Section 103 EMPACT Project Report

LAMP II- BETX Characterization of Chicago & O'Hare Airport Areas

I. Background

In 2003, state and Federal Section 105 funds became available to fund new initiatives in developing sampling and analysis methods to support ambient air monitoring of those compounds designated by US EPA as National Urban Air Toxics. One project that was approved and received grant funding was Illinois EPA's Large Area Monitoring Program (LAMP). The LAMP project was designed to test an innovative diffusion tube (passive sampling) technology for measuring ambient air concentrations of BETX (benzene, ethyl benzene, toluene and xylenes) and to perform a saturation study that would permit a preliminary characterization of BETX concentrations throughout the Greater Chicago Metropolitan area.

The 2003 LAMP project was deemed successful in that it found the diffusion tube technology to provide highly correlated results to those obtained from field deployed gas chromatographs. These correlations were developed through comparison of daily (hourly) measurements of BETX from three PAMS auto-gas chromatographs to diffusion tubes that collected collocated samples over a three-week period. The collocated results showed a good correlation between the two methods for all five compounds. During the summer of 2004, two LAMP sampling campaigns (each for a three-week period) comprised of 12 sites located across the Chicago area were performed. These two LAMP studies provided data that illustrated a geographic variability of BETX concentrations throughout the study area, identified hotspot areas along expressways and provided data for dispersion modeling (CRI) validation. The 2003 LAMP project report recommended a follow up Phase II study comprised of 15-20 sites that be designed to provide better definition of the hotspots, a more complete geographic (spatial) characterization of BETX across the Chicago region and to expand the methods comparison to VOC canisters.

In FY04, a proposal for an EMPACT grant to support a LAMP Phase II project was submitted to US EPA for consideration. The Illinois EPA was subsequently awarded the grant in August , 2004 with the grant period extending from October 1, 2004 through March 31, 2006.

II. Project Description

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 or without modeling to create and validate topographical charts of the data (isopleths). Such data can be used to complement other monitoring data thereby providing a level of detail unobtainable by other means. These monitoring data and derived isopleths can also serve to validate other sampling results, e.g. National Air Toxic Trend Site data, and to establish a baseline for future measurements.

The LAMP Phase II project was implemented in two phases. The project began with a three site, twelve month sampling program and then was expanded to include a fifteen site, one month field saturation study of BETX concentrations. Method comparisons were also conducted by comparing data obtained from collocated LAMP samples to data derived from both VOC canister sampling and real-time gas chromatography results.

Phase II - Twelve Month Study

The twelve month study served to establish the sampling methods, define the configuration of the sampling tubes, to train field staff and establish the analytical system and protocols. Monthly samples were taken at three sites, Schiller Park (near Chicago O'Hare Airport), Chicago-Jardine (downtown) and a third site in Northbrook (downwind of the urban core). These data were collected over a 12 month period and were used to establish annual average concentrations. These annual average data were then used to:

a) measure "community-oriented" population exposure (over an annual period)
b) provide baseline data
c) characterize concentrations near a significant point source, Chicago O'Hare Airport
d) compare the diffusion tube results to those obtained from VOC canisters and field gas chromatographs.

Additionally, results from the Phase II annual sampling were used to finalize the design and implementation of the Phase II saturation study.

Phase II - Chicago Metropolitan Area Study

The LAMP Phase II saturation study consisted of 15 sites scattered across the Chicago area and located to provide data to determine geographic (spatial) variability of BETX concentrations. An integral part of the network design was the location of three sites around Chicago O'Hare Airport, to assess an important emission source, and several sites located in hot-spot areas identified by the initial LAMP sampling project. The two sites collocated with VOC canister and field gas chromatograph measurements were also retained during the saturation study.. The LAMP Phase II project was also designed to provide data in many areas where no air toxic monitoring had been previously conducted and thereby, provide data for use in other studies , e.g. grid point data to allow for dispersion model validation and correlation to other study results such as the CRI and NATA.

During LAMP Phase II, collocated sampling of diffusion tubes with VOC canisters did occur at the two Illinois NATTS sites, Schiller Park and Northbrook, and with two field gas chromatograph (PAMS) sites, Chicago-Jardine and Northbrook. The BETX target compound data was be used to compare the results obtained by the three different sampling and analysis methods. Correlation of the methods and comparability of the results were considered to be an important component of the project.

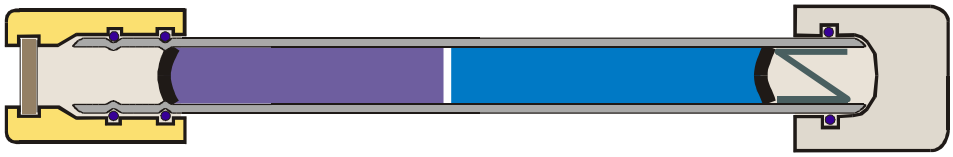
The saturation study produced monthly average results that were then used to:

a) determine geographic (spatial) variability of urban area concentrations and measure "community-oriented" population exposure
b) provide baseline and background data
c) characterize concentrations near significant point sources, Chicago O'Hare Airport and expressways
d) compare the diffusion tube results to those obtained from the currently recognized methods

III. Sampling and Analysis Method

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



Cross Sectional View of a Diffusion Tube

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. The analyses of the LAMP Phase II samples were accomplished at the Illinois EPA Air Monitoring Laboratory in Springfield, Illinois.

The sampling for a specific air toxic compound is accomplished using passive (diffusion) tube monitors packed with a specific sorbent. Each diffusion tube is equipped with a patented sampling head to allow quantitative recovery of selected analytes within a narrowly defined volatility range. For example and as deployed in LAMP Phase II, benzene, toluene and xylene were determined from a single sample tube. Each tube is packed with a sorbent material, which is amenable to the diffusive uptake rate of the selected analytes. For LAMP Phase II, which targeted BETX, a Carbopack B was used as the sorbent packing. For other compound studies, multiple diffusion tubes with different sorbent packings could be used to target additional analytes.

In order to assess precision for the LAMP Phase II, duplicate tubes were used at each sampling location during both the Twelve Month and Saturation Studies. Duplicate sampling also ensured that sample results could still be obtained, if one sample was lost.

The duplicate sampling scenario was a recommendation from the initial LAMP sampling project were some samples were lost to wind/hail damage and when sampling precision issues were not considered.

IV. Data and Results

A summary of the accumulated sampling results for the Phase II Twelve Month Study is provided in Table 1 and for the Phase II Saturation Study is provided in Table 2. All results are expressed in parts per billion by volume (ppb(v)). For all of these analyses, the minimum detection limit (MDL) was 0.03 ppb(v) and consistent with the procedures for reporting data to AIRS, when not detects were recorded, a value of ½ the MDL or 0.02 ppb(v) was substituted for the value.

Twelve Month Study

The data provided in Table 1 was used in an analysis to achieve the objectives as described in the Project Plan and listed previously in the Project Description. A discussion of each follows.

a) Measure community-oriented population exposure (over an annual average period).

Three sites were used in the study, Schiller Park located very near Chicago O'Hare Airport, Chicago-Jardine located downtown and Northbrook located downwind of the urban core and the Illinois National Air Toxics Trend Site (NATTS). Chicago-Jardine is a Type 2 PAMS site and Northbrook is a Type 3 PAMS site each providing volatile organic carbon measurements from June through August each summer. All three sites are located in areas of high population density and generally representative of the surrounding community. Schiller Park's location is different in that it is additionally impacted by both by Chicago O'Hare Airport and the nearby I-294 Expressway.

The LAMP-Phase II results show that annual average BETX concentrations at Northbrook and Chicago-Jardine to be very comparable, e.g. benzene 0.29 and 0.29 ppb, toluene 0.44 and 0.41 ppb, m/p xylene 0.18 and 0.16 ppb, respectively. Concentrations at Schiller Park were found to be much higher that those at Northbrook or Chicago-Jardine with benzene at 0.42 ppb, toluene at 0.68 ppb and m/p xylene at 0.31 ppb. These results indicate that Northbrook and Chicago-Jardine are likely representative of a significant portion of the urbanized area, where Schiller Park may be more representative of areas near major expressays or around Chicago O'Hare Airport generally.

b) Provide baseline data.

Routine measurements of BETX are made each summer as part of the PAMS program and throughout the year at Northbrook (NAATS) via one in six day canister samples. The 12 monthly LAMP samples provided an integrated average felt to more accurately represent annual average concentrations. The LAMP Phase II results show that there is significant variation in BETX levels from month to month. The highest monthly concentrations were approximately 100% higher than the lowest months, e.g. benzene with a high month of 0.6 ppb at Schiller Park compared to a lowest month at

0.32 ppb, toluene similarly with a high of 0.85 ppb compared to 0.55 ppb and m/p xylene with a high of 0.12 ppb compared to 0.06. This difference was generally found to be true for each of the three sites and for all of the five compounds.

The monthly average data also showed that the months with the highest concentrations were January-February and August-September. This would support the choice of August as a good month for a saturation study since it also included Summer, PAMS sampling for BETX. The lowest months were shown to be March and April, not surprisingly, as in Chicago, they are the wettest, windiest and least conducive period for accumulation of pollutant concentrations.

c) Characterize concentrations near Chicago O'Hare Airport.

The Schiller Park site is located ¼ mile Southeast of O'Hare Airport and ¼ mile West of the I-294 Expressway. There are also several major arterial streets nearby and high density residential and commercial areas within ½ mile. These communities surrounding O'Hare Airport can be characterized as ones with heavy car and truck congestion, impacted by traffic associated with O'Hare and obviously are impacted by aircraft emissions from and above the airport complex.

As would be expected and as reflected in the LAMP Phase II data, concentrations of BETX at Schiller Park were shown to be significantly higher, about 50% higher, than those recorded at Northbrook or Chicago-Jardine, both on a high month and annual basis. Based upon the emission impacts at Schiller Park, it would seem likely that the increased differences would be associated to both expressway/arterial traffic and to airport traffic and aircraft operations. As discussed later in this report, the Saturation Study was designed to provide further insight into possible emissions source impacts at the Chicago O'Hare area sites.

d) Comparison of the diffusion tube method to other methods.

The Twelve Month Study provided for LAMP samples to be collected at two sites, Schiller Park and Northbrook, where one in six day canister sampling also occurred throughout the year. This sampling was conducted to allow a comparison of data collected by the two different methods, diffusion tube versus summa-polished canister. The results of the accumulated sampling data are summarized in Table 3. For both Schiller Park and Northbrook, Table 3 lists the annual average concentrations represented by the diffusion tube (LAMP) and canister samples.

As can be seen from the data in Table 3 and as depicted in Figure 1, there was very good comparison between the two methods. The annual average results for all five compounds compared closely, especially at Schiller Park where concentrations were higher and shown to be nearly identical between the two methods. These results confirmed the good correlation of methods found in earlier LAMP studies that were of limited data and that recommended further study. The LAMP Phase II results show that the diffusion tube method can provide long-term (annual average) data comparable to those provided by the currently accepted summa-polished canister method.

Chicago Saturation Study

The data provided in Table 2 was used in an analysis to achieve the objectives as described in the Project Plan and listed in previously in the Project Description. A discussion of each follows.

a) Determine geographic variability of urban area concentrations and measure community-oriented population exposure.

The LAMP Phase II Saturation Study was performed during August, 2005 and utilized fifteen sites, eleven in the Chicago area and four in downstate areas. LAMP sites were collocated at Schiller Park, Northbrook and Chicago-Jardine to allow comparison to data collected at those sites during previous studies. Sites were selected to provide not only geographic coverage, but to also provide a mix of sites representing high population density, emission source influence (Chicago O'Hare Airport, expressways) and for background. The results of the Saturation Study are summarized in Table 2.

The August, 2005 LAMP Phase II results (based upon the annual averages obtained) have been visually depicted in Figure 2. As would be expected, the highest BETX levels were found at Cermak , Cicero and the sites around Chicago O'Hare Airport. Overall, the Cermak site, located less than ¼ mile from the Dan Ryan (I-90/94), recorded the highest levels followed closely by the Cicero site which was located within ¼ mile of I-290 (Eisenhower). The sites near Chicago O'Hare Airport, Park Ridge, Bensenville and Schiller Park also recorded some of the highest values. The lowest concentrations were found at Zion and Decatur. The range of annual average concentrations from the highest to lowest site were significant, e.g. comparing Cicero to Zion:

Compound	Cicero (high)	Zion (low)
Benzene	0.54 ppb	0.26 ppb
toluene	1.39 ppb	0.33 ppb
ethyl bezene	0.14 ppb	0.04 ppb
m/p-xylene	0.55 ppb	0.16 ppb
o-xylene	0.21 ppb	0.02 ppb

These findings show that compared to the background concentrations, the highest sites recorded levels of BETX from two to ten times higher.

The population-oriented sites were in a range from slightly above to about 100% above the background (Zion). These sites, however, were found to have levels considerably below the BETX concentrations measured at Cermak and Cicero. Figure 2. clearly illustrates these site-to-site comparisons and differences. The population oriented sites included DesPlaines-Office, Chicago-CAPS, Northbrook, Chicago-Jardine and Des Plaines-School. The data from the population sites showed them to compare relatively well between sites and also to be very comparable to results found for population oriented sites included in previous LAMP studies, e.g. Alsip, Naperville, Chicago-Washington, Chicago-Truman and Chicago-ComEd.

The LAMP Phase II data shows that areas near expressways are likely to experience the highest levels of BETX and that the urban population areas are markedly higher than background. Emissions from Chicago O'Hare Airport and the traffic in and around it

result in higher BETX levels than were found in urban population areas. A further analysis of the data collected near Chicago O'Hare Airport is provided in a following section.

b) Provide baseline and background data.

The sampling data provided in Table 2 included several downstate and background sites including; Springfield, Decatur, Zion, Wood River and E. St. Louis. This sampling was intended to develop baseline data and to achieve a better definition of background levels. In particular, the Metro East St. Louis site data was to provide a comparison from another major metropolitan area for the Chicago results with the E. St. Louis site providing a traffic oriented site and Wood River an industrial exposure (near two refineries).

The LAMP Phase II data found that BETX levels in E. St. Louis to be higher than the urban population sites in Chicago, but substantially lower than traffic oriented sites, Cermak and Cicero. The E. St. Louis site was located ¼ mile from the I-55 Expressway but the typical workday traffic volume was found to be significantly less (1/2) than that found on the Chicago expressways and that fact likely resulted in the lower concentrations. The Springfield site was located in an urban population area and the results found Springfield to compare closely with the results found at the Chicago urban population sites. Unfortunately, the Wood River probe was blown over in a storm, the samples ruined and no analysis on them performed.

The Decatur site was intended to provide an indication of downstate background levels and the LAMP Phase II results showed BETX concentrations there to be very comparable to those found at Zion. These results and those obtained in earlier LAMP studies indicate that both Decatur and Zion can serve to provide background data for BETX. In future studies, the issue of Metro East St. Louis background should be addressed, but the use of Decatur, at least initially would seem appropriate.

c) Characterize concentrations near significant point sources, Chicago O'Hare Airport and expressways.

In order assess BETX concentrations around Chicago O'Hare Airport, three LAMP Saturation Study sites were positioned around the airport boundaries including: Bensenville, Park Ridge and Schiller Park. Schiller Park was also one of the Twelve Month sampling sites. The LAMP Phase II data found these sites to comparable to slightly less than the BETX levels found at the traffic oriented sites, Cermak and Cicero, and to be considerably higher (30-50%) than the urban population sites. While Schiller Park could also be considered to be traffic oriented (site is ¼ from I-294), Bensenville and Park Ridge were clearly not directly affected by traffic and located in population areas. Thus, the difference between Park Ridge and Bensenville and other urban population sites lies with O'Hare Airport and the traffic associated with the area. That is, the 30-50% increase in BETX levels around Chicago O'Hare Airport could be associated to the airport, its traffic and traffic in the general area.

Three sites included in the LAMP Phase II were located very near major expressways, Cicero (1/4 mile from I-290), Cermak (1/4 mile from I-90/94) and Schiller Park (1/4 mile from I-294). During the Twelve Month Study, Schiller Park was found to have annual average concentrations approximately 50% higher than either of the two urban population

sites. The Saturation Study found similar results with the three traffic oriented sites being the highest of all 15 study sites and to be approximately 50% higher than the urban population sites. These results clearly showed the influence of traffic in the communities surrounding and near the major expressways and that areas along the expressways would likely experience the highest concentrations of BETX compounds found in the Chicago area.

d) Compare the diffusion tube results to those obtained from the currently recognized methods.

As previously discussed, the Twelve Month Study found the diffusion tube method to provide long-term (annual average) data comparable to the data obtained from the summa-polished canister method. Figure 1 illustrated the good comparability. During the Saturation Study, LAMP samples were collocated with two PAMS sites that operated field gas chromatographs during June through August, thereby, providing three months of comparative data for analysis.

The results obtained from comparing the two methods are summarized in Table 4 and graphically depicted in Figure 3. These results show that the diffusion tubes generally over predicted the BETX concentrations as measured by the field gas chromatographs. A previous LAMP study had shown a much better comparability, but it was based upon only one month of data at two sites. Before any judgment can be made relative to the correlation of these two methods, further review and study is needed, including additional field comparison testing.

In performing methods comparisons, one important aspect to consider is the precision of the methods under review. In order to assess precision for the LAMP Phase II, duplicate diffusion tubes were used at each sampling location during both the Twelve Month and Saturation Studies. A regression analysis was performed on all of these paired data and the results are summarized and shown in Figure 4. The regression analysis results found a slope of 1.0396, an offset of 1.742 and a correlation coefficient of 0.8726. Overall, an excellent correlation for ambient air quality measurements and an indication that the diffusion tube method can provide a high degree of reproducibility.

V. Summary

The 2005 LAMP Phase II project was performed consistent with the approved Project Plan. The accumulated sampling data was tabulated, analyzed and reported. The significant findings of the project were as follows:

1. The diffusion tube method was found to provide acceptable results.

   The LAMP Phase II results showed that the diffusion tube method provided long-term (annual average) data comparable to those provided by the currently accepted summa-polished canister method. Additionally, the study results found that the diffusion tube method to provided a high degree of reproducibility.

2. The LAMP Phase II Saturation Study found BETX concentrations to vary geographically (spatially) across the Chicago urbanized area.

   The LAMP Phase II data showed that areas near expressways are likely to experience the highest levels of BETX and that the urban population areas are markedly higher than background. Emissions from Chicago O'Hare Airport and the traffic in and around it result in higher BETX levels in that area than were found in the other urban population areas of Chicago.

3. Average BETX concentrations in Chicago were found to vary from month to month.

   The LAMP Phase II results show that there is significant variation in BETX levels from month to month. The highest monthly concentrations were approximately 100% higher than the lowest months.The monthly average data showed that the months with the highest concentrations were January-February and August-September. This supported the choice of August as a good month for a saturation study since it also included Summer, PAMS sampling for BETX. The lowest months were shown to be March and April, not surprisingly, as in Chicago, they are the wettest, windiest and least conducive period for accumulation of pollutant concentrations.

4. Further study is needed to compare the diffusion tube and the field gas chromatography methods.

   The study results showed that the diffusion tubes generally over predicted the BETX concentrations as measured by the field gas chromatographs. A previous LAMP study had shown a much better comparability, but it was based upon only one month of data at two sites. Before any judgment can be made relative to the correlation of these two methods, further review and study is needed, including additional field comparison testing.

Table 1
LAMP Data Summary, 2005

	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Average
Northbrook													
benzene	NA	NA	0.49	0.3	0.22	0.23	0.22	0.29	0.27	0.25	0.31	0.3	0.29
toluene	0.53	0.56	0.32	0.25	0.29	0.4	0.4	0.45	0.62	0.46	0.56	0.42	0.44
ethyl-benzene	0.03	0.08	0.02*	0.02*	0.02*	0.02*	0.04	0.06	0.08	0.05	0.07	0.06	0.04
m/p-xylene	0.19	0.26	0.11	0.07	0.11	0.17	0.19	0.22	0.32	0.21	0.18	0.18	0.18
o-xylene	0.03	0.08	0.02*	0.03	0.02*	0.02*	0.07	0.07	0.12	0.08	0.11	0.08	0.06
Schiller Park													
benzene	0.6	0.5	0.49	0.42	0.34	0.35	0.32	0.43	0.39	0.42	0.43	0.43	0.42
toluene	0.78	0.69	0.55	0.58	0.64	0.73	0.65	0.85	0.83	0.8	0.6	0.6	0.68
ethyl-benzene	0.1	0.08	0.06	0.06	0.08	0.09	0.07	0.11	0.12	0.1	0.08	0.08	0.09
m/p-xylene	0.34	0.31	0.22	0.22	0.29	0.31	0.26	0.43	0.42	0.36	0.28	0.28	0.31
o-xylene	0.12	0.11	0.09	0.09	0.1	0.13	0.1	0.14	0.14	0.12	0.09	0.1	0.11
Chicago-Jardine													
benzene	0.46	0.41	0.32	0.29	0.22	0.31	0.23	0.27	0.23	0.22	0.25	0.3	0.29
toluene	0.59	0.51	0.28	0.25	0.32	0.56	0.39	0.42	0.39	0.34	0.41	0.45	0.41
ethyl-benzene	0.02	0.06	0.02*	0.02*	0.04	0.09	0.05	0.05	0.04	0.04	0.04	0.06	0.04
m/p-xylene	0.08	0.19	0.08	0.08	0.13	0.35	0.18	0.16	0.17	0.14	0.15	0.2	0.16
o-xylene	0.03	0.07	0.03	0.02*	0.05	0.14	0.07	0.05	0.06	0.05	0.06	0.08	0.06

All values expressed in ppb(v)
NA – Not available, data invalidated
MDL is 0.03 ppbV – any result of 0.02* indicates a value below the MDL

Table 2
LAMP Project Results
August, 2005

		Sample Time Hours	Total Volume (l)		benzene	toulene	ethyl-benzene	m/p xylene	o-xylene
Bensenville	Sample 1	741	28.0	**ng**	36.8	140.5	12.2	48.6	25.5
	Sample 2			**ng**	44.8	152	11.8	50.1	22.1
				Ave.	40.8	146.3	12.0	49.4	23.8
				PPBV	0.41	1.33	0.10	0.40	0.21
Cermack	Sample 1	735	27.8	**ng**	48.3	94.9	11.8	47	17.4
	Sample 2			**ng**	59.3	94.3	11.8	44.9	14.7
				Ave.	53.8	94.6	11.8	46.0	16.1
				PPBV	0.54	1.07	0.13	0.53	0.20
Cicero	Sample 1	740	28.0	**ng**	41.5	146.5	16.9	66.3	24.9
	Sample 2			**ng**	45.7	134.1	15.8	56.5	18.7
				Ave.	43.6	140.3	16.4	61.4	21.8
				PPBV	0.47	1.39	0.14	0.55	0.21
Decatur	Sample 1	741	28.0	**ng**	17.4	52.5	6.2	22.5	8.7
	Sample 2			**ng**	15.6	48.9	4.5	20.3	8.0
				Ave.	16.5	50.7	5.4	21.4	8.4
				PPBV	0.18	0.48	0.04	0.18	0.07
DesPlaines-Office	Sample 1	741	28.0	**ng**	37.4	60.8	6.8	24	9.1
	Sample 2			**ng**	29.6	60.2	6.4	24.3	8
				Ave.	33.5	60.5	6.6	24.2	8.6
				PPBV	0.42	0.58	0.06	0.20	0.07
DesPlaines-School	Sample 1	743	28.1	**ng**	27.1	76.7	9.1	32.2	11.6
	Sample 2			**ng**	26.9	79.5	8.7	33.8	10.3
				Ave.	27.0	78.1	8.9	33.0	11.0
				PPBV	0.30	0.73	0.07	0.26	0.10
E. St. Louis	Sample 1	746	28.2	**ng**	33.5	94.7	15.0	51.1	18.0
	Sample 2			**ng**	35.0	97.1	17.3	56.3	19.1
				Ave.	34.3	95.9	16.2	53.7	18.6
				PPBV	0.38	0.90	0.13	0.44	0.15
Chicago-CAPS	Sample 1	740	28.0	**ng**	34.9	79.0	11.0	41.6	17.1
	Sample 2			**ng**	37.9	88.1	14.2	56.2	35.2
				Ave.	36.4	83.6	12.6	48.9	26.2
				PPBV	0.39	0.75	0.09	0.34	0.14
Chicago-Jardine	Sample 1	741	28.0	**ng**	24.3	44.1	5.7	19.8	6.4
	Sample 2			**ng**	23.0	45.1	6.0	21.1	6.8
				Ave.	23.7	44.6	5.9	20.5	6.6
				PPBV	0.27	0.42	0.05	0.16	0.05
Northbrook	Sample 1	739	27.9	**ng**	25.7	47.8	6.9	27.2	8.5
	Sample 2			**ng**	23.5	47.5	6.8	25.8	8.9
				Ave.	24.6	47.7	6.9	26.5	8.7
				PPBV	0.29	0.45	0.06	0.22	0.07

		Sample Time Hours	Total Volume (l)		benzene	toulene	ethyl-benzene	m/p xylene	o-xylene
Park Ridge	Sample 1	741	28.0	**ng**	30.9	103.3	14.4	57.2	18.6
	Sample 2			**ng**	29.0	111.5	15.0	60.1	19.1
				Ave.	30.0	107.4	14.7	58.7	18.9
				PPBV	0.35	0.98	0.12	0.47	0.15
Schiller Park	Sample 1	737	27.9	**ng**	37.9	88.8	13.8	51.6	16.7
	Sample 2			**ng**	56.1	124.9	47.1	126.5	51.0
				Ave.	47.0	106.9	30.5	89.1	33.9
				PPBV	0.43	0.85	0.11	0.43	0.14
Springfield	Sample 1	741	28.0	**ng**	26.0	89.5	14.4	47.8	16.9
	Sample 2			**ng**	25.5	83.5	12.3	44.5	15.7
				Ave.	25.8	86.5	13.4	46.2	16.3
				PPBV	0.29	0.82	0.11	0.38	0.13
Wood River	Sample 1	746	28.2	**ng**	Sample Voided				
				ng					
				Ave.					
				PPBV					
Zion	Sample 1	738	27.9	**ng**	22.7	35.1	5.10	18.9	0.00
	Sample 2			**ng**	23.6	32.9	0.00	13.2	0.00
				Ave.	23.2	34.0	2.55	16.1	0.00
				PPBV	0.26	0.33	0.04	0.16	0.02*

MDL is 0.03 ppbV Any results of 0.02* indicates a result below the MDL

Table 3
LAMP Tube vs Canister Results*
Jan – Dec, 2005

	Northbrook		Schiller Park	
Compound	LAMP	CANISTER	LAMP	CANISTER
benzene	.29	.19	.42	.42
toulene	.44	.40	.68	.69
ethyl-benzene	.05	.07	.09	.12
m/p xylene	.18	.19	.31	.29
o-xylene	.06	.07	.11	.13

*all values expressed in ppb(v)

Table 4
LAMP Tube vs Auto-g.c. Results
June – Aug,2005

	Northbrook		Chicago-Jardine	
Compound	LAMP	AUTO-g.c.	LAMP	AUTO-g.c.
benzene	.25	.13	.27	.16
toulene	.42	.38	.46	.33
ethyl-benzene	.04	.05	.06	.03
m/p-xylene	.19	.15	.23	.13
o-xylene	.05	.05	.09	.03

*all values expressed in ppb(v)

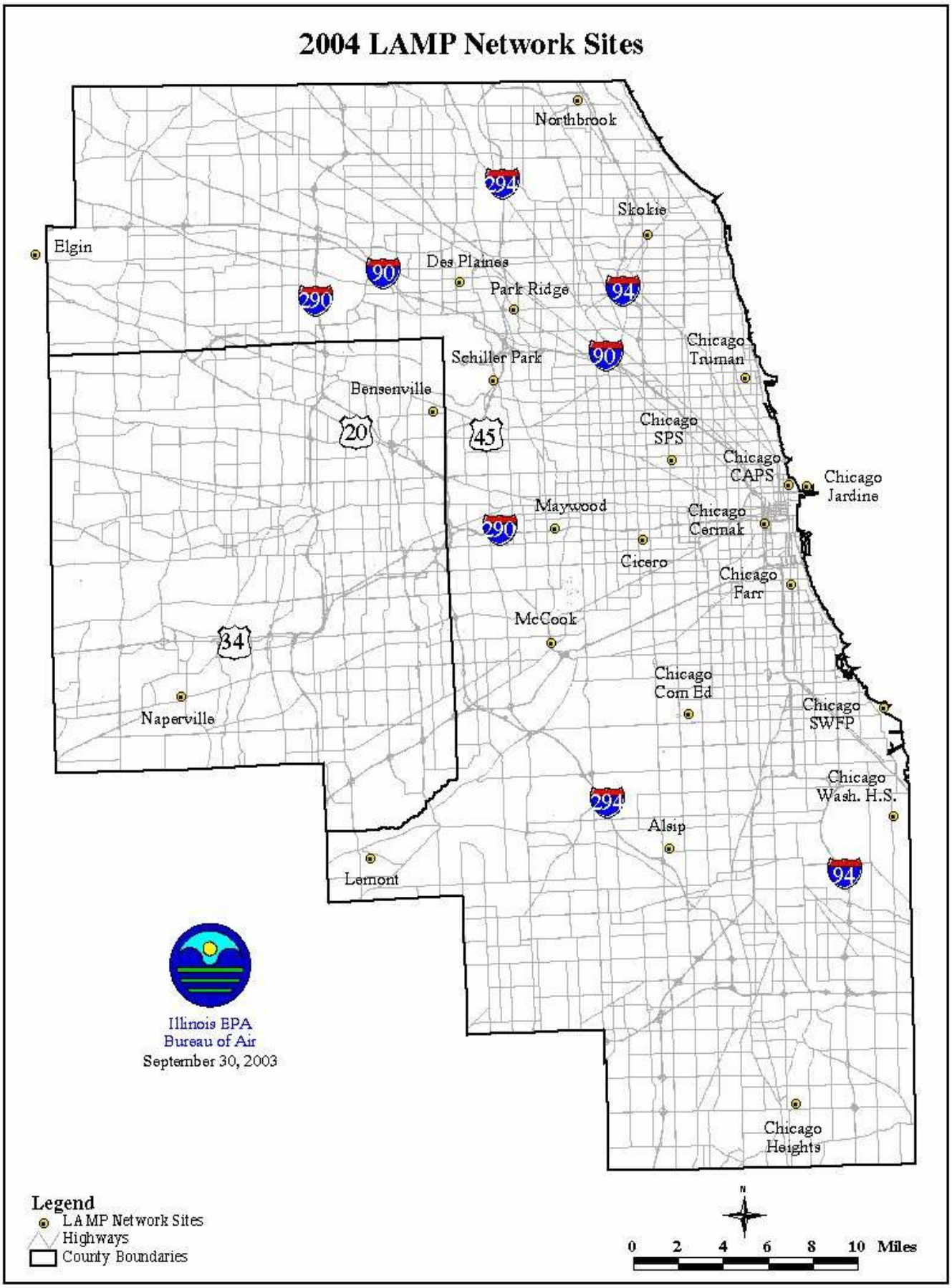

2004 LAMP Network Sites
Northbrook
Skokie
Elgin
Des Plaines
Park Ridge
Schiller Park
Bensenville
Chicago Truman
Chicago SPS
Chicago CAPS
Chicago Jardine
Maywood
Chicago Cermak
Cicero
Chicago Farr
McCook
Chicago Com Ed
Chicago SWFP
Chicago Wash. H.S.
Alsip
Lemont
Naperville
Chicago Heights
294
90
290
94
20
45
34
Illinois EPA
Bureau of Air
September 30, 2003
Legend
LAMP Network Sites
Highways
County Boundaries
N
0 2 4 6 8 10 Miles

Figure 1
LAMP 2005
Tubes vs Canisters, Jan - Dec, 2005

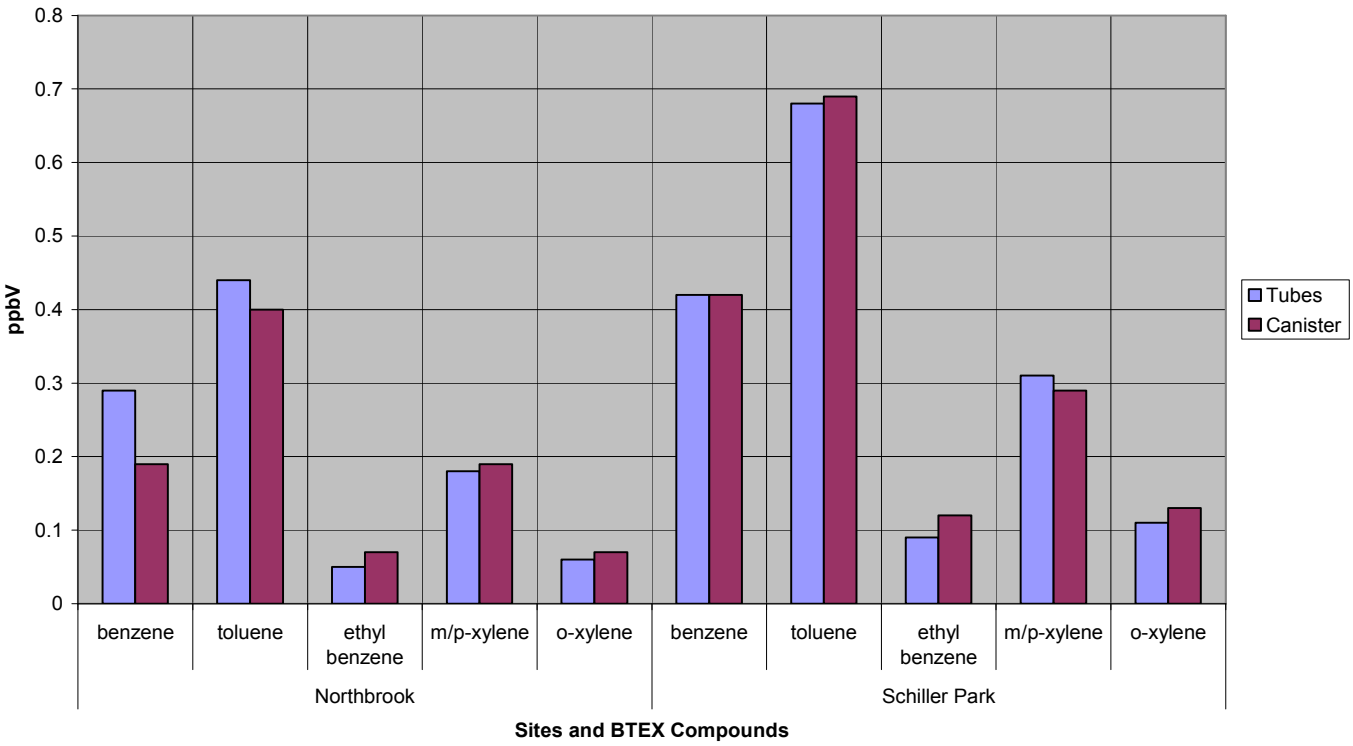


Figure 2
LAMP Project
August, 2005

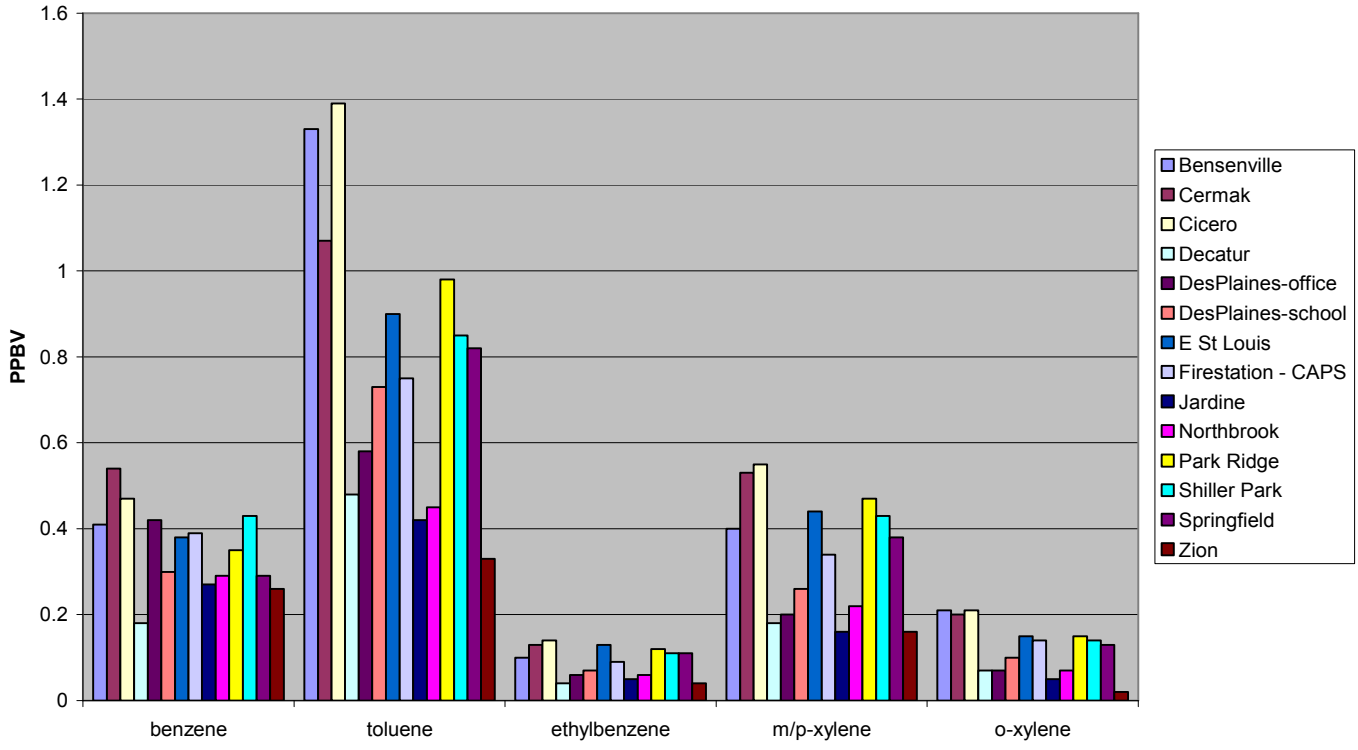


Figure 3
LAMP 2005
Tubes vs Auto gc, Jun - Aug, 2005

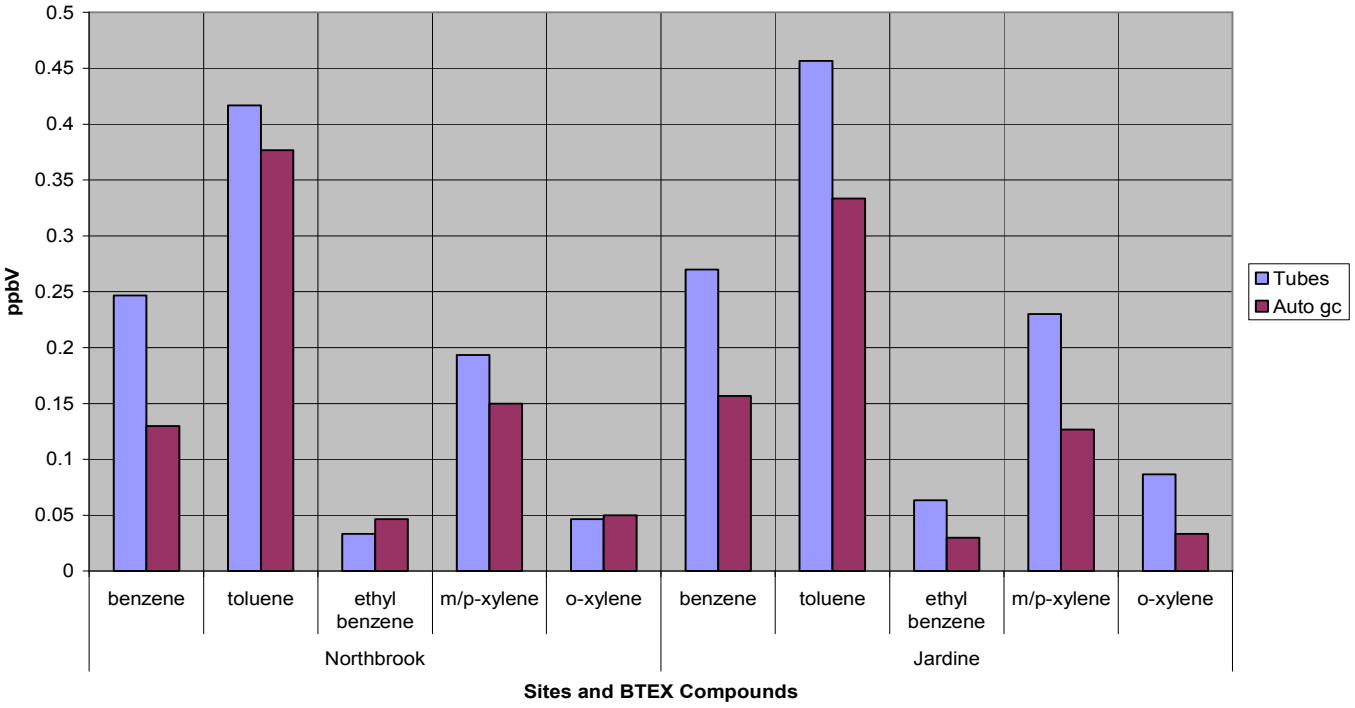


Figure 4
LAMP Study
Correlation of Collocated Samples