FY04 Project Plan for Large Area Monitoring Program (LAMP)

Phase II- BETX Characterization- Chicago & MetroEast St. Louis Areas

1. Background

In FY02, Federal Section 105 funds became available to fund new initiatives under the US EPA's National Urban Air Toxics Monitoring Strategy (UATIS). One project which was approved and received grant funding was Illinois EPA's Large Area Monitoring Program (LAMP)- Phase I which was designed to test an innovative diffusion tube (passive sampling) technology for measuring ambient air concentrations of BETX (benzene, ethylbenzene, toluene and xylenes) and to provide data derived from a saturation study that would permit a preliminary characterization of BETX concentrations throughout the Greater Chicago Metropolitan area.

The LAMP-Phase I was deemed quite successful in that it found the diffusion tube technology to provide highly correlated results to those obtained from field deployed auto-gas chromatographs. Daily (hourly) measurements of BETX from three PAMS auto-gas chromatographs were compared with collocated diffusion tubes that collected three-week integrated samples. These collocated results are illustrated in the attached Chart 9 and showed excellent correlation of the two methods. During the summer of 2002, two LAMP sampling campaigns at 12 sites across the urban area provided BETX data which illustrated a geographic variability of concentrations throughout the study area, see attached Chart 5, identified hotspot areas along the expressways and near the urban core and provided data for dispersion modeling (CRI) validation. The LAMP-Phase I report recommended a Phase II study comprised of 25 sites and be designed to provide better definition of the hotspots, to allow a more complete geographic (spatial) characterization of BETX across the Chicago region and other areas of concern statewide and provide more comparative data to VOC canisters and auto-gas chromatographs.

2. LAMP II Project Scope

The LAMP saturation sampling concept is ideally suited for monitoring medium to large urban areas with a diversity of emission sources. Through the use of a large number of samplers, detailed distributions of volatiles (BETX) can be developed in conjunction with modeling to create topographical charts of the data plotted as isopleths. Such data would be expected to complement PAMS and other monitoring data while providing a level of detail unobtainable by other means. These monitoring data derived isopleths used in conjunction with PAMS data could then be compared to modeling efforts, e.g. CRI and NATA, serve to validate other sampling results (National Trend site data) and to establish a baseline for future measurements.

The LAMP II project is to be designed to meet the following objectives:

a) Measure "community-orientated" population exposure.
Measure typical population exposure to ambient concentrations of BETX over a twelve month period in three areas; one site near the Chicago O'Hare Airport complex, one site downwind of the urban core (Chicago Loop) and in site in a highly populated area (Northbrook). Data from these three sites is to be compared to National Trend Site data provided by VOC canisters over the same twelve month period.

b) Determine geographic (spatial) variability of urban area concentrations.
LAMP-Phase II will employ 24 sites located across the Chicago urban area designed to provide data intended to distinguish influences from geographic factors such as terrain, major traffic thoroughfares, industrial point sources and micrometeorology influences such as lakeshore effects. See attached map. Six other sites will similarly be located in the MetroEast St. Louis area.

c) Provide baseline and background data.
Project measurement data will be provided in areas scheduled for development (Chicago O'Hare Expansion), serve as a reference for current monitoring programs (National Trend site data) and provide a point of reference for emission reduction programs or support the development of future control strategy development.

d) Characterize concentrations near significant point source.
LAMP- Phase II will include five sites located around Chicago O'Hare Airport to allow inter-comparison of urban air concentrations from other areas, to assess immediate area impacts of the airport, to allow a detailed analysis of the effectiveness of controls and highlight "hotspots" that might require additional investigation.

e) Compare the diffusion tube methodology to currently accepted methods
Provide detailed measurement to assess the comparability of diffusion tube method to the auto-gas chromatography data provided via PAMS sites and to VOC cannister data obtained from the National trend sites. This is to continue the method validation work began under LAMP-Phase I.

3. Project Description

The LAMP project would be implemented in two phases. The project would begin with a pilot scale design study and then be followed by the implementation of a field study in the Chicago area. Method comparisons would also be conducted to compare LAMP results to data derived from both VOC canister sampling and real-time gas chromatography results.

Phase I Pilot Study

The pilot study would serve to establish the sampling methods, define the configuration of sampling tubes and target analytes, to train field staff and establish the analytical system and protocols. Technical consultants from Perkin Elmer and Chromian Services, both innovators of the diffusion tube technology, would be utilized to finalize the project design. Results obtained from the pilot study would be used to finalize the design and implementation of LAMP Phase II (Chicago area sampling).

Phase II Chicago Metropolitan Area

The LAMP would consist of approximately 20 sites scattered across the area located to provide data to assess background levels, population exposure, impacts from sources or source categories (e.g. traffic, steel mills) and high risk point sources and to provide grid point data for dispersion model validation. The LAMP would provide extensive data in many areas where no air toxic monitoring has been conducted previously.

Samples would be taken simultaneously at two sites in VOC canisters and diffusion tube

sampling would be conducted at a real-time gas chromatography site. The data for certain target compounds would be used to compare the results obtained by the three different sampling and analysis methods. Correlation of the methods and comparability of the results are considered to be an important component of the project.

Final Report

All of the accumulated sampling data would be summarized in a final report. The data would be reviewed and analyzed for significant findings, e.g. identification of hot-spots or compounds of concern. The report would also summarize the comparison of the three sampling and analysis methods (diffusion, canister and real-time).

The report would also provide recommendation's for future studies, e.g. methods development or air quality investigation. Most importantly, the report would provide an assessment of the success and usability of the diffusion tube methodology.

4. Monitoring Program

a) Monitoring Site Locations

LAMP design would be specific according to the individual program, be it neighborhood or city. Samplers would be dispersed throughout the LAMP area, utilizing any convenient mounting location, such as trees, utility poles, lamp standards, brackets, signs. Mounting is achieved by simply attaching the monitors using a bracket or tie-wraps, for example. Monitors should be out of reach of casual interference, in locations where they would be left undisturbed for up to four weeks.

A major attraction of these monitors is that by virtue of their passive design they do not require pumps or other hardware. Sample uptake occurs through natural diffusion into the sorbent. Owing to the unique design, and according to Fick's Law of Diffusion, the uptake is quantitative within the method parameters.

b) Compounds Sampled

Unlike previous strategies, this program will permit the sampling and analysis of volatile non-polar and polar species. Each sampler is amenable to a selected set of analytes. The range of compounds analyzed may be extended by the use of co-located samplers of differing design. Compounds of particular interest would be selected from USEPA's List of 33 Air Toxic HAPs. Likely target compounds would include; benzene, toluene, xylenes, chloroform, carbon tetrachloride, methylene chloride, vinyl chloride, trichloroethylene and perchloroethylene.

c) Sampling Schedule

The samples would be collected over 2 to 4 weeks at the selected locations (integrated samples).

d) Sampling and Analysis Method

The air toxic compound sampling is accomplished using passive (diffusive) sorbent tube monitors. Each monitor is equipped with a patented sampling head to allow quantitative recovery of selected analytes within a narrowly defined volatility range. (For example,

benzene, toluene and xylene might be determined from a single sample. Vinyl chloride would require a second sample). Each monitor is packed with a sorbent material, which is amenable to the diffusive uptake rate of the selected analytes. Thus, tubes with different packings would generally be required for additional analytes.

Diffusive tube monitoring has been a proven technology used in personal (worker) studies and to a more limited extent in Europe for conducting ambient air quality studies. They are simple and convenient (no need for pumps or enclosures) way of determining target pollutant concentration. Because of their slow pollutant uptake rates, they are not suited for assessing short-term ambient air concentrations (e.g. hourly, daily) but are well suited for determing longer term (2-4 weeks) average levels which are ideal for being used in chromic exposure health studies.

The monitors are robust, and may be mailed for recovery and redeployment. Monitors are reusable, typically up to 100 times. There is no special cleaning procedure required following an initial conditioning.

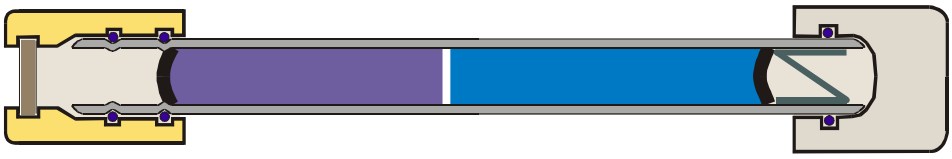

Figure 1 Cross Sectional View of a Diffusive Monitor

Gas chromatography is used to analyze the samples, which are introduced by an automated thermal desorber. Detection is typically accomplished using combinations of Flame Ionization/Electron Capture/Mass Spectrometer.

e) Program Coordination

The field sampling will be accomplished by staff from the Illinois EPA and the Cook County Department of Environmental Control. This includes sample set-up, collection, transportation and preparation of sample documentation. The Illinois EPA will be responsible for the laboratory analysis of collected samples. The accumulated sampling results will be sent to USEPA.

5. Project Costs

The LAMP project costs have been broken down into each of the two project phases and are projected as follows:

Budget Item (FY02)	Phase I. Pilot	Phase II. Chicago Area
1. Equipment	$ 1,000	$ 5,000
2. Commodities	$ 400	$ 1,600
3. Contractual	$ 2,000	$10,000

4. Personnel Services		$ 8,000	$17,000
5. Travel & OAE		$ 500	$ 1,500
	subtotal	$11,900	$35,100
	Total		$47,000