Evaluating New and Emerging Technology

Summary Information

Funding Opportunity:	Community-Scale Air Toxics Ambient Monitoring
RFA Number:	EPA-OAR-OAQPS-20-05
Project Title:	*Evaluating New and Emerging Technology for Ethylene Oxide Measurements within the Atlanta MSA Communities Identified in the 2014 NATA*
Applicant:	Georgia Environmental Protection Division *4244 International Parkway, Suite 120* *Atlanta, Georgia 30354*
Contact:	*DeAnna Oser, Ambient Air Monitoring Program Manager*
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Funding Requested:	*$571,670*
Total Project Cost:	*$571,670*
Project Period:	*November 1, 2020 – April 30, 2022*
DUNS Number:	*1469855440000*

Project Summary/Approach

Basis and Rationale

The Environmental Protection Agency (EPA)'s most recent National Air Toxics Assessment (NATA) released in August 2018 identifed three areas in Georgia requiring further study to better understand possible public health risks from exposure to ethylene oxide. The higher modeled risk associated with ethylene oxide in this latest version of the NATA affected many sources throughout the United States and was largely due to a change in the way EPA calculated the risk posed by ethylene oxide, now a confirmed carcinogen. The two known sources of ethylene oxide contributing to the NATA results in Georgia, were facilities that sterilize medical devices using ethylene oxide. Although the NATA was released in 2018, it's findings were based on information collected in 2014.

Using more up-to-date information about the two sterilization facilities identified in the NATA, the Georgia Environmental Protection Division (GA EPD) modeled the impact of their ethylene oxide emissions on neighboring communities. The results of GA EPD's modeling efforts showed that the impacts, although not as high as those modeled in the NATA, required further action including additional air pollution controls. When knowledge of GA EPD's modeling results and EPA's NATA findings were revealed to the public, there was great concern in the communities surrounding the two facilities identified in the NATA.

In August 2019, GA EPD and EPA held joint open house and community meetings in Cobb County[1] and in Covington, Georgia[2] to answer questions from a very concerned public. That same month GA EPD commited to monitoring air qualiy in Covington, Georgia and Cobb

[1] See - https://www.epa.gov/smyrna-eto/agenda-community-meeting-ethylene-oxide-smyrna-ga-sterigenics-facility

[2] See - https://www.epa.gov/covington-eto/agenda-community-meeting-ethylene-oxide-covington-ga-becton-dickinson

County, Georgia[3] for ethylene oxide. GA EPD also committed to monitoring backgound levels of ethylene oxide at two locations where there are no known sources of ethylene oxide for comparison. In September 2019, EPA approved GA EPD's monitoring plan[4] and GA EPD began collecting air quality samples in Cobb County and later in Covington by October.

GA EPD sought to identify all stationary sources of ethylene oxide emissions in Georgia to further assess their potential public health risk. GA EPD modeling revealed that another sterilization facility not identified in the NATA and located in Fulton County, Georgia required further action including additional air pollution controls. In January 2020, GA EPD began monitoring for ethylene oxide in Fulton County.

GA EPD is now engaged in a long-term study (September 2019 – August 2020) collecting samples of ethylene oxide at five distinct areas of Georgia, three communitites (identified in the NATA and by GA EPD), one rural area where there are no known sources of ethylene oxide, and one urban background area considered a National Air Toxics Trends Station (NATTS) site. Because the risks presented in the NATA models are based on long term chronic exposure to ethylene oxide, providing long-term air quality monitoring data to public health agencies and professionals is critically important for concerned communities in Georgia and nationwide. GA EPD has already collected over eight months of community level ethylene oxide data thus far, which is very rare nationwide. As the levels of ethylene oxide being measured are very close to the detection limits of current instrumentation, the study is helping us understand biases in sample collection that will have nationwide benefits. The two urban and rural background sites are providing information about background levels of ethylene oxide.

The study that GA EPD has conducted from September 2019 through August 2020 is Phase 1 of this study. GA EPD is requesting funding for Phase 2 with this grant application to collect an additional seven months of sampling at these sites to provide a greater dataset to encompass process changes of the identified facilities and the impact to the associated communities. This monitoring supports EPA's Draft 2018-2022 Strategic Plan, Goal 1, "A Cleaner, Healthier Environment," Objective 1.1 "Improve Air Quality".

This grant is requested to fund the next phase of the study (Phase 2) for an additional seven months of monitoring to provide sufficient data for public health agencies to complete a health assessment for the impacted communities as well as understanding the impact of the measurement technologies on the quality of the data we collect. The second phase of this study will provide a greater number of samples in the affected communities to allow the health agencies such as the Center for Disease Control's Agency for Toxic Substances and Disease Registry (ATSDR) and the Georgia Department of Public Health a greater confidence in the data

[3] Press release announcing monitoring: https://epd.georgia.gov/press-releases/2019-08-16/georgia-epd-monitor-air-quality-covington-and-smyrna-ethylene-oxide-0

[4] See https://epd.georgia.gov/document/document/gaaampqappethyleneoxideepasignaturepdf/download

used for the health assessment to determine the ethylene oxide concentration at the 95% upper confidence level.

This proposal requests funds to carry out Phase 2 activities of sampling (September 2020 through March 2021) and associated analyses to characterize the air in the communities identified by the NATA as well as in Fulton County, Georgia. Georgia is requesting 18 months of EPA support (November 2020 – April 2022) in the Evaluating New and Emerging Technology Category for the sampling, analysis, validation of the data, and reporting of the data. The data will be published as a final report and made available on the GA EPD website https://epd.georgia.gov/ethylene-oxide-information.

Technical Approach

This study utilizes a combination of passive samplers, pressurized samplers, and a continuous analyzer for the measurement of ethylene oxide in the Atlanta area. For each day that samples are collected with passive samplers in Cobb County, Fulton County, and the city of Covington, a sample will also be collected at the South DeKalb site utilizing the same passive sampling equipment. This comparison provides information on the variability in the ethylene oxide concentrations in an urban area which is not influenced by the local facilities. Comparisons of the specific sampler used to the measured concentration will allow GA EPD to determine if there is any bias from the specific sampler utilized. Measurements will be collected at a nearby GA EPD air monitoring station, the Near Road 285 site (NR-285) located along a major interstate to investigate the impact of mobile sources on the concentration of ethylene oxide as compared to the GA EPD NATTS site. Measurements will also be collected at the GA EPD background site in Douglas County, Georgia for comparison to the affected communities' concentrations of ethylene oxide.

The following aspects are considered when establishing the ethylene oxide air monitoring sites:

- Understanding the monitoring objective(s), specifically that the GA EPD's ethylene oxide sites are representative of a micro scale for the communities of City of Covington, Cobb County, and Fulton County
- Identifying the spatial scale most appropriate for the monitoring objective(s)
- Identifying the general locations where the monitoring site(s) should be placed according to wind direction
- Modeled ethylene oxide emissions data showing highest concentrations in the affected communities
- Transport of pollutants downwind of facilities
- Characterize air upwind of facilities

Due to the difficulty in laboratory analysis, the ethylene oxide samples in the Phase 1 were analyzed by the EPA contract laboratory [Eastern Research Group (ERG)], for consistency with other ethylene oxide measurements being collected at other regulatory sites. The Georgia Environmental Protection Division (GA EPD) Laboratory is working towards implementing analytical methodology for ethylene oxide analysis. Funds are requested through this grant for new, more sensitive, equipment for the analysis of ethylene oxide at the GA EPD Laboratory. See the attached budget spreadsheet for more details. Samples will be sent to ERG as well as the

Region 4 Laboratory operated by the Laboratory Services and Applied Science Division (LSASD) to compare the analytical results and gain a better understanding of the variability of the ethylene oxide concentration measurements.

For the ethylene oxide data readily available to date, samples have been collected in Summa® canisters and analyzed by both ERG and GA EPD Laboratory using the procedures of EPA Compendium Method TO-15[5], *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)*. Many of the measurements being collected are near the detection limit for most of the analytical equipment. While TO-15 has a number of options for collection (passive, pressurized) as well as analysis (in the way the GC/MS is calibrated and programmed), the method is a self-validating method and includes quality assurance procedures to ensure the results are comparable and valid. GA EPD seeks to evaluate that comparability between multiple laboratories (GA EPD, ERG, EPA Region 4 LSASD Laboratory). The analytical analysis of ethylene oxide is still emerging, and many unknowns exist due to the small national dataset for ethylene oxide. These interlaboratory comparisons will help us better understand the analytical technology.

While the analytical results are reliable and of good quality, the time needed for quality analytical results can be many months following sample collection before results are received. GA EPD, through a subaward with the Georgia Institute of Technology (Georgia Tech), also seeks to investigate the comparability of a continuous ethylene oxide monitoring system by Picarro to the measurements collected and analyzed by the traditional canister methodology. The continuous instrument would provide instantaneous information concerning the ethylene oxide levels for communities who could potentially use this technology for an approximation of the ethylene oxide levels in their air. The continuous ethylene oxide analyzer will be installed at the GA EPD South DeKalb NATTS site, which is also equipped with a suite of meteorological instruments. The data collected during this project will allow GA EPD to understand the fluctuation in the ethylene oxide concentration throughout a 24-hour period which is used for the traditional canister collection methodology. See the attached proposal in Appendix C.

Environmental Justice Impacts

The communities in which GA EPD is monitoring are in highly industrial areas. According to the U.S. Census Bureau (www.census.gov) census tract information for 2017 total estimated population demographics, the sampling sites are located in areas with varying levels of sensitive populations. Depending on the site, approximately 20-30% of the population are under 18 years of age and approximately 10-20% of the population is over 65 years of age. Approximately 30-100% of minority populations are represented at these monitoring site locations. In addition, approximately 10-20% of the population are below poverty. The ethylene oxide concentration data gathered as part of this grant will greatly add to the collective knowledge of ethylene oxide characterizations in the nation, as it will be one of the longest studies of the ethylene oxide concentration in impacted communities to date and one of the first to correlate evaluate continuous measurements of ethylene oxide on this scale.

[5] See https://www3.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf

Sampling Schedule:
To summarize, the GA EPD will sample ethylene oxide as follows:

- Every 6 days, samples will be collected in the communities of the City of Covington, Cobb County, and Fulton County, Georgia using passive samplers
- Once a month, a collocated sample should be collected in each community. The same site(s) should be used for collocation throughout the study for consistency.
- Once a month, a trip blank should be collected.
- Once a month, samples will be also collected at approximately ½ mile or 1 mile distance from one sampling point to assess spatial variation of ethylene oxide. Comparisons will be made determine gradient of ethylene oxide concentration at the specified distance from each facility. This will provide information to the community and the health agencies as to how the ethylene oxide dissipates in the air.
- Every 6 days, samples will be collected at the South DeKalb site for comparison using passive samplers and also approximately every 12 days collected using pressurized samplers
- Every 12 days, samples will be collected at the background General Coffee (Douglas County) site for comparison using a pressurized sampler.
- Approximately 8 samples per study will be collected at the NR-285 site for a qualitative comparison to assess possible mobile source variation.
- Approximately 16 samples per study will be collected concurrently using the passive canister sampler and the ATEC canister sampler at the South DeKalb site for a qualitative comparison of the sampler technologies.
- Approximately 620 samples will be collected as part of this ethylene oxide study for Phase 2
- Approximately ten samples will be analyzed by two laboratories
    - Approximately five with the GA EPD Laboratory and ERG from the same can, depending on availability of the laboratory
    - Approximately five with the GA EPD Laboratory and the Region 4 LSASD laboratory, depending on availability of the laboratory
- Approximately 45 samples collected at South DeKalb (including passive and pressurized sample collection) will be correlated with the Picarro continuous ethylene oxide instrument. The wind roses for this day will be used to see how the ethylene oxide concentration varied.

Project Schedule:
Phase 1 of the of the project is included to show what work was done. This grant proposal is requested only for the Phase 2 activities. As the project progresses, feedback from local stakeholders may initiate changes to the project. The dates of these activities may change due to unforeseen circumstances. However, this is the general timeline that the GA EPD will follow for this project.

Schedule of Monitoring Activities
Phase 1 (August 2019 – August 2020)

Activity	Date	Comments
QAPP approval	September 2019	Revised April 2020
Sampling	September 2019 – August 2020	Projected end date of Phase 1
Laboratory analysis begins	September 2019	
Field audit assessment	1 audit per study	Once per location per study

Project Phase 2 (November 2020 – April 2022)

Activity	Date	Comments
Sample collection	November 2020 through April 2021	Ongoing data evaluation
Laboratory analysis contract	October 2020	ERG procured as contract laboratory
Laboratory analysis	December 2020- July 2021	
Field audit assessment	1 audit per site	Once per location per study during Project Phase 2
Procurement of Picarro continuous ethylene oxide analyzer	October 2020	
Update QAPP	November 2020	
Calibration of Picarro instrument with ethylene oxide standard at GA EPD Laboratory	December 2020	
Sampling unit data comparison	January 2021-September 2021	Ongoing comparison of passive, ATEC, and Xonteck sampling units once receive lab analysis
Installation of Picarro instrument at South DeKalb monitoring site	December 2020 – June 2021	
Final calibration of Picarro instrument with ethylene oxide standard at GA EPD Laboratory	July 2021	
GA EPD submits quarterly grant progress reports to EPA	January 31, 2021 April 30, 2021 July 31, 2021 October 31, 2021 January 31, 2022	
Comparison of ethylene oxide concentrations between TO-15 and Picarro results	July 2021- December 2021	Quarterly reports will be submitted by Georgia Tech to GA EPD as discussed in Appendix C
Data Analysis of GA EPD measurements	Through January 2022	
Final Report	April 30, 2022	Incorporating all measurements made as part of this grant

Monitoring Objectives

- Characterizing ethylene oxide concentrations in the ambient air in areas located within select Georgia counties (Cobb County, Newton County, Fulton County, DeKalb County, and Douglas County).

- Evaluation of new technologies for analyzing ambient air concentrations. New continuous monitors have recently been developed that analyze for ethylene oxide. The continuous data collected will be compared to laboratory analytical methodology currently utilized by monitoring agencies.
- Providing quality data set to support estimates of community exposure for risk characterization by other agencies. Data collected during this study will provide ATSDR and the Department of Public Health with valuable information for an ongoing assessment for the health effecting on communities.
- Providing quality data to add to the National Inventory through upload of data collected at the South Dekalb, NR-285, and General Coffee sites.
- Providing quality assured data for trends and risk characterization.
- Assessing emission reduction activities.
- Improving air toxics emission inventories and model performance
- Final report of continuous data. Additional data collected at sites will be reported on the GA EPD Website https://epd.georgia.gov/ethylene-oxide-information.

The data collection and review for this project will follow the procedures outlined in the EPA approved *Quality Assurance Project Plan for the Georgia Ambient Air Monitoring Program Ethylene Oxide, September 2019*[6] *and Revision 1, March 2020*[7] for the measurement of ethylene oxide. GA EPD operates under a Quality Management Plan (approved April 2016) which can be provided upon request.

Phase 2 being requested will allow a study of the impacts that sampler type and analytical analysis has on the ethylene oxide concentrations being measured. This will allow the end-user to understand the impact of the measurement techniques on the sample concentration being reported. To date, many of the ethylene oxide concentration measurements across the nation have been collected using passive samplers and analyzed at a small number of laboratories. This study will evaluate the bias introduced in the measurement by comparison of sampler types and analytical techniques.

The following comparisions will be made:

1) At two study locations, the passive samplers will be evaluated to see if the sampler used impacts the concentration being measured. Collocated samples will be collected for a month with one sampler being rotated with the same type to study the impacts of the specific sampler. This will be conducted at four sites throughout the study.
2) For each of the non-passive sampling type systems, the same passive sampler will be collocated for one month to evaluate the effects of the sample collection method on the concentration of ethylene oxide measured.
3) Ten samples will be analyzed by multiple laboratories to evaluate the differences in the analytical techniques. These samples will be analyzed within the 30 day holding time and will be analyzed from the same sample canister. The laboratories to be

[6] See https://epd.georgia.gov/document/document/gaaampqappethyleneoxideepasignaturepdf/download
[7] See https://epd.georgia.gov/document/document/gaaampqappethyleneoxiderevision141420epasigned42020pdf/download

evaluated will be the GA EPD Laboratory, the Region 4 LSASD laboratory and Eastern Research Group.

4) Samples collected for approximately seven months using both passive and pressureized sampling methods

Environmental Results

Outcomes

- Short-term outcomes:
  - Increase the knowledge regarding the concentrations of ethylene oxide in ambient air based on the measurement technology utilized
  - Evaluate ethylene oxide sample collection methods
  - Characterizing ambient levels of ethylene oxide within community
  - Providing quality assured data for trends determination
- Mid-term outcomes:
  - Data for health assessments
  - Wide-scale deployment of new measurement techniques
  - Directly evaluating public exposure & environmental impacts in the vicinity of monitors
  - Providing quality assured data for risk characterization
- Long-term outcomes:
  - Assessing the effectiveness of specific emission reduction activities
  - Evaluating and subsequently improving air toxics emission inventories and model performance
  - Assess the bias of the measurement techniques explored in this project

Performance measures

- Adherence to 1-in-6 or 1-in-12 sampling schedule for selected sites
- 75% data completeness per quarter for the overall study
- Data quantity and quality meet those required by the approved *Quality Assurance Project Plan for the Georgia Ambient Air Monitoring Program Ethylene Oxide, September 2019 and Revision 1, March 2020*
- All results published on the Georgia EPD website (https://epd.georgia.gov/ethylene-oxide-information)
- Submit ethylene oxide data for the South DeKalb, NR-285 and General Coffee sites to the AQS database within 180 days after the end of the quarter
- Submit Quarterly Report, including progress reported on subaward
- Submit a Final Report

Programmatic Capability/Past Performance

GA EPD has a wealth of knowledge and experience in air monitoring. Our network has been in operation for over sixty years. We operate approximately 40 sites and collect data on approximately 200 pollutants, including criteria, chemical speciation, Near-Road, Photochemical Assessment Monitoring Station (PAMS), National Core Multi-Pollutant Monitoring (NCore), meteorological parameters, as well as NATTS and other toxics in the ambient air. We operate

under a Section 105 performance partnership agreement with the Environmental Protection Agency. We also receive or have received Section 103 grants for the $PM_{2.5}$ network, Near-Road monitoring network, and the NATTS network as well as multi-purpose grants through the Section 105. GA EPD has an established quality program with multiple approved Quality Assurance Project Plans.

GA EPD continues to meet all the reporting requirements for the applicable grants from EPA. Project Manager DeAnna Oser (B.S. Engineering) is manager of the Georgia Ambient Air Monitoring Program. She oversees budgeting and contracts, management and quality of the network, certifies the ambient air monitoring data, communication about the network with interested stakeholders, and communications with the Director of the GA EPD Lab on analytical issues of the network. She is responsible for reviewing and approving Standard Operating Procedures and Quality Assurance Project Plans for the network.

GA EPD has appropriate mechanisms in place to ensure that the expenditures associated with this grant proposal are tracked and documented, including personnel costs. In the recent Technical Systems Audits for both criteria and NATTS, GA EPD has had no major finding associated with financial practices and procedures.

Voluntary Cost Share/Match and Leveraged Funds

Due to the NATA results, community concerns prompted GA EPD to begin the first phase of the data study. The study began in the communities of Cobb County and in Covington, Georgia and then expanded to Fulton County, Georgia. Background monitoring was conducted at the South DeKalb and General Coffee network sites. The requested grant funds will utilize the equipment, training, and QA documentation that were invested during Phase 1. A majority of the necessary equipment was purchased in the previous phase of the study.

Phase 1 of this project which will continue through August 2020: Money spent through March 31, 2020 has been $709,000 in total. The Federal Grant Dollars reflects a multipurpose grant received by GA EPD from EPA in the amount of $153,165 which was used for these funds. The other Federal Grant Dollars used were Section 105 and Section 103 (NATTS and $PM_{2.5}$) funds. The remaining $449,900 were from GA EPD funds.

	Total Dollars	Federal Grant Dollars	Other Funding Sources
Equipment and Regular Operating Expenses	$272,000	$47,700	$223,660
Personnel Services	$437,000	$211,000	$226, 240
Total Amount Spent	$709,000	$258,700	$449,900

Detailed Budget Narrative – Funds are requested for September 2020 through March 2022

These funds include necessary equipment needed by the GA EPD Laboratory for the analysis of ethylene oxide as well as a subaward to the Georgia Institute of Technology for the evaluation of the new technology. The subaward will be overseen by DeAnna Oser, GA EPD Project Manager and will include quarterly progress reports being sent to GA EPD. The detailed budget is included in Appendix A.

Equipment	$228,045
Supplies	$9,702
Personnel Services	$107,450
Fringe Benefits for Personnel Services	$66,494
Contractual	$108,000
Subaward to Georgia Institute of Technology	$51,979
Total	$571,670

Community Benefit

The data that will be collected through this project will allow the Center for Disease Control Agency for Toxics Substance and Disease Registry (ATSDR) as well as the GA Department of Public Health have a more complete dataset for their respective health assessments. These health assessments will be completed for each of the Georgia communities in which the monitoring for Phase 2 will be conducted (City of Covington, Cobb County, and Fulton County). See Appendix B for the attached letter of support from the GA Department of Public Health. Since July 2019, GA EPD has worked with the communities of the City of Covington, Cobb County, and Fulton County to better understand the levels of ethylene oxide in these communities. GA EPD attended a number of town hall meetings, met with state and local officials to ensure that the concerns of these communities are addressed. As soon as the ethylene oxide measurements are quality assured, they are posted to the GA EPD ethylene oxide website (https://epd.georgia.gov/ethylene-oxide-information). The information posted for 2020 includes maps of each community and the measured ethylene oxide concentration along with the available wind rose for each sample collection day. Monthly averages of the measured concentrations are also being included on the maps. This allows the community to better understand the levels of ethylene oxide in the air over time.

The second phase of this project will allow GA EPD to conduct sufficient sampling for the applicable health agencies to confidently determine ethylene oxide exposure levels in the potentially affected communities. The higher confidence in data due to the longer sampling period. The ethylene oxide concentrations measured in each community, along with the background sites, will continue to be posted along with the applicable maps once the data is quality assured.

Statement on Quality Assurance

Phase 1 of *Characterization of Ambient Air Levels of Ethylene Oxide within the Atlanta MSA Communities Identified in the 2014 NATA* was conducted under an approved *Quality Assurance Project Plan for the Georgia Ambient Air Monitoring Program Ethylene Oxide, September 2019 and Revision 1, March 2020*. The data collected under Phase 2 of this project with the requested funds will be conducted following the quality assurance procedures of this document.