Project Title: Delaware Community Air Toxics Study (CATS)

Category: Community-scale Monitoring

Applicant: Ali Mirzakhalili, Administrator
Delaware Department of Natural Resources and Environmental Control
Division of Air and Waste Management
302-739-9402
ali.mirzakhalili@state.de.us

Project Lead: Terry Meade
Delaware Department of Natural Resources and Environmental Control
Division of Air and Waste Management
302-323-4542
terry.meade@state.de.us

Grant Eligibility: Current EPA 105 Grant # A-98315506-2

Funding Request: $231,187.00

Project Cost: $365,998.00 ($231,187.00 requested + $134,811.00 state contractual support)

Project Period: July 2007 through June 2009

Abstract

Delaware Air Quality Management Section (AQMS) is requesting funding to conduct a n enhanced community-level, volatile organic compound (VOC) monitoring project in Wilmington, Delaware that strives to investigate temporal and spatial variability o f ambient VOC concentrations. The project will engage five sampling sites centered around the existing Martin Luther King Boulevard monitoring station during a 24-month period. The project will address five key objectives: (*i*) Establish an enhanced VOC monitoring program to investigate areas identified as 'hotspots', (*ii*) Identify temporal and spatial variability of select VOCs at the community level, (*iii*) Create a time-resolved data set to gauge modeling efforts, (*iv*) Investigate potential changes in select VOC concentrations following Delaware's switch to reformulated (E_{10})gasoline, (*v*) Re-evaluate human health risk associated with select VOCs on a more temporally and spatially defined basis.

AQMS will utilize existing ambient air monitoring programs (i.e., ozone, VOC canister sampling, GC-MS project, and meteorological data) to analyze and evaluate project results. We foresee this project benefiting AQMS by providing a better understanding of temporal and spatial variations in select hazardous air pollutants, providing advancement opportunities toward our goal to protect public health. The potential for this project goes well beyond helping refine modeling efforts, tracking changes in VOC emissions, and increasing public awareness. We feel there is an opportunity to expand utilization of the gas chromatography – mass spectrometry program regionally as a tool in the concerted effort to monitor and improve air quality.

Background

In 2003, the Delaware Air Quality Management Section (AQMS), with the support of the Environmental Protection Agency (EPA) and assisted by Delaware Health and Social Services (DHSS), began a state-wide, two-phase Delaware Air Toxics Assessment Study (DATAS) with the intent to gain a better understanding of ambient air toxics concentrations throughout Delaware and the potential health risks associated with exposure to those toxics (DATAS *online*). This assessment complimented Delaware's goal to develop an improved air toxics monitoring network and emissions inventory to support the quantitative evaluation, characterization, and tracking of ambient air toxic concentrations.

The first phase of DATAS involved the development of a five-station monitoring network measuring nearly 120 compounds in ambient air throughout the 2003 calendar year and the development of a speciated air toxics emission inventory. Completed in 2005, Phase I quantified screening-level ambient air concentrations of several compound categories, including volatile organic compounds (VOC), carbonyls, metals, polycyclic aromatic hydrocarbons (PAH), and dioxin/furans (D/F). Further, data collected from the DATAS monitoring effort was used to assess the potential for human health risk, which along with the study results, was later presented to the public through brochures, displays at major public events, websites, and a series of public forums conducted throughout the state.

Results from DATAS-Phase I, including meteorological data and emission inventory were integrated into ambient air quality models using Industrial Source Complex (ISC) and Community Multi-scale Air Quality (CMAQ) models with the objective of creating a meaningful resource that can be used to more accurately characterize potential risk, both regionally and locally. This is Phase II of the two phase DATAS project, which is expected to be completed by mid-year 2007.

The culmination of the DATAS Phase I and II has resulted in a much clearer understanding of Delaware air quality on state and urban scale. Using knowledge of Delaware hazardous air pollutants (HAP's) gained from previous studies and a growing data set capable of validating simulated ambient air concentrations of selected pollutants, AQMS would like to further narrow its focus to investigate air toxics at specific communities.

Phase I of DATAS identified several prevalent volatile organic compounds (VOCs), such as benzene, 1,3-butadiene, and vinyl chloride, whose annual average concentrations were at or above national urban averages (EPA, 2004). These compounds are of particular concern because most are listed as known or probable human carcinogens. Phase II of DATAS has assured AQMS the ability to model ambient air concentrations for many of these pollutants. Using modeling results to identify potential areas of elevated air toxics (hot spots) and an in-house Gas Chromatograph-Mass Spectrometer (GC-MS) to analyze ambient samples, AQMS can generate spatially and temporally resolved VOC data on a community level. By employing the use of portable, sorbent-tube samplers and following EPA Compendium Method TO-17 for determining VOC concentrations using GC-MS, AQM can quickly and accurately analyze air samples in a very cost-effective manner. AQMS is proposing a multi-component project to evaluate the ambient spatial and temporal variability for specific VOC concentrations at the community level. This plan is presented in the following Scope-of-Work.

Scope-of-Work

AQMS's proposed study will implement state-of-the-art monitoring techniques complimented by a Gas Chromatograph-Mass Spectrometer (GC-MS) analytical platform to effectively collect and interpret ambient concentrations of select VOCs. By implementing 2-hour time resolutions to spatially characterize a 5 km x 5 km community centered at the existing Wilmington (Martin Luther King Blvd., MLK) monitoring site, AQMS believes this project will achieve the following objectives:

1. Establish an enhanced VOC monitoring program in Delaware capable of performing fast, accurate VOC measurements in communities identified through modeling as potential hotspots. The ability to continuously monitor specific risk drivers at the community level will aid in determining cause and effect of certain HAP's in the long term. Although monitoring trends indicate improved air quality in many areas, the risks associated with many of the compounds are still not fully understood (EPA, 2003).

2. Investigate temporal and spatial variations in VOC concentrations at community level. Much of the data currently available is based on 24 hour average concentrations across a large geographical area. The ability to identify temporal concentration variations throughout the day and spatial variability relative to a source will serve as a valuable tool for evaluating community health risk.

3. Build time-resolved VOC data set to be used for improved model validation. Computer simulations have become one of the main resources when estimating pollutant concentrations in ambient air. Unfortunately, most of the monitoring data used to validate model results is based on annual or 24 hour averages at best. Creating data sets with better time resolution (i.e., one hour or two hour increments) will aid in developing simulation programs better capable of elucidating diurnal patterns in pollutant concentrations.

4. Evaluate potential concentration changes in ambient air of specific VOCs resulting from reformulated gasoline (RFG) usage. In 2006 Delaware switched to gasoline with a 10% ethanol additive (E_{10} gasoline), as a result, the Wilmington area will likely experience a decline in concentrations several VOCs (Mayotte et al., 1994; Leong et al., 2002; Kirchstetter et al., 1996). The Wilmington area is of particular interest due to the proximity of major highways and the percentage of VOC concentrations contributed by on-road mobile sources (estimated by DATAS to be approximately 38% statewide).

5. Build community-level data set of specific hazardous air pollutants (HAPs) to accomplish mutual health-risk assessment goals in cooperation with Delaware Department of Health and Social Services (DHSS). Delaware AQMS and DHSS continue to work very closely to assess to the potential health risk associated with exposure to HAP's in Delaware communities. However, this is the first attempt by AQMS to quantify ambient concentrations of air pollutants at critical points within a specific community.

Monitoring Design

We are proposing to establish five monitoring sites at one kilometer intervals around the existing MLK site, defining a 5 km x 5 km study area. Based upon Phase II modeling output, the 1-km grid density will be sufficient to characterize sub-grid variability within our 5 km x 5 km area. For example, figure 1 presents predicted modeled benzene concentrations at 12, 4, and 1 km grid resolutions.

Using DATAS Phase I and II outputs, the monitoring sites will be established as follows.

- Modeled concentrations will be overlaid on GIS maps within the Wilmington area. Minimally modeled predictions for benzene, 1,3-butadiene, carbon tetrachloride, toluene, and ethyl benzene will be used. These compounds were revealed at elevated levels during DATAS, and also have potential for adverse human health effects.
- Population density tracks and sensitive receptors such as schools and hospitals will be identified.

- Monitoring site location will be selected within the appropriate 1 km grid considering proximity to a sensitive receptor, source, density track, and elevated VOC concentrations.

All sites will meet EPA siting criteria.

One control site to indicate background VOC levels will be selected using modeling results for the northern Delaware area. Samples will be collected in two-hour increments over a 24 hour period (12 samples/day/sampler) using PerkinElmer sequential tube samplers.

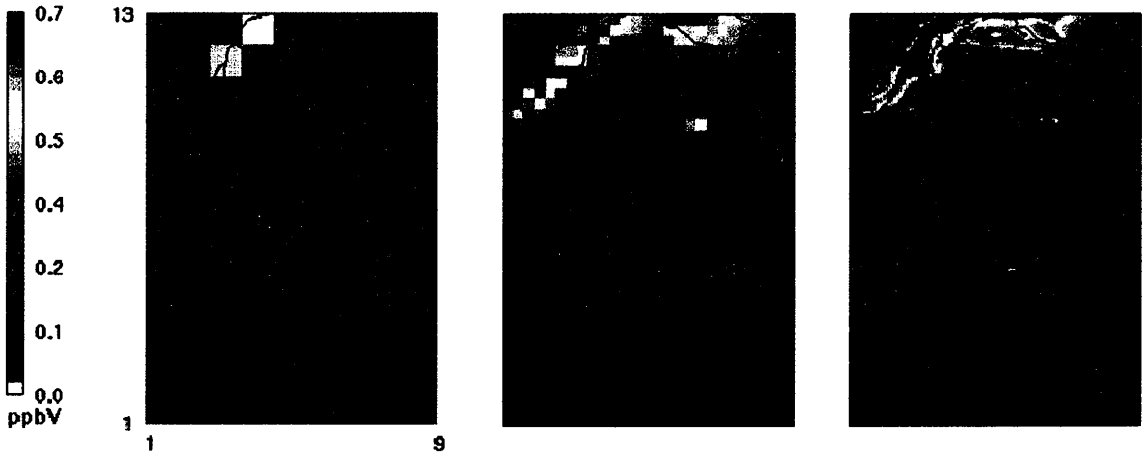

Figure 1: Model results indicating increased benzene concentrations in the Wilmington region. Maps, left to right, indicate 12, 4, and 1 km grid resolution.

Ambient air samples will be collected for 15 months using EPA's six-day sampling schedule for a total of 76 sample dates. At total of eight samplers (five community sites, one control, and two co-located samplers) and 76 sampling dates will result in over 4,000 time- and spatially-resolved characterizations, which results in 90% confidence when explaining temporal and spatial variations.

Sample collection, handling, and laboratory analysis will be conducted following guidelines outlined in EPA Method TO-17. Field installation and collection of sampling tubes will be performed by a trained Environmental technician. A PerkinElmer STS 25 sequential tube sampler (PerkinElmer Instrument; Shelton, CT) will be used to draw 4 liters of ambient air through prepacked, labeled Air Toxics tubes (Supelco; Bellfonte, PA) containing sorbent selected to retain target VOCs. After sampling, tubes are recapped with Swagelok fittings using PTFE ferrules, rewrapped with uncoated aluminum foil, and placed in a clean, opaque, airtight container before being transported to laboratory for analysis using GC-MS. This project proposal is based on a one-in-six day sampling schedule. This will permit immediate extraction and analysis sorbent tubes.

Following field collection, samples are loaded onto the PerkinElmer TurboMatrix Automated Thermal Desorber auto sampler, where the sorbent tubes are purged with dry, inert gas before analysis to remove water vapor and air. The sorbent tube can be held at temperatures above ambient for the dry purge. Within the GC method, the sample undergoes thermal desorption of the sorbent tube (primary desorption), followed by analyte refocusing on a secondary trap and rapid desorption of the trap. The next step involves injection/transfer of target analytes into a PerkinElmer Clarus 500 gas chromatograph (secondary desorption), and individual VOCs are then identified through separation of compounds by high resolution capillary gas chromatography (GC). A PerkinElmer Clarus 500 mass spectrometer then quantifies the

individual VOCs. Laboratory analysis, data analysis and interpretation will be performed by an AQMS Environmental Scientist familiar with the GC/MS platform and managing large data sets.

Data generated during this project will be stored in a system database to aid sample analysis and data selection through search queries. Quality assurance measures will include the use of co-located samplers (distributed volume pairs of one and four liter samples collected over the same time period) at one Wilmington site and at the control site. Sampler pump flow rates will be checked monthly to ensure consistent sample volumes. Additionally, precision of the laboratory analytical system will tested by performing monthly multiple point calibrations (0 to 50 ppb concentrations) and by including a set of six mid-concentration-range standards at a minimum of every tenth set of samples as outlined in EPA Method TO-17. Each sample set of sorbent tubes will also include field and laboratory blanks as described in Method TO-17.

Data Analysis

Resulting data will be evaluated against multiple variables including timing, meteorological, geographical, and anthropogenic (i.e., traffic patterns and emission inventory) factors to reveal temporal and spatial variations as well as source signatures. Data from the five proposed monitoring sites will be evaluated on 2, 8, and 24 hour basis using meteorological information including temperature, wind speed, and wind direction currently collected at the MLK monitoring station to identify potential temporal and spatial variations. Community-level data will be compared to existing VOC canister data being collected concurrent at the MLK station as well as VOC concentrations from the control site. VOC trends will also be investigated by comparing project results to Wilmington area monitoring results from the DATAS Phase I and modeling results from DATAS Phase II.

Time and spatially resolved VOC data collected from this project will also be used to validate new community level VOC computer simulations using the ISC model. Descriptive statistics, variable correlations, and temporal and spatial trend identifications will be evaluated using analysis of variance and multiple variable regression/correlation results from SAS statistical software. Additionally, AQMS proposes to utilize a strong collaborative relationship with Delaware DHSS on past and current risk assessment projects to evaluate human health risks associated with VOC concentrations identified in this Wilmington community.

Estimated time periods for each analysis area are included in the timeline below.

Project Timeline:

The following timeline (Figure 2) is based upon award notification in July, 2007 as indicate in the EPA request for proposals. However, if awards are delayed the proposed start date may need to shift accordingly. Siting, equipment and supplies procurement, and completion of required formal documentation will take approximately three months to complete. We propose a sampling period of 15 months, starting October, 2007 and continuing through December, 2008. Project updates will be provided in the form of reports submitted at the end of each quarter. The first two quarters of 2009 will be used for analyzing and interpreting data, comparing results with previous and concurrent studies, comparing data with modeling results, creating media to share results with public, and completing final report.

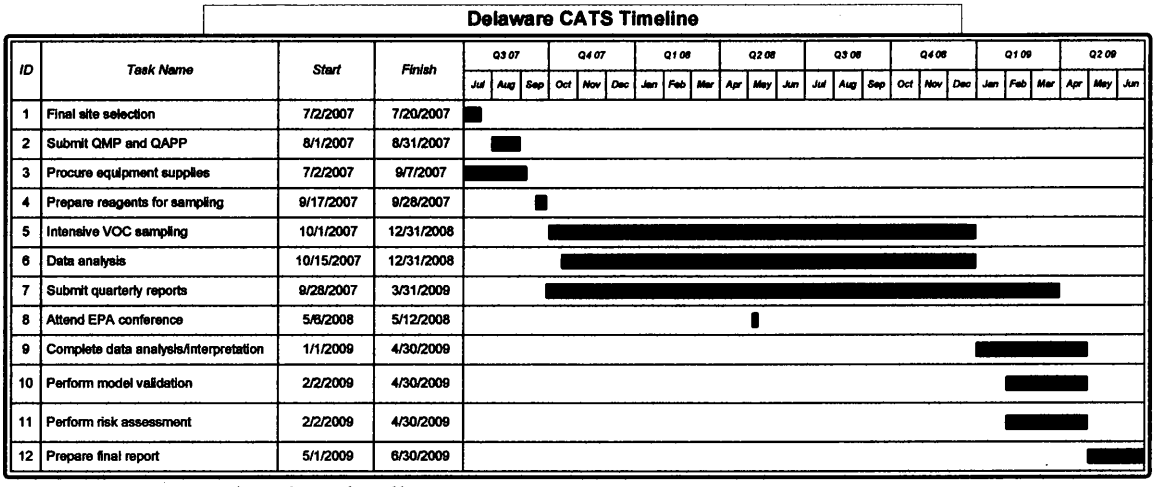

Figure 2: Proposed project timeline.

Environmental Outcomes

We expect the results of this study to shed new light on temporal and spatial variability of select VOCs within the Wilmington community. The success of this study will likely reveal the need to monitor other communities and sensitive areas in the Wilmington area as well as communities throughout the state. AQMS is currently conducting a pilot project in an industrial area near Delaware City, Delaware which previous studies indicated modeling results supported as a VOC hotspot. We expect the results of the pilot project to support the outcome of the Wilmington monitoring project. After data analysis begins, quarterly reports will include comparison between results from this project and existing VOC monitoring programs in Wilmington and Delaware City.

Upon the completion of this study, AQMS and DPHH will have a much better understanding of the health risks associated with exposure to specific HAP's in the Wilmington community. The departments worked together to complete risk assessments based on monitoring results of the state-wide DATAS project (Phase I) and are nearing completion of the risk assessments based on modeling results of the DATAS project (Phase II). We feel this project is the next progression moving from determining risks based on 24-hour average concentrations over large areas to determining risk as concentrations fluctuate throughout the course of the day and and/or as the community becomes more removed from the source. Risk assessment from study results will be performed upon completion of data analysis. Results will be made available to the public through AQMS webpage, brochures available at community events, and displays stationed at events such as the Delaware state fair.

Information gained from the completion of this study will be shared with the public through involvement with community action groups. AQMS will continue to play an active role by partnering with projects such as the Wilmington, Community-Based Air Toxics Reduction Program, a community action group comprised of local citizen, business, and government representatives with the goal of reducing the health and environmental impacts of air toxics within their community. Delaware AQMS continues to actively participate in numerous Wilmington area, community stakeholder groups such as the Southbridge Community Group, 4th-District Neighborhood Planning Council, Rosehill Community Center, People's Settlement, and the Claymont Coalition and will use the study results to further state-community ties and promote the efforts of similar groups to improve air quality in Delaware communities.

AQMS has invested a lot of time and resources to modeling HAP's in Delaware. Not only will this project benefit from existing modeling expertise, but modeling efforts will benefit from this undertaking as well. Although computer simulations have shown to be invaluable when

estimating HAP concentrations in ambient air, they still require monitoring data to measure their success. Results of this project will provide AQMS with a much more defined temporal and spatial resolution data set to better validate modeling results. Model comparison to study results will be conducted following data analysis. If available, the results will be discussed in the last quarterly report. Otherwise, comparison will be in the final report.

In an effort to protect air quality, many states and communities across the country were required to switch to reformulated gasoline for their automobiles, including Delaware. We expect the results of this community study to support similar studies which indicate decreased concentrations of select VOCs associated with E_{10} gasoline usage. Information from this study will likely help shape the future of AQMS as we enter an era where mobile sources play and increasingly larger role in air quality. Results from this objective will be discussed after data interpretation near the end of the project.

One of the overriding goals of this project is to design and implement an air monitoring resource capable of delivering temporally and spatially defined air quality data. Delaware AQMS has proven its commitment to completing quality environmental monitoring through research projects such as DATAS Phase I in 2005 and Enhanced–DATAS, completed in 2006. Projects such as these have given AQMS the ability to continually build upon its existing monitoring capabilities and professional knowledge base. AQMS will be relying upon that technical expertise to complete this project.

Short-, mid- and long-term project outcomes may be summarized as:

Short-term:

- Initiate time-resolved VOC monitoring program which can be applied to existing and future monitoring efforts
- Increase knowledge of spatial and temporal variability associated with VOC concentrations
- Validate and improve air quality model
- Re-evaluate health risks using new data obtained from this study

Mid-term:

- Use study information to support community action groups
- Continue to develop VOC monitoring program

Long-term:

- Continue to address HAPs on a community level
- Reduce HAPs through continued cooperation with community action groups
- Continue to develop VOC analytical system as a potential regional monitoring resource

Key Personnel and Biographical Information

Terry Meade, Environmental Scientist. Terry has worked in federal, state, and university programs designing and conducting field and laboratory research projects. He will serve as project lead and is responsible for project design, supervising data collection, conducting laboratory analysis, data interpretation, and report preparation. He will also coordinate public outreach activities upon project completion.

Betsy Frey, Environmental Scientist. Betsy is currently AQMS's quality assurance coordinator and will serve a similar role for this project. She will approve all study design and analytical plans for this project to assure data validity. Betsy will also be involved in statistically analyzing monitoring results.

Mohammed Majeed, Ph.D., P.E. Mohammed performs air quality modeling for AQMS and will perform all modeling related to this project. He played integral roles in modeling for DATAS-Phase I and E-DATAS projects, and continues to lead modeling efforts associated with DATAS-Phase II and state implementation plans (SIPs).

Joseph Martini, Program Manager. Joe serves as manager for the Air Monitoring and Surveillance Branch. Joe has extensive experience as a project manager and will assist with project design and management. Additionally, he will be advising the project lead on meeting timeline goals through project completion. Joe is responsible for managing current air monitoring programs (i.e., ozone, VOC canister, and DATAS-Phase II) which may be used to evaluate project results.

Sandra Geho, Environmental Technician. Sandra will continue her technical service for the state by providing field support for this project. She will be responsible for setting-up and collecting sample tubes, calibrating sampler flow rates, and equipment maintenance.

Budget

AQMS is requesting a budget of $231,187.00 to complete the project as outlined. The total budget for this project is estimated to be $365,998.00 with the State of Delaware contributing $134,811.00 as contractual support in the form of salaries and benefits currently existing in the AQMS system. Table 1 outlines the proposed budget totals and groups budget items into personnel and non-personnel categories. This table also separates budget areas into requested and in-kind support (contractual) categories. Table 2 (at the end of this document) offers greater budget detail by identifying different line-items required to complete the proposed project.

AQMS is proposing to analyze sample tubes in-house using a PerkinElmer Clarus 500, GC-MS analytical system housed in The Delaware Air Monitoring Laboratory. We estimate the operating budget (includes service contract, standards, consumables, and carrier gas) for the GC-MS alone to be $32,534.00, or $4.60 per sample based on the proposed number of 7296 samples. Contract analytical laboratories charge approximately $300.00 per tube for VOC analysis, so by analyzing sample tubes in-house, we estimate to save approximately $2,153,266.00 when conducting a project of this scope.

Table 1: Budget Summary

	Total	Requested Amount	Contractual Support
Total this Grant	**$365,998.00**	**$231,187.00**	**$134,811.00**
Personnel	**$212,774.00**	**$77,963.00**	**$134,811.00**
Salaries and Wages	$163,672.80	$59,972.00	$103,700.80
Fringe Benefits	$49,101.20	$17,991.00	$31,110.20
Non-Personnel	**$153,224.00**	**$153,224.00**	**$0.00**
Contract Services	$28,864.00	$28,864.00	$0.00
Equipment and supplies	$114,824.00	$114,824.00	$0.00
Travel	$8,255.00	$8,255.00	$0.00
Other	$1,281.00	$1,281.00	$0.00

Programmatic Capabilities and Past Performances

Per requirements of this RPF, AQMS receives 105 grant program funding. Our performance success in managing federally funded programs similar to this proposed project, is best demonstrated in work we have performed for the DATAS, E-DATAS , and PM2.5 programs.

DATAS

The DATAS, enacted in 2003, represented one of the most comprehensive ambient air toxic assessment studies embarked within the Region III states. Discussed throughout this proposal, the project involved a myriad of technical expertise, funding opportunities, and multi-

level agency networking to provide Delaware and Region III with a comprehensive evaluation of ambient air risk drivers.

The project entailed over $1 million in funding, of which $50,000 was directly federally funded, with sizeable in-kind laboratory assistance being provided through the federal laboratory network for the VOC and carbonyl analysis. AQMS has successfully completed DATAS Phase I, has met all EPA-reporting requirements, and has implemented, through involvement of the Delaware Cancer Consortium, a rigorous community outreach campaign enabling us to share our findings with target Delaware communities.

E-DATAS

As one of several initiatives to DATAS, AQMS, in 2003, submitted and was awarded $265,129 to implement real-time, single-particle mass spectrometry for use as an additional resource in characterizing atmospheric aerosols. This technology provided additional data necessary in identifying chemical markers for source apportionment, and thus provided information to AQMS that can be used to aid in the development of control strategies for reducing HAP impacts at the communities of interest.

Per this project, AQMS partnered with many technical experts, including collaboration with the National Exposure Research Laboratory. We presented the project scope-of-work at the September 2005 OAQPS Toxics Workshop, and presented the project, report, and its findings to EPA, Region III during an October 2006 presentation. AQMS has completed this project within scope as defined in the work plan, and delivered to EPA on-time and within budget.

PM2.5 Program

The AQMS receives 103 funds to operate a 7-station PM2.5 monitoring network within Delaware. Implemented in 1998, the program operates seamlessly, supporting collection, analysis, and attainment determinations for PM2.5. Additionally, AQMS collects and analyzes many of the speciated PM2.5 components, i.e., elemental / organic carbon, sulfur, etc.

Our current operating budget for this program is $579,063. AQMS is meeting all its 103 grant requirements.

References

Delaware Air Toxics Assessment Study (DATAS) online. http://www.dnrec.state.de.us/air/aqm_page/docs/pdf/DATAS%20Final%20Report.pdf.

Kirchstetter, T.W., B.C. Singer, R.A. Harley, G.R. Kendall and W. Chan. (1996) "Impact of Oxygenated Gasoline Use on California Light-Duty Vehicle Emissions" Environmental Science & Technology, 30; 661-670.

Leong S.T., S. Muttamara, and P. Laortanakul. (2002) Applicability of Gasoline Containing Ethanol as Thailand's Alternative Fuel to Curb Toxic VOC Pollutants from Automobile Emission. Atmospheric Environment, 36(21); 3495-3503.

Mayotte, S. C., C.E. Lindhjem, V. Rao and M.S. Sklar. (1994) "Reformulated Gasoline Effects On Exhaust Emissions: Phase I: Initial Investigation of Oxygenate, Volatility, Distillation and Sulfur Effects" SAE Paper No. 941973.

U.S. Environmental Protection Agency. 2003 Urban Air Toxics Monitoring Program. Technical Report. EPA-454/R-04-003. July 2004.

U.S. Environmental Protection Agency. Latest Findings on National Air Quality: 2002 Status and Trends. Technical Report. EPA 454/ K-03-001. August 2003.

Table 2: Budget Detail

	Requested	Contractual Support
Budget Detail: Personnel (salaries and wages)		
(1) Field technician @ $29,986/yr x 100% x 2 yrs	$59,972.00	
(1) Scientist @ $46,130/yr x 50% x 2 yrs		$46,130.00
(1) QA Coordinator @ $60,200/yr x 15% x 2 yrs		$18,060.00
(1) Program Mgr @ $70,054/yr x 10% x 2 yrs		$14,010.80
(1) Modeler @ $85,000 /yr x 15% x 2 yrs		$25,500.00
Subtotal	**$59,972.00**	**$103,700.80**
Budget Detail: Personnel (Benefits)		
Benefits for technician based on agency's total benefit percentage (30%), includes FICA, health insurance, disability, etc.	$17,991.00	
Benefits for remaining personnel based on agency's total benefit percentage (30%), includes FICA, health insurance, disability, etc.		$31,110.20
Subtotal	**$17,991.00**	**$31,110.20**
Budget Detail: Non-Personnel service contracts		
Service contract for GC/MS 2 yrs @ $14,432/yr	$28,864.00	
Subtotal	**$28,864.00**	
Budget Detail: Non-Personnel equipment & supplies		
Equiment: Additional tube samplers required for study		
Sequential tube samplers, 10 @ $5,100/unit	$51,000.00	
Sampler pumps, 10 @ $1,600/unit	$16,000.00	
Power adapters for samplers, 10 @ $355/unit	$3,550.00	
Rechargeable battery for sampler, 10 @ $445 each	$4,450.00	
General purpose cable for sampler, 10 @ $100 each	$1,000.00	
Supplies: Sample tubes (prepacked, 48 units (10 tubes/unit) @ $690/unit	$33,120.00	
VOC standards, 1 ampule/mo @ $100/amp x 24 mo	$2,400.00	
Consumables (oil and activated aluminum for vacuum pump, methanol, syringes, glassware, etc), approximately $500/yr x 2 yr	$1,000.00	
Carrier gas for GC, 1 tank/mo @ $90/tank + $6/mo rental	$2,304.00	
Subtotal	**$114,824.00**	
Budget Detail: Non-Personnel Travel		
Field vehicle, unlimited use of vehicle @ $360/month x 18 months	$6,480.00	
Required EPA conference (based on 5 day trip at per diem $60/day, hotel @ $115/day, conference fee $400, and air travel $500)	$1,775.00	
Subtotal	**$8,255.00**	
Budget Detail: Other Costs		
Sate audit fee, 0.1% of request total	$231.00	
Outreach brochures, bid estimate for 3,000	$800.00	
Laminated display for display at DE state fair, $250	$250.00	
Subtotal	**$1,281.00**	