

Pollutant Monitoring in Archival Storage Areas Using a Modified Solid-phase Microextraction Fiber

Mark Ormsby

Research and Testing Laboratory

National Archives and
Records Administration
College Park, MD USA



Washington, DC



College Park, MD



Specifications for Air Pollutants in Storage and Exhibit Areas

| | | |
|-----------------|---------|-------------------------------|
| Acetic Acid | 4.0 ppb | 10.0 $\mu\text{g}/\text{m}^3$ |
| Formaldehyde | 4.0 | 5.0 |
| SO ₂ | 1.0 | 2.7 |
| NO ₂ | 2.6 | 5.0 |
| Ozone | 2.0 | 4.0 |



Acetic Acid 4.0 ppb 10.0 $\mu\text{g}/\text{m}^3$



SPME / GC/MS

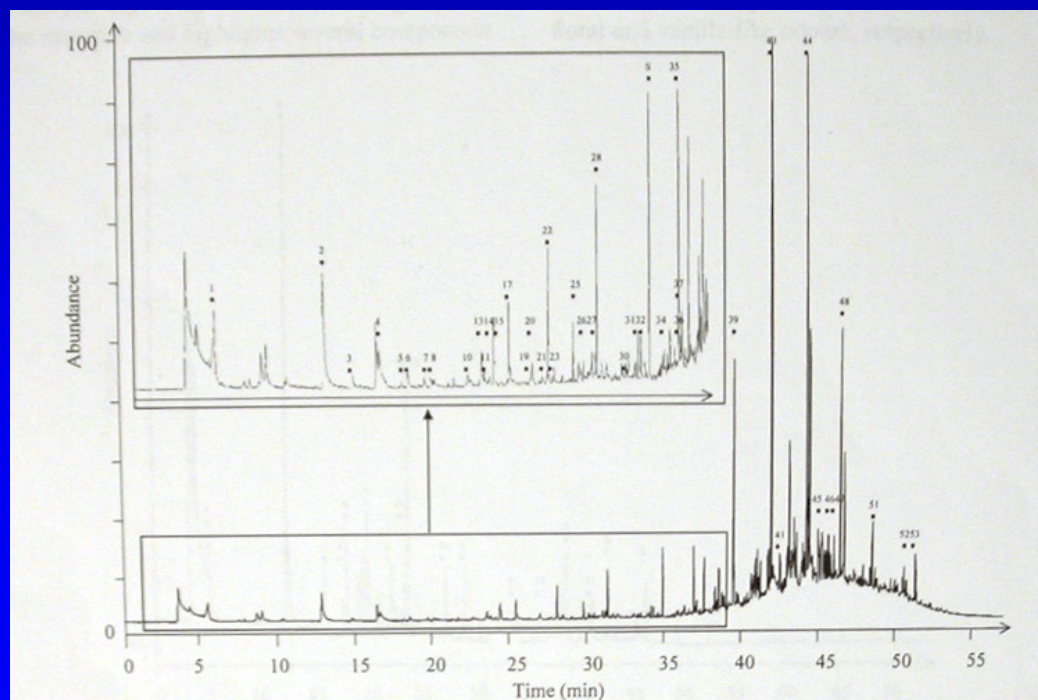


Identification of volatile organic compounds emitted by a naturally aged book using SPME/GC/MS

Agnes Lattuati-Derieux, Sylvette
Bonnassies-Termes, Bertrand Lavedrine

Journal of Chromatography A, 1026 (2004) 9-18

Acetic Acid
Toluene
Butyric Acid
Furfural
Benzaldehyde
Phenol
Nonanal
Decanal
Vanillin
Hexadecane
Heptadecane
Octadecane

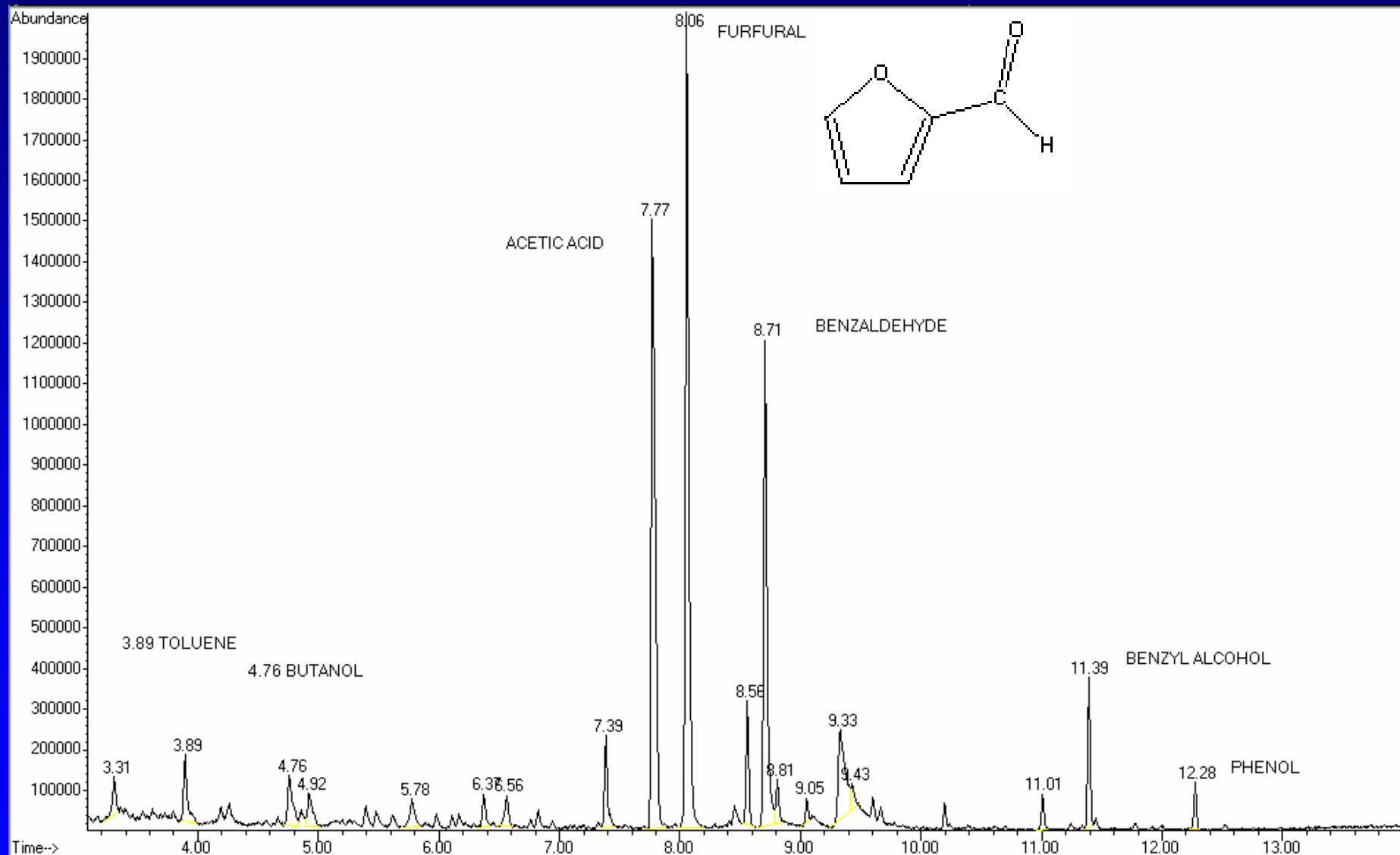


SPME / GC/MS of Volatiles in Storage Areas



Archives 2 Stack 190: Paper Based Records

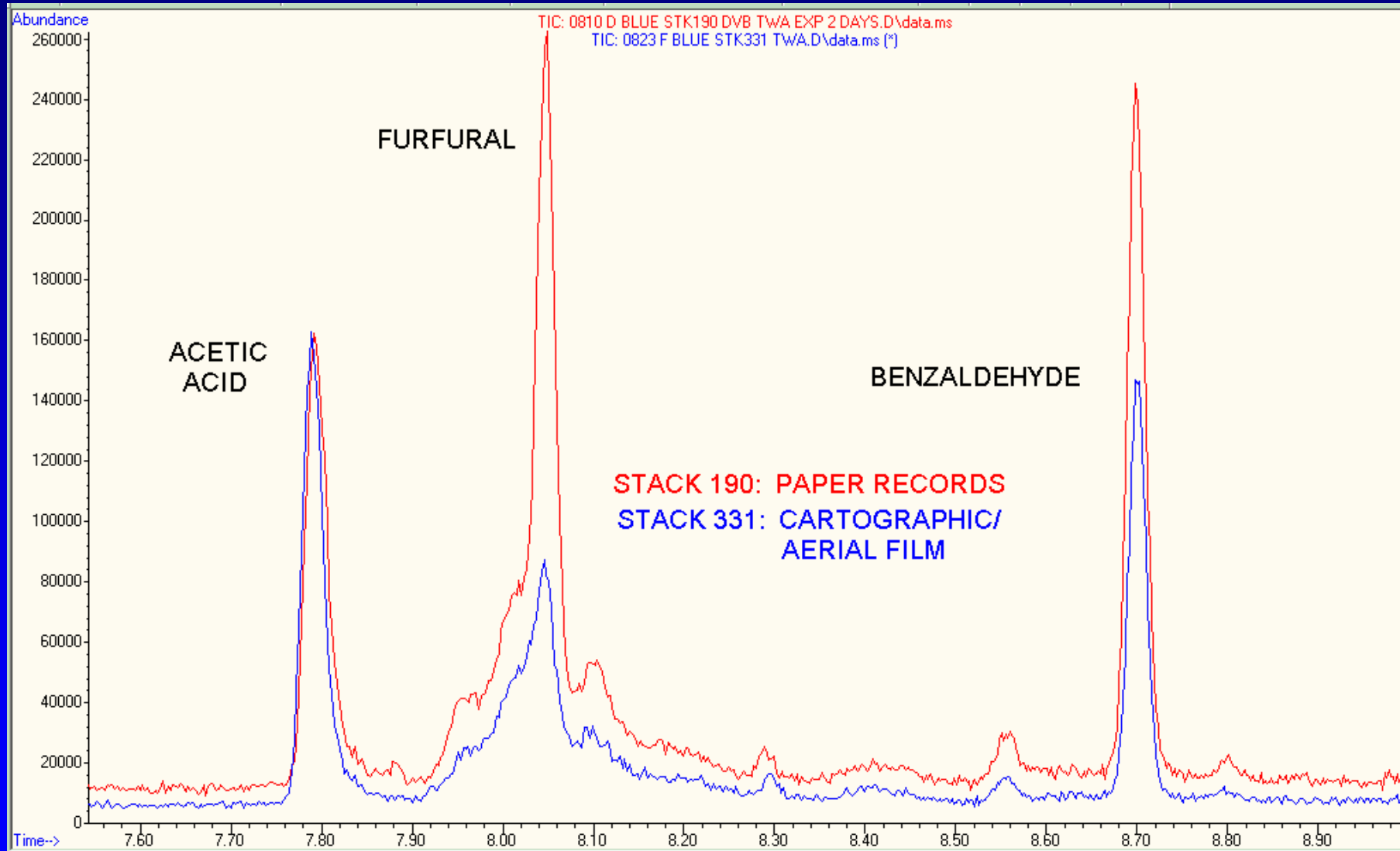
7 HR Direct Exposure CX/PDMS Fiber



Stack 331: Cartographic

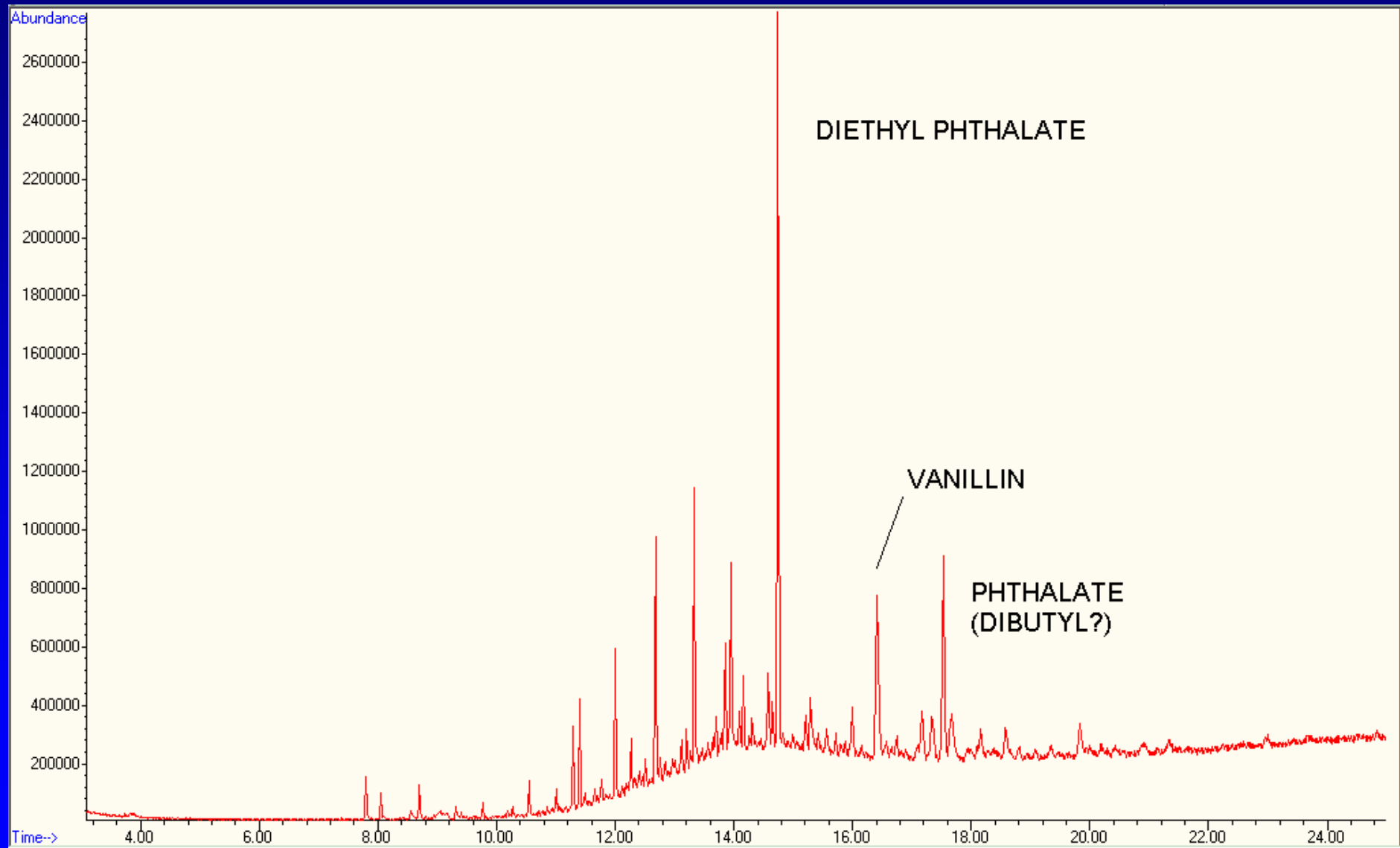


Comparison of Stacks 190 and 331



Archives 2 Stack 170: Paper Based Records

PA Fiber



Filtration in Air Handler Unit



**Archives 2
College Park, Maryland**



Fan Law

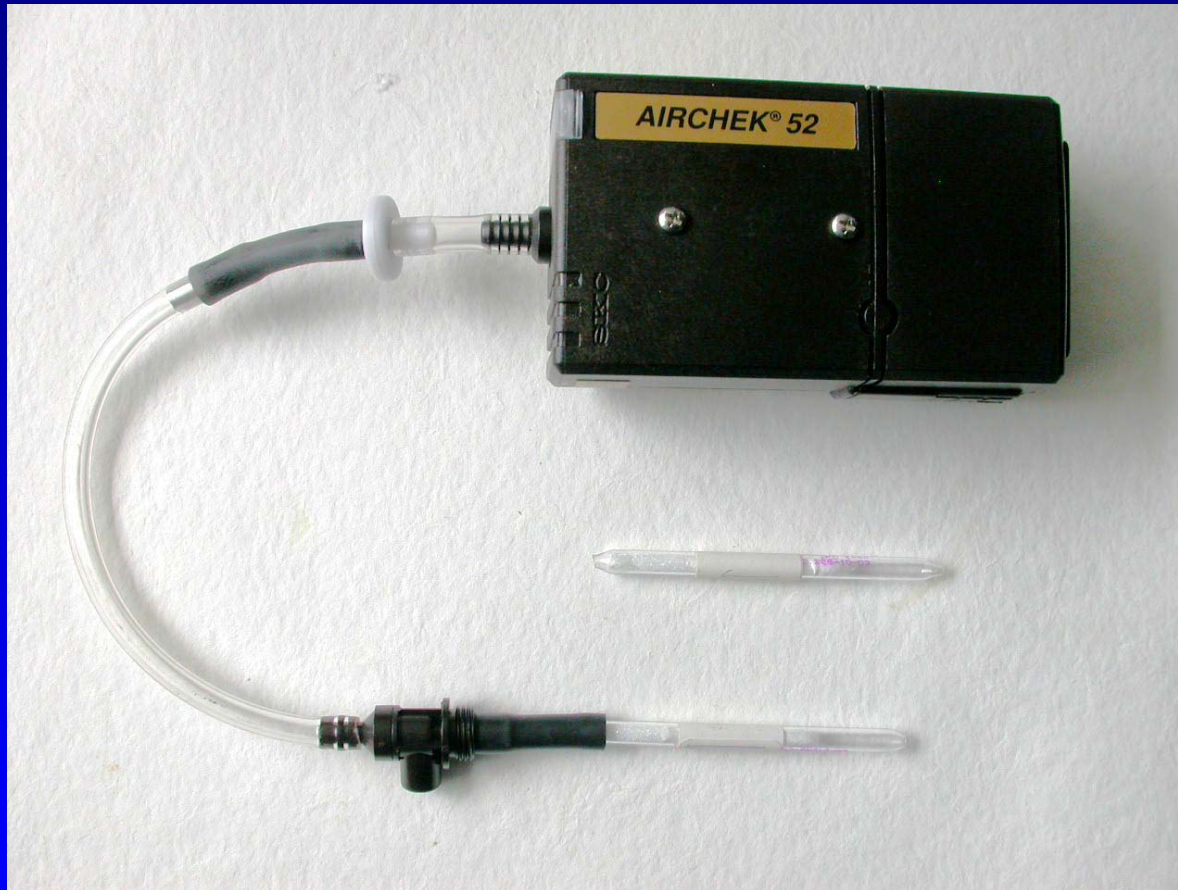
power needed
to drive fan \sim (fan speed)³

higher air
exchange rate \longrightarrow much higher
electrical cost

Air Handler Units



Air Sampling with Sorbent Tube

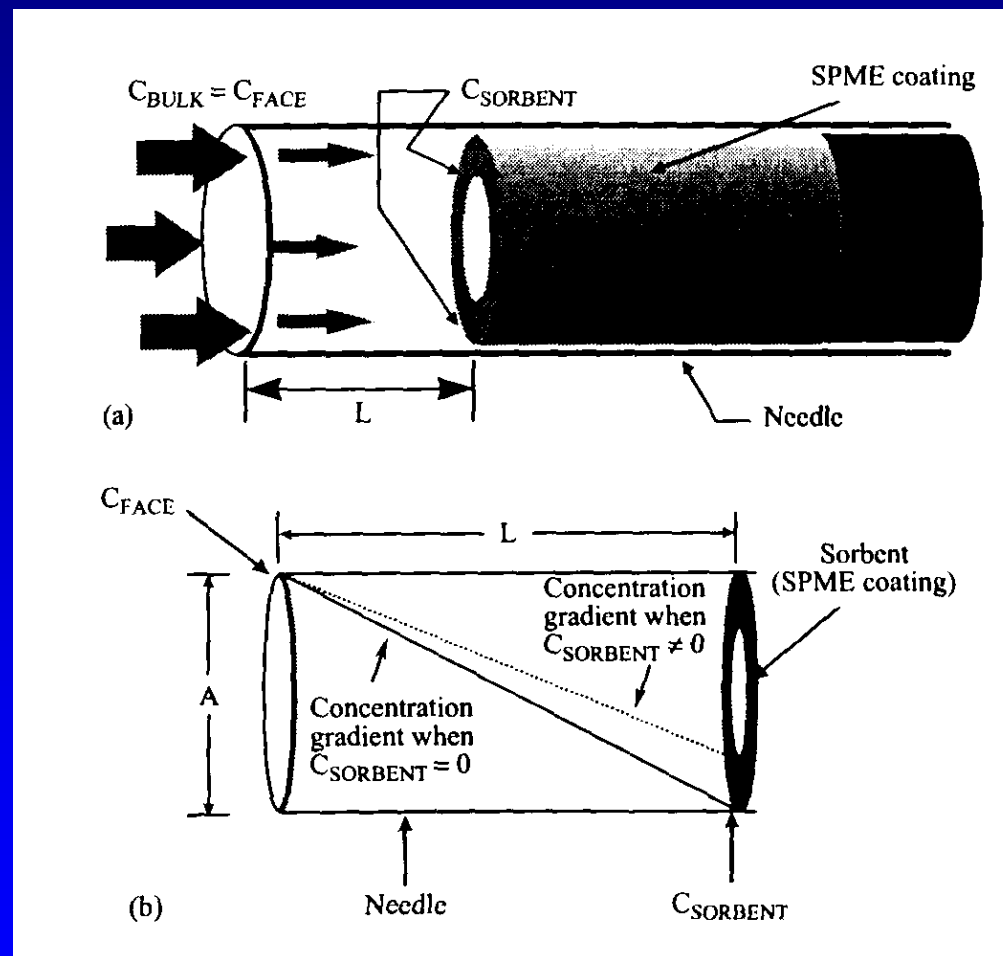


Occupational Safety and Health Administration
OSHA Method PV2119

Air Sampling with Sorbent Tube & SPME



Time Weighted Average (TWA) Sampling Using CX/PDMS and PDMS/DVB Fibers

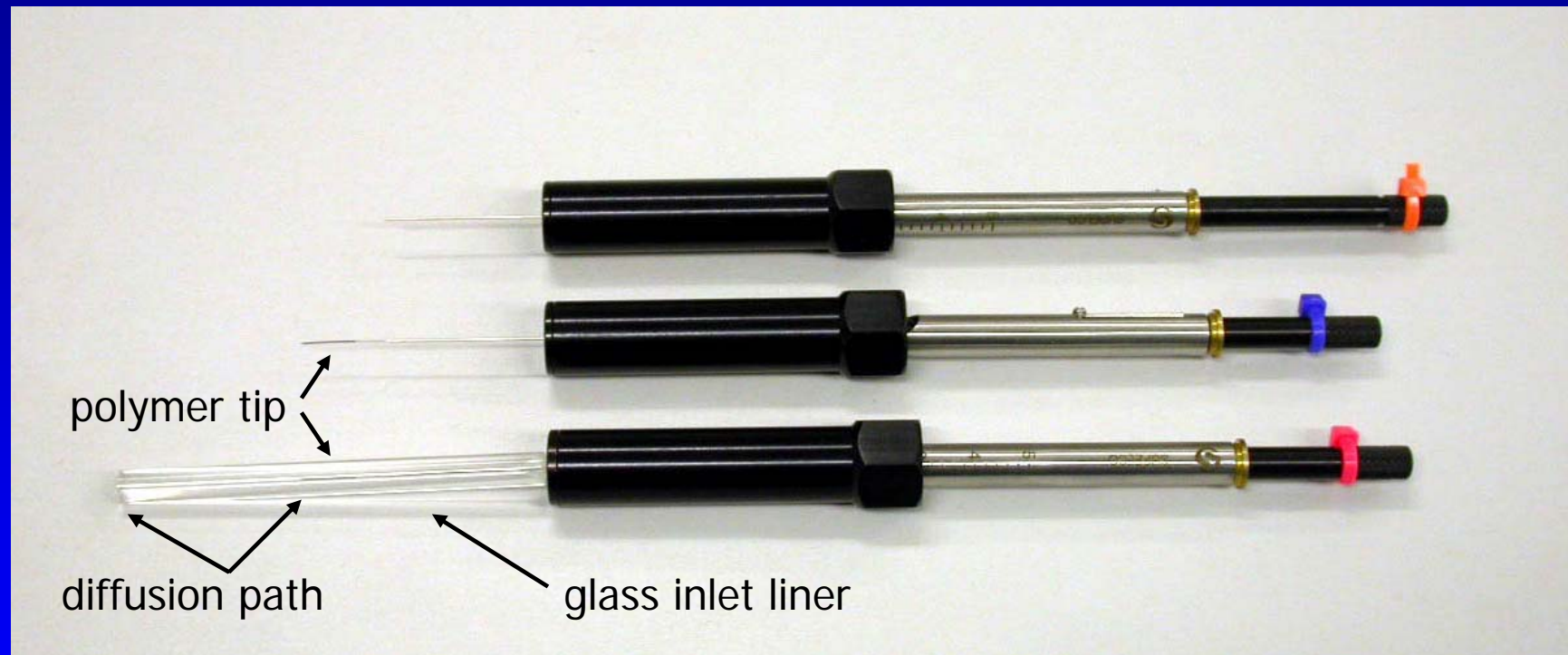


Muller, Gorecki, and Pawliszyn,
*Solid-Phase Microextraction in Analysis of
Pollutants in the Field*
Encyclopedia of Analytical Chemistry, 2000

Advantages of the TWA Method

- Sampling rate is independent of air flow rate because of small needle opening
- Same setup in an exhibit case, air duct, etc.
- No pumps, tubing

TWA Using a Glass Inlet Liner

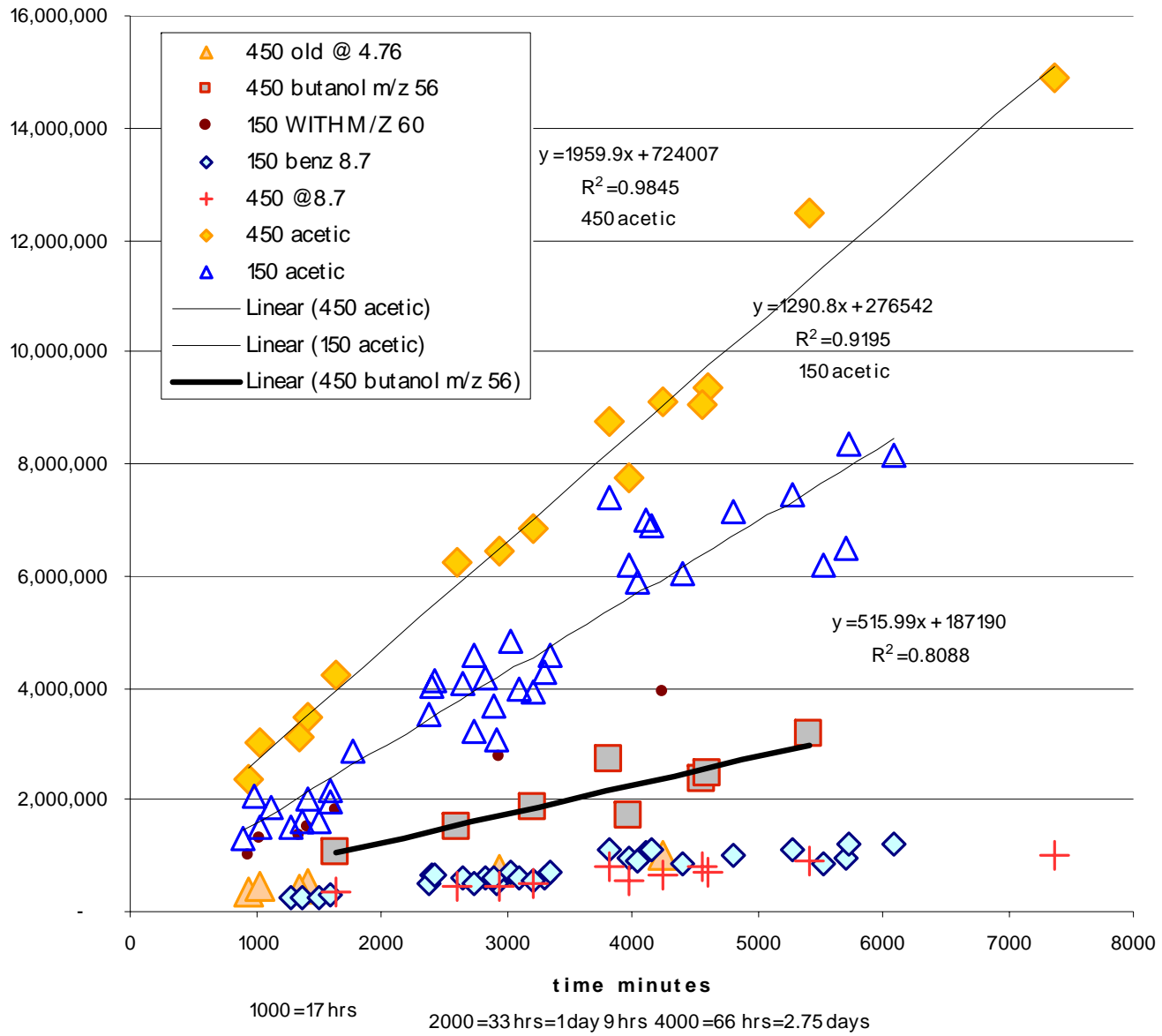


Typical acetic acid carryover
from 1st to 2nd desorption
CX/PDMS fiber

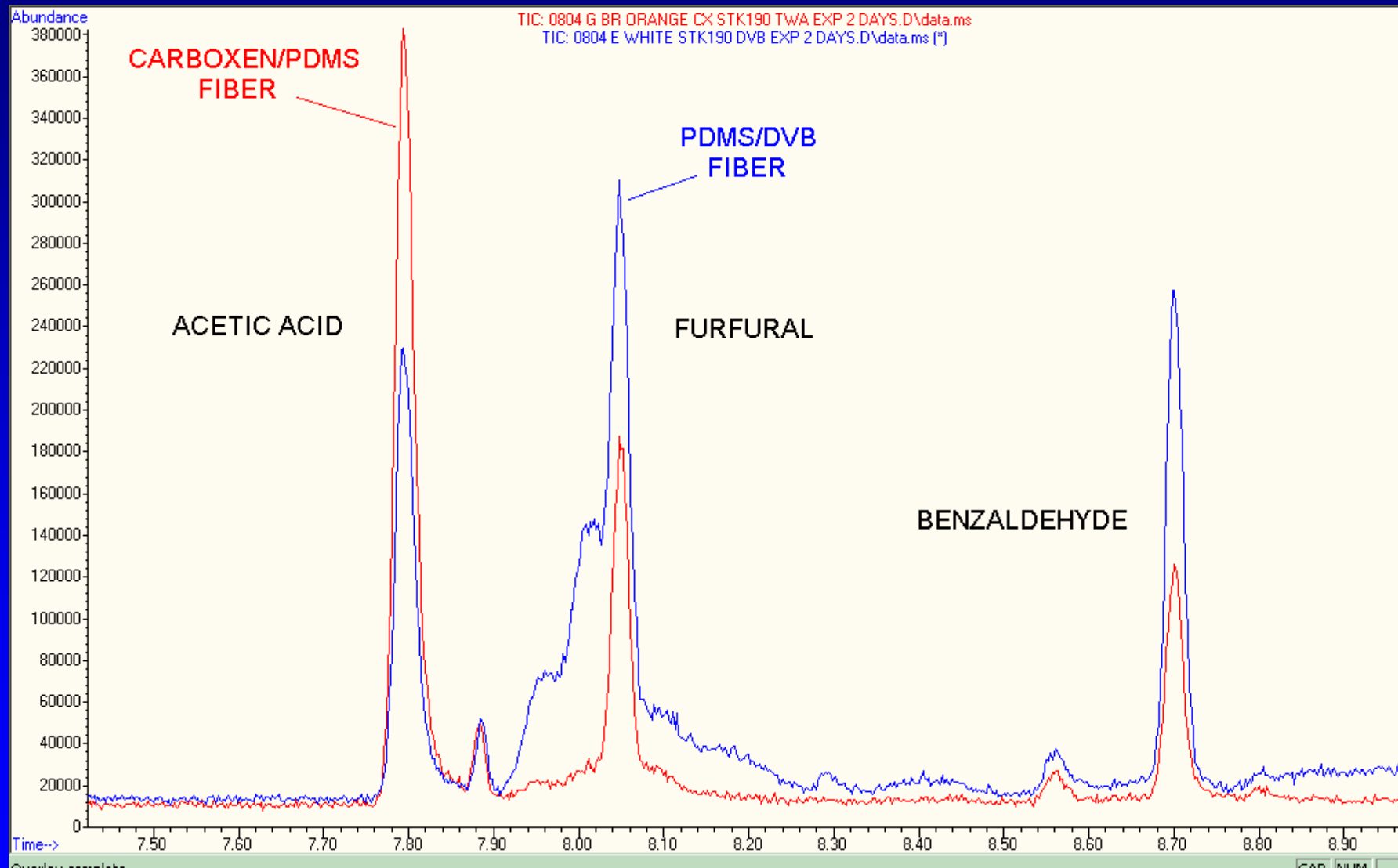
Standard TWA, fiber within needle: 20-30%

Modified TWA with glass inlet liner: 1-3%

TWA in stacks 150 and 450 using full glass liner



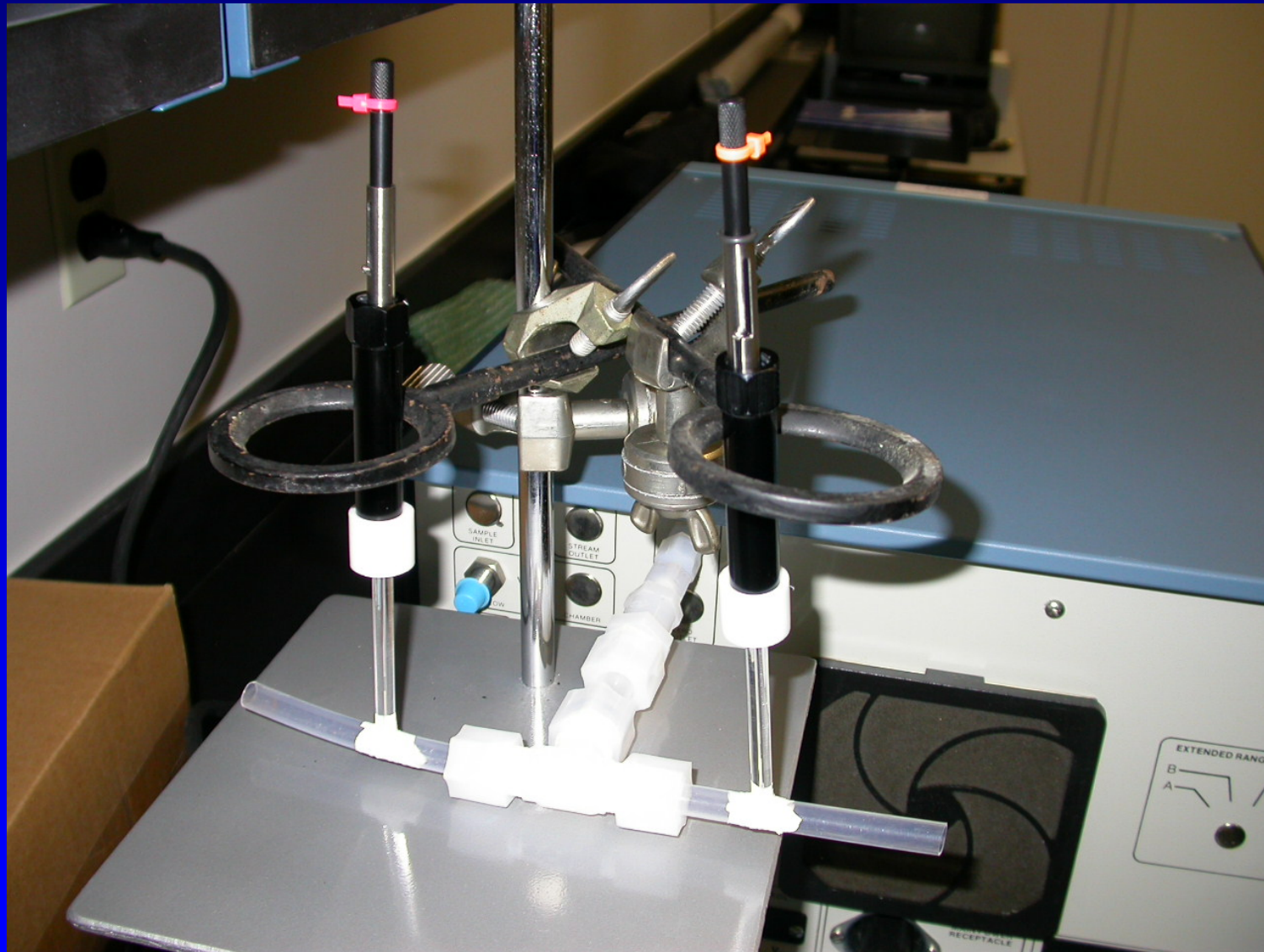
Comparison of Carboxen/PDMS and PDMS/DVB Fibers



Standard Exposure and TWA



TWA Calibration with Permeation Tube



Mark Ormsby
Research and Testing Laboratory, National Archives
mark.ormsby@nara.gov, 301-837-2026

Acknowledgements

- Research and Testing Laboratory,
Document Conservation Laboratory,
National Archives
- Jens Glastrup, Morten Rhyll-Svendsen
National Museum of Denmark
- Robert Shirey, Supelco
- Jacek Koziel, Iowa State University
- Chris Maines, National Gallery of Art