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SF-424
Application for Federal Assistance
Title: THE SHELBY COUNTY HEALTH DEPARTMENT

Document Status

Document Phase: Draft
Last Modified: 05/23/2011
Current Editor: Mike Jones
Delegate: Dennis Finney

IGMS Information

Competition Close Date:

AAShip:

Approving Region: HQ
Project Officer: Mike Jones
PO Phone:

Awarding Region: HQ
Grant Coordinator:

Solicitation Information

Opportunity ID:	EPA-OAR-OAQPS-11-05	**Competition ID:**	
Opportunity Title:	Community-Scale Air Toxics Ambient Monitoring	**Competition Title:**	
Opening Date:	03/23/2011	**Closing Date:**	05/23/2011
Grants.Gov Tracking Number:	GRANT10874312		
Date Received by EAPPLY:	05/23/2011		

Submission Information

Submission:	Application	**Grant:**	Non-Construction
Date Submitted:	05/23/2011	**Time Submitted:**	11:46:10 AM
Type of Application:	New		

Applicant Information

	Grants.gov	IGMS
Applicant Type:	B: County Government	
Applicant Name:	THE SHELBY COUNTY HEALTH DEPARTMENT	
Applicant DUNS #:	0411748890000	
Organizational Unit:	SHELBY COUNTY HEALTH DEPT	
Sub Org Unit:	POLLUTION CONTROL SECTION	
EIN:	62-600841	
Address:	814 JEFFERSON AVENUE	
City:	MEMPHIS	
State:	TN: Tennessee	
Zip:	38105-5041	
County:		
POC Name:	JAMES HOLT	
POC Phone:	901-544-7737	
POC E-Mail:		
POC FAX #:		

Project Information

Federal Agency: EPA

CFDA:	66.034
Project Title:	Reducing Exposure to Airborne Chemical Toxics (REACT): A Community-Scale Air Monitoring Project in Memphis
Project Period Start:	09/01/2011
Project Period End:	09/30/2014

Congressional Districts

Estimated Funding

Federal	$574,404
Applicant	$0
(For all applicants including states)	
State	$0
(For state contribution to non-state applicants)	
Local	$0
Other	$0
Program Income	$0
TOTAL	**$574,404**

Is the Application subject to review by State Executive Order 12372 Process?	No - Program Not Covered By E.O. 12372
Available for Review:	
Is the Applicant delinquent on any Federal Debt?	No

Authorized Representative

Key Contacts

Budget Summary

Application Attachments

Notifications History

OMB Number: 4040-0004
Expiration Date: 03/31/2012

Application for Federal Assistance SF-424

* 1. Type of Submission: ☐ Preapplication ☒ Application ☐ Changed/Corrected Application	* 2. Type of Application: ☒ New ☐ Continuation ☐ Revision	* If Revision, select appropriate letter(s): * Other (Specify):
* 3. Date Received: 05/23/2011	4. Applicant Identifier:	
5a. Federal Entity Identifier:	5b. Federal Award Identifier:	

State Use Only:

6. Date Received by State:	7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name: THE SHELBY COUNTY HEALTH DEPARTMENT

* b. Employer/Taxpayer Identification Number (EIN/TIN): 62-600841	* c. Organizational DUNS: 0411748890000

d. Address:

* Street1:	814 JEFFERSON AVENUE
Street2:	
* City:	MEMPHIS
County/Parish:	
* State:	TN: Tennessee
Province:	
* Country:	USA: UNITED STATES
* Zip / Postal Code:	38105-5041

e. Organizational Unit:

Department Name: SHELBY COUNTY HEALTH DEPT	Division Name: POLLUTION CONTROL SECTION

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:		* First Name:	JAMES
Middle Name:			
* Last Name:	HOLT		
Suffix:			

Title: ASSISTANT MANAGER

Organizational Affiliation:
THE SHELBY COUNTY HEALTH DEPARTMENT - POLLUTION CONTROL

* Telephone Number: 901-544-7737	Fax Number: 901-544-7308

* Email: JIM.HOLT@SHELBYCOUNTYTN.GOV

Application for Federal Assistance SF-424

*** 9. Type of Applicant 1: Select Applicant Type:**

B: County Government

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

Environmental Protection Agency

11. Catalog of Federal Domestic Assistance Number:

66.034

CFDA Title:

Surveys, Studies, Research, Investigations, Demonstrations, and Special Purpose Activities Relating to the Clean Air Act

*** 12. Funding Opportunity Number:**

EPA-OAR-OAQPS-11-05

* Title:

Community-Scale Air Toxics Ambient Monitoring

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

14 Affected areas.doc

Add Attachment | Delete Attachment | View Attachment

*** 15. Descriptive Title of Applicant's Project:**

Reducing Exposure to Airborne Chemical Toxics (REACT):
A Community-Scale Air Monitoring Project in Memphis

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

Application for Federal Assistance SF-424

16. Congressional Districts Of:

* a. Applicant: 9th TN

b. Program/Project: 9th TN

Attach an additional list of Program/Project Congressional Districts if needed.

Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: 09/01/2011

* b. End Date: 09/30/2014

18. Estimated Funding ($):

* a. Federal	574,404.00
* b. Applicant	0.00
* c. State	0.00
* d. Local	0.00
* e. Other	0.00
* f. Program Income	0.00
* g. TOTAL	574,404.00

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

☐ a. This application was made available to the State under the Executive Order 12372 Process for review on ______.

☐ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

☒ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes," provide explanation in attachment.)**

☐ Yes ☒ No

If "Yes", provide explanation and attach

Add Attachment | Delete Attachment | View Attachment

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☒ ** I AGREE

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix:

* First Name: Mark

Middle Name:

* Last Name: Luttrell

Suffix:

* Title: Shelby County Mayor

* Telephone Number: 901-544-4000

Fax Number: 901-544-4759

* Email: Mark.Luttrell@shelbycountytn.gov

* Signature of Authorized Representative: Lorrie Brooks

* Date Signed: 05/23/2011

OMB Approval No. 4040-0006
Expiration Date 07/30/2010

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

	Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
			Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1.	AIR POLLUTION	66.034	$	$	$ 574,404.00	$	$ 574,404.00
2.							
3.							
4.							
5.	Totals		$	$	$ 574,404.00	$	$ 574,404.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total
	(1) AIR POLLUTION	(2)	(3)	(4)	(5)
a. Personnel	$ 36,000.00	$	$	$	$ 36,000.00
b. Fringe Benefits					
c. Travel	11,500.00				11,500.00
d. Equipment					
e. Supplies					
f. Contractual					
g. Construction	526,904.00				526,904.00
h. Other					
i. Total Direct Charges (sum of 6a-6h)	574,404.00				$ 574,404.00
j. Indirect Charges					$
k. TOTALS (sum of 6i and 6j)	$ 574,404.00	$	$	$	$ 574,404.00
7. Program Income	$	$	$	$	$

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SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	$	$	$	$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$	$	$	$	$
14. Non-Federal	$				
15. TOTAL (sum of lines 13 and 14)	$	$	$	$	$

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)			
	(b)First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$	$	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

Tracking Number:GRANT10874312

Funding Opportunity Number:EPA-OAR-OAQPS-11-05 Received Date:2011-05-23T11:46:10-04:00

Funding Opportunity: Community-Scale Air Toxics Ambient Monitoring, EPA-OAR-OAQPS-11-05
Category: Community-Scale Monitoring.

Reducing Exposure to Airborne Chemical Toxics (REACT) via Community-Scale Air Monitoring in Memphis

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  Attachment 5. Properties and Analytical Parameters of Target compounds 16

Summary Information

Project Title: Reducing Exposure to Airborne Chemical Toxics (REACT): A Community-Scale Air Monitoring Project in Memphis

Applicant:

The Shelby County Health Department Pollution Control Section (SCHD PCS)
814 Jefferson Avenue, Memphis, TN 38105
Contact Person: James (Jim) Holt, Assistant Manager
Phone: (901) 544-7737; Fax: (901) 544-7308; E-mail: jim.holt@shelbycountytn.gov

The Shelby County Health Department, Pollution Control Section is an air pollution control agency defined in Section 302(b)(3) of the Clean Air Act. The Section is funded through 105 Grant Funds.

Funding Requested: $574,404. A cooperative agreement is requested with EPA

Project Cost: $574,404. The study is totally federally funded. No matching funds are being used.

Project Period: September 01, 2011 – September 01, 2014

DUNS Number: 041174889

1. Basics and Rationale

Exposure to air toxics in metropolitan areas may be of significant health concern because populations and emission sources are concentrated in the same geographic area [1]. However, exposure to "non-criteria" air toxics and the associated health risks are in need of more study, mainly due to three factors: First, current monitoring capacity is insufficient for reliable evaluation of public health risk, identifying emission sources, or implementing effective pollution control strategies [2]. Measurements are available for only a subset of air toxics in relatively few locations and for small study populations [3]. Centrally located sampling sites do not reflect actual levels of pollutants at residential areas and monitoring data are generally scarce for major cities [4, 5], forcing a reliance on emission measurements and model predictions that tend to bias the levels of urban air toxics. As a result, the modeling programs, e.g., National Air Toxics Assessment (NATA), provide only screening level predictions that do not represent known temporal and spatial variation of pollutant concentrations [3]. Second, exposure differentials related to socioeconomic conditions have rarely been examined for air toxics [6]. Although it is commonly hypothesized that higher levels of air pollutants exist in socially disadvantaged neighborhoods [6], little evidence supports this hypothesis for air toxics with field monitoring data. No field study has been designed for examining the effect of socioeconomic status (SES) on ambient air toxics [7]. Third, identifying high-priority mixtures is a fundamental question in mixture exposure assessment [8]; however, few analyses of mixture exposures and their distributions have been conducted, in part due to the number and complexity of mixtures. Inhalation exposure is largely a multi-pollutant process, and there has been a clear trend over the past two decades to include consideration of multi-chemical exposures and risks [9]. US EPA [10], ATSDR [11] and others have repeatedly stated that exposure information used in risk assessments should account for inter-pollutant dependencies. Still, methods to evaluate likelihood of co-exposures have not been adequately tested, and the identities and probabilities of specific mixtures - especially high concentration mixtures of greatest potential health concern - remain unknown. Such knowledge gaps may limit the relevance of risk assessments, and it can impede environmental epidemiological investigations that require accurate and unbiased exposure assessments [12]. These limitations warrant an environmental monitoring of a wide range of air toxics at featured spatial units (e.g., the census tract) to examine the urban ambient air toxics and mixtures in terms of spatiotemporal variations as well as socio-demographically differential distributions.

Air toxic risks and the differentials are expected in Memphis, given its large African-American population (over 60%), significant poverty figure (25%), segregations, high cancer rates [13], and major industrial sources. Memphis is a city of 677,000, encompassed by Shelby County (population of 0.92 million, area of 2,030 km^2), which in turn is the center of the 8 county Memphis Metropolitan Statistical Area containing over 1.3 million people. Major industries located in Memphis include transportation carriers, a petroleum refinery, petrochemical storage and transfer facilities, waste disposal facilities, a power plant, and etc. [14]. Major air toxics emissions include variety of aliphatic, aromatic, halogenated compounds and carbonyls. Based on the 2009 Toxic Release Inventory (TRI) data, some VOCs with top emissions (over 100,000 lb/year) include methyl methacrylate, n-hexane, methanol, ethylene glycol, and toluene (Attachment 2). VOCs are also precursors of tropospheric ozone formation, and Shelby County has had ozone nonattainment issues for a long period. Health concerns are greater in urban and industrial areas that contain both small and very large emission sources in proximity to residential areas. There are 8 elementary schools within 1 mile of these facilities, and 16 schools within 2 miles. For example, the Southwest Memphis, a low SES community, is located in proximity to the city's main stationary air pollution emission sources in the President's Island industrial area. In addition, nearby transportation sources include Interstates 40 and 55; Memphis International Airport, and several railyards. Memphis has been ranked the No. 6 Asthma Capital in 2010 [15], and epidemiologic evidence has indicated the association of allergic responses or childhood asthma with exposures to ambient air pollutant mixtures [12]. Many local communities and organizations have expressed their concern about the health effects from air pollution, especially those at low SES.

Toxics risks in Memphis are still poorly understood, partially due to lack of community-scale air toxic monitoring and plausible analysis tools. Ambient monitoring of air toxics at the community level has been conducted in many metropolitan areas, e.g., Los Angeles, CA [16, 17], New York, NY [18], Detroit, MI [19], Minneapolis, MN [20], Houston, TX [17], and Elizabeth, NJ [17], as summarized in Attachment 3. In Tennessee, however, no extensive ambient VOC monitoring program provides site-specific information regarding spatial and temporal variation and other factors. Metropolitan areas, e.g., Memphis, encompass major industries that may emit large amounts of air toxics and influence surrounding populations. The Cumulative Exposure Project (CEP) analysis indicated that concentrations of eight air toxics may exceed benchmark levels in essentially all census tracts across the U.S. [21]. However, no data are available to document the community-based air toxics pollution levels and risk potentials. The data obtained from only a few monitoring stations are restricted in terms of the number of pollutants monitored, time period, geographic coverage, and other factors, thus, estimates of exposure distributions for specific or typical regions are unavailable. Memphis is facing critical need to enhance air toxics monitoring in order to support implementation of new air quality standards or control programs.

This proposal entails a comprehensive air toxics exposure assessment (The "REACT" Project) for the metropolitan Memphis. Comparison neighborhoods to be studied include urban areas in Germantown, a small (population of 41,000) fairly densely populated town with a mixture of industry, commerce and housing, and Collierville, a town with population of about 39,000 most of which is suburban without significant industrial emissions. With substantial diversity in emission sources, urbanization/industrialization, SES and ethnicity, the metropolitan Memphis presents many excellent opportunities to sample a diverse airshed, which is similar to many areas across the nation.

2. Technical Approach

Objectives

The REACT project targets metropolitan Memphis area that has communities along an urban/industrial gradient. The overall objective of the proposed project is to characterize the distribution and concentrations of ambient air toxics in Memphis, identify major sources, and estimate non-carcinogenic and carcinogenic risks. Such information would fill a critical knowledge gap in assessing and managing exposures, and in practice serves one of the most effective emission reduction tools. The proposed research has the following specific aims:

(1) To measure ambient concentrations of air toxics in the metropolitan communities which include varying degrees of urbanization and industrialization, and estimate the health risks. This will result in a database with descriptive statistics, e.g., means and frequency distributions, of community-scale ambient air toxics concentrations. Immediate practical uses of this database include, for example, an assessment of the ability of fixed monitoring sites to portray population exposure in different neighborhoods, the derivation of actual exposures for general, susceptible, and "high end" exposure population subsets, and estimate cancer and non-cancer risks such as respiratory and neurological illnesses.

(2) To assess the significance of seasons and industrial/urban/suburban environments on the air toxics concentrations. A sufficiently large number of areas will be studied in these two cities to characterize the neighborhood effects and other differences.

(3) To identify the socioeconomic and racial determinants of individual exposure to air toxics and priority air toxic mixtures. "Risk maps" will be generated to display unequally distributed risks across communities with a gradient of socioeconomic status. Special care will be taken to examine the disproportionate burden of environmental pollution in socioeconomically disadvantaged communities.

(4) To identify the "hot-spots" or the major sources contributing to air toxics pollutions. Neighborhoods located particularly close to outdoor sources of target compounds will be oversampled to examine these relationships for the potentially high-end contributions of ambient sources to exposures. Spatial pattern analysis will be applied to characterize the cluster locations.

(5) To evaluate the extent to which concentrations predicted using dispersion models represents the actual emission levels of point, area, and mobile sources, as well as whether concentrations measured at conventional fixed site monitors represent exposures estimated for the study population. This design in which samples are collected on census tract levels is conducive to a mechanistic examination of the data and appropriate for model testing. Dispersion modeling results are available from recent NATA 2005 database. Fixed site monitoring information will come from air toxics monitoring in Memphis.

(6) To identify common mixtures, estimate probabilities of priority mixtures selected on the basis of toxicity and/or interest, and develop multivariate models of exposure distributions using copulas that efficiently and accurately represent 'tail' dependencies, i.e., structures that govern high concentration mixtures. This information is needed to help address a number of important issues in exposure and risk assessments, including identifying the most exposed individuals (MEIs), the mixtures of greatest concern, and the likelihood that individuals are simultaneously (or sequentially) exposed to high concentrations of several or many pollutants.

To increase the representativeness of results, the samplers will be deployed in a variety of neighborhoods. State-of-the-art methods will be used to collect time-integrated air toxics samples, time-location information, and other data that represent exposure levels. Urban/industrial/ suburban areas of metropolitan Memphis are selected as field study sites given the significance of existing exposures, the diversity of source conditions, the gaps of air toxics information available, the strong partnerships with local community and governmental organizations, and the proximity to the investigators.

Sampling Plan

Ambient air toxics concentrations will be measured at representative census tracts in Memphis, Germantown and Collierville, TN. Census tracts are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Analyses of variability of ambient air toxics have showed that VOC concentrations within a small community are quite homogeneous, but displayed large seasonal variation [22, 23]. Thus, a single sampling location with repeated samples is representative of community exposure. A screening analysis (supported by another funded grant) will be first performed to identify potential "hot/cold spots" (spatial clusters of high and low concentrations, respectively) based on the 2005 NATA data. There are totally 216 tracts in Shelby County that houses Memphis. We will select 100 tracts and collect 1-2 day integrated samples in 4 seasons from 2012 to 2013. Seasonal samples are addressed as VOCs show large seasonal variations [24]. WHO [25] suggests that the minimum sample size to represent any target population in exposure studies is 50 sites. Larger samples are needed if the target population will be divided into subpopulations based upon residence location, ambient pollution sources, transportation modes, socioeconomic status, etc. Since the total number of sampling sites in this phase of the study will be approximately 100, certain of these factors can be investigated. To ensure the data quality, 10% and 5% of the samples will be duplicates and blanks, respectively. The total number of samples to be collected will be 460, including 400 air toxics samples, 40 extra duplicate samples, and 20 blank samples.

Monitoring sites in census tracts will be selected based upon presence of industries (past and present), number of people with possible exposure, and proximity to neighborhoods. The study will potentially monitor the residential areas in the Southwest Memphis, Douglas Community, Woodstock/Millington area, and the old Frayser industrial areas. Specifically schools in these low-income residential areas will be targeted for monitoring. All of these neighborhoods have had local community organizations showing concern about public health and a long history of local industry in the residential areas. In addition, to examine neighborhood background emissions for comparison detailed sampling will be conducted at the Ambient Air Monitoring Work plan For National Core (NCORE) monitoring station in Shelby Farms. The site is selected because it has no nearby industry and not in close proximity to a large roadway. The research team will also request input from EPA experts to examine or suggest sampling sites via a cooperative agreement.

Sampling and Analytical Methods

Air sampling in accordance with the US EPA Compendium of Air Toxics Methods TO-15 [26] will be adopted for collecting air toxics samples. The TO-15 method based on whole air sampling with canisters will be used for all of the VOC samples. The TO-15 sampling method, starting at the intake end, is composed of a programmable flow controller (Nutech Model 2702) and a 6-L pre-cleaned and pre-evacuated canister (Restek Corporation). Long-term integrated samples (>8 hr) are preferred as they are more representative of the average exposure and can avoid possible peak concentrations during short-term sampling, and a 24-hr sampling duration will be used. The flow rate depends on the sampling duration: it is 4.1 ml/min for 24-hr, and 2.1 ml/min for 48-hr.

All the samples will be handled identically using a standard protocol. Upon return to the laboratory, samples will be analyzed 5 days of receipt using an automated Nutech preconcentrator (Nutech Model 8900) and gas chromatograph/mass spectrometer (GC/MS, Model 6890/5973 running Chemstation®, G1701BA, Version B.01, Hewlett-Packard) following well-developed procedures (Attachment 4). A wide range of VOCs will be included as target compounds (Attachment 5), which include alkanes, alkenes, aromatics, halogenated compounds, terpenes, carbonyls and others. VOC selection is based primarily on toxicity, TRI database information, and frequency of occurrence as determined in previous studies, e.g., the Michigan three cities study by Jia et al. [24]. Method detection limits (MDLs) for nearly 100 target compounds are typically in the range of 20-100 parts-per-trillion (ppb) based on mass spectrometric analysis in the scan mode, which are low enough for detecting the air toxics levels commonly encountered in the ambient air. For target compounds that are not amenable to TO-15 analysis by GC/MS, Fourier Transform infrared spectrometry (FTIR) is an additional analytical technique that will be used to analyze selected VOCs. Long pathlength gas cells of 10 meters and 36 meters will be used for sample analysis in situations when the GC/MS data are inconclusive. A quality assurance project plan (QAPP) will be developed that includes detailed protocols for all study components.

3. Data Analysis

The following outlines the general approach and methods for each objective.

Analysis 1: Characterization of full and extreme value distributions of exposures and risks (Objective 1). We will characterize the full distribution of pollutant exposures using both standard (e.g., lognormal) as well as and extreme value distributions that match observed exposure distributions. This work will include an evaluation of uncertainty, heterogeneity, outliers, and differences among selected groups. The standard and extreme value distributions will be fitted to concentration measurements in CrystalBall (Oracle, Redwood Shores, CA). Cancer and non-cancer risks will be estimated using slope factor and hazard quotient methods.

Analysis 2: Investigation of ambient toxics exposure determinants (Objectives 2 and 3). Mixed-models and nested analysis will be applied to apportion and weigh the variance components of ambient concentrations to five sources: city, census tract, season, sampling and analysis. Indicators will be developed to represent demographic, socioeconomic, housing, and seasonal factors that might plausibly affect exposures. A number of statistical techniques will be applied to identify the determinants, including classification and regression tree (CART), ordinary linear square (OLS) and quantile regressions (QR). These analyses will be performed using common statistical packages such as SAS 9.2 (SAS Institute Inc., Cary, NC).

Analysis 3: Source identification and apportionment (Objective 4). We will identify whether ambient concentrations are spatially clustered using geospatial information system (ArcGIS 10.0, ESRI, Redlands, CA). A global test (e.g., Global Moran's I) will be used to examine whether there exists global spatial autocorrelation. If the global spatial patterns appear no random, we will further characterize the cluster locations using hot spot analysis and cluster and outlier Analysis (e.g., Anselin Local Moran's I). We will apply trajectory analysis (the NOAA HYSPLIT model) to trace the most likely sources of extreme events. Common VOC sources, source profiles, and source contribution will be determined using factor analysis and positive matrix factorization (EPA PMF 3.0 Model).

Analysis 4: Comparison of modeling results with monitoring data (Objective 5). The agreement between modeling and monitoring will be evaluated using linear regression: a slope of close to 1.0 indicates good agreement. The model performance may also be evaluated using three statistics: mean difference between the modeled and measured concentrations (mean error), the root mean square error (RMSE), and the fractional bias (FB).

Analysis 5: Analysis and modeling of exposure mixtures (Objective 6). Multivariate exposure distributions of key mixtures, identified in Analysis 3, will be developed using the copula technique. We will examine Archimedean copulas (Product, Gumbel, Frank, and Clayton), elliptical copulas (Gaussian), and others. The best-fit copula will be determined by comparing the Cramer-Von Mises statistics obtained in the goodness-of-fit tests, after which copula parameters are estimated using the inversion of Kendall's tau method. All copula analyses will use package "Copula" (Ver. 0.9-7) [27] in R (Ver. 2.11.1).

4. Environmental Justice Impacts

Disproportionate distribution of air toxics in socioeconomically disadvantaged communities has emerged as a priority area for public health intervention [28]. The proposed project will generate "riskscapes" for a wide range of air toxics and mixtures, displaying unequally distributed risks across communities with a gradient of socioeconomic status (SES). It will elucidate the role of SES and race/ethnicity in environmental risk assessment. The results are expected to inform both the regulatory agencies and the impacted populations. (1) The findings will help air pollution control agencies determine priorities in risk assessment and air monitoring. This study will identify risk drivers and their disproportionate distributions in disadvantaged neighborhoods. Environmental stressors will be linked to health problems of socially vulnerable communities. Environmental managers can direct ambient air toxic monitoring towards concentrations of the worst pollution exposure risk and its large industrial neighbors that always house low SEE populations. (2) The study also targets on educating minority populations about the health risks associated with toxic output and living in close proximity to toxic sites, a merit of toxics disparity studies [29]. Efforts include educational outreach programs, community wide campaigns, and workshops. They will increase knowledge concerning the risks of living in close proximity to hazardous waste sites and may be instrumental in lessening the migration of such populations into neighborhoods with hazardous sites. (3) The participatory decision making process will build upon government and community collaboration in problem-solving, access to information and research capabilities at the local level. Political activities such as voting behavior and collective action may repel the location of new toxics release facilities in disadvantaged neighborhoods. (4) Efforts at the community level may be the impetus for larger scale policy changes at the state and regional level that may more strictly ensure the proper identification, assessment, evaluation, and regulation of toxic waste exposure among populations in vulnerable communities. In summary, this study will be the first field monitoring campaign to assess environmental health disparities in this region. We expect that the results will provide a starting point for local-scale assessments; identify locations of concern for further investigation; prioritize air toxic and mixtures, emission sources, and schools; inform monitoring programs; help communities better design their own assessment; and develop more effective target risk reduction activities.

5. Community Collaboration / Outreach

The Shelby PCS has undertaken a number of events, projects and grant activities to increase awareness of air quality issues in the Memphis area. One major noteworthy event was at Riverview Kansas Elementary school in Southwest Memphis. This air quality education event, held in October 2009, utilized the staff of Pollution Control Section, U.S. EPA Region IV, as well as a number of other health professionals. Over 400 children, parents, and some community members attended the event. Information tables were set up to provide outreach on a number of air quality topics. Particular interest was shown by attendees on the in the toxics air monitoring that Pollution Control was performing at the school.

The PCS was tasked with developing and implementing a modest grant program in the Riverview Kansas Community in Southwest Memphis. The total grant funds totaled $150,000 and the funds were distributed to 501c3 organizations within that community. The PCS proposed that the grants be used for environmental and community improvement. The applications were reviewed by the PCS the awards made by Shelby County Government. Seven awards were made in the community, as summarized in Attachment 6. Over 1,000 Southwest community members have been touched by these projects and a great deal of health, environmental and air quality information has been provided to the community. The projects were completed by late 2010. In addition, several community meetings were held to discuss the events at local churches. The PCS visited over 500 homes in this Southwest Memphis community, walking door-to-door, to deliver grant information and air quality information.

Additionally, the PCS has provided air quality materials and teaching aids to **<u>all</u>** City of Memphis Schools (totaling over 250) and Shelby County Schools (totaling over 60), as well as a number of private schools (totaling 20). This was completed in early 2011. The PCS also has consistently aired air quality videos through the Comcast network in the Memphis region. This air quality information is estimated to reach 500,000 people every day.

6. Environmental Results

Figure 1 provides a Gantt chart for major tasks/outputs, and Table 1 lists anticipated environmental outcomes. Milestones include completion of data collection components, data analysis, modeling, and report/manuscript preparation. The third year will be largely used for data analysis and write-ups; however, some follow-up and confirmatory laboratory and field studies may be conducted.

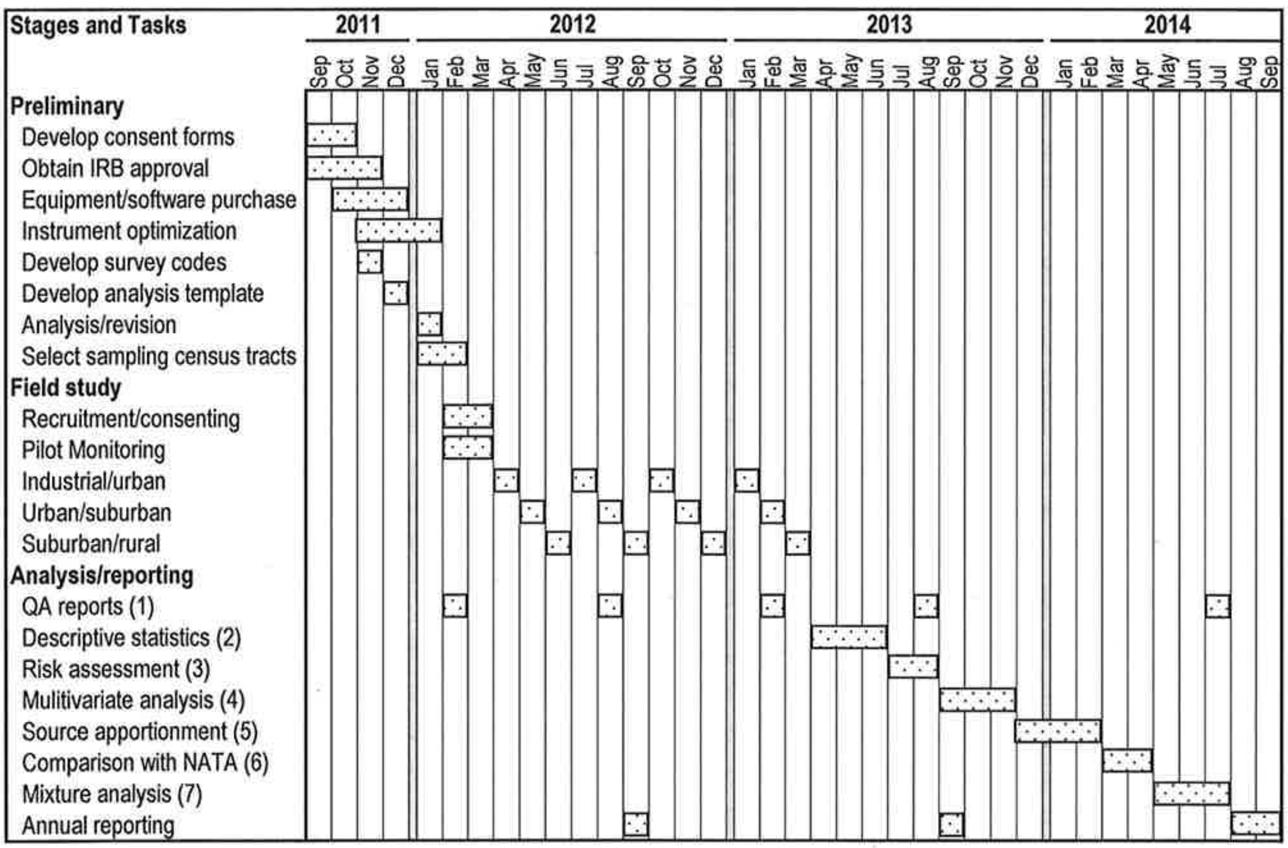

Figure 1. Proposed schedule and milestones of the study

Notes for analysis/reporting components:

(1) Summary of issues such as blank, reproducibility, recovery and comparability.

(2) Data summary, descriptive and graphical summary for each VOC, and probability distributions.

(3) Estimate cancer and non-cancer risks; identify priority VOCs and risk drivers.

(4) Spatial and temporal variances; neighborhood, socioeconomic, and seasonal effects.

(5) Use GIS, factor analysis, PMF and trajectory analysis to identify air toxics sources and to determine source

profiles and contributions.

(6) Comparison between monitoring results and concentrations modeled in NATA 2005.

(7) Multivariate probabilities of VOC mixtures.

Table 1. Environmental outcomes.

Time Frame	Objective
Short Term	Problem identification – To determine high exposure communities and sites.
	Increase community awareness - To provide the results to the local communities/organizations.
	Improve air quality models – To provide additional information concerning air toxics emissions for emission inventories and models.
Mid-term	State and Local policy actions – If the data indicates a significant source of air toxics, states and local agencies may use the data to develop policies or regulations to reduce emissions.
Long-term	Reduce air toxics emissions through additional policy or regulatory restrictions.

Besides using data to promote more effective regulations, the monitoring efforts will also have implications in urban and suburban planning in providing air quality data that will help developers decide where to build commercial and residential real estate so that exposure to air toxics can be minimized. By sharing monitoring data with industries in a constructive manner, industries, especially those listed in the TRI as contributors of air toxics release, can think about the need to install air pollution control equipment or modify their manufacturing practices to reduce community exposure to air toxics. Due to the lack of air monitoring data in the past, many industries have no ideas where the air toxics are transported to or how soon they are broken down photochemically. Environmental protection agencies will have to present air monitoring data to induce industries to keep up with their good corporate image by implementing maximum achievable control technologies (MACT). Lastly, the availability of air monitoring data will allow citizens to work more effectively with air pollution control agencies and industries because unbiased reliable data is always the foundation of sound decision-making among the different stakeholders of environmental impact.

7. Programmatic Capability and Past Performance

The Pollution Control Section staff is diverse with a wealth of air monitoring and administrative experience. It has successfully managed a number of EPA Grants (Attachment 7). The program has been audited extensively during the past several years. In 2006, EPA audited the permitting program including NSR/PSD and the audit was very favorable. The Air Monitoring Branch monitors for all criteria pollutants, PM2.5, and presently is preparing to operate a NCORE site. In 2006, EPA's auditing found the Branch operated favorably with appropriate monitoring, reporting, and internal controls.

In addition, the PCS was awarded a community action grant for approximately $230,000 to study emissions from tank barges. This study utilized three detection methods including summa canisters, forward looking infrared (FLIR) camera, and open-path fourier transform infrared (FTIR) remote sensing. The final report was submitted to EPA in September 2010, and the results have been presented at the 2011 National Air Quality Conference, 2011 National Air Toxic Workshop, the 2010 Air and Waste Management Workshop, and the 2010 EPA Region IV Air Monitoring Workshop.

Projector manager Mr. James Holt (M.S. and B.S.Ed.) is currently working as Assistant Manger of the Pollution Control Section, focusing on budgeting, management, and development of various environmental projects. He has twenty years experience working as an environmental regulator including: positions in air pollution for advanced air monitoring and air pollution permitting. He has prepared and edited detailed air pollution operating and construction permits for major and minor sources in Shelby County, and enforced air pollution regulations by developing notices of inquiry (NOIs), notices of violation (NOVs), and consent orders. He will administer the project, assist in site selection, sample collection and interpretation and manuscript preparation, and handle contractual responsibilities including assisting in preparation of progress and final reports.

Project collaborator Dr. Chunrong Jia is currently an assistant professor in Environmental Health Sciences at the School of Public Health, the University of Memphis. He is the only Environmental Health professor with expertise in air pollution in Memphis. He has substantial experience in field sampling and laboratory analysis of air toxics, and handling of large air toxics databases. He completed many exposure assessment studies in the Detroit area, MI, and elsewhere that addressed air toxics and particles [24, 30]. He also conducted several secondary data analysis studies using large national-scale databases, such as NHANES [31] and RIOPA [32]. He has developed and applied many statistical techniques and models to interpret exposure measurements and estimate health risks. Dr. Jia's laboratory is capable of monitoring air toxics, particulate matter and other meteorological parameters. Dr. Jia's biosketch is listed as Attachment 8. He will be responsible for sampling plan, field sampling, data organization, analysis and interpretation, and preparation of manuscripts and reports.

Project collaborator Dr. Ngee-Sing Chong is a professor of chemistry and director of the electron microscopy center at Middle Tennessee State University and had served as a member of Tennessee Air Pollution Control Board and as a senior chemist of the Air Monitoring Division of Texas Commission on Environmental Quality (TCEQ). He completed over 10 air monitoring projects in urban and residential areas near industrial facilities such as petrochemical refineries, waste incinerators, and landfills. Dr. Chong's laboratory has a Nutech preconcentrator with 16-position canister autosampler, canister cleaner, dynamic dilutor, and an Agilent 6890/5973 GC-MS system. This system is capable of analyzing a wide range of air toxics with high sensitivity. Other qualifications and instruments refer to Attachment 9. He will be responsible for laboratory analysis of air toxics samples, quality control, and assist in preparation of manuscripts and reports.

8. Budget

(1) Personnel: Funds are requested for administration by the SCHD ($12,000/yr for 3 years).

(2) Fringe benefits: None.

(3) Travel: Funds are requested for the project manager to travel to Washington, DC for annual program progress review ($1,500/yr for 3 years), and to attend national or international scientific conferences to present project findings in the 2nd and 3rd year ($2,000/yr).

(4) Equipment: None.

(5) Supplies: Funds are requested for general purpose office supplies, e.g., paper, printing, copying, and binding reports ($1,000/yr for 3 years).

(6) Subcontracts:

Subcontract 1 to Dr. Chunrong Jia at the University of Memphis for sampling design, field sample collection, data organization and analysis, and preparation of manuscripts and reports. A total of **$270,968** is requested (Attachment 10). The detailed budget for this subcontract is narrated as follows:

(a) Personnel costs include one-month summer salary / yr for Dr. Jia for 3 years (total $22,196), and salary for a field specialist for 3 years (total $98,909). The field specialist is responsible for field sample collection, data entry, data organization and preparation of reports.

(b) Fringe benefits are requested for Jia and the specialist (35.4 %) of salary (total $42,871).

(c) Travel cost includes travel for the specialist to collect field samples (total $10,000), and travel for Dr. Jia to present findings in international conferences in the 2nd and 3rd year ($1,500/yr).

(d) Cost for supplies includes shipment of 460 canisters from Memphis, TN to Murfreesboro, TN at $20/canister (total $9,200). Funds are also requested for miscellaneous supplies and consumables (e.g., tools, shelters, locks, shelves, etc.) for sample collections (total $6,000).

(e) The negotiated Facilities and Administration (F&A) rate for the University of Memphis is 41.0% of MTDC, effective July 12, 2010. The total F&A costs requested for subcontract 1 are $78,792.

Subcontract 2 to Dr. Ngee-Sing Chong at the Middle Tennessee State University for purchase of samplers (canisters), laboratory analysis or VOC samples, data analysis and organization, preparation of manuscripts and reports. A total of **$255,936** is requested (Attachment 11). The detailed budget for this subcontract is narrated as follows:

(a) Personnel includes one-month summer salary / yr for Dr. Chong for 3 years (total $27,610), salary for an hourly-paid lab analyst (@$12/hr × 20 hr/wk × 45 wk/yr × 3 yr = $32,400), an instrument support engineer (Mr. Weatherly, 7.407 of efforts, total $11,126), a data analyst (Ph.D., Dr. B.G. Ooi, 7.574% of efforts, total $13,908). The total personnel cost is $85,044.

(b) Fringe benefits are requested for Chong (20.67 % of salary, total $5,707), the lab analyst (7.65 % of salary, total $2,479), the instrument support engineer (51.64 % of salary, total $5,746), and the data analyst (41.88% of salary, total $5,825).

(c) Funds are requested for Dr. Chong to present findings at national/international conferences in the 2nd and 3rd year ($1,500/yr).

(d) Supplies include purchase of 50 canister sampling systems @$800/system (total $40,000), laboratory analyses of 460 samples @ $80/sample (total $36,800), and miscellaneous supplies and consumables (e.g., standards and reagents) totaling $13,800.

(e) The negotiated Facilities and Administration (F&A) rate for MTSU is 29% of MTDC. The total F&A costs requested for subcontract 2 are $57,536.

(7) Indirect cost: there will be no indirect cost from SCHD.

The Total Direct Costs: $574,404. Total Funds Requested: $574,404.

9. Leveraging

The PCS, working with the Tennessee Department of Conservation, monitored for air toxics at a fixed air monitoring station from June 2008 to January 2010. The monitoring station was located at Riverview Elementary School, which is relatively near the President's Island industrial area. This area contains an oil refinery, chemical plants, and petrochemical storage facilities. The air toxics sampled for 24 hours, every six days. The samples were analyzed for 60 volatile organic compounds and 13 carbonyl compounds.

Dr. Jia currently has two closely related, ongoing projects funded by the University of Memphis. These projects examine levels and disparities of air toxics in Memphis. The preliminary results will help decide the strategies of sampling and data analysis for this project. Dr. Jia's projects can partially support his research activities relating to this project, e.g., travel, office supplies and preparation of reports and manuscripts.