URBAN COMMUNITY AIR TOXICS MONITORING PROJECT, PATERSON CITY, NJ (UCAMPP)

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I. PROJECT SUMMARY

The main objective of the Urban Community Air Toxics Monitoring Project, Paterson City, NJ (UCAMPP) is to characterize local air toxics related to different land use patterns in a highly industrialized urban community, i.e., a "hot-spot". This objective will be accomplished by strategically placing air toxics monitoring stations in community-oriented locations (middle to neighborhood scale) that will capture industrial, commercial and mobile source dominated emissions. Two of the monitoring stations will be located at Paterson public schools allowing UCAMPP to measure the community's potential for exposure, especially children, a susceptible subpopulation. UCAMPP will: 1) characterize the spatial resolution of local air toxics; 2) determine concentration gradients; 3) identify source signatures from various land use(s); 4) evaluate modeling results using monitoring data; 5) field test new sampling and analyses techniques for air toxics that are currently difficult to quantify; 6) characterize the concerns of an Environmental Justice (EJ) community; 7) provide information and develop tools so that the New Jersey Department of Environmental Protection (NJ DEP) and the local community can better address exposure and risk issues related to air toxics; and 8) identify risk reduction strategies. This study will serve as a pilot project and provide valuable information that can be applied to other communities around the state and the nation.

Paterson City (Paterson) in Passaic County, NJ, was chosen for this project because it is a mixed-use urban community with high population density and has all the characteristics of an environmental justice community. The NJ DEP has existing programs that are addressing some of the air toxics problems in this community including Compliance & Enforcement Initiative, an air toxics risk evaluation and a $PM_{2.5}$ monitor. The NJ DEP has committed to providing additional resources, e.g., the staff time needed for data management/assessment and a portion of sample collection and analyses.

UCAMPP identified a suite of air toxics from an initial NJ emissions inventory and from the targeted compounds in this grant solicitation. Three monitoring sites have been identified to target specific land use types, i.e., industrial, commercial and mobile. A background site has also been identified. Sampling frequency will be one in six days over the course of a year and will begin in September 2004.

The NJ DEP will partner with the Environmental Occupational Health and Sciences Institute (EOHSI). Researchers at EOSHI have developed new and advanced techniques for measuring air toxics e.g., acrolein and hexavalent chromium. EOHSI will donate some of the equipment and the personnel necessary for sample collection, a portion of the sample/data analyses, and for a small pilot study to field-test their new methods.

UCAMPP is also partnering with the Paterson Public Schools District. They have agreed to allow UCAMPP to place air toxics monitoring equipment at two of their public schools to capture mobile and industrial source oriented emissions. The NJ DEP has monitoring equipment at the background and commercial sites. UCAMPP will hire high school student interns to assist with sampling (under the supervision of our field technicians) and will incorporate an educational component for the students which will explain what air toxics are, health effects, how they are regulated, risk reduction strategies and employment opportunities.

NJ DEP staff have the ability to analyze UCAMPP data using a variety of methods such as Geographic Information System (GIS) spatial analysis techniques, multivariate statistical methods (factor and discriminate analyses), back trajectory models, conditional probability functions, chemical fingerprinting, and linear and mixed model approaches. The results will be used to identify which air toxics are associated with specific land uses/sources, for model evaluation, to identify high-risk exposures, and assist in determining the most effective risk reduction strategies.

II. PURPOSE

The National Air Monitoring Strategy, which includes the Urban Air Toxic Monitoring Program (UATMP), consists of an extensive network of fixed site monitors throughout the country. It has been recognized that these monitors, while adequate for establishing trends, do not always reflect the variety of local air toxics problems that afflict many of our urban communities. The overall purpose of UCAMPP is to better understand the risks from exposure to local air toxic emissions that can be related to living and working in a mixed-use, highly urbanized "hot-spot" community. This will be accomplished by collecting multiple measurements, across many groups of pollutants, at multiple sites, and developing the evaluation tools and risk reduction strategies that can be applied in other communities. This effort will assist local, state and national decision-makers.

III. OBJECTIVES

The main objective of UCAMPP is to characterize local air toxics related to different land use patterns in a "hot-spot" urban community. This will be accomplished by strategically placing air toxics monitoring stations in locations that capture industrial, commercial and mobile source dominated emissions while measuring the community's potential for exposure. The UCAMPP will: 1) characterize the spatial resolution of local air toxics; 2) determine concentration gradients; 3) identify source signatures from various land use; 4) evaluate modeling results with monitoring data; 5) field test new sampling and analyses techniques for air toxics which are currently difficult to quantify; 6) characterize the concerns of an Environmental Justice (EJ) community; 7) provide information to the NJ DEP and community groups to better address exposure and risk issues related to air toxics; and 8) assist in the identification of risk reduction strategies. This study will serve as a pilot project and provide valuable information that can be applied to other communities around the state and the nation.

IV. METHODS

A. Location (See Figure 1)

Paterson was chosen for this monitoring project because it is a mixed-use urban community and qualifies as an air toxics "hot-spot" due to the industrial (e.g., textiles; dyes; chemicals; metal fabrication, refinishing and recovery; plastics; printing; electronics; paper and food products, etc.), commercial (e.g., dry-cleaning, fast food restaurants, photo labs, commercial heating/boilers, salons, print shops, etc.), and mobile source (US I-80, Route 19 and County Route 649, 639 and 648) dominated sectors. All of these areas either contain or are fringed with residential land use, allowing for population oriented air toxics monitoring. The schools that have been chosen as monitoring site locations allow UCAMPP the unique opportunity to monitor air toxics where children, a susceptible subpopulation, spend a large portion of their time.

Paterson has all the characteristics of an Environmental Justice community with a disproportionately large percentage of families living at or below the poverty level. Nineteen percent of the families in Paterson live at or under the poverty level compared to 6.3% for the state. Paterson has a high population density and rich ethnic diversity. According to the U.S. Census data, 2000, there are about 149,000 residents, of which 1/3 are white, 1/3 black and the balance are some other race. Fifty percent of the population considers themselves to be Hispanic or Latino. Paterson has more than three times the state average for hospitalization rates due to asthma (Wallace, 2003). A study in Paterson (Freeman et al., 2002) found that 21% of participating third graders had been diagnosed with asthma or a related health problem. Paterson is located in Passaic County which has the fifth highest hospitalization rate for asthma in New Jersey (NJDHSS, 2003). Twenty-eight air toxics (Leikauf, 2002) have been associated with exacerbations of asthma and the 1996 National Air Toxics Assessment (NATA) identified fourteen air toxics which are causing elevated cancer and noncancer risks (NJ DEP, 2003) in Passaic County.

The NJ DEP has past, current and future initiatives related to air toxics in Paterson including a Compliance and Enforcement Initiative, a $PM_{2.5}$ monitor that has been operating since 1998, and the Paterson Air Toxics Evaluation Pilot Project (PATEPP) respectively, all of which provide additional resources for UCAMPP.

B. Monitoring

UCAMPP will be able to clarify spatial resolutions, concentration gradients, patterns, and source signatures of air toxics by strategically placing air-sampling equipment in the proximity of different land use types. Paterson approximates an irregularly shaped circle about 6 km in diameter and is composed of sections that are dominated by industrial, commercial and mobile sources. Monitoring locations were determined using Geographic

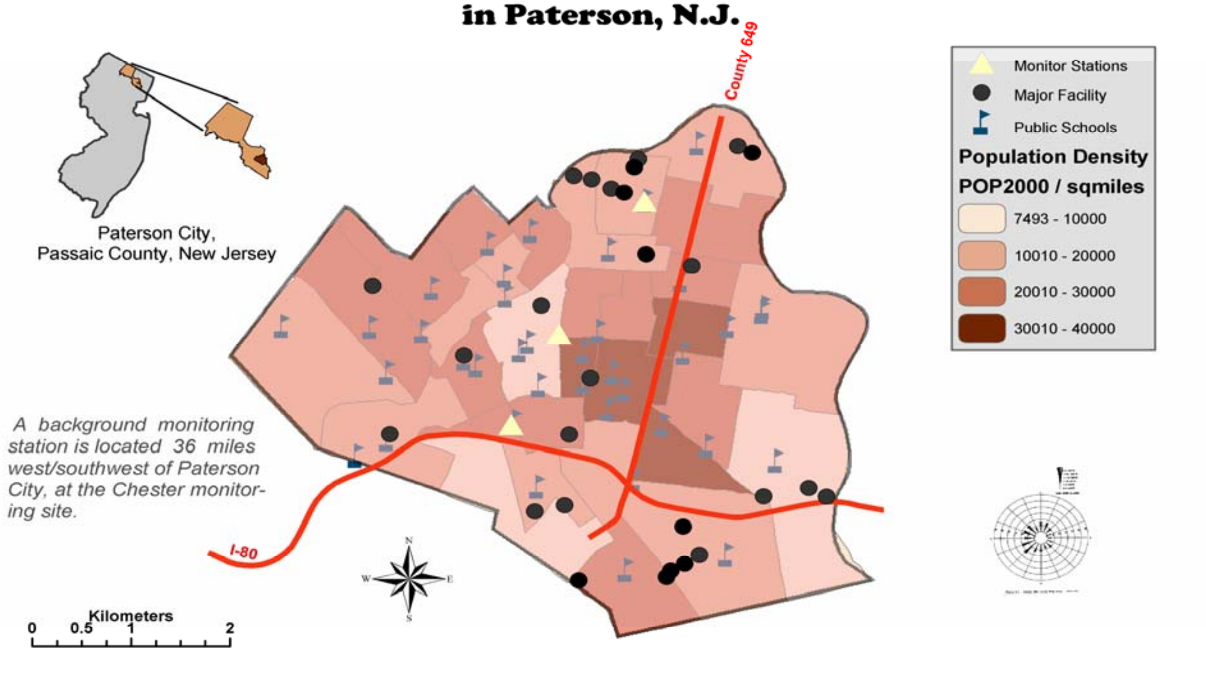
Information System (GIS) layers of population density, source location/identification, land use, school location and a wind rose (see Figure 1). Three sampling locations will be between two to four kilometers from each other and will reflect industrial, commercial and mobile source oriented land use. The background site will be at the NJ DEP designated background site in Chester, NJ, which has been operating since 2001 and is about 58 km west/southwest of Paterson. The air monitoring equipment will be sited at two public schools that are located in close proximity to the industrial and mobile source dominated areas. The NJ DEP has communicated with the Paterson School District, identified the schools with assistance from the Paterson School District and has received preliminary approval to site monitors at the Paterson public schools. This affords us the unique opportunity to monitor air toxics at locations where children spend a large portion of their time. The commercial site will be located where the NJ DEP has an existing $PM_{2.5}$ monitor.

UCAMPP will measure the same analytes at all four sites. Analyte selection was determined by combining the targeted list from the grant solicitation with an initial NJ air toxics emissions inventory and cost. Sampling frequency will be one in every six days. This sampling schedule will allow for 44 weekday and 16 weekend measurements, totaling 60 measurements at each site throughout the year. One in six day monitoring will avoid collecting multiple samples that have been influenced by a single episode or event (e.g., release or inversion). This sampling schedule will coincide with monitoring at the three other NJ DEP air toxics monitoring sites (Camden, Elizabeth, and New Brunswick) to allow for a comparison to other air toxics data.

C. Site Location (See Figure 1)

UCAMPP will monitor industrial land use/stationary source dominated and mobile source dominated air toxics emissions on the roofs of two Paterson public schools. These schools were chosen based on their proximity to the sources/land use types, a wind rose, flat roofs, easy access through stairwells, and security for both the field technicians and monitoring equipment. All of these schools are three-story buildings. The commercial site will be downtown at an existing NJ DEP monitoring site located on the roof of a four-story building. These three sites are strategically located around Paterson at the neighborhood (i.e., 0.5 km to 4.0 km) spatial scale. The distribution of the monitoring equipment around Paterson will allow UCAMPP to determine which air toxics are related to specific land use types, the associated concentration gradients and spatial variability, all of which are integral to the goals of this project. The background site will be the state designated background site for air toxics monitoring presently located in Chester, NJ. See below for details on each site. All sites will conform to uniform siting requirements.

Figure 1. Major Source and Proposed Air Toxics Monitoring Stations in Paterson, N.J.



1. Industrial Land Use/Stationary Source Dominated
The industrial land use/stationary source dominated air toxics monitoring site will be on the roof of Paterson Public School #10 (PS#10) which is located at the corner of Mercer and Keen Street and just SSE of a highly industrialized area known as Bunker Hill. PS#10 is between 0.1 km and 1.2 km from most of the stationary sources in this area. Bunker Hill hosts a variety of large industrial facilities including but not limited to Daicolor-Pope, Inc., a facility that produces powdered azo-dyes and emits copper compounds; Chase Facile, a printing and laminating facility known to emit methyl ethyl ketone and toluene and has been subjected to enforcement actions; Uniquema, a producer of shampoos and cosmetics; Kirker Chemical which produces nail polish and resins and emits toluene, mixed isomer xylenes, acetone and aromatic hydrocarbons; KBF Metals, a metal recovery operation (from photolab chemicals); Passaic Color Chemical which produces azo-dyes; Polaris Plating which emits nickel and zinc compounds and Galaxy Chemical, another dye manufacturer which has been subject to multiple enforcement actions. Local meteorology will be measured at this site. The UCAMPP air monitoring results from this site is of particular interest to the NJ DEP Northern Field Office because it will assist our field inspectors in targeting their enforcement actions. This site is located in the northern area of the city.

2. Mobile Land Use Dominated
The mobile source oriented site will be at 22 Passaic Street on the roof of Public School # 2 (PS#2). PS#2 is located between 0.1 km to 0.8 km from major mobile sources such as U.S. Interstate Route 80, Route 19, a major NJ Transit Bus Depot, an active rail yard/line, and is surrounded by County Routes 639, 673 and 648. A study prepared for the New Jersey Department of Transportation indicated that PM concentrations were 35% higher over the road during normal traffic patterns than that measured in nearby air (Eichinger and Kraye 1998). In addition to higher PM levels, we also expect to find different ratios of elemental carbon and selected PAHs. These ratios will be studied to determine their usefulness as indicators for diesel emissions. This site is located in the southwestern central part of the city.

3. Commercial Land Use/Area Source Dominated
The commercial land use oriented site will be located at 176 Broadway in downtown Paterson. The site has housed the NJ DEP $PM_{2.5}$ monitor since November 1998. This site is surrounded by typical urban downtown sources such as dry cleaners, fast food restaurants, photo finishing, commercial heating/boilers, salons, print shops, etc. The commercial site is located in the center of Paterson.

4. Background Site
This background site will be located thirty-six miles WSW of Paterson in Chester, New Jersey. Chester is the NJ DEP designated background site for the Urban Air Toxics Monitoring Program. UCAMPP will provide additional sampling equipment for the Chester site, (i.e., for PAHs, PM_{10} metal speciation, carbonyls and Cr (VI)) in order to measure the same analytes at all sites. The NJ DEP will donate the staff time to assist with sample collection. The NJDEP pays for the VOC canister and analyses at this site.

D. Sample Analyses
1. Volatile Organic Compounds (VOCs) (See Section XII, Table 1)
VOCs will be collected using ATEC samplers (model 2200) and SUMA canisters. Sampling and analyses will follow protocols outlined in method TO-15. The US EPA UATMP supported contractor, Eastern Research Group, Inc. (ERG), will perform the sample analyses. The VOC samples collected at the four permanent sites in NJ, i.e., Camden, Elizabeth, New Brunswick, and Chester, are also analyzed by ERG, Inc., so the data obtained from UCAMPP will be comparable to the data from the other sites.

2. Carbonyls (See Section XII, Table 2)
Carbonyl samples will be collected using a passive sampler-PAKS (Zhang et al. 2000, 2003). For this project, the preparation of the dansylhydrazine (DNSH) cartridges and subsequent sample analysis will be performed by Dr. Junfeng (Jim) Zhang's laboratory at EOHSI. The PAKS is a tube-type C_{18} cartridge coated with dansylhydrazine. The samples will be extracted with acetonitrile and analyzed by a High Performance Liquid Chromatography (HPLC)/Fluorescence method (Zhang et al. 2000). The method has been documented in the "Technical Assistance Document (TAD) for the National Ambient Air Toxics Trends and Assessment Program" (US EPA, 2003). In general, the DNSH/HPLC/Fluorescence method has better sensitivity and selectivity compared to the

DNPH/HPLC/UV method, i.e., TO-11A. Use of a passive sampler for ambient air monitoring has the advantage of not requiring a power supply. The DNSH passive sampling method was compared to the active DNPH method during the Relationship of Indoor, Outdoor and Personal Air Study (RIOPA). The results indicate that the diffusive sampler is valid for 24 to 48 hours of sampling for carbonyl compounds in outdoor, indoor, and personal air (Weisel et al. 2002). Additionally, acrolein and crotonaldehyde were not detected in many of the DNPH samples, but were detected with the PAKS method. On August 1, 2003, Dr. Zhang et al. submitted "Optimizing the PAKS Method for Sampling of Airborne Acrolein" (Herrington et al. 2003) to the US EPA Office of Research and Development. Results showed that the passive PAKS method has a recovery rate of 111.52% (±7.83) for acrolein and 100.22% (±8.17) for crotonaldehyde, without adverse effects on the measurements of other carbonyls.

3. Speciated PM_{10} (See Section XII, Table 3)
Speciated PM_{10} samples will be collected using a TE-SASS Aerosol Speciation Sampler. This sampler includes five channels for sample collection. This will enable UCAMPP to collect samples for metal speciation, hexavalent chromium, elemental/organic carbon and for quality control. The channels for metal speciation and Cr (VI) will be Teflon coated to reduce the chances of contamination. Samples for metal speciation will be collected on Teflon-membrane filters. The flow rate is 6.7 LPM. UCAMPP will obtain metal concentrations by speciating PM_{10} by the IO-3 method for Inductively Coupled Mass Spectrometry (ICP-MS) at EOHSI.

4. Hexavalent Chromium (Cr (VI)) (See Section XII, Table 4)
Samples for Cr (VI) analysis will be collected using cellulose filters as specified by TAD for the National Ambient Air Toxics Trends and Assessment Program (US EPA 2003). In summary, the filters will be pre-treated with sodium bicarbonate solution, dried in a nitrogen environment, and stored in labeled, sealed and clean petri dishes in the freezer until sampling. After sample collection, the Cr (VI) samples will be analyzed immediately by a method developed and modified by Buckley et al. (2003) at EOHSI. The analytical method includes sonification of the sample filter with water, filtration, separation by Ion Chromatography (IC), and detection by ICP-MS (IC/ICP/MS). The MDL is 0.06 ng/mL.

It is recognized that there are problems with sampling and analyses of airborne Cr (VI) due to the reduction of Cr (VI) to Cr (III) that can occur on sample media, in storage and during analyses. The sodium bicarbonate treated filters should address those problems. The slow oxidation of Cr (III) to Cr (VI) due to the sodium bicarbonate treated filters will be addressed by analyzing the samples immediately after collection. EOHSI will donate the time and materials for a small pilot project to demonstrate the reliability of this method. If the methods for sampling and/or analyses prove unsatisfactory, UCAMPP will modify the method after approval by the US EPA.

The results of Cr (VI) will be compared to the total chromium concentration obtained from the PM_{10} sample speciation. This work is very important because the determination of Cr (VI) is essential when calculating risk and formulating risk reduction strategies.

5. Elemental/Organic Carbon (See Section XII, Table 5)
Samples collected on quartz filters will be analyzed for elemental carbon and organic carbon (EC/OC) using thermal/optical analysis at Research Triangle Institute (RTI).

6. Polycyclic Aromatic Hydrocarbons (PAH) (See Section XII, Table 6)
PAH samples will be collected by a Tisch modified PUF hi-volume sampler utilizing a quartz fiber filter and a polyurethane foam (PUF) plug backup. Samples will be analyzed by Dr. Fan's laboratory using Gas Chromatography/Ion Trap Mass Spectrometry (GC/ITMS) and Tandem MS (Varian Saturn 2200). Sampling and analysis will follow the protocols outlined in the Quality Assurance Project Plan (QAPP) for the New Jersey Atmospheric Deposition Network (NJADN) (Eisenreich & Reinfelder 2002) because the same suite of compounds was analyzed as part of the NJADN.

7. Meteorology
Wind speed and direction data are essential to evaluating the monitoring results. They will be recorded at PS#2 (the mobile source oriented site). The equipment will be donated by EOHSI. This site was chosen for the meteorology station to provide additional data to assist in determining indicators of diesel emissions.

8. Quality Assurance/Quality Control (QA/QC)

The NJ DEP has an approved general quality assurance plan on file with the US EPA. The NJ DEP plans to submit a QA/QC plan that is specific to UCAMPP to the US EPA before monitoring begins. UCAMPP will include at least five-percent field blanks, five-percent duplicates (from collocated samplers) and five-percent control samples (i.e., samples with spiking standards) for a total of 15% of the samples dedicated to QA/QC. Cr (VI) will have an additional 5% of the samples dedicated to QA/QC. Once the NJ DEP has been notified of the grant award, we will complete our Quality Management Plan (QMP), Data Quality Objectives (DQO) and Quality Assurance Project Plan (QAPP) and forward them to the US EPA.

V. LEVERAGE OF OTHER RESOURCES

A. Community-Based Risk Assessment

The NJ DEP has committed the resources for the Paterson Air Toxics Evaluation Pilot Project (PATEPP). The PATEPP is a community-based pilot project that is being implemented by the Bureau of Air Quality Evaluation (BAQEv) of the NJ DEP. The main parts of this project include community outreach and involvement, a detailed emissions inventory, modeling of ambient levels of air toxics, calculation of risk (both individual and cumulative) and the formulation of risk reduction strategies. Since a large component of PATEPP is community outreach, there will be a series of meetings with community members and local groups to determine their concerns and needs. A similar project in Camden, NJ, found that the community meetings were helpful in identifying sources that posed problems for the community. Risk reduction strategies will be discussed at these meetings to determine if these strategies meet the needs of the community and to obtain community buy-in.

Both UCAMPP and PATEPP will use many of the same resources. For example, PATEPP has compiled a preliminary emissions inventory that was used to target specific air toxics for monitoring during UCAMPP. The emissions inventory was compiled from a detailed search of existing databases including but not limited to the National Toxics Inventory (NTI), Toxics Release Inventory (TRI), NATA 1999, New Jersey Environmental Management System (NJEMS), NJ DEP Release and Pollution Prevention Report (RPPR) and Dun and Bradstreet. It will be supplemented with more detailed information including allowable emissions, actual emissions reported to the NJ DEP Emissions Statement program, operational data, information obtained from the Compliance and Enforcement Initiative and site visits by staff from the NJ DEP and Passaic County Health Department. A microinventory will be completed of neighborhoods that are selected to house monitoring sites for UCAMPP to complete and refine the emissions inventory, for source identification, and as part of the process of formulating risk reduction strategies.

Once the emissions inventory is complete, concentrations of air toxics will be modeled by BAQEv staff using the Industrial Source Complex Short Term Model Version 3 (ISCST3). The modeling results and associated risk, including cumulative risk, will be evaluated using the monitoring data and the NATA 1999 results. The data obtained during PATEPP will be used to help identify risk reduction strategies.

B. Background Site in Chester, NJ

The NJ DEP maintains an Urban Air Toxics Monitoring Site at this location. Using Chester as the background site for UCAMPP will save the cost of VOC sampling and analyses at one site. The NJ DEP will donate staff time for the collection of the other samples at Chester.

C. $PM_{2.5}$ monitor

The NJ DEP maintains a $PM_{2.5}$ monitoring station that has been operating in Paterson since November 1998. For the past 5 years, annual averages of $PM_{2.5}$ have ranged from 12.3 to 13.7 µg/m^3 with the 98th%tile of the 24-hour average samples ranging from 30 µg/m^3 to 41 µg/m^3. The $PM_{2.5}$ monitor is located on the roof at 176 Broadway Ave. This location will be used as the commercial source dominated site. UCAMPP will be able to incorporate an historical analysis of the $PM_{2.5}$ data into our overall data analysis. UCAMPP will also be able to identify ratios of PM_{10} to $PM_{2.5}$.

D. Paterson Compliance and Enforcement Initiative

The NJ DEP conducted a two-phase environmental compliance outreach and enforcement initiative in Paterson. The initiative began in September 2003 with outreach to the residents, community groups, trade associations and local chapters of commerce. The second phase included targeted enforcement of specific facilities. This initiative has provided valuable information regarding the community, regulated businesses, site-specific information and data gaps. The knowledge gained during the initiative provides more accurate information for the risk assessment, i.e., for refining the emissions inventory, modeling and in helping to formulate risk reduction strategies. The information obtained during UCAMPP will also assist the NJ DEP to target facilities for compliance and enforcement actions.

E. NJ DEP Donated Salary, Fringe and Indirect Costs

The NJ DEP has committed to donating the salary, fringe and indirect costs associated with the management of this project and the data analyses. The estimated donated costs total $154,850.

F. EOHSI Donated Equipment and Analyses

EOHSI will provide 4 sampling pumps for carbonyl sample collection and one Met Tower to collect meteorological data. EOHSI has also committed time and effort for the field evaluation of the Cr (VI) method.

VI. RESULTS

A. Data submission

The NJ DEP plans to submit the quality assured data ninety days after the quarter ends to the Air Quality System (AQS) and have a final report to US EPA ninety days after the project period ends.

B. Spatial Resolution, Concentration Gradients, & Source Signatures of Air Toxics

The data will be analyzed to characterize spatial resolutions, concentration gradients and source signatures of air toxics influenced by specific land use types/sources. UCAMPP will determine how the proximity to sources of air toxics impacts the local air shed, exposure and risk to the community, and to provide information needed for the formulation of risk reduction strategies. In addition, data analyses will include work on identifying indicators (markers) of diesel emissions. Researchers will use a variety of analytical methods including but not limited to GIS spatial analysis, multivariate statistical methods (factor and discriminate analyses), linear and mixed model approaches, back trajectory models, conditional probability functions and chemical fingerprinting. Available statistical software includes SAS, S-Plus, SPSS and PMF, PSCF, Sigma Plot and Statgraphics Plus.

C. Community-Based Risk Assessment

1. Model to Monitor Relationship

The modeling results from PATEPP and NATA, 1999, will be evaluated using the monitoring results and associated risks, including cumulative risk. Model evaluation will be extremely useful to the local, state and federal air pollution control authorities and public health professionals because modeling is less costly than monitoring. If there is disagreement between the two results, this is also useful because it will give us the information we need to modify the model to more accurately reflect real world scenarios.

2. Pre-Air Toxics Reduction Monitoring

The end result of the PATEPP project (which will be implemented alongside of UCAMPP) is the formulation of risk reduction strategies so UCAMPP will provide a baseline for pre-air toxics reduction monitoring.

D. Strategy to Address Air Toxics Emissions

The results of this study will be used as a baseline effort to assist in future activities aimed at reducing local air toxics emissions in an urbanized industrialized community. The tools (e.g., compiling emissions inventory, monitoring site determination, community outreach, risk reduction strategies, etc.) that are developed in this scoping project will provide for more efficient and expeditious methods that can be implemented in other communities in the state and around the nation to reduce air toxics exposures and related risks.

E. Community Outreach

UCAMPP plans to use this monitoring project as a platform to educate students at Paterson Public Schools on what air toxics are, where they come from, how they are regulated, associated health effects, exposure/risk reduction strategies and related job opportunities. UCAMPP will also train student interns (2 at a time) from the Paterson public school district so that they can work as paid field technicians.

F. Incorporation of Advanced Technologies
The UCAMPP will incorporate two advanced, newly developed methods for measuring acrolein and hexavalent chromium. The methods were developed by EOHSI researchers and have been used in the laboratory and some limited field studies. The field testing (sampling and analysis over a one year period) of these methods is important so that they can be incorporated with confidence on a routine basis.

VII. ADDITIONAL INFORMATION

A. National Toxics Inventory (NTI): Emissions Inventory
The BAQEv is within the NJ DEP Division of Air Quality and has been participating in the development of the New Jersey portion of the NTI since the summer of 1999. In 2001 they began making regular submissions to the inventory using the CDX system. The next submission is planned for June 2004 when the first draft of the 2002 NTI will be due. The NTI will serve as a basis for the air toxics evaluation in Paterson. It will be supplemented with more detailed permit information (e.g., allowable emissions and other operational data), actual emissions reported to the NJ DEP Emissions Statement program, and site visits by staff from the NJ DEP and Passaic County Health Department to gather more facility-specific information.

VIII. KEY UNITS/PERSONNEL

A. New Jersey Department of Environmental Protection
1. The Division of Science, Research and Technology (DSRT)
The DSRT has compiled a multifaceted, multi-talented team for this project. The principal investigator is Linda J. Bonanno, Ph.D., who has experience in air sampling, cumulative risk assessment and data management/analyses. Ms. Gail Carter is an expert GIS analyst who will be working on the spatial analyses for UCAMPP. Leo Korn, Ph.D., and Alex Polissar, Ph.D., bring years of experience in data management and mathematical and statistical analyses of environmental measurements. DSRT has the necessary software and hardware for data management and analyses and is donating staff time to manage and analyze the data obtained from UCAMPP.

2. Bureau of Air Quality and Evaluation (BAQEv)
Joann Held, Bureau Chief, is responsible for coordinating the NJ DEP Air Toxics Program. Ms. Held has evaluated exposure to air toxics in ambient air (Held et al. 2001; Mayes and Held 2002), has prepared the first comprehensive air toxics emissions inventory for New Jersey, and is the lead for the Camden Waterfront South Air Toxics Pilot Project and the Paterson Air Toxics Evaluation Pilot Project. She has participated in several US EPA Peer Review panels, including one for the "Framework for Cumulative Risk Assessment." Her Bureau has extensive experience with the National Air Toxics Assessment (NATA), and has prepared risk assessment maps for the state based on the NATA results. She has 5 modelers on staff who each have 7 to 20 years of experience with dispersion modeling.

3. Bureau of Air Monitoring (BAM)
The BAM, under the direction of Charlie Pietarinen, has been responsible for monitoring of air toxics for over 11 years. Under his direction, four fixed air toxics monitoring sites have been measuring air toxics around the state and one air toxics monitoring platform has been initiated. Mr. Pietarinen brings invaluable experience in monitoring and sample analyses. He is active nationally with the STAPPA Standing Air Monitoring Workgroup (SAMWG) on which he has served for over a decade.

B. Environmental Occupational Science and Health Institute (EOHSI)
EOHSI has over ten years of experience in measuring and modeling air toxics in ambient air. EOHSI has a staff with diverse expertise that includes a strong analytical component. Dr. Fan, Assistant Professor at the Exposure Measurement and Assessment Division at EOHSI, will be the co-principal investigator for UCAMPP. She has many years experience with sampling and analysis of air toxics such as VOCs, carbonyls, and PAHs in ambient air, personal air, diesel exhaust, and wood smoke (Fan et al. 1995, 1997, 1999, 2003; Zhang et al. 2000). She is the co-principal investigator of the Camden project "Personal and Ambient Exposures to Air Toxics in Camden, NJ," and is responsible for the design and implementation of the field and lab experiments.

Table 1: Toxic Volatiles by TO-15.

Target Analytes	Additional Analytes	Additional Analytes
1,1,2,2-Tetrachloroethane	1,1,1-Trichloroethane	cis-1,3-Dichloropropene
1,2-Dichloropropane	1,1,2-Trichloroethane	Dibromochloromethane
1,3-Butadiene	1,1-Dichloroethane	Dichlorodifluoromethane
Acetone	1,1-Dichloroethene	Dichlorotetrafluoroethane
Acrolein (also by DNSH)	1,2,4-Trichlorobenzene	Ethyl Acrylate
Acrylonitrile	1,2,4-Trimethylbenzene	Ethyl Tert Butyl Ether
Benzene	1,2-Dibromoethane	Hexachloro-1,3-Butadiene
Carbon Tetrachloride	1,2-Dichloroethane	m-Dichlorobenzene
Chloroacetic Acid	1,3,5-Trimethylbenzene	Methyl Methacrylate
Chloroform	Acetonitrile	Methyl Tert-Butyl Ether
Cumene	Acetylene	n-Octane
Ethylbenzene	Bromochloromethane	o-Dichlorobenzene
Ethylene Dichloride	Bromodichloromethane	p-Dichlorobenzene
Ethylene Oxide	Bromoform	Propylene
m,p-Xylene	Bromomethane	Tert-Amyl Methyl Ether
Methyl Ethyl Ketone	Chlorobenzene	trans-1,2-Dichloroethylene
Methyl Isobutyl Ketone	Chloroethane	Trichlorofluoromethane
Methylene Chloride	Chloromethane	Trichlorotrifluoroethane
o-Xylene	Chloromethylbenzene	Vinyl Chloride
Styrene	Chloroprene	
trans-1,3-Dichloropropene	Cis-1,2-Dichloroethene	
Trichloroethylene		

Table 2: Carbonyls by DNSH

Target Analytes	Additional Analytes	Additional Analytes
Acetaldehyde	2,5-dimethylbenzaldehyde	Hexaldehyde
Acetone	Benzaldehyde	Isovaleraldehyde
Acrolein	Butyr/Isobutyraldehyde	Propionaldehyde
Formaldehyde	Crotonaldehyde	Tolualdehydes
		Valeraldehyde

Table 3: Speciated PM 2.5 by ICPMS

Targeted Analytes	Additional Analytes	Additional Analytes	Additional Analytes	Additional Analytes
Arsenic	Aluminum	Gold	Potassium	Tantalum
Barium	Antimony	Hafnium	Rubidium	Terbium
Beryllium	Bromine	Indium	Samarium	Tin
Cadmium	Calcium	Iridium	Scandium	Titanium
Chromium (total)	Cerium	Iron	Selenium	Vanadium
Copper	Cesium	Lanthanum	Silicon	Wolfram
Lead	Chlorine	Magnesium	Silver	Yttrium
Manganese	Cobalt	Molybdenum	Sodium	Zirconium
Nickel	Europium	Niobium	Strontium	
Zinc	Gallium	Phosphorous	Sulfur	

Table 4:

Targeted Analytes
Hexavalent Chromium

Table 5 : Species by Thermal/Optical analysis

Targeted Analytes	Additional Analytes
Elemental Carbon	Carbonate Carbon Organic Carbon Total Carbon OCX (Pk4 C)

Table 6: Semivolatiles by PAH-EOHSI Method

1-Methylfluorene	Benzo[b+k]fluoranthene	Fluorene
3,6-Dimethylphenanthrene	Benzo[e]pyrene	Indeno[1,2,3-cd]pyrene
4,5-Methylenephenanthrene	Benzo[g,h,i]perylene	Methyldibenzothiophenes
Anthracene	Chrysene/Triphenylene	Methylphenanthrenes
Benz[a]anthracene	Coronene	Naphthacene
Benzo[a]fluorene	Cyclopenta[cd]pyrene	Perylene
Benzo[a]pyrene	Dibenzo[a,h+a,c]anthracene	Phenanthrene
Benzo[b]fluorene	Dibenzothiophene	Pyrene
Benzo[b]naphtho[2,1-d]thiophene	Fluoranthene	Retene

XIII. BIOSKETCH

A. Linda J. Bonanno, Ph.D., is a Research Scientist with the Division of Science, Research and Technology of NJ DEP. She earned a joint doctoral degree in Environmental Science and Public Health from Rutgers University and the University of Medicine and Dentistry of New Jersey. Dr. Bonanno has worked on sample analyses and data management for the NHEXAS study, field sampling for the Hudson County Chromium Study, supervised air sampling for the Particle Exposures of High-Risk Subpopulations study in NY, NY, and has experience in monitoring indoor air contamination. Her present areas of research include air toxics, cumulative risk assessment and data management/analyses.

B. Joann Held, M.S., has been Chief of the Bureau of Air Quality Evaluation since 1991 and has worked for the NJ DEP since 1979. This Bureau is responsible for dispersion modeling and risk assessment in support of the Air Quality Permitting Program, and for development of the overall Air Toxics program in the NJ DEP. The Bureau has also developed risk screening tools using pre-modeled scenarios in support of permitting review and regulation development. Ms. Held received a BS in Meteorology from St. Louis University and a MS in Air Pollution Control from the Harvard School of Public Health. Prior to coming to the Department she was at the Geophysical Fluid Dynamics Laboratory (Princeton, NJ) where she worked with numerical models of the global oceans. She also spent a summer at the National Center for Atmospheric Research (Boulder, CO) working on a sensitivity analysis of small-scale acid rain models.

C. Charlie Pietarinen is Chief of the Bureau of Air Monitoring (BAM) with the NJ DEP. Mr. Pietarinen received a BS degree in Biology from Valparaiso University and has over 25 years experience in air pollution including air toxics monitoring. BAM's program includes routine monitoring for criteria pollutants, air toxics and acid deposition. BAM is responsible for data acquisition, quality assurance, data reporting, special purpose monitoring projects and the oversight of third party monitoring projects. BAM operates and maintains over 25 continuous air monitoring stations and over 20 particulate sampling locations. Under Mr. Pietarinen's direction, four comprehensive air toxics monitoring sites have been established. He has extensive knowledge of ambient air monitoring instrumentation and practices and is the NJ DEP's principal liaison with the US EPA and other parties on air monitoring issues.

D. Zhihua (Tina) Fan, Ph.D., is an Assistant Professor in the Department of Environmental and Community Medicine at the University of Medicine and Dentistry of New Jersey. Her expertise is in air pollution, method development for air sampling and analyses, exposure measurement and assessment, atmospheric chemistry, and health risk assessment. She has conducted research on the development of sampling devices for personal exposures to PAHs and carbonyls (DNSH method); the development and evaluation of EPA standard method 311 to measure organic Hazardous Air Pollutants (formaldehyde, methanol, styrene, etc.) from furniture coatings; aldehydes, arylamines, and glycol ethers from stationary source emissions; herbicides in foods and beverages; and VOCs from land fill gases. She has conducted human exposure studies to particulate, VOCs, ozone, and other air toxics in a controlled environmental facility in addition to studying chemical interactions among indoor pollutants and their impacts on human health.

E. Alex Polissar, Ph.D., is a Research Scientist with the Division of Science, Research and Technology of NJ DEP. Alex Polissar has received his Masters degree from Moscow State University and Ph.D. degree from Institute of Atmospheric Physics, Russian Academy of Sciences. His area of expertise is aerosol sciences, and has focused on the sources, transformations and transport of airborne particulate matter. He served on the staff of the Institute of Atmospheric Physics in Moscow for approximately 13 years. Since 1994 Alex Polissar worked at Clarkson University, New York, as a Research Associate. His work was related to $PM_{2.5}$ federal reference method studies, air quality monitoring, statistical analyses of the aerosol data, and receptor modeling. He joined NJ DEP in September 2001. He specializes in studies of air quality, climate change, statistical analysis of aerosol data, receptor modeling, and the study of the sources and the transport of atmospheric aerosols. Alex is the author of over 20 peer reviewed journal articles.

F. Leo R. Korn, Ph.D., is a Research Scientist with the Division of Science, Research and Technology of NJ DEP and Adjunct Assistant Professor, Division of Biometrics, UMDNJ-School of Public Health, Piscataway, NJ. Dr. Korn is a statistician who has worked on environmental, epidemiological and medical studies. He has been involved with many studies involving exposure to air pollutants, including several concerned with the effects of environmental exposures on various conditions such as Chronic Fatigue Syndrome and Gulf War related illness and exposure to particulate matter. His current research as a statistician is involved with the estimation of chemical concentrations in the environment. Several of his published articles are in this field and some software that he developed for his research has become part of a commercial software module, 'EnvironmentalStats for Splus'.

G. Gail P. Carter, M.S., P.G., C.P.M., is a Research Scientist with the Division of Science, Research and Technology of NJ DEP. She has a bachelor degree in Geology from the University of Arizona, a Masters in Geography from Rutgers University, and is a registered Professional Geologist. For the 13 years prior to joining DSRT, she worked for the New Jersey Geological Survey as staff and later as manager of the groundwater hydrology bureau. Her primary work is in the application of GIS methods and models in water related topics; including drinking water, marine water, contaminant transport, and ambient surface and ground water monitoring design. She successfully petitioned for sole source aquifer status for ¾ of New Jersey’s aquifers, developed the groundwater classification scheme for New Jersey, participated in the Source Water Assessment project, and many other efforts. She is an Advisory Board Member to the New Jersey Academy of Science, a liaison to the New Jersey Science Teachers Association, and on the Science Advisory Committee for the Jacques Cousteau National Estuarine Research Reserve.

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