UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
RESEARCH TRIANGLE PARK, NC 27711

May 7, 2021

MEMORANDUM

SUBJECT: Effect of Canister Type on Background Ethylene Oxide Concentrations

TO: Richard Wayland, Director
Air Quality Assessment Division, Office of Air Quality Planning and Standards

FROM: Lara Phelps, Director LARA PHELPS Digitally signed by LARA PHELPS Date: 2021.05.07 14:12:07 -04'00'
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The U.S. Environmental Protection Agency (EPA) National Air Toxics Trends Stations (NATTS) network and other state and local air monitoring agencies currently use EPA Methods TO-15 and TO-15A to quantify ethylene oxide (EtO) concentrations in ambient air. Recently, questions have been raised among the ambient air monitoring community regarding potential bias in ambient EtO measurements when using certain types of stainless-steel sample containers. Preliminary study results show this likely to be the case.

Researchers in the Office of Research and Development (ORD) have begun a study to investigate background EtO concentrations that may be observed in different types of specially prepared stainless-steel canisters typically used for TO-15/TO-15A sampling and analysis. Initial results indicate that silicon-ceramic lined canisters may be suitable for ambient EtO monitoring after sufficient canister qualification, whereas electropolished canisters may not be suitable. This determination is based on the elevated concentrations of EtO observed in humidified air samples stored in electropolished canisters as compared to the minimal concentrations observed in humidified air samples stored in silicon-ceramic coated canisters over a one-month storage period.

To make this assessment, ORD acquired a limited number of new commercially available stainless-steel canisters specifically manufactured for the purpose of ambient sampling and analysis of volatile organic compounds. Containers obtained for this study included both silicon-ceramic coated canisters from two vendors and electropolished canisters from one vendor. The canisters were initially cleaned using a canister cleaning method involving 20 cycles of pressurization/evacuation heated to ~70°C using humidified zero air, leak checked, and pressurized with humidified zero air following TO-15A guidelines for initial canister qualification. The laboratory-generated samples were analyzed by preconcentration/gas chromatography-mass spectrometry within one week and again after 4 – 5 weeks to evaluate changes in background EtO concentrations after typical laboratory holding periods.

Initial one-week results showed EtO concentrations in the samples stored in the silicon ceramic-lined canisters were below the method detection limit (MDL) for all samples, whereas EtO was measured at

detectable concentrations in all of the samples stored in electropolished canisters. After the 4 – 5 week holding period, the background EtO concentrations observed in the silicon-ceramic canisters were below the MDL for the majority of the samples. However, the EtO concentrations in the electropolished canisters had increased over the 4 – 5 week hold time by a factor of 7 to 10 times from the initial one-week values corresponding to EtO concentrations substantially higher than typical ambient EtO concentrations.

While results generated from this research effort are considered preliminary, these early findings indicate electropolished canisters may not be suitable for ambient EtO monitoring as they may contribute an unacceptably high positive EtO bias in ambient samples for sample holding periods longer than a few days. The silicon-ceramic coated canisters from the two vendors demonstrated better performance with lower EtO background concentrations overall. Regardless of canister type, it is recommended laboratories perform canister validation procedures outlined in TO-15A to confirm background EtO concentrations in specific canisters are within acceptable limits for typical laboratory sample hold times. ORD plans to continue this research effort to gain a better understanding of these ambient EtO interference issues and provide technical guidance on optimized methods to accurately measure EtO in ambient air.