

**EMERGING TECHNOLOGIES TEST REPORT**

**Proton Transfer Reaction/Time of Flight Mass Spectrometry (PTR-TOF-MS) Measurements of “Everyday Sources” for Ethylene Oxide**

**The Advanced Medical Technology Association  
Washington, DC**

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## **Project Summary**

Montrose Air Quality Services was contracted by The Advanced Medical Technology Association (AdvaMed) to conduct a study to measure the concentrations of ethylene oxide (EtO) in various “Everyday” sources. The study was conducted using Montrose’s state-of-the-art mobile laboratory platform utilizing an Ionicon Proton Transfer Reaction Mass Spectrometer model PTR-TOF-MS-6000x3 (PTR-MS). The study took place on August 21, 2019 in Ashburn, Virginia.

The PTRMS was operated in oxygenal ( $O_2^+$ ) chemical ionization mode to collect real time (1/5 sec) data for measurement of EtO. The TOF tube was operated at a voltage of 100V for measurement of EtO. These operational conditions were identified through method development experiments to provide optimal detection of EtO and resolution from its isomer, acetaldehyde.

## **Summary of Measurements**

Eleven different “Everyday” sources were sampled, some at multiple conditions. Each source was sampled via a heated-head pump through a heated sample line with a heated stainless steel probe. Because of the complexity of the sample matrices, the samples were dynamically diluted using NIST traceable mass flow controllers (MFC) prior to measurement. Dilution decreases the sample complexity minimizing the main interferences such as isomers, fragmentation of other compounds, and/or reduction of the reagent ions available for the target compound to associate. The dilution process decreases the potential for measurement bias due to interferences.

Montrose has conducted research to identify possible interfering compounds for this method and verified by direct measurement that acetaldehyde, benzene, toluene, ethylbenzene, and xylenes, if present, would not bias the PTRMS response of target compound EtO. However, there is a small possibility that some other unknown compound(s) may be present in the sample matrix that could bias the analytical results as reported. However, the likelihood is small given that our experienced PTRMS operators failed to observe any evidence of this on-site.

The results listed in Table 1 below are the concentrations as measured directly on-site. However, a specialized sampling enclosure was not employed to guarantee a fully representative sample was collected for measurement.

**Table 1: Analytical Results for Everyday Sources. (Worst Case)**

Everyday Source	EtO Concentration	
	ppbv	ug/m3
Mercedes Sprinter Bluetec Diesel, idle	100	180
Mercedes Sprinter Bluetec Diesel, revved	140	252
Diesel generator from Sprinter	190	342
Toyota 4 runner, ~2003 model, idle	110	198
Toyota 4 runner, ~2003 model, high RPM	230	414
Gas generator cold start	18,000	32,400
Gas lawn mower cold start	3,000	5,400
Gas lawn mower	450	810
Gas grill	140	252
Charcoal fire	5,000	9,000
Wood fire pit	750	1,350
Kimchi (freshly opened)	1,800	3,240
Kombucha (freshly opened)	400	720
Sauerkraut (freshly opened)	100	180
Kimchi repeat (after sitting)	480	864

The results provided in this report relate only to the items tested. Data analysis and deconvolution was performed by Dr. Antonios Tasoglou of RJ Lee.

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