

## **Mott Manufacturing Limited**

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### **Fume Hood Performance Test**

Test Date: January 10, 2002

Project: Standard 96" Airguard II Walk in Hood

Test Conducted By: A. Sinnamon  
Report Prepared By: A Sinnamon  
Test Audited By: William Stover

## Certificate of Fume Hood Test Report Accuracy

**Project:** Standard Test Program

**Hood Type:** 96" Airguard II Walkin Hood  
**Model Number:** 7511061  
**Manufacturer:** Mott Manufacturing Limited  
**Place of Manufacture:** Brantford, Ontario

**Customer:** N/A

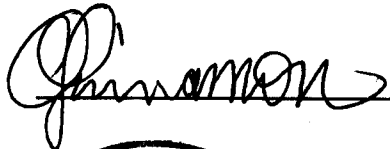
**Mott Test No.** 2002001

We have reviewed the complete contents of this report and confirm that the details presented are complete and accurate.

- All tests were conducted according to the protocols identified
- All equipment was calibrated as reported
- The fume hood identified was the fume hood tested
- The fume hood performance was as reported

Our signatures below confirm our agreement with all performance data presented in this report.

Test Technician:

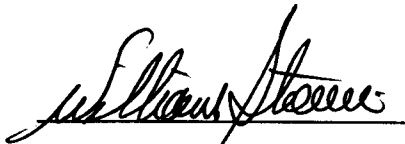


Andy Sinnamon

Engineer's Stamp:

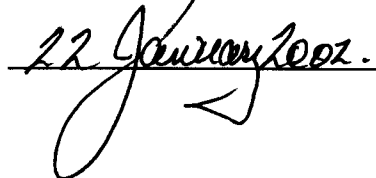


Company Officer:



Wm Stover P. Eng  
Chairman / CEO

Date:



## Executive Summary

All performance tests were conducted to ASHRAE 110-1995 protocol on the model number 7511061 96" Standard Airguard II walkin hood.

Tests were conducted at both 80 and 100 feet per minute with the upper sash at full open and 18" positions. Performance was found to be satisfactory under all tested conditions.

In summary, the overall performance for the hood tested was:

80 FPM Face Velocity with upper sash at 18"	+12.3% / -7.8%
100 FPM Face Velocity with upper sash at 18"	+14.2% / -7.3%
80 FPM Face Velocity with upper sash at 31"	+21.1% / -10.6%
100 FPM Face Velocity with upper sash at 31"	+19.2% / -16.7%
Static Tracer Gas	better than AM 0.01
Perimeter Scan	better than 0.01 ppm
Sash Movement Effect	SME-AM 0.117 ppm (peak)

The following report provides detailed results for each test performed.

## Summary of Test Results

### Mott Sigma Systems™ 7511061 96" Airguard II Walkin Hood

The following test results are confirmed with the spreadsheet or graphical computer output which is included in this report. All tests were conducted according to the protocol identified by ASHRAE 110-1995.

#### 1. Face Velocity Tests

Sash Position	Face Velocity	Maximum Variance	Minimum Variance
31"	100fpm	+19.2%	-16.7%
18"	100fpm	+14.2%	-7.3%
31"	80fpm	+21.1%	-10.6%
18"	80fpm	+12.3%	-7.8%

Computer spreadsheets are included with this report providing more details regarding these tests.

#### 2. Static Tracer Gas Tests

Sash Position	Face Velocity	Mannequin Position	Average Containment Performance
31"	80fpm	Left	Better than AM0.010
31"	80fpm	Center	Better than AM0.010
31"	80fpm	Right	Better than AM0.010
18"	80fpm	Left	Better than AM0.010
18"	80fpm	Center	Better than AM0.010
18"	80fpm	Right	Better than AM0.010
31"	100fpm	Left	Better than AM0.010
31"	100fpm	Center	Better than AM0.010
31"	100fpm	Right	Better than AM0.010
18"	100fpm	Left	Better than AM0.010
18"	100fpm	Center	Better than AM0.010
18"	100fpm	Right	Better than AM0.010

Computer graphs are included with this report providing more details regarding these tests.

### 3. Dynamic Tracer Gas Tests

#### Sash Movement Effect Test conducted with mannequin centre

Sash Positions	Face Velocity	Max SF <sub>6</sub> Detection
31" Open to Fully Closed	100	SME-AM 0.015 (peak)
18" Open to Fully Closed	100	below SME-AM 0.01 (no peak observed)
31" Open to Fully Closed	80	SME-AM 0.117 (peak)
18" Open to Fully Closed	80	below SME-AM 0.01 (no peak observed)

#### Perimeter Scan Test conducted with mannequin centre

Sash Position	Face Velocity	Max SF <sub>6</sub> Detection
31"	100	less than 0.01 ppm
18"	100	less than 0.01 ppm
31"	80	less than 0.01 ppm
18"	80	less than 0.01 ppm

Computer graphs are included with this report providing more details regarding these tests.

### 4. Flow Visualization Test

The following tests were conducted with titanium tetrachloride and smoke candle challenges. The tests were conducted at face velocities of 100 ft/min and 80 ft/min with the sash set to 18" and 31". Performance was similar under all conditions.

Test	Results
Smoke along 1" gap below lower door	Smooth draw rearward evenly over entire length Of the airfoil
Smoke along left and right inner wall and work surface parallel to fume hood face, 6 inches behind fume hood face	Smooth flow to rear of hood over entire height of sash opening.
Smoke discharged on rear baffle in 8" circle	Smoke flows upward into hood chamber. No reverse flow.
Smoke candle ignited inside fume hood, sash was opened and closed at variable rates. Fume hood was allowed to be fully filled with smoke between sash openings	Fume hood did not demonstrate any reverse flow No smoke escaped from the fume hood when the sash was raised. The fume hood cleared of smoke when sash was opened. No smoke escaped at any time.

# Mott Manufacturing Ltd

## Face Velocity Test

**Project:** Standard Hood testing

**Test No:** 2002001.1

**Test Performed By:** A Sinnamon

**Date:** 10 Jan 2002

**Fume Hood Model No:**

**Test Witnessed By:**

**Fume Hood Description:** 96" Airguard II Walkin Hood

**Required Normalized Face Velocity (ft/min):** 100

**Connection:** Direct

Phoenix setting:

Fan RPM: 578

Damper Setting - % Open: 0

Var Speed Cont: 27.0

Sash Height (in): 31.000

Face Width (in): 86.500

Interior Depth (in): 24.500

Static

**Sash Cells**

Horizontal Cells: 6

Vertical Cells: 3

Sash Cell Area: 1.0

Sash Cell Height (in): 10.333

Sash Cell Width (in): 14.417

(sq ft)

**Sash Cell Centre Line Coordinates referenced from Lower Left Corner**

**Actual Face Velocity Measurements (ft/min)**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	100	94	89	81	90	110				
2	15.500	102	92	91	89	96	110				
3	5.167	102	94	98	97	101	116				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Measured Variance from Average**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	2.9%	-4.0%	-8.3%	-16.7%	-7.5%	12.9%				
2	15.500	5.2%	-5.6%	-6.5%	-8.2%	-1.9%	12.9%				
3	5.167	5.2%	-3.2%	0.5%	-0.7%	3.9%	19.2%				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Actual Corrected (to STP) Overall Average Test Face Velocity (ft/min):**

97

**Variance Actual Corrected Overall Average Face Velocity to Required Normalized Face Velocity:**

-2.6%

**Normalized Face Velocities (ft/min) @ STP**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	102.9	96.0	91.7	83.3	92.5	112.9				
2	15.500	105.2	94.4	93.5	91.8	98.1	112.9				
3	5.167	105.2	96.8	100.5	99.3	103.9	119.2				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Results Summary @ STP**

	ft/min	% Variance
<b>Normalized Corrected Overall Average Face Velocity</b>	<b>100</b>	
<b>Normalized Corrected Maximum Face Velocity</b>	<b>119</b>	<b>19.2%</b>
<b>Normalized Corrected Minimum Face Velocity</b>	<b>83</b>	<b>-16.7%</b>
<b>Average Corrected Normalized Flow Rate (CFM):</b>	<b>1862</b>	

# Mott Manufacturing Ltd

## Face Velocity Test

**Project:** Standard Hood testing

**Test No:** 2002001.2

**Test Performed By:** A Sinnamon

**Date:** 10 Jan 2002

**Fume Hood Model No:**

**Test Witnessed By:**

**Fume Hood Description:** 96" Airguard II Walkin Hood

**Required Normalized Face Velocity (ft/min):** 80

**Connection:** Direct

Phoenix setting:

Fan RPM: 494

Damper Setting - % Open: 0

Var Speed Cont: 23.0

Sash Height (in): 31.000

Face Width (in): 86.500

Interior Depth (in): 24.500

Static

### Sash Cells

Horizontal Cells: 6

Vertical Cells: 3

Sash Cell Area: 1.0

Sash Cell Height (in): 10.333

Sash Cell Width (in): 14.417

(sq ft)

### Sash Cell Centre Line Coordinates referenced from Lower Left Corner

#### Actual Face Velocity Measurements (ft/min)

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	86	78	75	74	78	91				
2	15.500	90	79	76	78	80	83				
3	5.167	90	83	82	85	85	100				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

#### Measured Variance from Average

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	3.7%	-5.8%	-9.6%	-10.6%	-5.9%	10.1%				
2	15.500	8.3%	-5.2%	-8.8%	-5.7%	-3.1%	-0.3%				
3	5.167	8.2%	-0.2%	-1.6%	3.0%	2.4%	21.1%				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Actual Corrected (to STP) Overall Average Test Face Velocity (ft/min):**

83

**Variance Actual Corrected Overall Average Face Velocity to Required Normalized Face Velocity:**

3.5%

#### Normalized Face Velocities (ft/min) @ STP

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	25.833	83.0	75.3	72.3	71.5	75.2	88.1				
2	15.500	86.7	75.8	73.0	75.4	77.5	79.8				
3	5.167	86.6	79.8	78.7	82.4	81.9	96.9				
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

#### Results Summary @ STP

	ft/min	% Variance
<b>Normalized Corrected Overall Average Face Velocity</b>	<b>80</b>	
<b>Normalized Corrected Maximum Face Velocity</b>	<b>97</b>	<b>21.1%</b>
<b>Normalized Corrected Minimum Face Velocity</b>	<b>72</b>	<b>-10.6%</b>
<b>Average Corrected Normalized Flow Rate (CFM):</b>	<b>1490</b>	

# Mott Manufacturing Ltd

## Face Velocity Test

**Project:** Standard Hood testing

**Test No:** 2002001.3

**Test Performed By:** A Sinnamon

**Date:** 10 Jan 2002

**Fume Hood Model No:**

**Test Witnessed By:**

**Fume Hood Description:** 96" Airguard II Walkin Hood

**Required Normalized Face Velocity (ft/min):** 100

**Connection:** Direct

Phoenix setting:

Fan RPM: 494                      Damper Setting - % Open: 0                      Var Speed Cont: 20.0

Sash Height (in): 18.000              Face Width (in): 86.500              Interior Depth (in): 24.500

Static

**Sash Cells**

Horizontal Cells: 6                      Vertical Cells: 2                      Sash Cell Area : 0.9 (sq ft)

Sash Cell Height (in): 9.000              Sash Cell Width (in): 14.417

**Sash Cell Centre Line Coordinates referenced from Lower Left Corner**

**Actual Face Velocity Measurements (ft/min)**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	107	101	104	101	108	120				
2	4.500	104	99	97	99	105	115				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Measured Variance from Average**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	1.9%	-4.3%	-0.6%	-4.1%	3.0%	14.2%				
2	4.500	-0.8%	-5.3%	-7.3%	-5.3%	-0.4%	9.1%				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Actual Corrected (to STP) Overall Average Test Face Velocity (ft/min):**

105

**Variance Actual Corrected Overall Average Face Velocity to Required Normalized Face Velocity:**

5.0%

**Normalized Face Velocities (ft/min) @ STP**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	101.9	95.7	99.4	95.9	103.0	114.2				
2	4.500	99.2	94.7	92.7	94.7	99.6	109.1				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Results Summary @ STP**

	ft/min	% Variance
<b>Normalized Corrected Overall Average Face Velocity</b>	<b>100</b>	
<b>Normalized Corrected Maximum Face Velocity</b>	<b>114</b>	<b>14.2%</b>
<b>Normalized Corrected Minimum Face Velocity</b>	<b>93</b>	<b>-7.3%</b>
<b>Average Corrected Normalized Flow Rate (CFM):</b>	<b>1081</b>	

# Mott Manufacturing Ltd

## Face Velocity Test

**Project:** Standard Hood testing

**Test No:** 2002001.4

**Test Performed By:** A Sinnamon

**Date:** 10 Jan 2002

**Fume Hood Model No:**

**Test Witnessed By:**

**Fume Hood Description:** 96" Airguard II Walkin Hood

**Required Normalized Face Velocity (ft/min):** 80

**Connection:** Direct

Phoenix setting:

Fan RPM: 323

Damper Setting - % Open: 0

Var Speed Cont: 15.0

Sash Height (in): 18.000

Face Width (in): 86.500

Interior Depth (in): 24.500

Static

**Sash Cells**

Horizontal Cells 6

Vertical Cells 2

Sash Cell Area : 0.9

Sash Cell Height (in): 9.000

Sash Cell Width (in): 14.417

(sq ft)

**Sash Cell Centre Line Coordinates referenced from Lower Left Corner**

**Actual Face Velocity Measurements (ft/min)**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	84	78	80	78	88	91				
2	4.500	80	77	75	77	81	85				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Measured Variance from Average**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	4.0%	-3.8%	-1.0%	-4.4%	8.1%	12.3%				
2	4.500	-1.1%	-5.6%	-7.8%	-4.6%	-0.4%	4.2%				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

**Actual Corrected (to STP) Overall Average Test Face Velocity (ft/min):**

81

**Variance Actual Corrected Overall Average Face Velocity to Required Normalized Face Velocity:**

1.4%

**Normalized Face Velocities (ft/min) @ STP**

CELL		A	B	C	D	E	F	G	H	I	K
	location	7.208	21.625	36.042	50.458	64.875	79.292	N/A	N/A	N/A	N/A
1	13.500	83.2	77.0	79.2	76.5	86.4	89.8				
2	4.500	79.1	75.5	73.8	76.3	79.7	83.3				
3	N/A										
4	N/A										
5	N/A										
6	N/A										
7	N/A										
8	N/A										

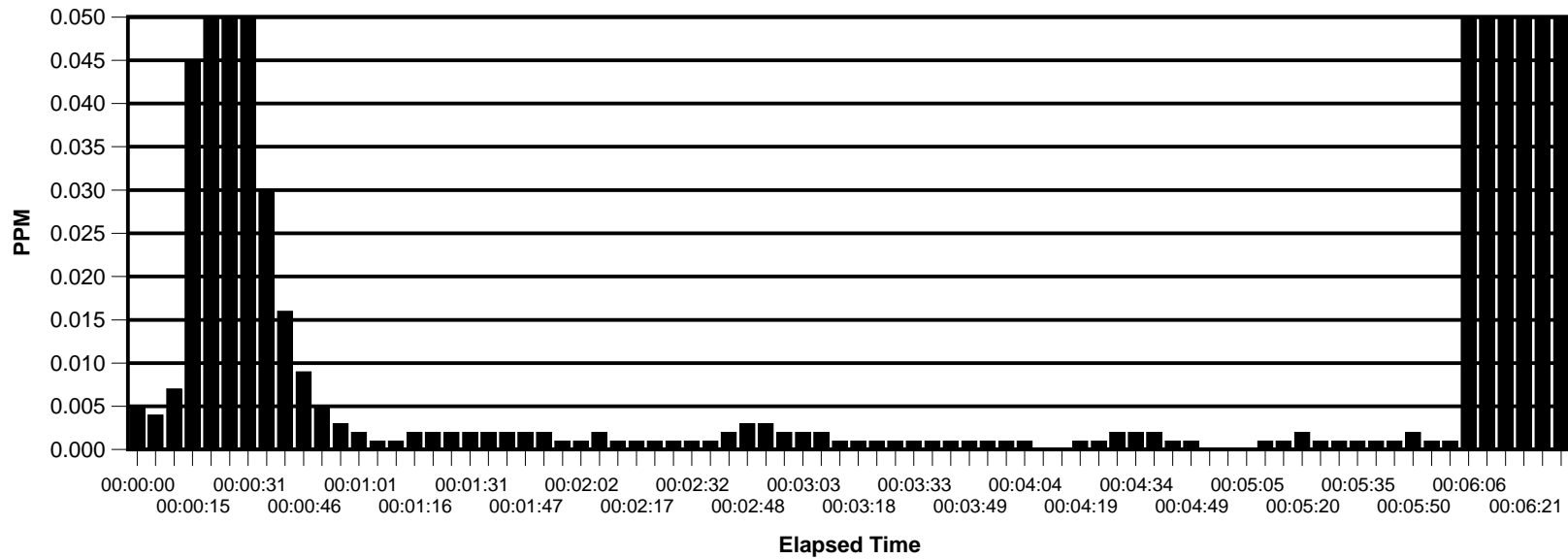
**Results Summary @ STP**

	ft/min	% Variance
<b>Normalized Corrected Overall Average Face Velocity</b>	<b>80</b>	
<b>Normalized Corrected Maximum Face Velocity</b>	<b>90</b>	<b>12.3%</b>
<b>Normalized Corrected Minimum Face Velocity</b>	<b>74</b>	<b>-7.8%</b>
<b>Average Corrected Normalized Flow Rate (CFM):</b>	<b>865</b>	

## **Guide to Interpreting Graphs**

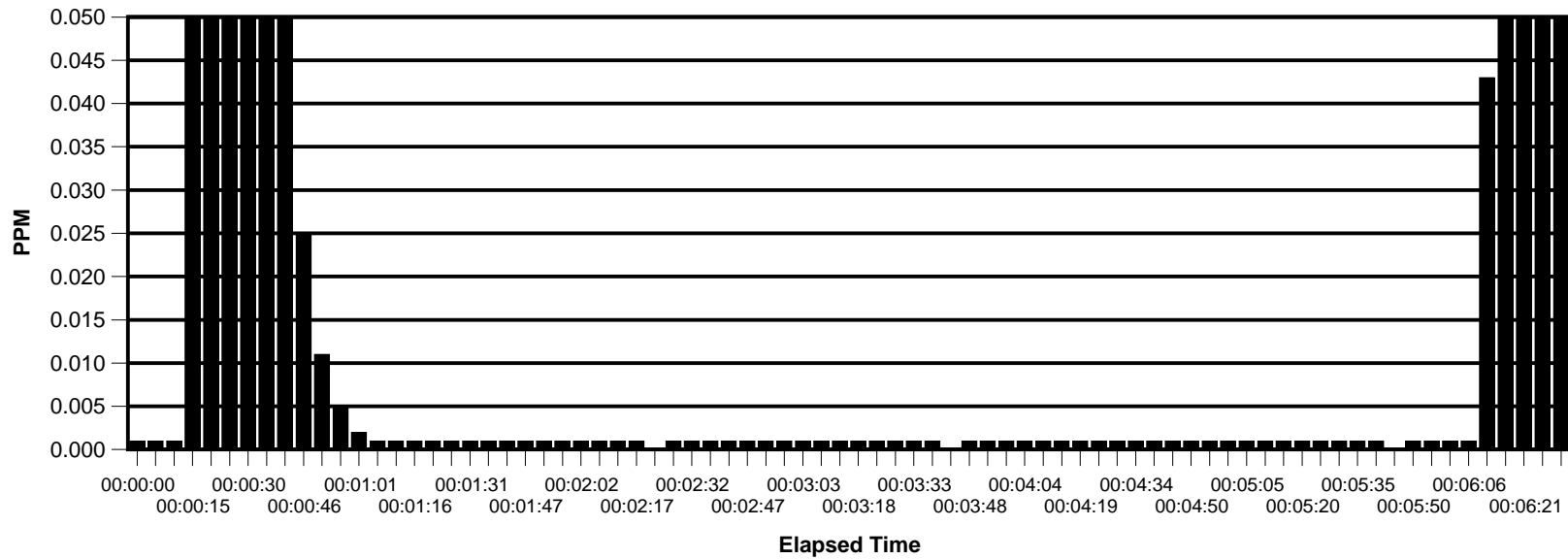
All Tracer gas test graphs will have a peak at the beginning and a peak at the end. This is an indication of the gas that was deliberately introduced to verify that the instrument was functioning at the beginning and end of each test. Actual test results begin when the initial peak has fallen below 0.010 parts per million. Only peaks which appear in between the initial and final peaks would indicate a loss of containment.

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



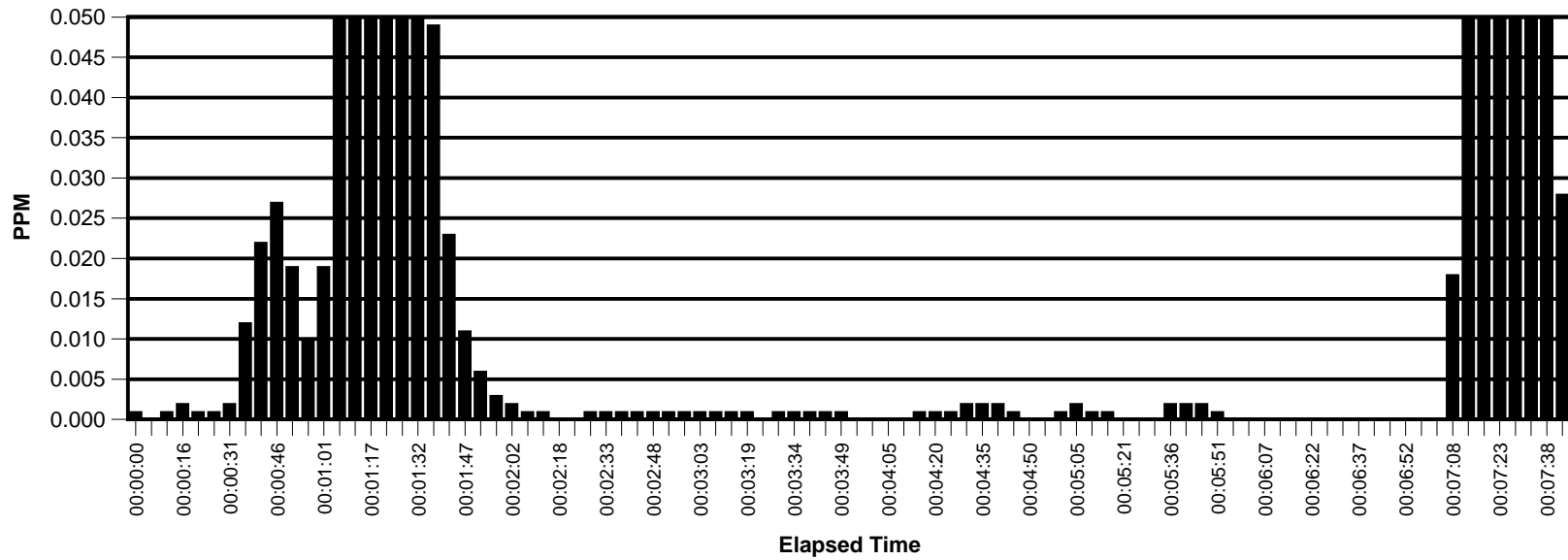
Hood Number 7511061  
80 FPM Mannequin Right - Sash at 31"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



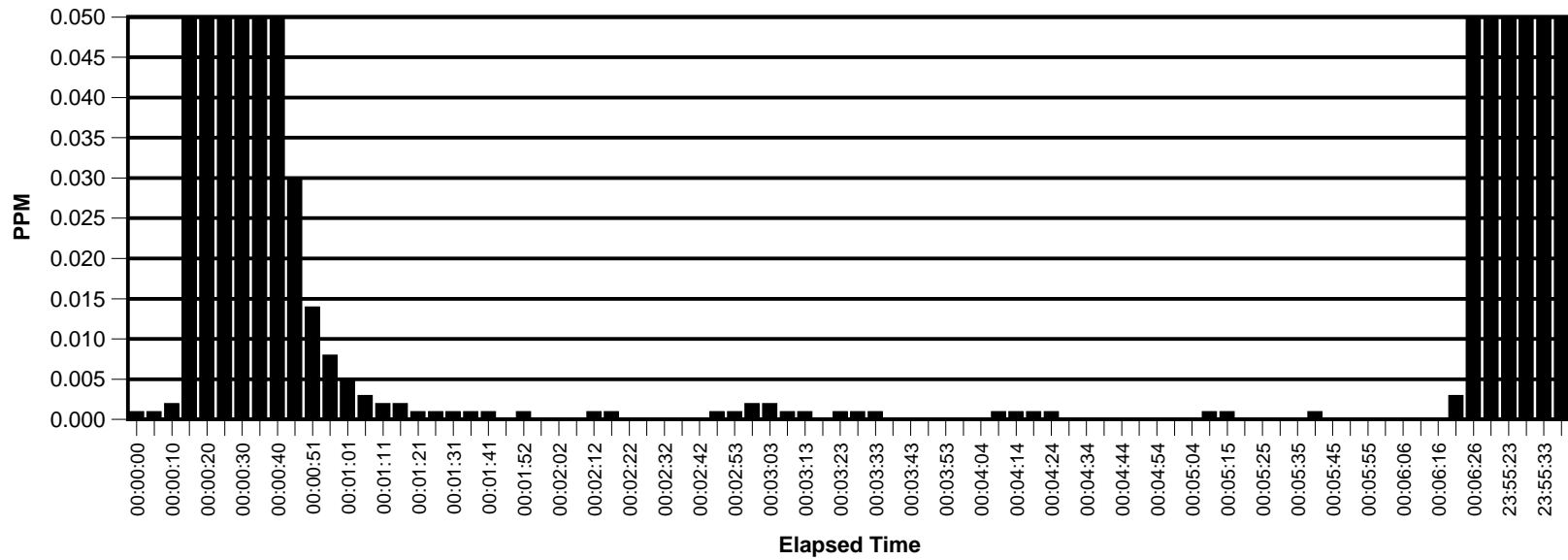
Hood Number 7511061  
100 FPM Mannequin Right - Sash at 31"  
Results Adjusted for -1 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



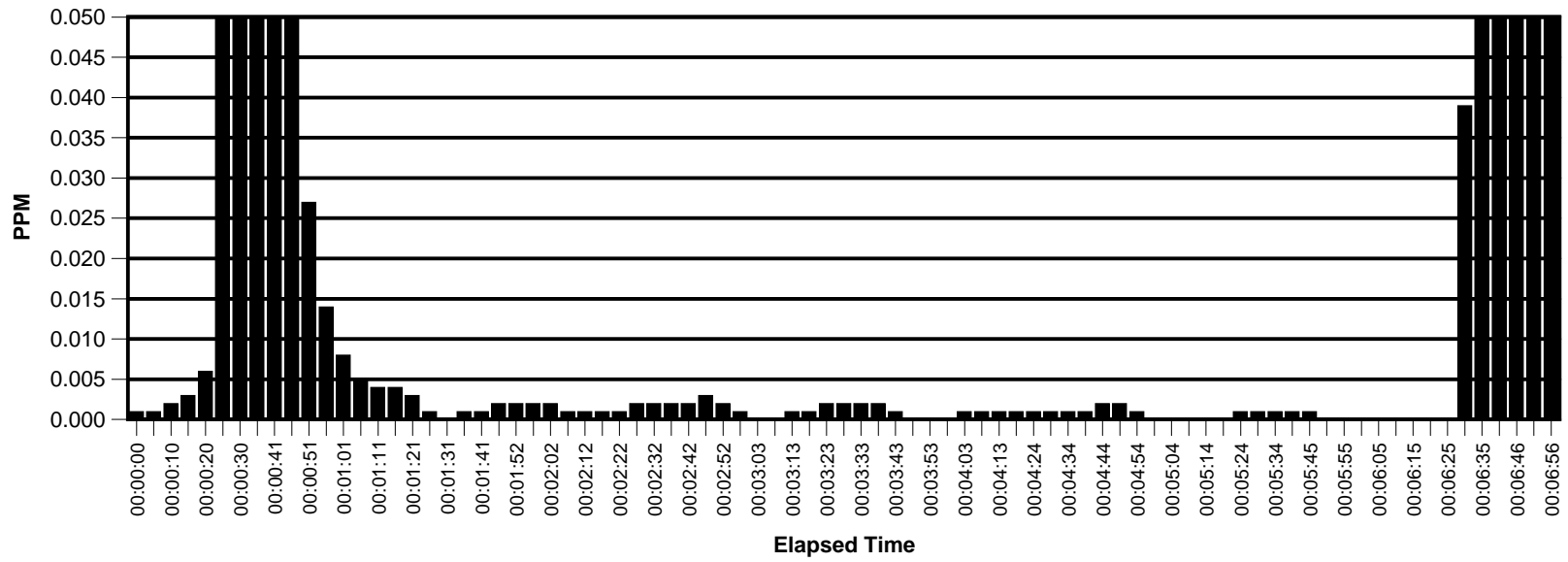
Hood Number 7511061  
100 FPM Mannequin Right - Sash at 18"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



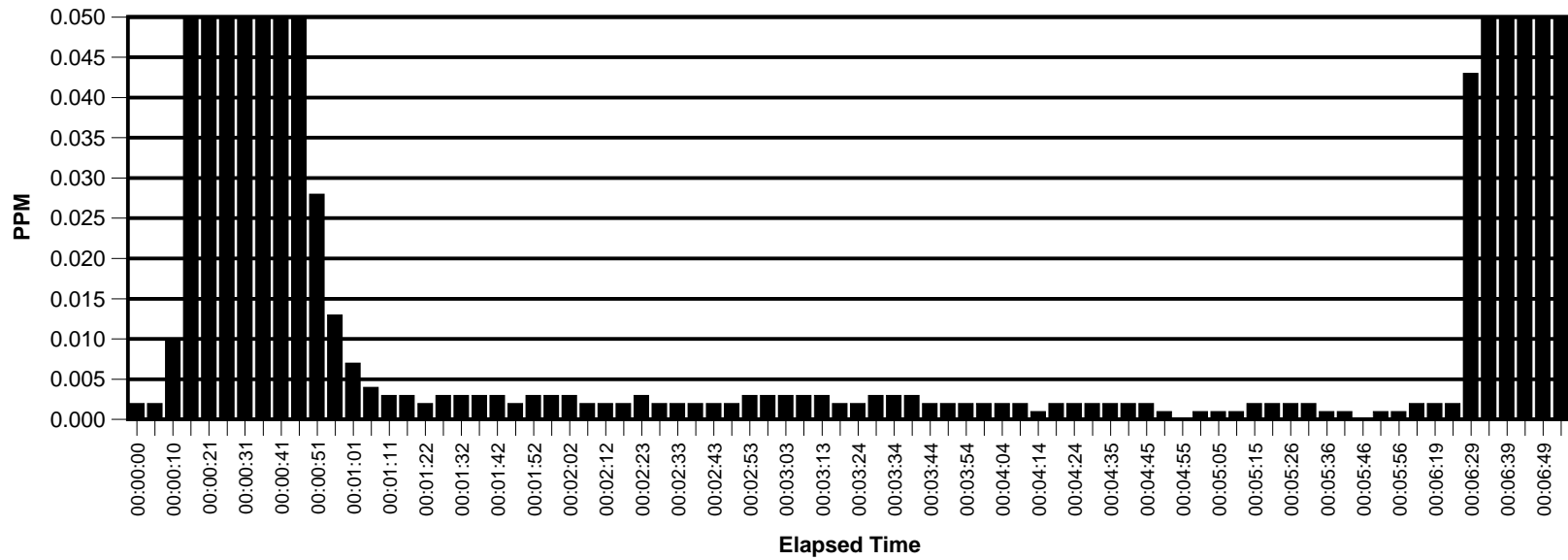
Hood Number 7511061  
80 FPM Mannequin Right - Sash at 18"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



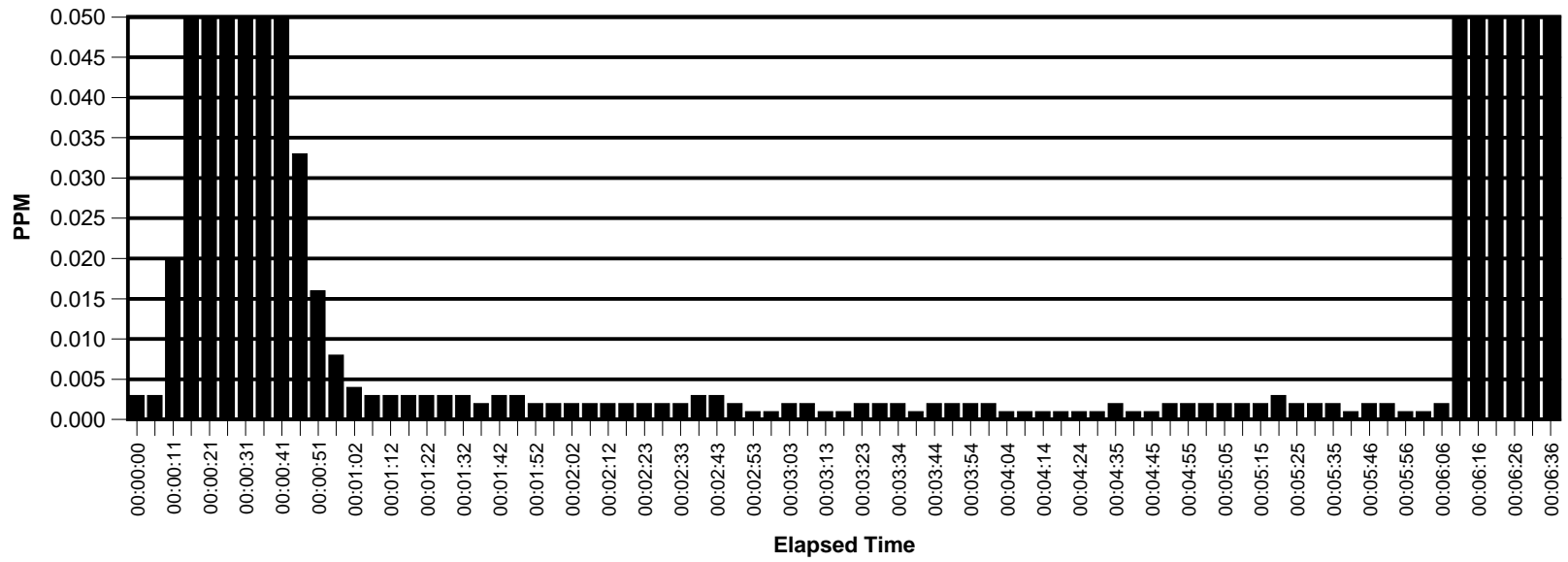
Hood Number 7511061  
100 FPM Mannequin Left - Sash at 31"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



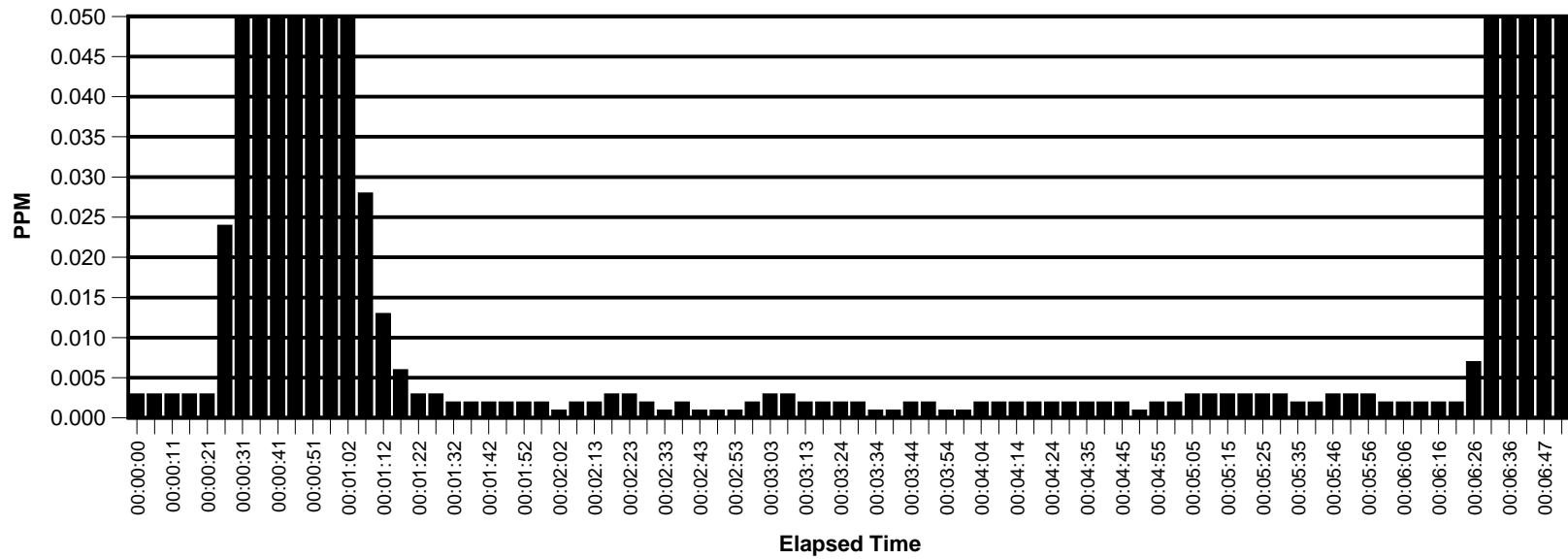
Hood Number 7511061  
80 FPM Mannequin Left - Sash at 31"  
Results Adjusted for -3 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



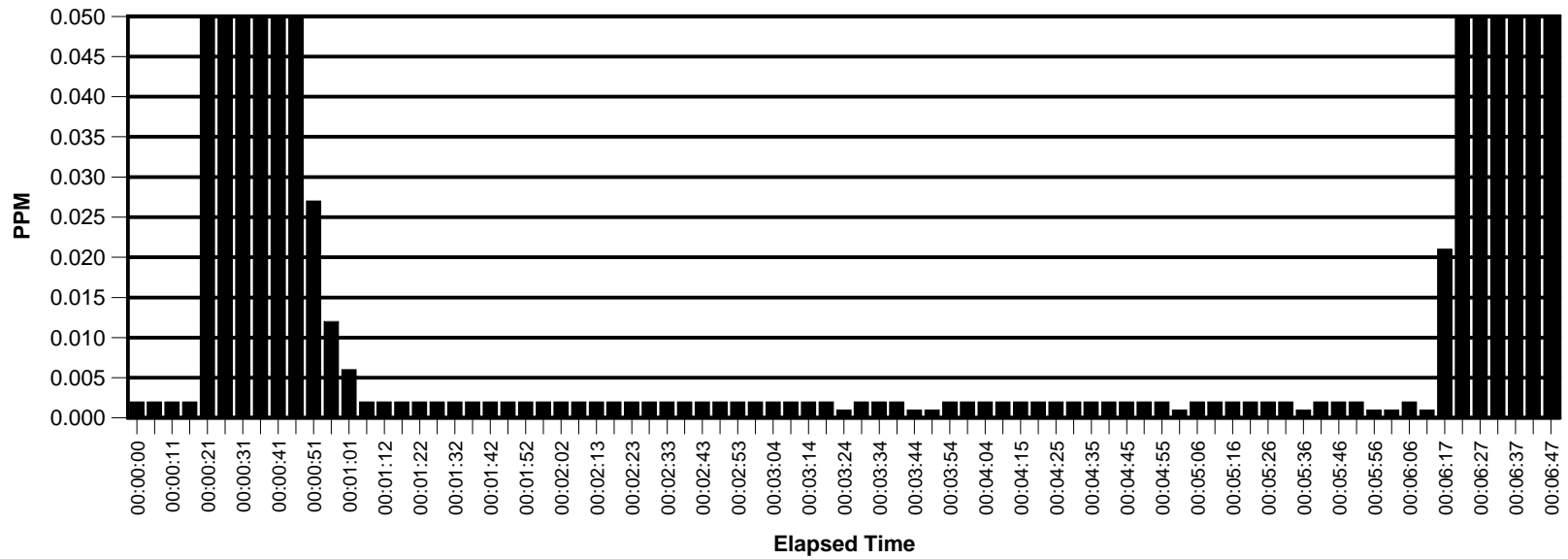
Hood Number 7511061  
100 FPM Mannequin Left - Sash at 18"  
Results Adjusted for -3 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



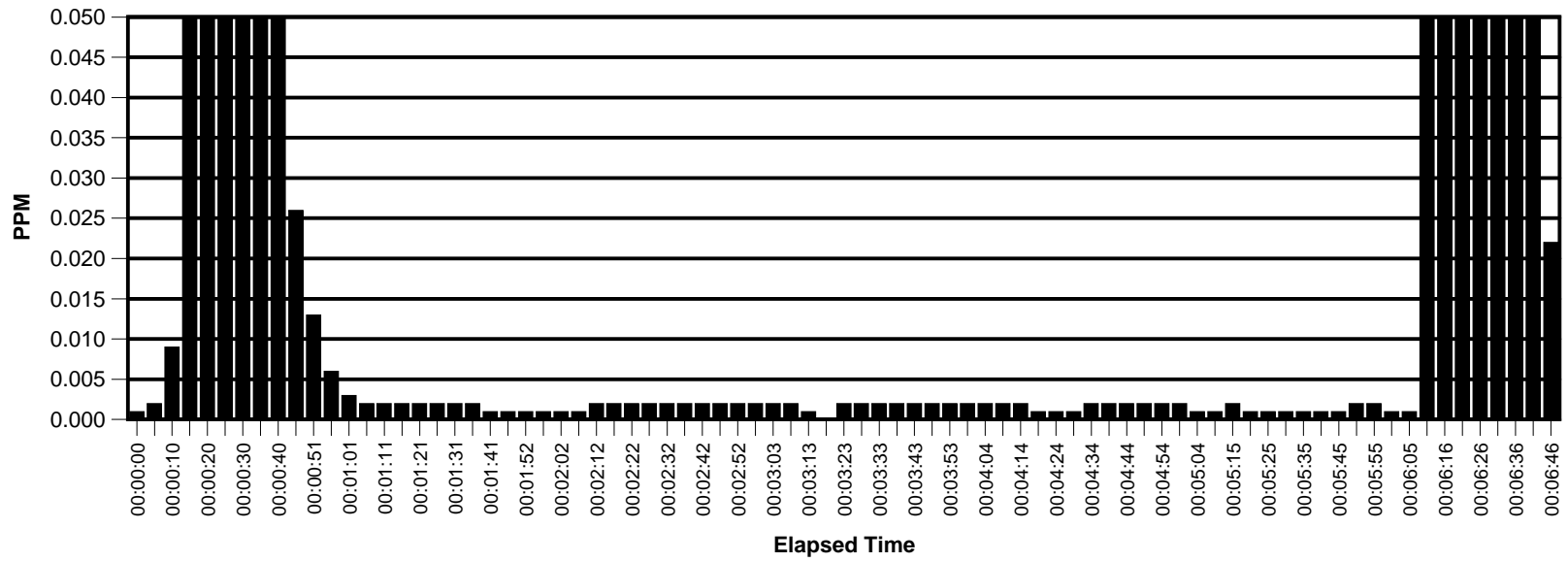
Hood Number 7511061  
80 FPM Mannequin Left - Sash at 18"  
Results Adjusted for -3 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



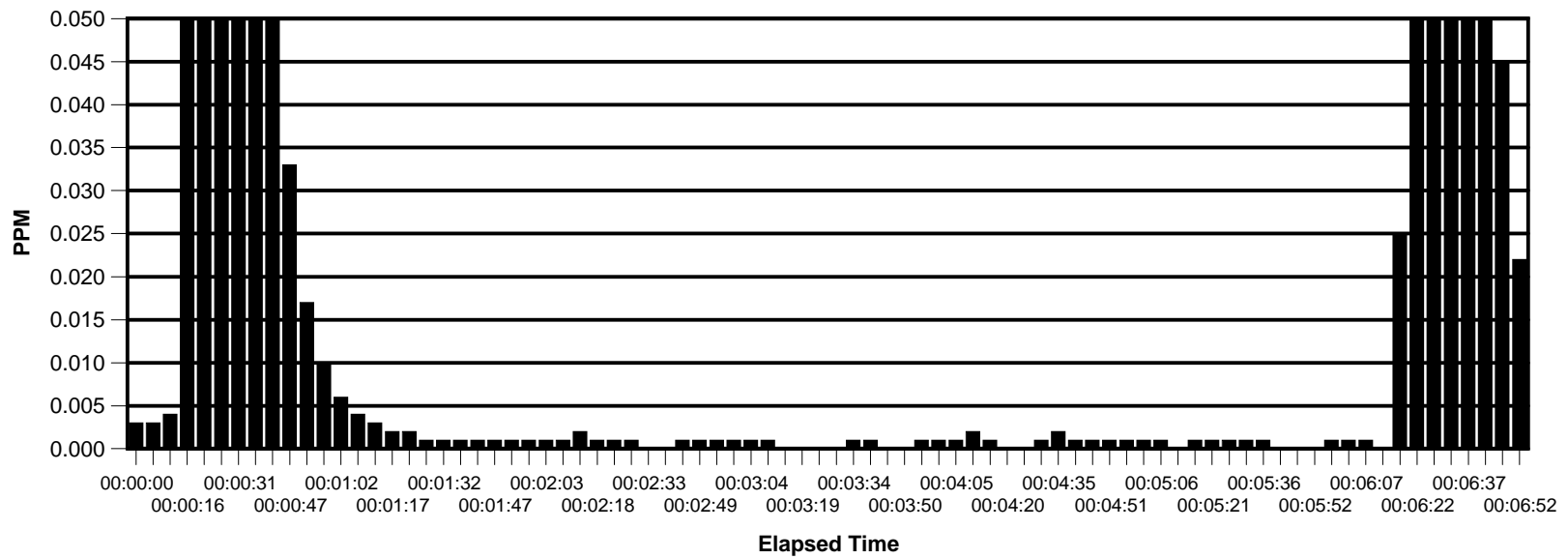
Hood Number 7511061  
100 FPM Mannequin Centre - Sash at 31"  
Results Adjusted for -2 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



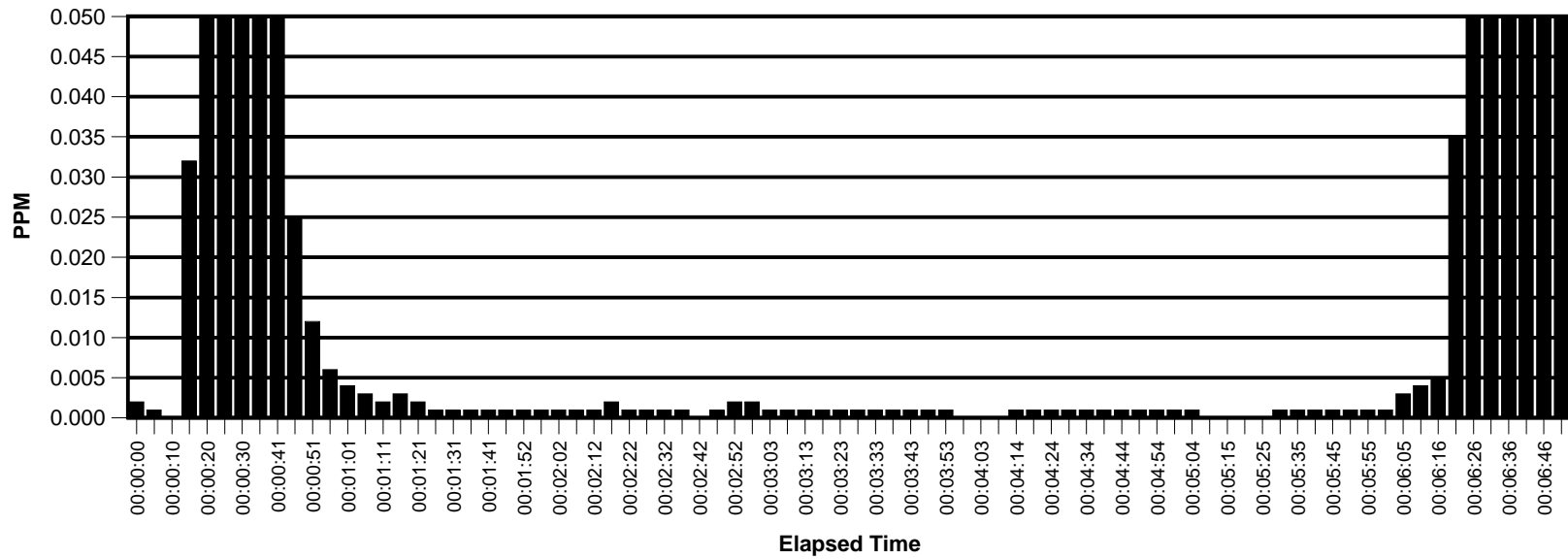
Hood Number 7511061  
80 FPM Mannequin Centre - Sash at 31"  
Results Adjusted for -2 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



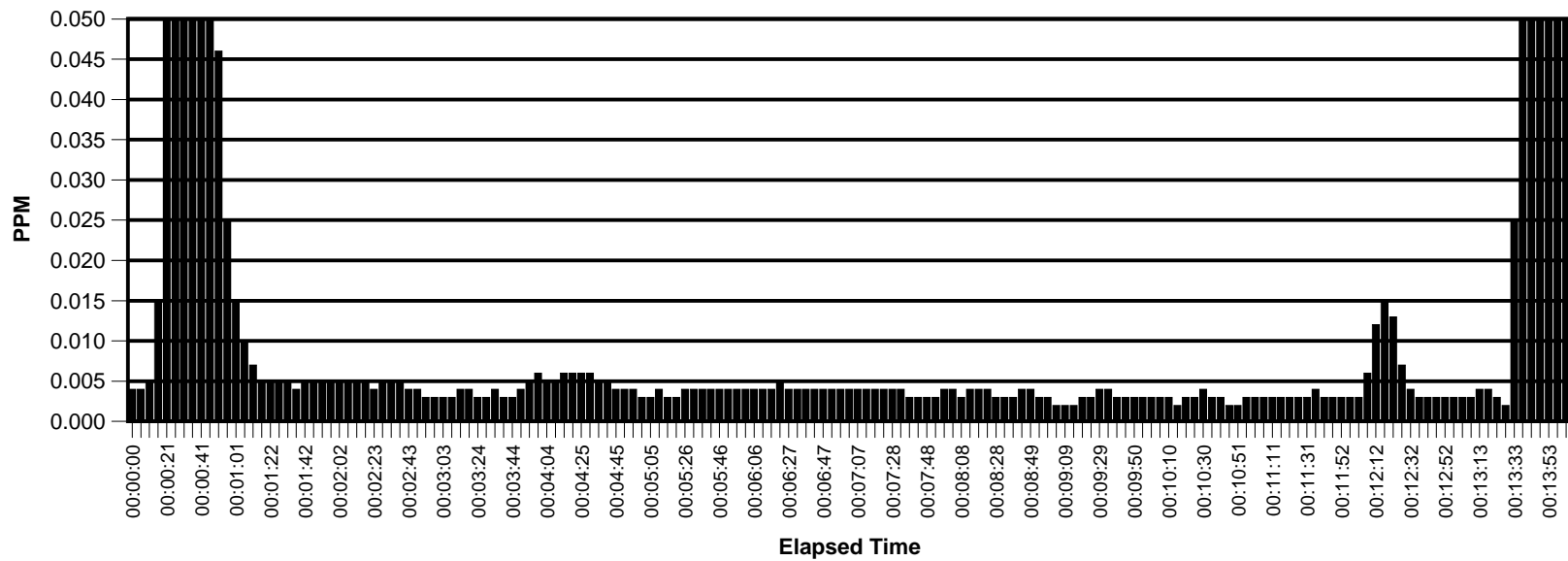
Hood Number 7511061  
100 FPM Mannequin Centre - Sash at 18"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



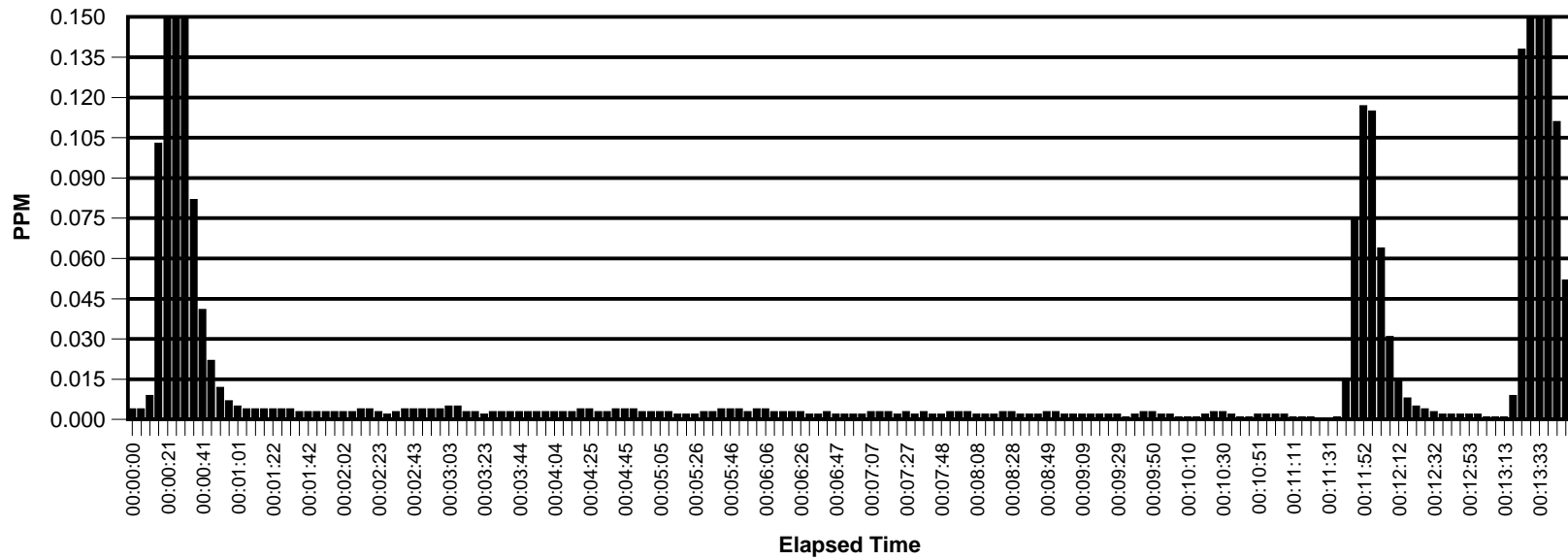
Hood Number 7511061  
80 FPM Mannequin Centre - Sash at 18"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



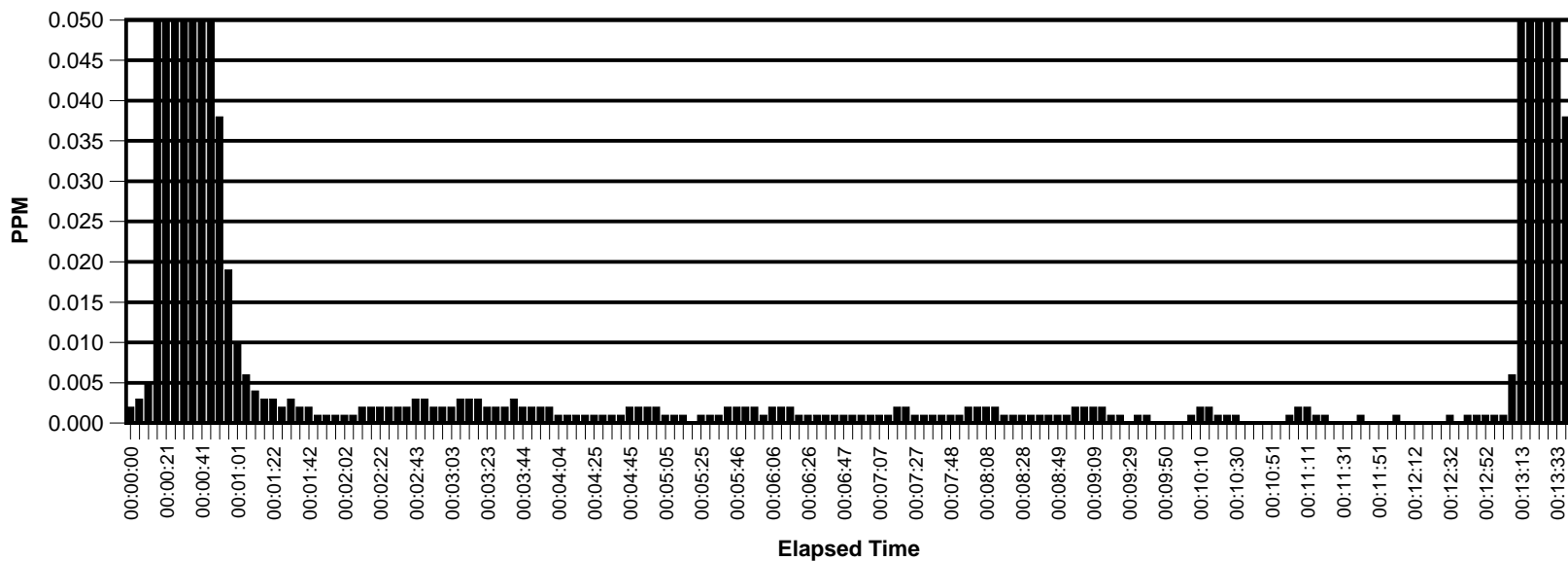
Hood Number 7511061  
100 FPM Sash Movement Effect - Sash starts at 31"  
Results Adjusted for 0 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**

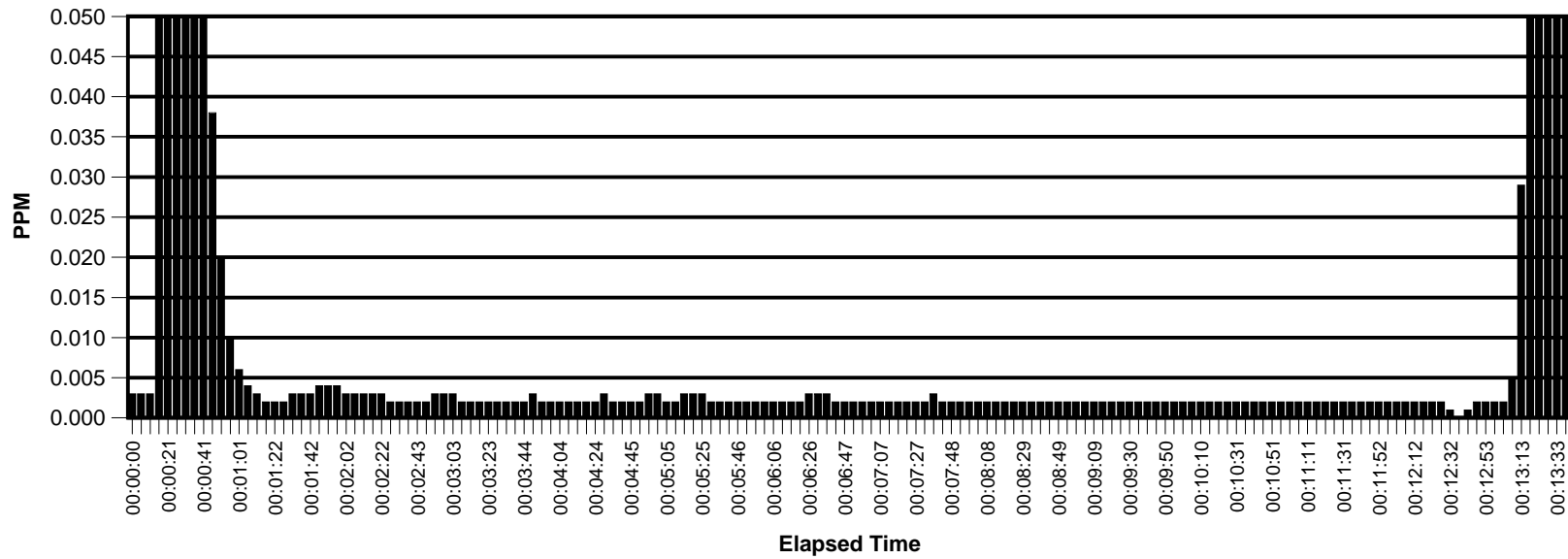


Hood Number 7511061  
80 FPM Sash Movement Effect - Sash starts at 31"  
Results Adjusted for 0 PPB background

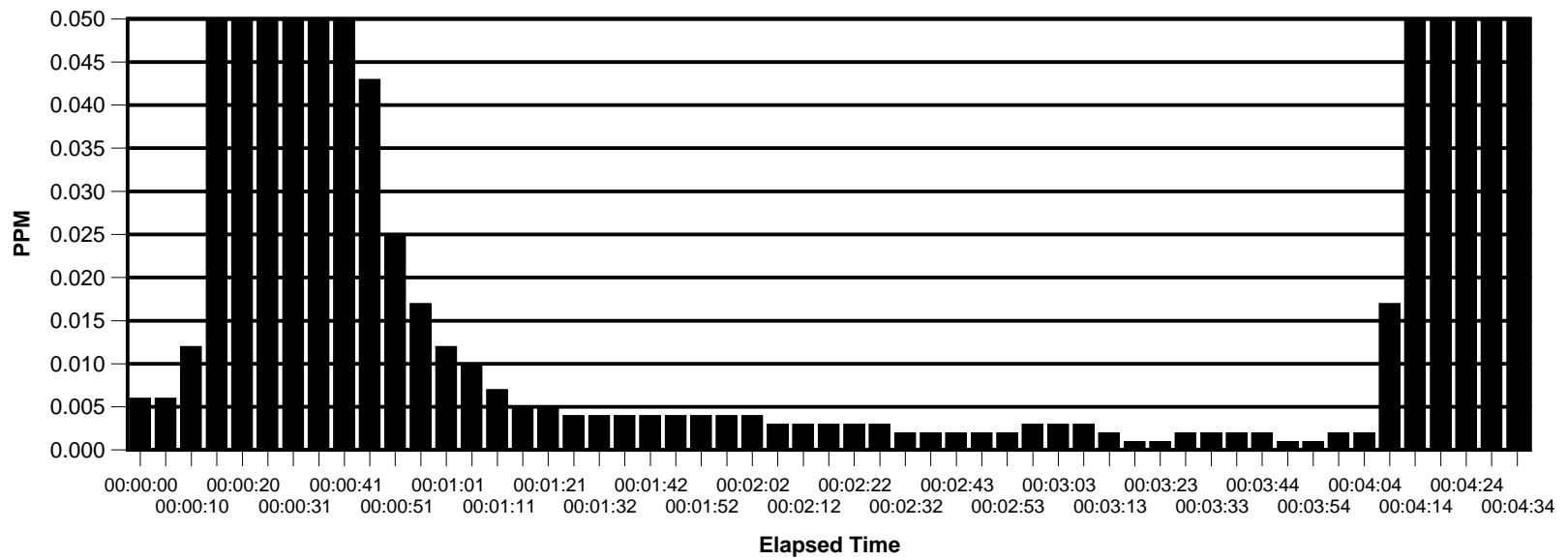
**Mott Manufacturing Ltd**  
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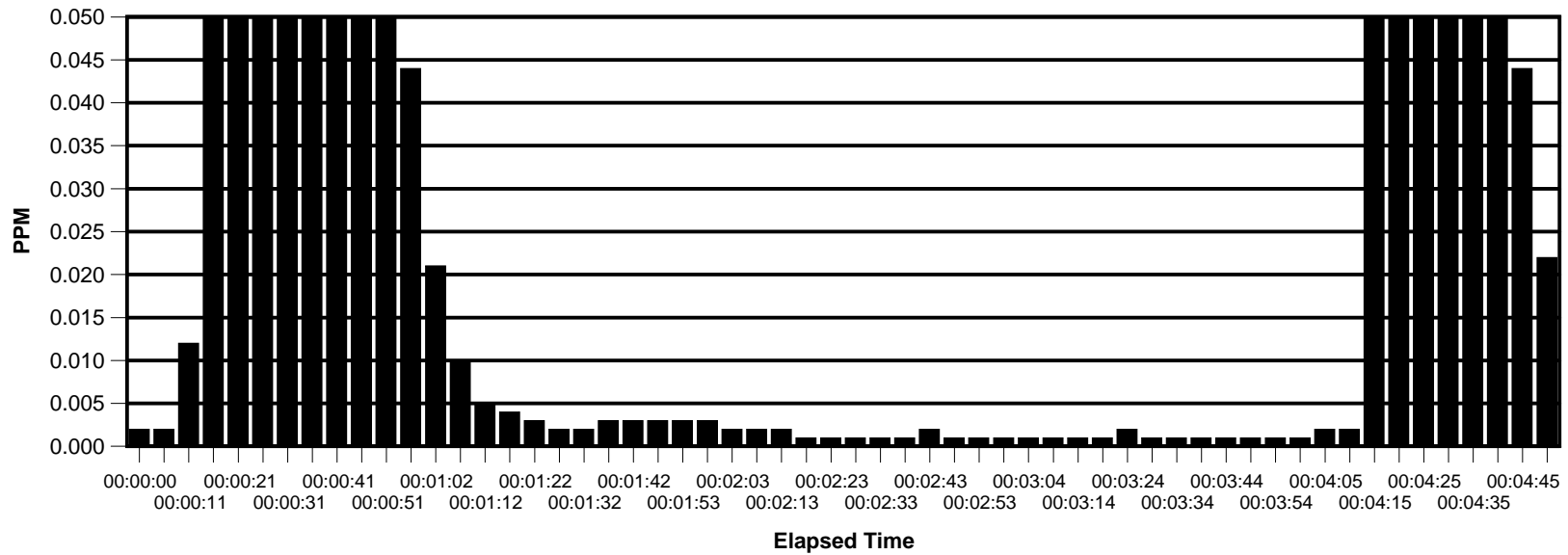


**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



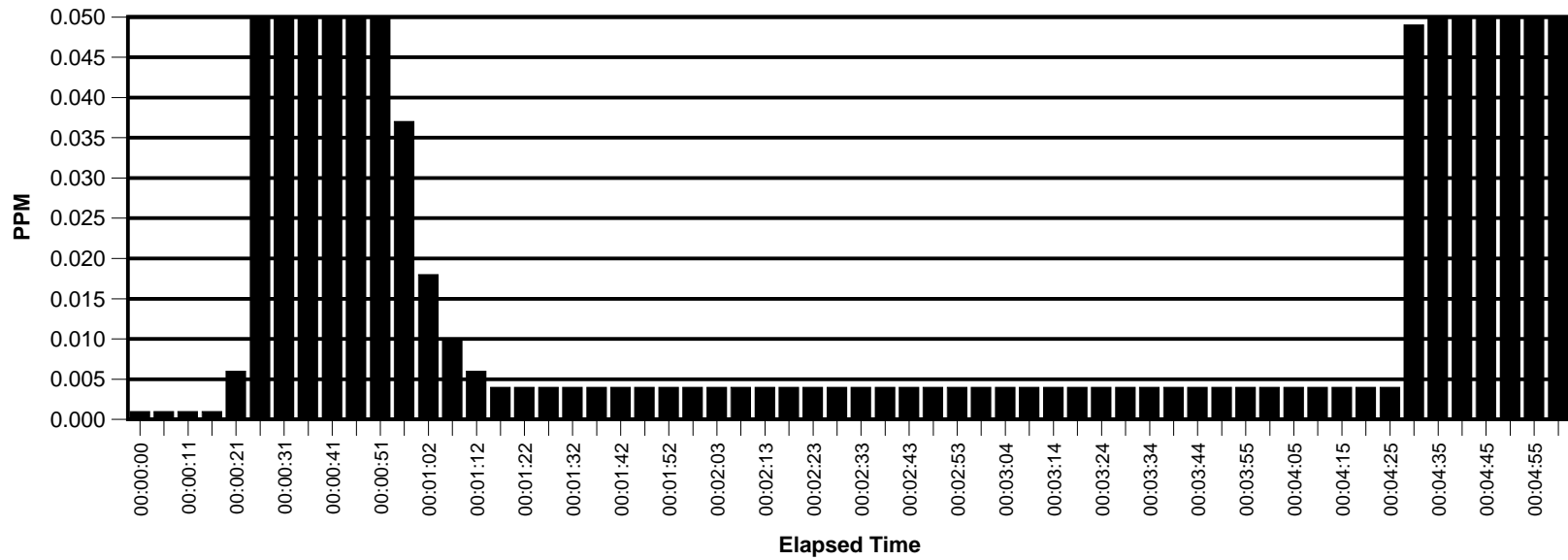
Hood Number 7511061  
100 FPM Perimeter Scan - Sash at 31"  
Results Adjusted for -5 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



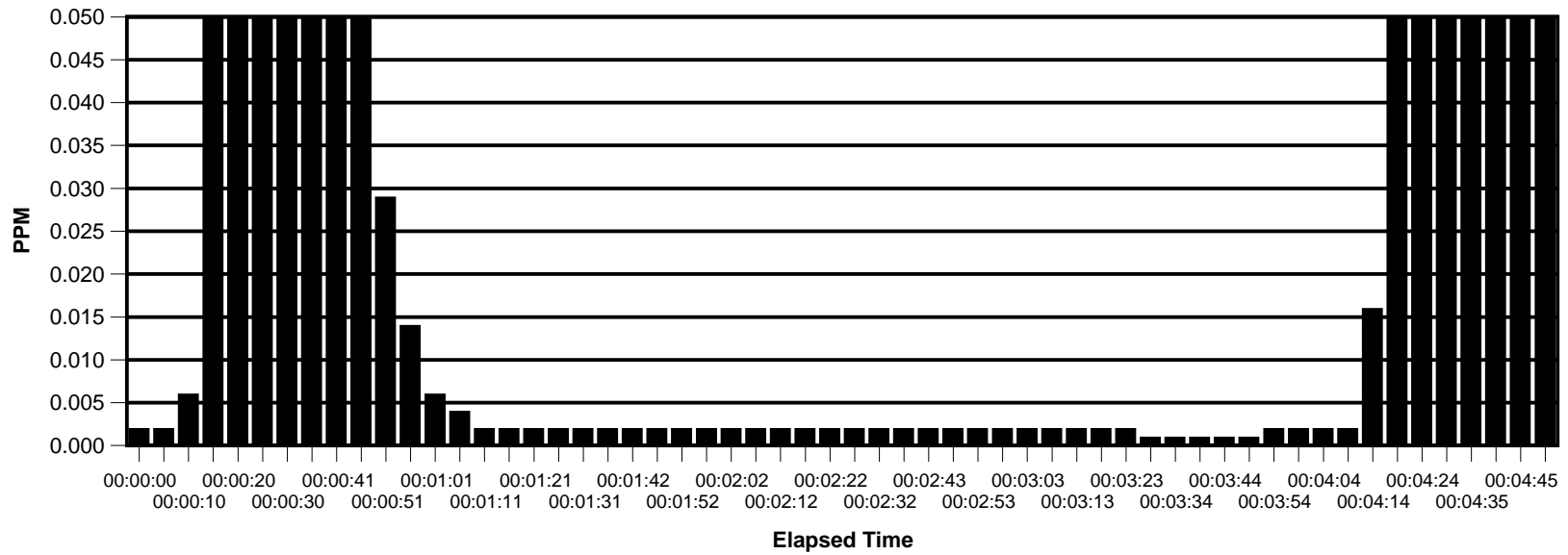
Hood Number 7511061  
80 FPM Perimeter Scan - Sash at 31"  
Results Adjusted for -5 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



Hood Number 7511061  
100 FPM Perimeter Scan - Sash at 18"  
Results Adjusted for -4 PPB background

**Mott Manufacturing Ltd**  
**ASHRAE 110-1995 Gas Tracer Test**  
**Standard Airguard II 96" walkin Hood**



Hood Number 7511061  
80 FPM Perimeter Scan - Sash at 18"  
Results Adjusted for -2 PPB background

## Summary of Test Equipment and Test Facility

### Test Facility

**Size** 19 feet wide x 19 feet long x 14 feet high

**Features** An approximate acoustic R value in the range of 1000 to 2000.

Ventilation system includes a roof mounted, variable speed, centrifugal, forward curved, AMCA arrangement 4, exhaust fan connected to a 24 inch diameter sheet metal duct that contains no acoustic interior or exterior lining and is approximately 60 feet long and includes one 90 degree elbow, one 180 degree elbow, straightening vanes, a roof mounted mixing box complete with an opposed blade bypass damper, and a calibrated flow venturi. Duct velocities are less than 1500 ft/min.

A Phoenix variable air volume valve and fume hood monitor are permanently installed and may be used to regulate air flow in both constant volume and variable volume applications.

Differential static pressure between test facility and next adjacent room is less than 0.02 inches water gauge.

Make up air system is a natural flow design that introduces make up air into the test facility from the manufacturing facility through a screened grill mounted in the full width of the wall at ceiling height opposite the fume hood. Grill velocities are less than 50 feet/minute.

SF<sub>6</sub> system consisting of a source pressurized bottle external to the test room, a pressure rated rubber supply hose, and a calibrated discharge tower to ASHRAE 110-1995 standards that discharges 4.0 litres through a calibrated nozzle at 30 psi. The SF<sub>6</sub> supply system receives regular maintenance to ensure that background levels are maintained at zero ppm during all tests. SF<sub>6</sub> system is calibrated to 4.0 litres/min within 24 hours of each ASHRAE 110-1995 test.

### Test Equipment

**Face Velocity Measurement** TSI VelociCalc Flow Meter  
Model 8355-E-GB  
Serial Number 96070427  
Accuracy: +/- 2 feet/min for the range 30 to 500 ft/min  
Calibrated 01/2001  
ASHRAE 110-1995 requires +/- 5% accuracy

TSI VelociCalc Plus Flow Meter  
Model 8384-E-GB  
Serial Number 00010281  
Accuracy: +/- 2 feet/min for the range 30 to 500 ft/min  
Calibrated 01/2001  
ASHRAE 110-1995 requires +/- 5% accuracy

**SF<sub>6</sub> Detection**

Miran Sapphire Infrared Gas Analyzer

Model 205A

Serial Number S00148

Accuracy: +/- 10% for 0.01 ppm to 1.0 ppm

+/- 20% for less than 0.01 ppm

Calibrated within 24 hours of each test

ASHRAE 110-1995 requires +/- 10% for concentrations above 0.1 ppm and +/- 25% for concentrations between 0.01 and 0.1 ppm.

**Calibration Equipment****For SF<sub>6</sub> flow rate:**

Primary flow calibrator

Model: Gillian Gilibrator 2

Serial Number 911433

Gillian Flow Cell

Serial Number: 912436-5

Calibrated: 1/2001

**For Infrared Gas Analyzer:**

Miran supplied closed loop calibration system consisting of pump and hoses of known volume.

Digital Syringe 0-10 micro-litres

Model: Hamilton

Serial number 03560

## **Abbreviated Test Protocols**

### **Face Velocity Test**

1. Follow procedures as outlined in ASHRAE 110-1995 Section 6.2.
2. Adjust the sash opening and airflow settings to obtain the desired face velocity.
3. Locate the hot wire anemometer in the first face velocity monitoring position.
4. Set the time constant on the hot wire anemometer to 5 seconds.
5. Move all witness and test personnel clear from the fume hood.
6. Begin logging velocity readings on a personal computer.  
Relocate hot wire anemometer for all face velocity monitoring points and repeat steps 5 to 6 inclusive for each monitoring point.
7. Import readings into the Lotus 123 spreadsheet to confirm the face velocity variance above and below the average face velocity.

### **Tracer Gas Test**

1. Follow procedures as outlined in ASHRAE 110-1995 Sections 7.1 to 7.11.
2. Confirm the calibration of the tracer gas ejector within 24 hours of the test to verify the flow rate of 4.0 litres/minute +/- 10%.
3. Open the main valve and the regulating valve on the SF<sub>6</sub> storage bottle kept outside the test facility.
4. Increase the fan speed to its maximum and open the sash to its maximum opening for approximately 5 minutes to ensure minimal background levels of SF<sub>6</sub>.
5. Execute the "zeroing" procedure on the infrared gas analyzer.
6. Adjust the sash position and airflow settings to obtain the desired face velocity.
7. Position the manikin in the center position.
8. Open the tracer gas block valve and confirm an operating pressure of 30 psi.
9. Allow the infrared gas analyzer readings return to less than 0.01 ppm, begin recording SF<sub>6</sub> concentration levels every 5 seconds for the next 5 minutes.
10. "Challenge" the infrared gas analyzer by directing some air from inside the fume hood to the manikin mounted filter so that the analyzer records an SF<sub>6</sub> level of at least 0.10 ppm.
11. Allow the infrared gas analyzer readings return to less than 0.01 ppm.
12. Close the tracer gas block valve.
13. During the 5 minute recording period, continuously monitor cross drafts ensuring that cross drafts do not exceed 10% of the face velocity.
14. Position the manikin in the left position.
15. Repeat Steps 4 to 6 inclusive.
16. Repeat Steps 8 to 13 inclusive.
17. Position the manikin in the right position.
18. Repeat Steps 4 to 6 inclusive.
19. Repeat Steps 8 to 13
20. The average SF<sub>6</sub> detection level at the end of the 5 minute test period not including the opening "challenge" is noted for each manikin position for each face velocity tested. The maximum SF<sub>6</sub> detection level for the three manikin positions is the Containment Rating for each face velocity tested.