Using the Through The Probe Laboratory at Sites With Large Sampling Manifolds

By

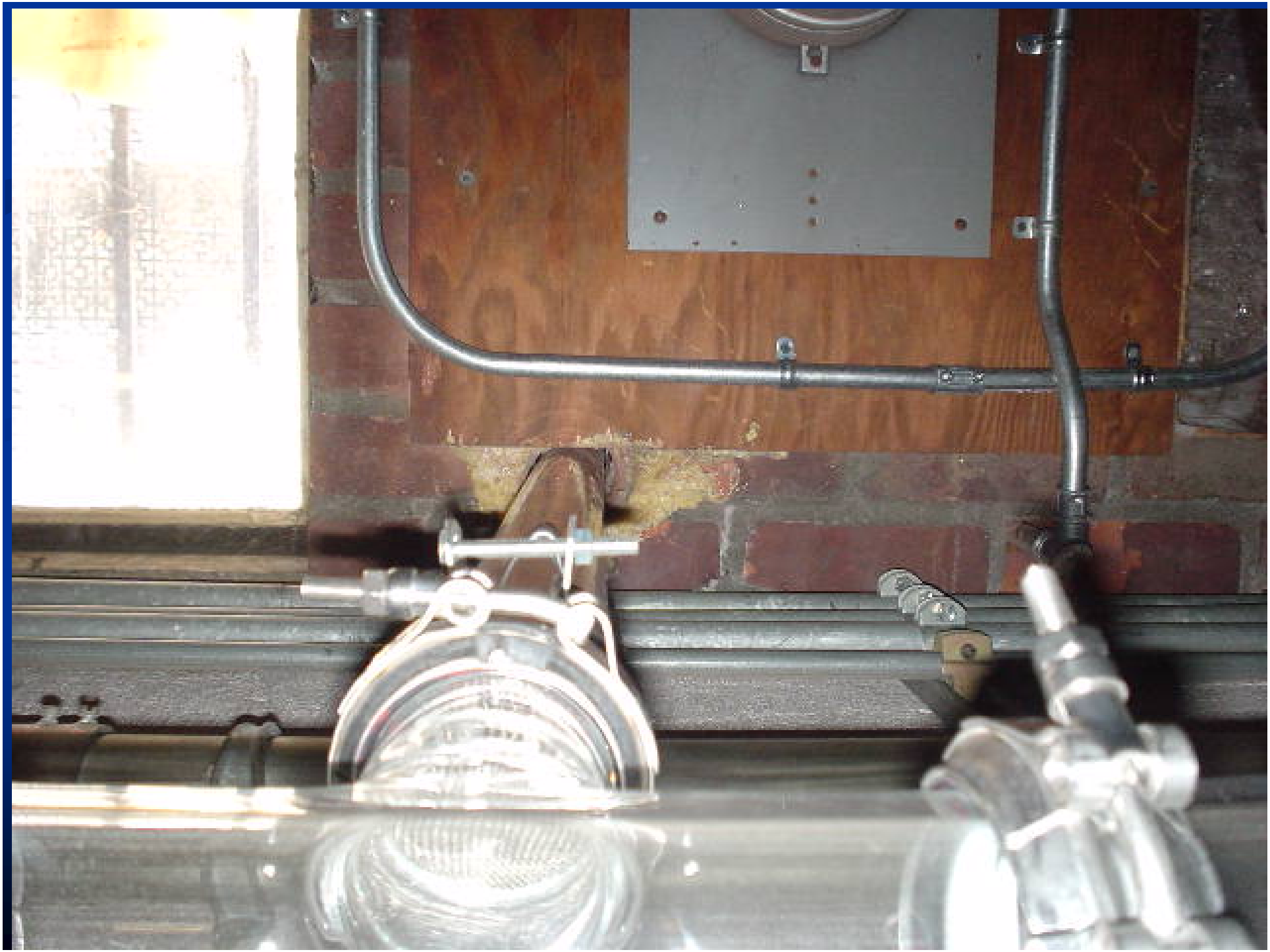
Avraham Teitz, Mark Shanis, Mustafa Mustafa, and Mark Winter

Manifolds in Region 2

- Common manifold for all analyzers – analyzer hook up by individual ¼" Teflon pigtails
- Manifold constructed of borosilicate glass
- Variety of sizes – 1", 2", 3", 4"
- Flow volumes typically 15-40 liters/minute
- Use of a blower motor or vacuum pump to generate air flow


Turn OFF


GE Capital Modu
516 752-9
805553




FIRST AID


RI Department of Environmental Management
RI Department of Health
East Providence Air Monitoring Site

TTP Laboratory Trailer Interface

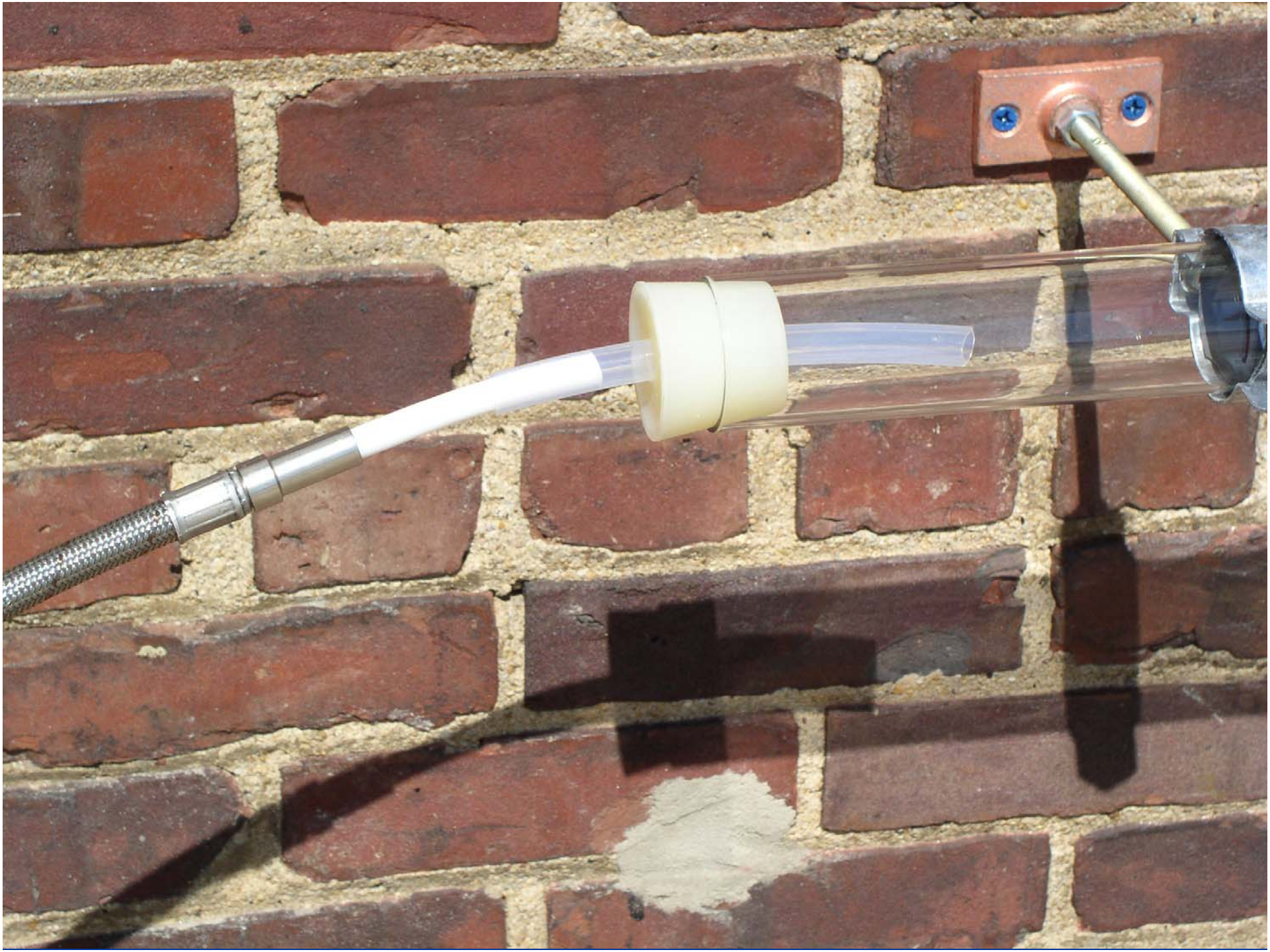
- ½" o.d. Teflon lined steel jacketed presentation line – 150' in length
- Maximum flow rate of 14.5 liters/minute

Problems adapting TTP Laboratory to Region 2 Manifold Systems

- Adapting ½" o.d. presentation line to glass manifolds of various sizes
- Insufficient sample flow from TTP risks burnout of blower motors or negative pressure in manifold
- 14.5 liters/minute TTP flow results in excessive residence times – outside EPA specification of 20 seconds

To address TTP/Region 2 Issues:

- Region 2 constructed a 2" Glass manifold
- Adapted presentation line to manifold using silicone stoppers
- Attached suite of CO, NO_x, SO_2, and O_3 analyzers to the manifold with ¼" pigtails
- Conducted TTP audits of the analyzers and compared the results of using the manifold vs. plugging in to the back of the analyzers




DESA-MAB


EXIT
DANGER

Experimental Procedure

- TTP to provide O_3, SO_2, CO, and NO_x
- Presentation line connected to analyzers via manifold
- Presentation line connected directly to back of analyzers - with a tee to vent to atmosphere
- Examine the differences in analyzer accuracy when connected to the manifold vs. connection at the back of analyzer


Environics
Thermo Environmental Instruments
Thermo Environmental Instruments
NON-FLAMMABLE GAS

Ozone Results

Glass Manifold			Back of Analyzer			
TTP Ozone (ppm)	Station Ozone (ppm)	% Difference	TTP Ozone (ppm)	Station Ozone (ppm)	% Difference	Difference in % Difference
0.000	0.000		0.000	0.000		
0.420	0.418	-0.5%	0.422	0.421	-0.2%	-0.3%
0.186	0.184	-1.2%	0.186	0.187	0.3%	-1.5%
0.074	0.074	0.1%	0.074	0.074	-0.3%	0.4%
0.000	0.000		0.000	0.001		

Sulfur Dioxide Results

Glass Manifold			Back of Analyzer			
TTP SO_2 (ppm)	Station SO_2 (ppm)	% Difference	TTP SO_2 (ppm)	Station SO_2 (ppm)	% Difference	Difference in % Difference
0.000	0.000		0.000	0.000		
0.402	0.403	0.4%	0.402	0.403	0.4%	0.0%
0.190	0.189	-0.3%	0.190	0.189	-0.3%	0.0%
0.076	0.075	-0.7%	0.076	0.074	-2.0%	1.3%
0.002	0.000		0.002	0.000		

NO Results

Glass Manifold			Back of Analyzer			
TTP NO (ppm)	Station NO (ppm)	% Difference	TTP NO (ppm)	Station NO (ppm)	% Difference	Difference in % Difference
0.004	0.000		0.004	0.000		
0.417	0.418	0.3%	0.417	0.425	2.0%	-1.7%
0.270	0.271	0.3%	0.270	0.277	2.5%	-2.2%
0.166	0.167	0.6%	0.166	0.169	1.8%	-1.2%
0.084	0.082	-2.3%	0.084	0.083	-1.1%	1.2%
0.004	0.000		0.004	0.000		

NO_x Results

Glass Manifold			Back of Analyzer			
TTP NO_x (ppm)	Station NO_x (ppm)	% Difference	TTP NO_x (ppm)	Station NO_x (ppm)	% Difference	Difference in % Difference
0.004	0.000		0.004	0.000		
0.417	0.418	0.3%	0.417	0.425	2.0%	-1.7%
0.270	0.273	1.0%	0.270	0.277	2.5%	-1.5%
0.166	0.167	0.6%	0.166	0.169	1.8%	-1.2%
0.084	0.083	-1.1%	0.084	0.083	-1.1%	0.0%
0.004	0.000		0.004	0.000		

NO_2 Results

Glass Manifold			Back of Analyzer			
TTP NO_2 (ppm)	Station NO_2 (ppm)	% Difference	TTP NO_2 (ppm)	Station NO_2(ppm)	% Difference	Difference in % Difference
0.001	0.001		0.001	0.000		
0.327	0.328	0.4%	0.328	0.337	2.7%	-2.3%
0.179	0.182	1.5%	0.179	0.185	3.5%	-2.0%
0.077	0.078	1.1%	0.079	0.078	-0.7%	1.9%

Carbon Monoxide Results

Glass Manifold			Back of Analyzer			
TTP CO (ppm)	Station CO (ppm)	% Difference	TTP CO (ppm)	Station CO (ppm)	% Difference	Difference in % Difference
0.2	0.3		0.2	0.3		
39.9	41.6	4.2%	39.9	41.4	3.7%	0.7%
18.8	19.5	3.5%	18.8	19.3	2.6%	0.9%
7.5	8.3	11.1%	7.5	8.6	14.4%	-3.3%
0.2	0.8		0.2	0.9		

Significant Findings

- Back of the analyzer results tended to be higher than manifold results
- Differences were typically in the 1-2% range

Caveats

- Initial equilibration of the manifold system took 2.5 hours
- Possibility of error induced by constant switching of presentation line from manifold to back of analyzer
- CO station analyzer zero drift could have compromised lowest comparison point for the CO comparison

Conclusions

- TTP Laboratory is suitable for audits of large manifold based systems
- Differences between manifold audits and back of the analyzer audits are typically in the 1-2% range
- Acceptance criteria for manifold audits may have to be "stretched" to account for this variability
- Further study to quantify the variability between the manifold and the back of analyzer sample delivery is warranted