16:05:19	45	0.132	90.2	43.6

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	16:09:19	49	0.145	90.9	44.8
	16:13:19	53	0.127	88.2	46.0
	16:17:19	57	0.123	92.3	42.4
	16:21:19	61	0.110	88.9	44.2
	16:25:19	65	0.095	88.9	44.8
	16:29:19	69	0.093	91.6	39.3
	16:33:19	73	0.081	88.2	43.6
	16:37:19	77	0.081	90.9	38.7
	16:41:19	81	0.076	89.6	41.1
	16:45:19	85	0.067	90.7	42.8
	16:49:19	89	0.061	91.4	39.8
	16:53:19	93	0.056	88.6	44.1
	16:57:19	97	0.055	91.6	37.5
	17:01:19	101	0.048	88.9	41.1
	17:05:19	105	0.051	91.6	37.5

Table A- 10. Holmes HAP 240 Sorbent Tube Test Data

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
4-Feb-00	675.49	890	0-20	0.038	20	
	686.88	895	0-20	0.038	20	
	662.76	890	0-20	0.037	20	0.038
	4113.99	890	20-45	0.231	45	
	4324.04	900	20-45	0.240	45	
	3568.51	740	20-45	0.241	45	0.237
	2731.78	860	45-65	0.159	65	
	2696.02	850	45-65	0.159	65	
	2686.18	840	45-65	0.160	65	0.159
	9958.44	860	65-85	0.579	85	
	9690.19	850	65-85	0.570	85	
	8447.42	760	65-85	0.556	85	0.568[a]
	1770.06	890	85-105	0.099	105	
	1746.01	890	85-105	0.098	105	
	1660.22	885	85-105	0.094	105	0.097
3-Mar-00	LOST	LOST	0-20	LOST	20	
	182.62	900	0-20	0.010	20	
	176.32	875	0-20	0.010	20	0.010
	4576.21	870	20-45	0.263	45	
	4736.07	890	20-45	0.266	45	
	4448.44	830	20-45	0.268	45	0.266
	1642.62	810	45-65	0.101	65	
	1714.28	850	45-65	0.101	65	
	1592.95	900	45-65	0.088	65	0.097
	966.06	870	65-85	0.056	85	
	963.25	910	65-85	0.053	85	

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m³	Elapsed Time At End of Sample, minutes	Set Average, mg/m³
	843.87	770	65-85	0.055	85	0.054
	668.96	910	85-105	0.037	105	
	650.68	875	85-105	0.037	105	
	659.76	885	85-105	0.037	105	0.037
23-Mar-00	432.54	850	0-20	0.025	20	
	469.34	930	0-20	0.025	20	
	474.14	920	0-20	0.026	20	0.026
	5890.67	910	20-45	0.324	45	
	5725.13	930	20-45	0.308	45	
	5755.61	900	20-45	0.320	45	0.317
	2440.82	920	45-65	0.133	65	
	2261.54	900	45-65	0.126	65	
	2464.37	930	45-65	0.132	65	0.130
	1310.52	890	65-85	0.074	85	
	1364.52	900	65-85	0.076	85	
	1179.82	760	65-85	0.078	85	0.076
	1042.04	890	85-105	0.059	105	
	1053.68	860	85-105	0.061	105	
	1060.61	910	85-105	0.058	105	0.059

[a]Stuck Valve? Data not used.

Table A- 11. Hunter Hepatech 375 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m³	Temp., °F	Relative Humidity, Percent
7-Feb-00	10:48:59	4	0.003	90.2	36.9
	10:52:59	8	0.004	90.3	36.9
	10:56:59	12	0.005	90.3	35.9
	11:00:59	16	0.006	89.9	36.9
	11:04:59	20	0.006	90.1	36.0
	11:08:59	24	0.007	90.3	35.9
	11:12:59	28	0.051	90.6	35.9
	11:16:59	32	0.098	90.2	35.9
	11:20:59	36	0.115	90.7	35.9
	11:24:59	40	0.120	90.0	36.0
	11:28:59	44	0.118	90.5	35.9
	11:32:59	48	0.108	90.2	35.9
	11:36:59	52	0.086	90.6	36.0
	11:40:59	56	0.070	90.6	34.9
	11:44:59	60	0.058	90.4	35.9
	11:48:59	64	0.045	90.3	36.0
	11:52:59	68	0.038	90.0	35.9
	11:56:59	72	0.033	90.0	35.9
	12:00:59	76	0.026	90.1	35.9
	12:04:59	80	0.023	90.1	36.0
	12:08:59	84	0.019	90.0	35.9
	12:12:59	88	0.019	90.5	35.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	12:16:59	92	0.017	90.7	36.0
	12:20:59	96	0.014	90.6	35.9
	12:24:59	100	0.012	90.5	35.9
	12:28:59	104	0.012	90.3	36.0
2-Mar-00	14:37:00	2	0.001	83.4	36.9
	14:41:00	6	0.001	84.7	35.7
	14:45:00	10	0.001	87.5	33.9
	14:48:00	14	0.001	88.1	39.9
	14:52:00	18	0.002	90.2	39.9
	14:56:00	22	0.002	90.2	38.7
	15:00:00	26	0.002	88.2	40.5
	15:04:00	30	0.026	93.7	34.5
	15:08:00	34	0.093	91.0	42.4
	15:12:00	38	0.108	88.9	46.6
	15:16:00	42	0.117	94.4	41.8
	15:20:00	46	0.123	90.3	44.2
	15:24:00	50	0.114	89.5	46.6
	15:28:00	54	0.100	91.5	41.7
	15:32:00	58	0.088	88.8	45.4
	15:36:00	62	0.065	90.8	42.3
	15:40:00	66	0.051	87.4	43.5
	15:44:00	70	0.041	90.8	40.5
	15:48:00	74	0.033	88.1	41.7
	15:52:00	78	0.027	90.2	39.3
	15:56:00	82	0.021	88.8	39.9
	16:00:00	86	0.017	88.2	40.0
	16:04:00	90	0.014	91.0	36.4
	16:08:00	94	0.011	88.2	39.4
	16:12:00	98	0.010	90.1	37.5
	16:16:00	102	0.009	88.8	38.1
	16:20:00	106	0.007	89.5	38.1
	16:24:00	110	0.007	90.9	35.7
10-Apr-00	0:05:16	0	0.006	80.0	41.7
	0:09:16	4	0.008	80.7	41.7
	0:13:16	8	0.007	85.4	35.1
	0:17:16	12	0.007	88.1	33.3
	0:21:16	16	0.010	89.5	39.3
	0:25:16	20	0.009	90.9	36.3
	0:29:16	24	0.007	88.1	39.9
	0:33:16	28	0.038	94.3	33.9
	0:37:16	32	0.104	92.2	43.5
	0:41:16	36	0.117	90.2	46.0
	0:45:16	40	0.128	91.5	47.2
	0:49:16	44	0.133	89.5	46.6
	0:53:16	48	0.131	91.5	46.0
	0:57:16	52	0.120	88.8	46.0

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	1:01:16	56	0.097	90.1	44.1
	1:05:16	60	0.087	90.2	42.9
	1:09:16	64	0.078	89.5	44.8
	1:13:16	68	0.060	92.2	39.3
	1:17:16	72	0.053	88.9	42.4
	1:21:16	76	0.041	91.6	39.3
	1:25:16	80	0.038	90.3	39.3
	1:29:16	84	0.032	88.8	41.1
	1:33:16	88	0.027	92.2	37.5
	1:37:16	92	0.027	90.8	36.9
	1:41:16	96	0.024	89.5	39.3
	1:45:16	100	0.018	90.8	38.1
	1:49:16	104	0.022	92.2	36.3
	1:53:16	108	0.021	89.6	40.5

Table A- 12. Hunter Hepatech 375 Sorbent Tube Test Data

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
7 Feb 00	484.16	900	0-20	0.027	20	
	420.48	850	0-20	0.025	20	
	451.52	905	0-20	0.025	20	0.026
	3709.61	875	20-45	0.212	45	
	3614.56	900	20-45	0.201	45	
	3279.57	775	20-45	0.212	45	0.208
	1384.61	925	45-65	0.075	65	
	1376.45	875	45-65	0.079	65	
	1343.98	875	45-65	0.077	65	0.077
	3294.72	905	65-85	0.182	85	
	3216.02	905	65-85	0.178	85	
	602.52	275	65-85	0.110	85	0.156[a]
	335.36	640	85-105	0.026	105	
	310.32	790	85-105	0.020	105	
	336.95	860	85-105	0.020	105	0.022
2 Mar 00	230.52	900	0-20	0.013	20	
	226.77	910	0-20	0.012	20	
	226.05	900	0-20	0.013	20	0.013
	5159.22	925	20-45	0.279	45	
	5135.36	910	20-45	0.282	45	
	4976.70	875	20-45	0.284	45	0.282
	1170.31	925	45-65	0.063	65	
	1023.26	900	45-65	0.057	65	
	1072.31	900	45-65	0.060	65	0.060
	364.70	890	65-85	0.020	85	
	304.12	895	65-85	0.017	85	
	302.42	775	65-85	0.020	85	0.019

Date Set No.	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m³	Elapsed Time At End of Sample, minutes	Set Average, mg/m³
	221.51	880	85-105	0.013	105	
	193.98	740	85-105	0.013	105	
	171.65	890	85-105	0.010	105	0.012
10-Apr-00	355.24	835	0-20	0.021	20	
	363.93	910	0-20	0.020	20	
	371.78	890	0-20	0.021	20	0.021
	4985.85	960	20-45	0.260	45	
	4850.64	935	20-45	0.259	45	
	4737.36	940	20-45	0.252	45	0.257
	1580.17	250	45-65	0.316	65	
	1544.12	910	45-65	0.085	65	
	1548.03	790	45-65	0.098	65	0.166
	203.93	860	65-85	0.012	85	
	661.45	840	65-85	0.039	85	
	547.05	925	65-85	0.030	85	0.027
	472.99	940	85-105	0.025	105	
	412.69	875	85-105	0.024	105	
	472.85	850	85-105	0.028	105	0.026

[a]Stuck Valve? Data not used.

Table A- 13. Honeywell 11200 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m³	Temp., °F	Relative Humidity, Percent
24-Feb-00	14:22:00	2	0.002	84.7	35.7
	14:26:00	6	0.003	87.4	34.5
	14:30:00	10	0.003	89.5	35.1
	14:34:00	14	0.003	89.6	38.2
	14:38:00	18	0.003	91.0	37.0
	14:42:00	22	0.003	88.3	40.0
	14:46:00	26	0.032	93.7	33.9
	14:50:00	30	0.100	93.0	41.7
	14:54:00	34	0.118	91.6	44.2
	14:58:00	38	0.127	89.6	46.0
	15:02:00	42	0.125	90.9	44.2
	15:06:00	46	0.127	88.9	47.2
	15:10:00	50	0.119	92.3	43.0
	15:14:00	54	0.093	88.2	46.0
	15:18:00	58	0.064	88.2	46.0
	15:22:00	62	0.041	90.2	43.0
	15:26:00	66	0.032	87.5	46.0
	15:30:00	70	0.020	90.2	43.0
	15:34:00	74	0.017	89.4	43.5
	15:38:00	78	0.013	88.7	44.7
	15:42:00	82	0.010	90.8	42.9
	15:46:00	86	0.009	88.0	45.9
	15:50:00	90	0.007	90.8	42.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	15:54:00	94	0.005	88.0	45.3
	15:58:00	98	0.004	90.8	42.3
	16:02:00	102	0.004	89.4	43.5
	16:06:00	106	0.003	88.7	43.5
29-Feb-00	15:02:00	2	0.002	82.6	33.9
	15:06:00	6	0.001	85.4	37.5
	15:10:00	10	0.002	89.5	33.9
	15:14:00	14	0.001	90.1	37.5
	15:18:00	18	0.002	87.4	45.3
	15:22:00	22	0.002	92.9	37.5
	15:26:00	26	0.007	91.6	38.7
	15:30:00	30	0.081	92.3	39.3
	15:34:00	34	0.106	92.3	39.9
	15:38:00	38	0.117	92.2	41.7
	15:42:00	42	0.121	93.6	42.3
	15:46:00	46	0.113	91.5	42.3
	15:50:00	50	0.111	90.2	42.9
	15:54:00	54	0.090	90.2	43.5
	15:58:00	58	0.054	88.8	43.5
	16:02:00	62	0.029	91.0	38.8
	16:06:00	66	0.022	89.0	41.2
	16:10:00	70	0.015	91.0	38.8
	16:14:00	74	0.012	92.2	39.3
	16:18:00	78	0.007	90.1	41.7
	16:22:00	82	0.006	89.4	41.7
	16:26:00	86	0.004	91.6	38.1
	16:30:00	90	0.004	89.6	39.9
	16:34:00	94	0.003	91.6	38.1
	16:38:00	98	0.003	91.6	39.3
	16:42:00	102	0.003	90.2	40.5
	16:46:00	106	0.002	89.5	40.5
15-Mar-00	10:20:00	0	0.001	88.8	35.7
	10:24:00	4	-0.001	88.1	36.9
	10:28:00	8	0.000	90.8	33.9
	10:32:00	12	0.001	93.0	32.2
	10:36:00	16	0.000	88.9	44.2
	10:40:00	20	0.001	86.8	49.1
	10:44:00	24	0.001	91.5	43.5
	10:48:00	28	0.020	91.5	44.1
	10:52:00	32	0.064	90.8	46.6
	10:56:00	36	0.084	90.2	46.0
	11:00:00	40	0.084	88.9	48.5
	11:04:00	44	0.082	91.6	44.2
	11:08:00	48	0.085	88.9	47.3
	11:12:00	52	0.071	89.6	46.0
	11:16:00	56	0.056	89.6	46.0

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	11:20:00	60	0.034	88.7	47.2
	11:24:00	64	0.019	90.8	44.7
	11:28:00	68	0.011	88.0	47.2
	11:32:00	72	0.009	90.2	43.6
	11:36:00	76	0.004	88.2	45.4
	11:40:00	80	0.005	89.6	44.8
	11:44:00	84	0.003	91.5	43.5
	11:48:00	88	0.004	88.0	45.9
	11:52:00	92	0.003	90.1	44.1
	11:56:00	96	0.002	88.8	44.1
	12:00:00	100	0.002	88.1	44.1
	12:04:00	104	0.002	90.8	42.3
11-Apr-00	13:47:00	2	0.005	88.1	44.1
Alt. Loc'n #1	13:51:00	6	0.004	90.8	41.1
	13:55:00	10	0.006	89.5	41.1
	13:59:00	14	0.006	90.8	41.7
	14:03:00	18	0.008	91.5	39.3
	14:07:00	22	0.007	90.1	41.7
	14:11:00	26	0.024	90.2	41.1
	14:15:00	30	0.098	93.0	39.9
	14:19:00	34	0.133	93.7	41.1
	14:23:00	38	0.144	93.7	42.4
	14:27:00	42	0.148	91.6	41.7
	14:31:00	46	0.144	90.9	43.0
	14:35:00	50	0.144	90.8	43.5
	14:39:00	54	0.120	90.1	43.5
	14:43:00	58	0.082	89.4	42.3
	14:47:00	62	0.055	90.1	40.5
	14:51:00	66	0.039	90.1	39.9
	14:55:00	70	0.032	88.0	41.7
	14:59:00	74	0.024	91.6	36.9
	15:03:00	78	0.020	90.2	38.1
	15:07:00	82	0.017	89.6	39.3
	15:11:00	86	0.014	92.7	36.2
	15:15:00	90	0.012	90.0	38.6
	15:19:00	94	0.010	92.1	36.8
	15:23:00	98	0.010	91.6	37.5
	15:27:00	102	0.008	89.5	39.3
	15:31:00	106	0.007	90.9	37.5
	15:35:00	110	0.008	90.8	37.5
	15:39:00	114	0.007	89.4	38.7
12-Apr-00	9:42:01	42	0.067	91.6	43.5
Alt Loc'n #2	9:46:01	46	0.090	90.9	42.9
	9:50:01	50	0.119	90.9	44.8
	9:54:01	54	0.099	90.2	44.8
	9:58:01	58	0.093	90.9	43.5

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	10:02:01	62	0.078	90.1	42.9
	10:06:01	66	0.051	88.7	42.3
	10:10:01	70	0.036	91.5	38.7
	10:14:01	74	0.028	88.7	41.7
	10:18:01	78	0.021	92.2	36.9
	10:22:01	82	0.016	89.4	40.5
	10:26:01	86	0.014	90.9	38.7
	10:30:01	90	0.011	90.9	37.5
	10:34:01	94	0.011	88.8	40.5
	10:38:01	98	0.009	92.2	36.3
	10:42:01	102	0.008	90.1	38.7
	10:46:01	106	0.006	89.4	39.3
	10:50:01	110	0.006	92.3	35.1
	10:54:01	114	0.005	88.2	41.7

Table A- 14. Honeywell 11200 Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
24 Feb 00						
Data Not Taken						
29 Feb 00	249.36	489	0-20	0.025	20	
	254.31	98	0-20	0.130	20	
	240.02	101	0-20	0.119	20	0.091
	4784.04	102	20-45	2.345	45	
	4434.46	103	20-45	2.153	45	
	4594.56	107	20-45	2.147	45	2.215*
	487.39	109	45-65	0.224	65	
	448.26	124	45-65	0.181	65	
	457.14	125	45-65	0.183	65	0.196
	76.86	132	65-85	0.029	85	
	75.65	133	65-85	0.028	85	
	69.42	136	65-85	0.026	85	0.028
	51.55	137	85-105	0.019	105	
	50.72	138	85-105	0.018	105	
	53.07	174	85-105	0.015	105	0.017
15 Mar 00	180.11	840	0-20	0.011	20	
	180.72	890	0-20	0.010	20	
	185.09	875	0-20	0.011	20	0.010
	4386.50	870	20-45	0.252	45	
	3665.18	840	20-45	0.218	45	
	4395.00	865	20-45	0.254	45	0.241
	440.82	890	45-65	0.025	65	
	400.97	875	45-65	0.023	65	
	402.56	875	45-65	0.023	65	0.024
	92.13	870	65-85	0.005	85	

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	135.72	875	65-85	0.008	85	
	88.64	750	65-85	0.006	85	0.006
	97.42	890	85-105	0.005	105	
	54.51	875	85-105	0.003	105	
	53.35	890	85-105	0.003	105	0.004
11-Apr-00	485.33	860	0-20	0.028	20	
	507.76	860	0-20	0.030	20	
	512.51	860	0-20	0.030	20	0.029
	5970.33	835	20-45	0.358	45	
	6425.41	890	20-45	0.361	45	
	6250.21	850	20-45	0.368	45	0.362
	889.73	875	45-65	0.051	65	
	846.04	860	45-65	0.049	65	
	848.98	890	45-65	0.048	65	0.049
	228.96	825	65-85	0.014	85	
	230.80	850	65-85	0.014	85	
	222.45	760	65-85	0.015	85	0.014
	160.18	860	85-105	0.009	105	
	170.99	875	85-105	0.010	105	
	167.72	860	85-105	0.010	105	0.010
12-Apr-00	864.55	940	0-20	0.046	20	
	868.92	890	0-20	0.049	20	
	854.14	875	0-20	0.049	20	0.048
	7299.52	935	20-45	0.390	45	
	7639.47	910	20-45	0.420	45	
	7988.19	890	20-45	0.449	45	0.420
	645.96	940	45-65	0.034	65	
	603.16	925	45-65	0.033	65	
	602.54	940	45-65	0.032	65	0.033
	168.34	860	65-85	0.010	85	
	161.21	920	65-85	0.009	85	
	127.21	800	65-85	0.008	85	0.009
	93.30	925	85-105	0.005	105	
	94.48	910	85-105	0.005	105	
	105.18	875	85-105	0.006	105	0.005

*Valve stuck? Data from this trial not used in averages

Table A- 15. Austin HM 400 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
24-Feb-00	9:01:00	1	0.002	88.0	40.4
	9:05:00	5	0.001	87.3	41.7
	9:09:00	9	0.001	89.4	38.0
	9:13:00	13	0.002	90.1	36.3
	9:17:00	17	0.002	86.7	40.5

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	9:21:00	21	0.002	90.8	36.3
	9:25:00	25	0.004	89.6	37.5
	9:29:00	29	0.054	91.6	38.1
	9:33:00	33	0.092	93.7	36.3
	9:37:00	37	0.096	91.5	40.5
	9:41:00	41	0.095	88.7	43.5
	9:45:00	45	0.089	90.8	39.3
	9:49:00	49	0.101	90.8	39.3
	9:53:00	53	0.101	88.7	39.9
	9:57:00	57	0.077	92.9	35.7
	10:01:00	61	0.053	87.4	39.3
	10:05:00	65	0.039	90.8	35.7
	10:09:00	69	0.024	86.7	39.3
	10:13:00	73	0.018	90.2	33.9
	10:17:00	77	0.011	88.2	39.9
	10:21:00	81	0.012	88.9	39.9
	10:25:00	85	0.007	92.2	37.5
	10:29:00	89	0.006	87.3	41.1
	10:33:00	93	0.005	91.5	37.5
	10:37:00	97	0.004	88.7	40.5
	10:41:00	101	0.004	90.8	38.1
	10:45:00	105	0.003	88.7	40.5
	10:49:00	109	0.003	90.7	37.4
1-Mar-00	9:28:00	3	-0.001	83.9	36.9
	9:32:00	7	-0.001	85.3	39.9
	9:36:00	11	-0.001	87.3	36.9
	9:40:00	15	-0.001	88.2	34.5
	9:44:00	19	0.000	88.9	36.9
	9:48:00	23	0.000	91.6	34.0
	9:52:00	27	0.011	88.2	41.8
	9:56:00	31	0.056	92.3	39.3
	10:00:00	35	0.084	92.3	40.5
	10:04:00	39	0.090	88.8	44.8
	10:08:00	43	0.084	91.5	41.7
	10:12:00	47	0.092	88.1	41.7
	10:16:00	51	0.079	90.9	37.5
	10:20:00	55	0.066	88.1	40.5
	10:24:00	59	0.045	88.8	37.5
	10:28:00	63	0.028	90.1	36.3
	10:32:00	67	0.021	87.4	39.3
	10:36:00	71	0.013	91.5	35.1
	10:40:00	75	0.010	86.7	39.3
	10:44:00	79	0.005	90.9	34.5
	10:48:00	83	0.004	86.7	42.3
	10:52:00	87	0.004	90.8	39.3
	10:56:00	91	0.003	88.7	41.1

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m³	Temp., °F	Relative Humidity, Percent
	11:00:00	95	0.003	90.8	38.1
	11:04:00	99	0.002	87.5	40.5
	11:08:00	103	0.002	91.0	36.3
	11:12:00	107	0.002	89.6	38.1
	11:16:00	111	0.002	90.3	37.5
8-Mar-00	10:33:00	3	0.002	89.9	45.9
	10:37:00	7	0.001	89.9	44.6
	10:41:00	11	0.001	92.7	40.4
	10:45:00	15	0.002	90.1	44.7
	10:49:00	19	0.002	88.7	45.3
	10:53:00	23	0.002	94.3	38.7
	10:57:00	27	0.023	93.0	39.3
	11:01:00	31	0.076	93.7	39.9
	11:05:00	35	0.085	93.7	41.2
	11:09:00	39	0.099	93.5	42.9
	11:13:00	43	0.099	92.8	43.5
	11:17:00	47	0.097	91.4	42.3
	11:21:00	51	0.087	91.5	40.5
	11:25:00	55	0.061	90.1	39.3
	11:29:00	59	0.039	89.4	39.9
	11:33:00	63	0.024	91.4	37.4
	11:37:00	67	0.015	89.3	39.2
	11:41:00	71	0.010	91.4	36.2
	11:45:00	75	0.006	90.8	38.1
	11:49:00	79	0.004	89.4	38.1
	11:53:00	83	0.003	92.9	36.9
	11:57:00	87	0.003	90.7	39.2
	12:01:00	91	0.003	90.0	39.2
	12:05:00	95	0.003	89.3	39.2
	12:09:00	99	0.002	91.6	35.7
	12:13:00	103	0.002	91.6	36.9
	12:17:00	107	0.002	89.6	39.9
	12:21:00	111	0.002	92.1	38.6

Table A- 16. Austin HM 400 Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m³	Elapsed Time At End of Sample, minutes	Set Average, mg/m³
24 Feb 00	377.00	910	0-20	0.021	20	
	345.59	860	0-20	0.020	20	
	345.20	860	0-20	0.020	20	0.020
	4304.41	860	20-45	0.250	45	
	4241.11	840	20-45	0.252	45	
	4353.94	850	20-45	0.256	45	0.253
	413.89	870	45-65	0.024	65	
	397.69	875	45-65	0.023	65	
	343.65	650	45-65	0.026	65	0.024

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	78.56	890	65-85	0.004	85	
	87.09	870	65-85	0.005	85	
	88.86	870	65-85	0.005	85	0.005
	55.23	850	85-105	0.003	105	
	52.74	890	85-105	0.003	105	
	49.42	750	85-105	0.003	105	0.003
1 Mar 00	198.91	850	0-20	0.012	20	
	198.36	890	0-20	0.011	20	
	196.62	890	0-20	0.011	20	0.011
	4717.22	890	20-45	0.265	45	
	4574.08	850	20-45	0.269	45	
	4813.78	880	20-45	0.274	45	0.269
	430.21	890	45-65	0.024	65	
	413.27	900	45-65	0.023	65	
	412.18	890	45-65	0.023	65	0.023
	82.81	900	65-85	0.005	85	
	72.55	880	65-85	0.004	85	
	73.95	860	65-85	0.004	85	0.004
	61.73	880	85-105	0.004	105	
	56.38	850	85-105	0.003	105	
	55.90	780	85-105	0.004	105	0.003
8 Mar 00	388.39	950	0-20	0.020	20	
	404.77	960	0-20	0.021	20	
	400.44	950	0-20	0.021	20	0.021
	4760.41	940	20-45	0.253	45	
	4540.46	925	20-45	0.245	45	
	4691.33	910	20-45	0.258	45	0.252
	443.81	940	45-65	0.024	65	
	381.22	870	45-65	0.022	65	
	372.59	950	45-65	0.020	65	0.022
	70.35	900	65-85	0.004	85	
	74.42	940	65-85	0.004	85	
	57.31	760	65-85	0.004	85	0.004
	56.05	860	85-105	0.003	105	
	58.08	840	85-105	0.003	105	
	54.23	830	85-105	0.003	105	0.003

Table A- 17. Electrocorp 224C4 MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
23-Feb-00	14:23:00	3	0.008	83.9	39.2
	14:27:00	7	0.008	86.6	36.3
	14:31:00	11	0.008	88.7	33.3
	14:35:00	15	0.010	90.1	39.9
	14:39:00	19	0.010	88.0	42.3

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:43:00	23	0.009	91.5	38.1
	14:47:00	27	0.042	90.8	38.7
	14:51:00	31	0.100	90.1	39.9
	14:55:00	35	0.116	90.1	39.9
	14:59:00	39	0.123	91.5	43.5
	15:03:00	43	0.122	90.1	41.1
	15:07:00	47	0.128	90.1	41.7
	15:11:00	51	0.114	86.8	44.2
	15:15:00	55	0.103	91.6	39.3
	15:19:00	59	0.091	88.9	43.0
	15:23:00	63	0.077	90.8	39.9
	15:27:00	67	0.064	88.7	42.3
	15:31:00	71	0.056	89.4	41.7
	15:35:00	75	0.049	91.5	38.1
	15:39:00	79	0.040	87.4	43.5
	15:43:00	83	0.033	91.4	37.4
	15:47:00	87	0.033	88.6	40.4
	15:51:00	91	0.028	90.7	37.4
	15:55:00	95	0.029	90.7	37.4
	15:59:00	99	0.023	87.4	41.1
	16:03:00	103	0.021	91.5	36.3
	16:07:00	107	0.018	87.4	39.3
	16:11:00	111	0.017	91.7	35.8
2-Mar-00	10:03:00	3	0.000	80.7	46.0
	10:07:00	7	0.000	84.7	41.1
	10:11:00	11	0.000	86.1	38.1
	10:15:00	15	0.000	87.4	37.5
	10:19:00	19	0.001	88.8	36.9
	10:23:00	23	0.001	90.9	33.3
	10:27:00	27	0.018	87.6	43.0
	10:31:00	31	0.077	94.5	40.0
	10:35:00	35	0.113	92.4	41.8
	10:39:00	39	0.121	88.9	46.0
	10:43:00	43	0.114	88.9	44.8
	10:47:00	47	0.117	91.7	40.6
	10:51:00	51	0.110	88.9	46.6
	10:55:00	55	0.091	89.6	46.0
	10:59:00	59	0.078	90.3	42.4
	11:03:00	63	0.065	87.4	46.0
	11:07:00	67	0.047	89.5	41.7
	11:11:00	71	0.042	90.9	40.5
	11:15:00	75	0.034	87.0	43.6
	11:19:00	79	0.027	90.4	38.8
	11:23:00	83	0.023	87.7	41.8
	11:27:00	87	0.018	88.8	39.9
	11:31:00	91	0.015	90.2	36.9

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	11:35:00	95	0.013	86.8	42.3
	11:39:00	99	0.010	90.2	38.7
	11:43:00	103	0.010	88.1	40.5
	11:47:00	107	0.007	89.5	39.3
	11:51:00	111	0.007	89.5	32.7
11-Apr-00	9:36:00	1	0.012	83.3	38.7
	9:40:00	5	0.013	84.7	36.3
	9:44:00	9	0.016	88.8	31.6
	9:48:00	13	0.014	89.5	37.5
	9:52:00	17	0.016	90.9	38.1
	9:56:00	21	0.016	88.8	41.1
	10:00:00	25	0.019	93.0	35.7
	10:04:00	29	0.066	92.3	37.5
	10:08:00	33	0.117	93.0	38.1
	10:12:00	37	0.135	92.9	39.3
	10:16:00	41	0.148	91.5	39.9
	10:20:00	45	0.151	91.5	41.1
	10:24:00	49	0.147	90.2	42.4
	10:28:00	53	0.134	90.2	42.4
	10:32:00	57	0.115	90.9	40.5
	10:36:00	61	0.098	88.8	41.1
	10:40:00	65	0.090	90.8	38.1
	10:44:00	69	0.080	89.5	39.3
	10:48:00	73	0.063	92.9	36.9
	10:52:00	77	0.058	88.8	39.3
	10:56:00	81	0.043	89.5	38.1
	11:00:01	85	0.042	92.3	34.5
	11:04:01	89	0.041	89.6	40.5
	11:08:00	93	0.039	89.6	39.3
	11:12:01	97	0.032	93.0	36.3
	11:16:01	101	0.031	89.6	39.3
	11:20:01	105	0.026	90.2	38.7
	11:24:01	109	0.022	91.5	36.3
	11:28:01	113	0.024	89.5	39.3

Table A- 18. Electrocorp 224C4 Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
23 Feb 00	401.67	860	0-20	0.023	20	
	396.77	890	0-20	0.022	20	
	381.16	860	0-20	0.022	20	0.023
	4341.08	890	20-45	0.244	45	
	4348.01	875	20-45	0.248	45	
	4230.53	850	20-45	0.249	45	0.247
	1161.09	775	45-65	0.075	65	

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	1506.75	960	45-65	0.078	65	
	1445.84	900	45-65	0.080	65	0.078
	633.44	890	65-85	0.036	85	
	621.70	930	65-85	0.033	85	
	600.44	875	65-85	0.034	85	0.034
	407.20	860	85-105	0.024	105	
	418.22	870	85-105	0.024	105	
	546.33	800	85-105	0.034	105	0.027
2 Mar 00	174.69	910	0-20	0.010	20	
	176.84	940	0-20	0.009	20	
	169.69	910	0-20	0.009	20	0.009
	4780.69	910	20-45	0.263	45	
	4825.65	940	20-45	0.257	45	
	4677.63	900	20-45	0.260	45	0.260
	1311.67	950	45-65	0.069	65	
	1289.16	940	45-65	0.069	65	
	1315.08	940	45-65	0.070	65	0.069
	436.55	900	65-85	0.024	85	
	434.01	940	65-85	0.023	85	
	374.63	800	65-85	0.023	85	0.024
	268.52	940	85-105	0.014	105	
	274.98	950	85-105	0.014	105	
	267.72	920	85-105	0.015	105	0.014
11-Apr-00	445.01	825	0-20	0.0270	20	
	504.67	875	0-20	0.0288	20	
	485.10	890	0-20	0.0273	20	0.0277
	5934.40	860	20-45	0.3450	45	
	5820.35	910	20-45	0.3198	45	
	5835.40	875	20-45	0.3335	45	0.3328
	1991.51	900	45-65	0.1106	65	
	1903.36	875	45-65	0.1088	65	
	1950.62	890	45-65	0.1096	65	0.1097
	221.23	225	65-85	0.0492	85	
	796.79	835	65-85	0.0477	85	
	719.96	750	65-85	0.0480	85	0.0483
	558.61	860	85-105	0.0325	105	
	522.21	850	85-105	0.0307	105	
	549.71	875	85-105	0.0314	105	0.0315

Table A- 19. Dust Free Inc. MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
24-Feb-00	12:22:00	2	0.001	79.3	36.9
	12:26:00	6	0.001	82.0	35.1
	12:30:00	10	0.001	84.7	32.1

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	12:34:00	14	0.001	86.2	38.8
	12:38:00	18	0.002	87.6	37.6
	12:42:00	22	0.002	90.3	34.0
	12:46:00	26	0.024	137.6	38.1
	12:50:00	30	0.086	90.1	46.6
	12:54:00	34	0.107	90.8	47.2
	12:58:00	38	0.119	92.3	46.6
	13:02:00	42	0.114	90.2	48.4
	13:06:00	46	0.108	90.9	46.0
	13:10:00	50	0.104	88.9	47.2
	13:14:00	54	0.085	91.6	41.1
	13:18:00	58	0.059	88.2	43.6
	13:22:00	62	0.038	90.1	42.3
	13:26:00	66	0.028	88.7	42.9
	13:30:00	70	0.016	90.1	41.7
	13:34:00	74	0.015	90.1	39.3
	13:38:00	78	0.011	88.0	43.5
	13:42:00	82	0.008	92.8	36.9
	13:46:00	86	0.007	88.7	40.5
	13:50:00	90	0.005	90.8	38.1
	13:54:00	94	0.004	90.8	37.5
	13:58:00	98	0.004	88.8	41.7
	14:02:00	102	0.003	92.3	36.3
	14:06:00	106	0.003	88.1	40.5
1-Mar-00	13:48:00	3	0.001	84.7	38.7
	13:52:00	7	0.001	88.1	34.5
	13:56:00	11	0.001	90.1	35.1
	14:00:00	15	0.002	87.5	45.4
	14:04:00	19	0.001	90.9	39.3
	14:08:00	23	0.002	89.6	39.9
	14:12:00	27	0.023	92.4	38.2
	14:16:00	31	0.090	95.2	37.0
	14:20:00	35	0.114	93.8	39.4
	14:24:00	39	0.110	91.6	41.1
	14:28:00	43	0.104	89.6	43.6
	14:32:00	47	0.108	90.9	41.7
	14:36:00	51	0.092	88.7	43.5
	14:40:00	55	0.058	90.8	41.7
	14:44:00	59	0.042	90.1	41.7
	14:48:00	63	0.025	87.5	42.4
	14:52:00	67	0.015	92.3	36.3
	14:56:00	71	0.011	88.2	39.3
	15:00:00	75	0.008	91.6	36.3
	15:04:00	79	0.005	89.6	37.5
	15:08:00	83	0.004	90.9	37.5
	15:08:00	87	0.004	90.9	37.5

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	15:12:00	91	0.004	90.8	36.3
	15:16:00	95	0.003	88.0	42.9
	15:20:00	99	0.003	92.2	36.9
	15:24:00	103	0.003	89.4	39.9
	15:28:00	107	0.003	90.8	38.7
	15:32:00	111	0.002	91.5	38.1
23-Mar-00	10:17:00	2	0.047	29.2	26.9
	10:21:00	6	0.048	26.9	25.1
	10:25:00	10	0.053	26.3	24.5
	10:29:00	14	0.052	92.3	51.6
	10:33:00	18	0.055	91.6	54.7
	10:37:00	22	0.054	90.2	57.2
	10:41:00	26	0.070	90.1	56.5
	10:45:00	30	0.127	32.1	29.8
	10:49:00	34	0.148	30.4	26.9
	10:53:00	38	0.155	31.5	26.3
	10:57:00	42	0.145	28.6	25.7
	11:01:00	46	0.134	29.2	25.1
	11:05:01	50	0.135	29.8	24.0
	11:09:01	54	0.109	26.9	23.4
	11:13:01	58	0.079	26.3	23.4
	11:17:01	62	0.054	24.6	22.8
	11:21:01	66	0.038	24.6	22.8
	11:25:01	70	0.031	23.4	22.3
	11:29:01	74	0.027	24.0	22.8
	11:33:01	78	0.022	23.4	22.2
	11:37:01	82	0.019	22.8	22.2
	11:41:01	86	0.017	22.8	21.7
	11:45:01	90	0.013	22.8	21.7
	11:49:01	94	0.012	22.8	21.7
	11:53:01	98	0.009	22.2	21.7
	11:57:01	102	0.009	22.2	21.7
	12:01:01	106	0.008	22.2	21.1
	12:05:01	110	0.007	82.7	56.0

Table A- 20. Dust Free Inc. Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
24 Feb						
Data Not Taken						
1 Mar 00	205.80	840	0-20	0.012	20	
	200.02	890	0-20	0.011	20	
	198.21	860	0-20	0.012	20	0.012
	4144.32	870	20-45	0.238	45	
	4051.61	850	20-45	0.238	45	

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
	4111.35	840	20-45	0.245	45	0.240
	1052.67	850	45-65	0.062	65	
	1130.54	890	45-65	0.064	65	
	959.52	840	45-65	0.057	65	0.061
	75.72	870	65-85	0.004	85	
	69.86	870	65-85	0.004	85	
	77.11	840	65-85	0.005	85	0.004
	51.52	850	85-105	0.003	105	
	52.38	860	85-105	0.003	105	
	52.17	810	85-105	0.003	105	0.003
23 Mar 00	1344.19	840	0-20	0.080	20	
	1464.33	880	0-20	0.083	20	
	1444.61	860	0-20	0.084	20	0.082
	5567.10	865	20-45	0.322	45	
	5399.64	835	20-45	0.323	45	
	5701.21	860	20-45	0.331	45	0.326
	791.10	875	45-65	0.045	65	
	744.33	865	45-65	0.043	65	
	751.85	860	45-65	0.044	65	0.044
	283.83	860	65-85	0.017	85	
	258.87	850	65-85	0.015	85	
	237.78	740	65-85	0.016	85	0.016
	177.12	890	85-105	0.010	105	
	163.78	865	85-105	0.009	105	
	173.60	890	85-105	0.010	105	0.010

Table A- 21. M20 Filter MINICAMS® Test Data

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
15-Mar-00	14:12:00	2	0.000	86.0	39.9
	14:16:00	6	0.000	88.1	38.1
	14:20:00	10	0.001	90.8	33.9
	14:24:00	14	0.001	88.8	42.3
	14:28:00	18	0.001	88.8	42.9
	14:32:00	22	0.001	93.0	38.7
	14:36:00	26	0.019	90.3	40.6
	14:40:00	30	0.075	93.8	39.4
	14:44:00	34	0.099	92.4	41.2
	14:48:00	38	0.103	90.8	42.3
	14:52:00	42	0.100	90.8	43.5
	14:56:00	46	0.097	89.4	44.7
	15:00:00	50	0.085	91.4	20.5
	15:04:00	54	0.064	91.4	25.7
	15:08:00	58	0.039	91.4	32.7
	15:12:00	62	0.024	92.4	34.0

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	15:16:00	66	0.017	93.1	36.4
	15:20:00	70	0.011	94.5	34.6
	15:24:00	74	0.006	94.9	37.5
	15:28:00	78	0.006	95.6	35.7
	15:32:00	82	0.004	96.3	35.7
	15:36:00	86	0.004	96.3	35.7
	15:40:00	90	0.003	97.0	34.5
	15:44:00	94	0.003	97.7	36.3
	15:48:00	98	0.002	98.0	35.8
	15:52:00	102	0.002	97.3	35.2
	15:56:00	106	0.002	98.0	35.2
16-Mar-00	10:43:00	3	0.000	84.0	35.7
	10:47:00	7	0.000	88.1	32.1
	10:51:00	11	0.000	89.5	33.9
	10:55:00	15	0.001	90.2	38.7
	10:59:00	19	0.001	88.9	41.1
	11:03:00	23	0.001	90.9	38.1
	11:07:00	27	0.025	91.6	36.9
	11:11:00	31	0.081	92.3	38.7
	11:15:00	35	0.097	92.3	38.7
	11:19:00	39	0.103	92.3	40.5
	11:23:00	43	0.101	90.9	41.7
	11:27:00	47	0.098	90.9	36.9
	11:31:00	51	0.084	91.6	30.4
	11:35:00	55	0.052	91.6	37.5
	11:39:00	59	0.030	91.6	39.9
	11:43:00	63	0.016	93.4	39.2
	11:47:00	67	0.012	94.8	38.6
	11:51:00	71	0.008	94.8	38.6
	11:55:00	75	0.006	95.6	37.5
	11:59:00	79	0.003	95.6	37.5
	12:03:00	83	0.004	96.3	37.5
	12:07:00	87	0.003	97.1	37.5
	12:11:00	91	0.003	97.1	37.5
	12:15:00	95	0.002	97.8	38.1
	12:19:00	99	0.002	97.7	37.5
	12:23:00	103	0.002	97.7	36.3
	12:27:00	107	0.002	99.1	36.9
16-Mar-00	14:11:00	1	0.003	87.4	38.7
	14:15:00	5	0.004	88.1	39.3
	14:19:00	9	0.005	91.5	35.1
	14:23:01	13	0.005	88.8	39.9
	14:27:01	17	0.004	90.2	38.7
	14:31:01	21	0.006	90.9	36.3
	14:35:01	25	0.008	90.2	37.5
	14:39:01	29	0.074	92.3	38.1

Date	Time	Elapsed Time, Minutes	MeS Concentration, mg/m^3	Temp., ^{o}F	Relative Humidity, Percent
	14:43:01	33	0.112	93.6	37.5
	14:47:01	37	0.120	92.3	38.7
	14:51:01	41	0.119	93.7	39.9
	14:55:01	45	0.119	92.3	39.9
	14:59:01	49	0.114	93.5	33.9
	15:03:01	53	0.090	92.8	35.1
	15:07:01	57	0.056	92.8	39.3
	15:11:01	61	0.036	93.5	38.7
	15:15:01	65	0.023	94.2	38.7
	15:19:01	69	0.015	94.9	38.1
	15:23:01	73	0.010	95.6	37.5
	15:27:01	77	0.008	96.3	38.1
	15:31:01	81	0.006	97.0	37.5
	15:35:01	85	0.005	97.8	38.1
	15:39:01	89	0.004	97.8	38.1
	15:43:01	93	0.003	98.5	37.5
	15:47:01	97	0.003	99.2	36.9
	15:51:01	101	0.003	99.2	36.9
	15:55:01	105	0.002	99.2	36.3
	15:59:01	109	0.002	99.3	36.3

Table A- 22. M20 Filter Sorbent Tube Test Data

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m^3	Elapsed Time At End of Sample, minutes	Set Average, mg/m^3
15 Mar 00	243.30	835	0-20	0.015	20	
	265.88	925	0-20	0.014	20	
	263.43	920	0-20	0.014	20	0.014
	4530.34	910	20-45	0.249	45	
	4405.42	900	20-45	0.245	45	
	4639.85	890	20-45	0.261	45	0.251
	339.94	925	45-65	0.018	65	
	293.53	900	45-65	0.016	65	
	322.60	935	45-65	0.017	65	0.017
	46.09	890	65-85	0.003	85	
	80.49	900	65-85	0.004	85	
	55.48	760	65-85	0.004	85	0.004
	50.65	875	85-105	0.003	105	
	62.04	925	85-105	0.003	105	
	71.26	940	85-105	0.004	105	0.003
16 Mar 00	160.63	825	0-20	0.010	20	
	150.15	870	0-20	0.009	20	
	153.34	860	0-20	0.009	20	0.009
	4280.11	840	20-45	0.255	45	
	4221.89	840	20-45	0.251	45	
	4212.00	830	20-45	0.254	45	0.253

Date	Mass MeS, ng	Flow Rate, lpm	Sampling Interval, minutes	Average Concentration, mg/m³	Elapsed Time At End of Sample, minutes	Set Average, mg/m³
	313.02	840	45-65	0.019	65	
	324.11	860	45-65	0.019	65	
	306.34	830	45-65	0.018	65	0.019
	87.29	840	65-85	0.005	85	
	98.30	860	65-85	0.006	85	
	86.84	735	65-85	0.006	85	0.006
	63.96	860	85-105	0.004	105	
	58.06	840	85-105	0.003	105	
	65.18	940	85-105	0.003	105	0.004
16 Mar 00	526.39	875	0-20	0.030	20	
	518.67	875	0-20	0.030	20	
	500.67	860	0-20	0.029	20	0.030
	36.23	890	20-45	0.002	45	
	37.91	860	20-45	0.002	45	
	39.16	775	20-45	0.003	45	0.002*
	348.84	850	45-65	0.021	65	
	330.05	875	45-65	0.019	65	
	366.38	890	45-65	0.021	65	0.020
	109.78	890	65-85	0.006	85	
	107.06	890	65-85	0.006	85	
	84.45	765	65-85	0.006	85	0.006
	97.99	860	85-105	0.006	105	
	100.66	875	85-105	0.006	105	
	93.77	850	85-105	0.006	105	0.006

*Valve stuck? Data not used in averages.

When the third baseline test was done it was seen from the MINICAMS® outputs that the concentration of MeS was not beginning to increase until 25 minutes after the test start, so the sampling time for the second bank of sorbent tubes was increased to 25 minutes, so that peak concentration was reached before turning on the filter.

Because the MINICAMS® was located some 70 feet from the sample inlets, and because the MINICAMS® operates on a 4-minute sampling/analysis/cleardown cycle, the concentrations reported for each "elapsed time" actually represent values present approximately 5 minutes earlier.

The test data summarized in Table A- 23 compares the vapor concentration reductions calculated from the MINICAMS® data and the Tenax sorbent tube data on each model of filter unit. It can be seen that the two measurement methods yield similar results.

Table A- 23. Correlation Between MINICAMS® and Sorbent Tube Data

Test Item	Average Concentration Decrease per 20-Minute Interval, Percent	
	MINICAMS® Data	Sorbent Tube Data
Honeywell 11200	70.3	69.2
Aller Air 4000	69.5	63.0
Austin HM 400	67.7	65.1
M20	65.2	63.0
Dust Free Inc.	64.4	64.2

Test Item	Average Concentration Decrease per 20-Minute Interval, Percent	
	MINICAMS® Data	Sorbent Tube Data
Honeywell 63500	61.8	51.9
Hunter Hepatech 375	56.9	51.6
Electrocorp	50.8	53.4
Bionaire LC-1060	36.3	36.2
Holmes HAP 240	28.4	37.6
None (Baseline)	11.9	15.9

The sorbent tube data from all the tests, averaged among trials and expressed as mean concentration for the sampling time interval, is illustrated in Figure A- 1. The MINICAMS® data, averaged among trials but not normalized for initial concentration, is illustrated in Figure A- 2.

Table A- 24. Normalized Vapor Concentration

Time, min.	M20	Honeywell 11200	Austin HM 400	Aller Air 4000	Dust Free	Honeywell 63500	Hunter 30375	Electrocorp 224C4	Bionaire LC-1060	Holmes HAP 240	None (Baseline)
0	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
4	0.072	0.092	0.092	0.087	0.080	0.079	0.088	0.091	0.095	0.095	0.100
8	0.043	0.073	0.070	0.066	0.059	0.059	0.076	0.079	0.090	0.089	0.097
12	0.026	0.046	0.047	0.047	0.040	0.045	0.065	0.068	0.078	0.081	0.094
16	0.018	0.026	0.031	0.031	0.028	0.037	0.051	0.059	0.075	0.073	0.093
20	0.012	0.019	0.020	0.023	0.023	0.033	0.041	0.048	0.070	0.068	0.091
24	0.008	0.013	0.014	0.019	0.020	0.028	0.033	0.041	0.062	0.062	0.088
28	0.006	0.010	0.009	0.013	0.016	0.023	0.029	0.035	0.058	0.059	0.086
32	0.005	0.007	0.007	0.010	0.014	0.021	0.024	0.028	0.053	0.054	0.086
36	0.004	0.005	0.005	0.008	0.012	0.019	0.020	0.025	0.052	0.051	0.080
40	0.003	0.005	0.004	0.006	0.009	0.017	0.018	0.023	0.049	0.047	0.080
44	0.003	0.004	0.004	0.005	0.009	0.016	0.016	0.020	0.044	0.045	0.078
48	0.003	0.003	0.003	0.004	0.007	0.015	0.013	0.018	0.039	0.042	0.075
52	0.002	0.002	0.003	0.004	0.007	0.015	0.013	0.016	0.039	0.039	0.073
56	0.002	0.002	0.003	0.003*	0.006	0.013	0.011	0.014	0.039	0.039	0.071*
60	0.002*	0.002	0.002	0.003*	0.005	0.013*	0.008	0.012	0.039*	0.039*	0.070*

*Extrapolated Value

The negative logarithm (base 10) of the fractional concentration was calculated and is presented in Table A- 25.

Table A- 25. Logarithmic Reduction of Vapor Concentration

Time, min.	M20	Honeywell 11200	Austin HM 400	Aller Air 4000	Dust Free	Honeywell 63500	Hunter 30375	Electrocorp 224C4	Bionaire LC-1060	Holmes HAP 240	None (Baseline)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.146	0.038	0.038	0.063	0.061	0.106	0.054	0.039	0.021	0.024	0.002
8	0.370	0.139	0.153	0.183	0.203	0.237	0.119	0.102	0.045	0.052	0.013
12	0.588	0.342	0.329	0.328	0.359	0.356	0.185	0.167	0.106	0.094	0.027
16	0.746	0.585	0.512	0.517	0.551	0.455	0.295	0.230	0.132	0.139	0.032
20	0.936	0.725	0.698	0.651	0.702	0.527	0.385	0.321	0.157	0.168	0.041

Time, min.	M20	Honeywell 11200	Austin HM 400	Aller Air 4000	Dust Free	Honeywell 63500	Hunter 30375	Electrocorp 224C4	Bionaire LC-1060	Holmes HAP 240	None (Baseline)
24	1.099	0.886	0.872	0.734	0.841	0.621	0.476	0.390	0.208	0.207	0.055
28	1.255	1.052	1.039	0.897	0.932	0.710	0.540	0.453	0.238	0.233	0.067
32	1.324	1.164	1.189	1.026	1.055	0.771	0.628	0.560	0.274	0.272	0.067
36	1.412	1.299	1.343	1.135	1.166	0.827	0.707	0.613	0.313	0.302	0.098
40	1.489	1.349	1.363	1.267	1.231	0.896	0.764	0.652	0.314	0.335	0.098
44	1.519	1.414	1.430	1.315	1.282	0.929	0.811	0.707	0.357	0.359	0.107
48	1.573	1.529	1.499	1.415	1.385	0.986	0.902	0.756	0.404	0.395	0.123
52	1.605	1.610	1.575	1.417	1.416	1.014	0.916	0.830	0.413	0.430	0.134
56	1.631	1.616	1.590	1.526*	1.455	1.067	0.969	0.861	0.442	0.434	0.139*
60	1.651*	1.667	1.612	1.553*	1.484	1.100	1.114	0.975	0.462*	0.436*	0.141*

*Extrapolated Values

Table A- 26. Calculated Dosages Inside Test Room

Exposure Time, min.	Normalized Dosage, mg-min/m^3										
	M20	Honeywell 11200	Austin HM 400	Aller Air 4000	Dust Free	Honeywell 63500	Hunter 30375	Electrocorp 224C4	Bionaire LC-1060	Holmes HAP 240	None (Baseline)
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.344	0.384	0.384	0.373	0.361	0.357	0.377	0.383	0.391	0.389	0.399
8	0.574	0.713	0.709	0.679	0.639	0.632	0.706	0.724	0.762	0.756	0.792
12	0.713	0.950	0.944	0.906	0.836	0.840	0.989	1.018	1.099	1.095	1.174
16	0.802	1.094	1.101	1.062	0.972	1.003	1.221	1.272	1.406	1.402	1.548
20	0.861	1.185	1.204	1.169	1.073	1.142	1.405	1.486	1.695	1.685	1.916
24	0.901	1.251	1.272	1.252	1.159	1.262	1.555	1.664	1.958	1.946	2.275
28	0.928	1.296	1.319	1.316	1.231	1.363	1.680	1.817	2.197	2.188	2.623
32	0.950	1.330	1.352	1.361	1.291	1.451	1.785	1.944	2.420	2.415	2.966
36	0.967	1.355	1.376	1.395	1.343	1.532	1.872	2.048	2.631	2.625	3.297
40	0.981	1.375	1.394	1.422	1.387	1.604	1.946	2.144	2.833	2.822	3.616
44	0.994	1.392	1.410	1.443	1.424	1.670	2.013	2.231	3.018	3.007	3.932
48	1.005	1.406	1.424	1.461	1.455	1.731	2.071	2.309	3.185	3.181	4.240
52	1.016	1.417	1.436	1.477	1.481	1.791	2.122	2.378	3.341	3.344	4.537
56	1.025	1.427	1.447	1.494	1.507	1.845	2.171	2.438	3.496	3.500	4.831
60	1.032*	1.436	1.457	1.510*	1.529	1.875	2.210	2.490	3.647*	3.650*	5.122*

*Extrapolated Value

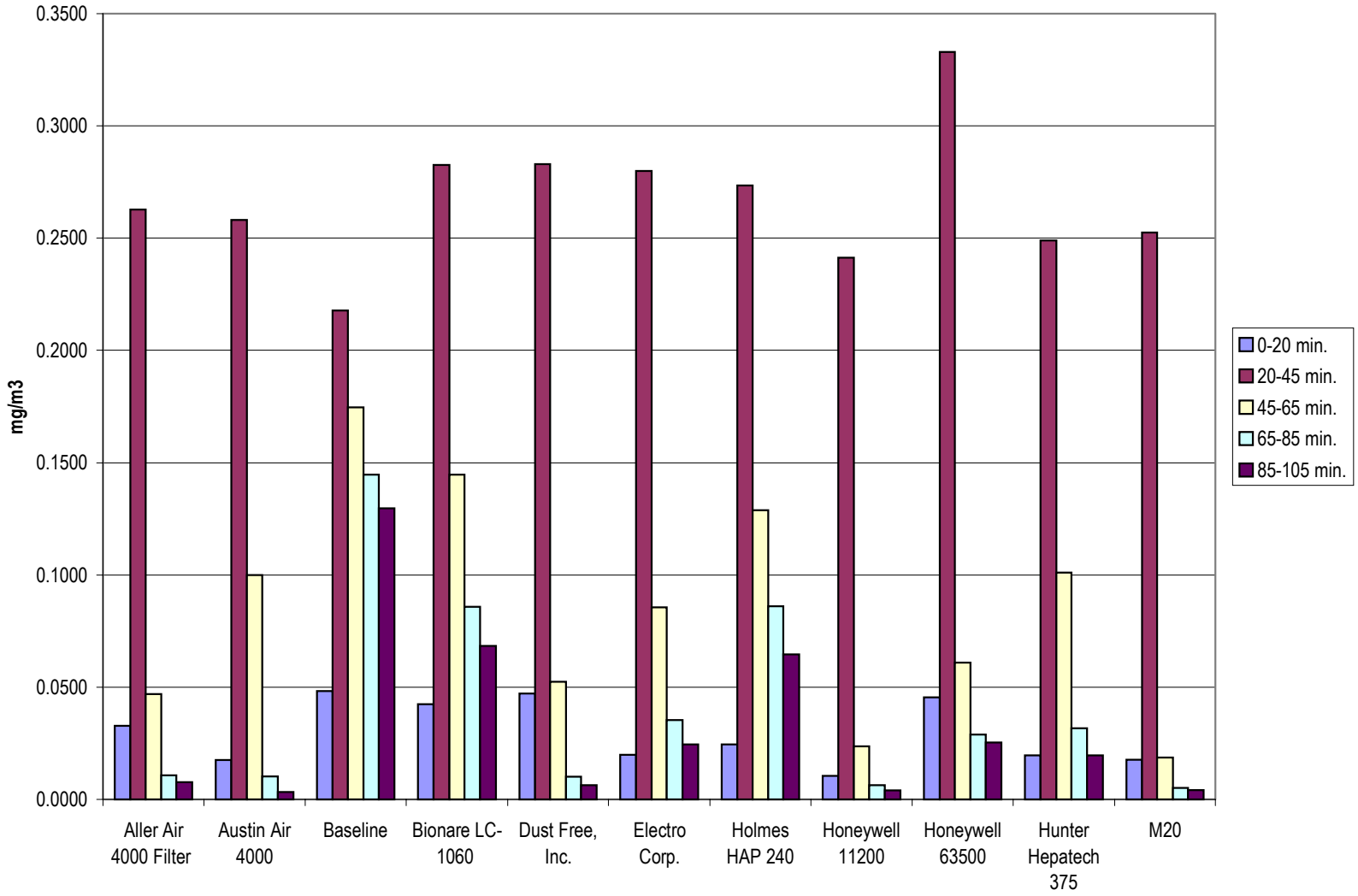

Figure A- 1. Mean Concentration vs. Time, Sorbent Tube Data

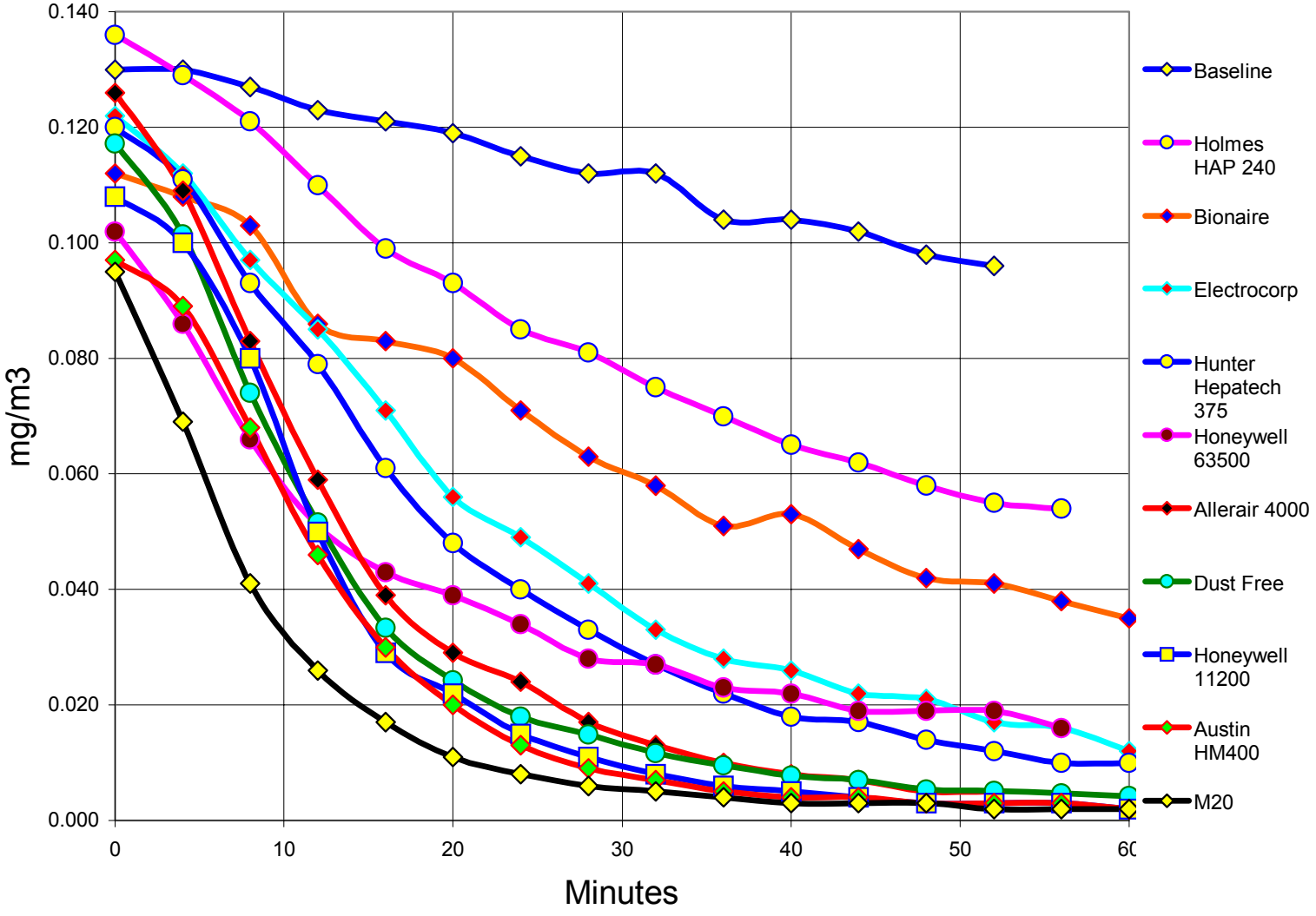

Figure A- 2. Mean Concentration vs. Time, MINICAMS® Data

APPENDIX B.
Filter Unit Pictures

Figure B- 1. Aller Air 4000

Figure B- 2. Austin HM400

Figure B- 3. Bionaire LC-1060

Figure B- 4. Dust Free Inc.

Figure B- 5. Electrocorp 224C4

Figure B- 6. Holmes HAP 240

Figure B- 7. Honeywell 11200

Figure B- 8. Honeywell 63500

Figure B- 9. Hunter 30375