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1989 Air Toxics Monitoring Data

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I. INTRODUCTION

The Louisiana Department of Environmental Quality (LDEQ) has operated the air toxics monitoring station since 1984. This station, located near the Louisiana State Capitol, is one of the few monitoring sites in the country to provide round-the-clock monitoring of Volatile Organic Compounds.

1989 brought a number of changes to the LDEQ air toxics monitoring program. In July of 1989 the old Radian 110A system was replaced by a continuous monitoring system possessing much greater analytical capabilities. The new system consists of a XonT ch Model 930 Organic Vapor Concentrator, a Hewlett Packard Model 5890 Gas Chromatograph fitted with a Flame Ionization Detector (FID) & a Electrolytic Conductivity Detector (ELCD), and dual Hewlett Packard Model 3396 computing integrators. The XonTech sample concentrator contains two Tenax/Charcoal traps which alternate between sample collection and sample injection. Samples are collected hourly over a 57 minute time period. The Hewlett Packard Gas Chromatograph is equipped with a sample splitter which divides each sample between two analytical columns. The column connected to the FID is a megabore capillary (0.53 mm O.D. x 50 m long) with a 2.53 um bonded film of SPB-1 (methyl silicone). Connected to the ELCD is a smaller capillary (0.32 mm O.D. x 25 m long) with a 1.0 um film of SPB-1. The FID is used for the analysis of selected alkane and aromatic hydrocarbon species while the ELCD is used to analyze selected chlorinated hydrocarbon species. Each detector is connected to its own computing integrator which identifies and quantitates the eluting compounds. A value for total hydrocarbons is computed by multiplying the total area of all peaks detected on the FID by the response factor for n-hexane. A value for total chlorinated hydrocarbons is computed by multiplying the total area of all peaks detected on the ELCD by the response factor for ethylene dichloride.

All data collected is written to unique data files within each integrator. Periodically each integrator is polled by a portable computer which then collects the data for editing and transfer onto the agency database. The system is calibrated three times a week utilizing compressed gas cylinders containing known amounts of the compounds of interest. The calibrations are scheduled on a random basis to avoid any biasing of the data.

During May of 1989 the LDEQ Toxic Air Monitoring System (TAMS) was placed into operation. As of December 31, 1989 four samplers were in operation around the greater Baton Rouge area. These samplers are

located at the Capitol Site, Baker, Port Allen, and Geismar. Each sampler collects ambient air samples onto Tenax Cartridges which are subsequently transported to the Air Toxics Laboratory for GC/MS analysis. Samples are collected at each site once a week.

This report will summarize the analytical data generated during the 1989 sampling period.

II. CAPITOL SITE CONTINUOUS MONITORING DATA

During the calendar year 1989 the continuous monitoring station collected and analyzed a total of 6221 validated ambient air samples on the FID detector. A total of 3436 of these samples were also analyzed by the ELCD detector. These figures are lower than the data capture figures for 1988 for a number of reasons. During its last few months of operation the Radian 110A system was plagued by a number of breakdowns and computer failures which resulted in a loss of data. Additionally once the new equipment was installed it took some time to remove all of the "bugs" from the system. Most of the initial effort on the new system was directed toward getting the FID going in order to provide hydrocarbon data for an ongoing ozone study. The ELCD detector was not used at this time because of some flow problems. The splitter and dual column configuration was not installed in the Gas Chromatograph until late November. For that reason there is no data on the ELCD detector for nearly four months. It is currently felt that once the new system is sufficiently debugged it will be capable of providing about 700 sample analyses per month on each detector.

The mean average level of total hydrocarbons measured during 1989 was 43.3 parts per million by volume (ppbv) which is about 10% lower than the level measured in 1988. The mean average level of chlorinated VOC measured in 1989 was 2.8 ppbv which is about the same as the 1988 level. Table 1 provides a set of descriptive statistics for all of the target compounds analyzed. As found in all of the previous monitoring data, the median concentration for each of the target compounds is considerably lower that the mean average concentration. The maximum level of total hydrocarbons measured during 1989 was 3031.1 ppbv while the maximum level of chlorinated hydrocarbons measured was 208.9 ppbv.

The most striking fact about the monitoring data is that the levels of volatile organic compounds observed are highly variable. During any given twenty-four hour period the range of measured concentrations can be quite high. The high standard deviations for all of the target compounds demonstrate the high degree of variability in the measured concentrations. Some of this variability can be seen when the monitoring data is grouped into monthly mean averages (Table 2). The causes of this variability can best be explained by examining what effects the site location and the local meteorology have upon the analytical data.

(AROMATICS ARE NOT A FUNCTION OF WIND DIRECTION)

Due to the close proximity of the monitoring site to sev ral large industrial facilities the on factor that can most dramatically influence the levels of compounds measured is the wind direction. Figure 1 illustrates how the concentrations vary with the wind direction. In this diagram the data for each compound was sorted into small wind sector groups and a mean average for each group was computed. In most cases the highest average levels are recorded when the wind was from a north to northwesterly direction. There are several petrochemical industries located in this direction which generally explains the higher readings. Weather can effect the data in many other ways. During periods of stagnant air when there is very little wind the concentrations of volatile organic compounds can reach very high levels. Conversely during periods of rain the concentrations can drop to very low levels. Therefore it can be simply stated that changing weather patterns can result in a change in the observed concentrations of the target compounds.

Table 3 provides the diurnal variations of the target compound concentrations by sorting the data into groups based upon the hour of the day the samples were collected. Generally, the highest levels of hydrocarbons occurred around 7:00 am while the lowest levels were found around noon. This trend is most likely due to two factors. First many of these compounds play a significant role in the photochemical reactions involved in the formation of ozone. Secondly, a short time after the sun comes up in the morning the mixing height begins to move upward. As this layer of air expands it begins dilute the concentrations of volatile organic compounds built up during the night and early morning hours. However, it should be pointed out that because of the proximity of the monitoring site to several point sources of hydrocarbons, the daily maximum does not always follow this pattern. Upon close examination of the daily data it can be seen that the daily maximum can occur at virtually any time of the day. Generally the chlorinated hydrocarbons show little diurnal variation in concentration.

Table 4 demonstrates how the concentrations of compounds measured varied with the day of the week. Generally the observed levels for most compounds was highest on Tuesdays and lowest on Sundays. When the averages for all samples collected on the weekdays was compared to the averages for all samples collected on the weekends, no significant differences could be seen.

III. TAMS DATA

The TAMS network began operation in June of 1989 collecting samples at each site on a weekly basis. The samples were collected on Tenax cartridges composed of a glass tube (5/8" O.D. x 7" long) packed with 3 grams of Tenax TA. After sample collection the Tenax cartridges were transported back to the Air Toxics Laboratory where they were analyzed by Gas Chromatography/Mass Spectroscopy (GC/MS). The analytical protocol used for the analysis was EPA Method TO-1.

Two types of sampling equipment were utilized in the sampling program. At the Capitol and Baker sites XonTech Model 920 samplers were installed. This type of sampler utilizes mass flow controllers to maintain a stable and accurate flow. Each sampler has three sampling channels capable of independent operation. This configuration permitted the use of two different sampling strategies. Each sampling day one channel was programed to sample from 6:00 am to 10:00 am while another channel was programmed to sample from 12:00 am to 10:00 am. The third channel collected a duplicate sample from 12:00 am to 10:00 am. At the Port Allen and Geismar sites Andersen VOTA samplers were installed. These samplers are capable of using only one sampling strategy and thus they were programmed to sample from 12:00 am to 10:00 am. A secondary (backup) tube was installed in a piggy back fashion on the active sampling channel in order to provide breakthrough data.

The GC/MS was calibrated for a total of twenty-three target compounds. Table 5 provides the mean average concentrations of these compounds detected a each site. The measured levels of benzene at the Baker and Geismar sites were somewhat higher than the levels found at the Capitol and Port Allen Sites. The Geismar site had levels of ethylbenzene that were over five times higher than the amounts measured at any of the other sites. The Port Allen site had the highest detected levels of ethylene dichloride. The samples collected from 6:00 am to 10:00 am generally indicated somewhat lower concentrations than the samples collected from midnight to 10:00 am. A more detailed summary of the results from each site is provided in the appendix.

All samples collected were also subjected to qualitative analysis utilizing a computer library search routine to identify the spectra generated from the chromatographic peaks. In virtually all of the samples analyzed about 95% of the compounds detected were

hydrocarbons. The pattern of hydrocarbons found is very similar to the classic profile of gasoline which seems to sugg st that mobile sources and evaporative emissions are a major contributor to the emissions of these compounds. The analysis of the Geismar samples detected a significant amount of styrene present at that location. During the warm weather months the analysis of samples from the Baker site detected significant amounts of natural hydrocarbons such as isoprene, alpha pinene, beta pinene, and limonene. A list of all compounds identified qualitatively is provided in Table 6.

Table 7 provides a comparison of data generated at the capitol site by three different sampling and analysis programs. On this table the mean average data for the two TAMS strategies are compared to the mean averages generated by the Continuous Monitoring Station (CMS) and to the mean averages generated by the Urban Air Toxics Monitoring Program (UATMP).

(TABLE 1)

CAPITOL SITE CONTINUOUS MONITORING STATION
SUMMARY OF DESCRIPTIVE STATISTICS

(Concentrations in Parts per billion by volume)

HYDROCARBONS

Compound	Mean Avg.	StDev.	Minimum	Median	Maximum
Propane	5.93	22.37	0.0	2.5	1109.3
Butane	6.12	15.65	0.0	2.8	552.2
Pentane	3.46	10.15	0.0	1.9	511.1
Hexane	1.46	5.63	0.0	0.8	323.1
Benzene	2.88	8.30	0.0	2.0	468.2
Toluene	2.10	4.44	0.0	1.3	147.6
Ethylbenzene	0.43	1.08	0.0	0.2	28.8
o-xylene	0.96	2.22	0.0	0.4	55.3
Unknowns	20.22	40.34	0.0	12.5	1240.3
Tot. Hydrocarbons	43.31	87.55	0.0	29.0	3031.1

CHLORINATED HYDROCARBONS

Compound	Mean Avg.	StDev.	Minimum	Median	Maximum
Vinyl Chloride	0.68	3.16	0.0	0.3	132.1
Methylene Chloride	0.12	0.87	0.0	0.0	32.9
1,1-dichloroethene	0.11	1.06	0.0	0.0	48.8
Chloroform	0.08	0.79	0.0	0.0	33.7
Ethylene dichloride	0.53	2.96	0.0	0.0	70.7
Carbon tetrachloride	0.05	0.35	0.0	0.0	27.3
Trichloroethylene	0.01	0.09	0.0	0.0	3.9
Perchloroethylene	0.02	0.13	0.0	0.0	3.9
Unknowns	1.26	4.52	0.0	0.5	160.3
Tot. Cl. Hydrocarbons	2.86	8.12	0.0	1.2	208.9

(TABLE 2)

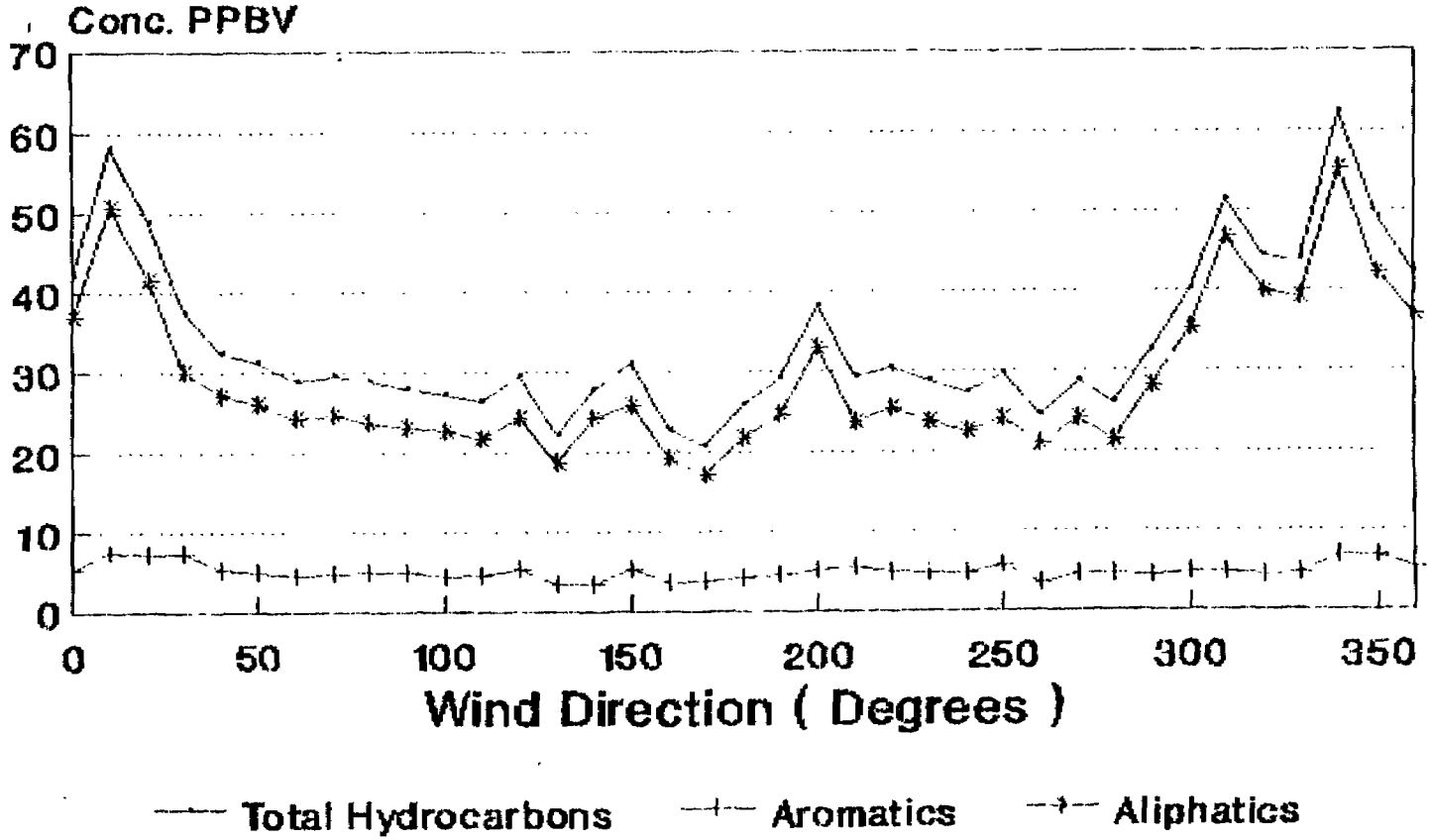
MONTHLY AVERAGE CONCENTRATIONS
(Parts Per Billion by Volume)

Compound	Jan.	Feb.	March	April	May	June
# of Samples - FID	556	520	561	348	475	527
Propane	12.0	11.1	8.7	9.8	6.8	13.4
Butane	16.0	13.0	8.6	10.0	3.5	4.0
Pentane	3.2	4.7	2.1	2.3	1.6	2.5
Hexane	1.5	3.2	1.1	1.2	0.8	1.1
Benzene	5.0	6.5	3.4	3.2	3.0	3.7
Toluene	2.7	2.9	1.2	1.8	1.7	1.4
Ethylbenzene	0.6	0.6	0.3	0.2	0.5	0.2
o-xylene	1.6	0.8	0.5	0.5	1.1	0.8
# of Samples - ELCD	554	564	397	312	428	496
Vinyl chloride	0.6	0.7	1.1	1.3	0.4	0.8
Methylene chloride	0.1	0.0	0.1	0.1	0.3	0.2
1,1-dichloroethene	0.0	0.0	0.1	0.8	0.0	0.2
Chloroform	0.0	0.0	0.3	0.1	0.2	0.0
Ethylene dichloride	0.3	0.6	0.5	0.4	0.7	0.5
Carbon tetrachloride	0.0	0.0	0.2	0.1	0.1	0.0
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0
Perchloroethylene	0.0	0.0	0.1	0.0	0.0	0.0

Compound	July	Aug.	Sept.	Oct.	Nov.	Dec.
# of Samples - FID	333	568	601	608	592	532
Propane	6.1	-	-	-	-	5.5
Butane	2.2	1.6	2.4	3.8	3.3	5.6
Pentane	2.4	5.9	4.0	5.1	4.0	2.3
Hexane	1.1	1.7	1.4	1.6	1.7	1.1
Benzene	2.6	1.7	1.4	1.9	1.8	1.0
Toluene	1.4	2.5	2.1	2.7	3.0	1.3
Ethylbenzene	0.2	0.8	0.5	0.4	0.5	0.3
o-xylene	0.6	0.8	0.9	1.4	1.7	0.6
# of Samples - ELCD	269	0	0	0	27	388
Vinyl chloride	0.7	-	-	-	0.3	0.0
Methylene chloride	0.1	-	-	-	0.0	0.0
1,1-dichloroethene	0.0	-	-	-	0.0	0.0
Chloroform	0.1	-	-	-	0.0	0.0
Ethylene dichloride	0.2	-	-	-	1.2	1.0
Carbon tetrachloride	0.0	-	-	-	0.1	0.0
Trichloroethylene	0.0	-	-	-	0.0	0.0
Perchloroethylene	0.0	-	-	-	0.1	0.0

(FIGURE 1)

Capitol Site Hydrocarbons
Wind Sector Analysis



1989 Monitoring Data

(TABLE 3)

DIURNAL ANALYSIS
(Parts Per Billion by Volume)

	Hour of the Day							
	0	1	2	3	4	5	6	7
Propane	7.0	8.3	7.6	6.6	7.3	7.6	6.9	7.9
Butane	6.2	8.8	6.5	6.5	6.4	6.6	7.6	8.6
Pentane	3.2	4.3	3.7	3.0	3.2	3.2	4.2	4.4
Hexane	1.6	1.7	1.6	1.3	1.4	1.3	1.6	1.9
Benzene	2.9	3.0	2.7	2.6	2.8	2.9	3.2	3.8
Toluene	2.2	2.3	2.1	1.7	1.7	1.9	2.5	3.0
Ethylbenzene	0.4	0.4	0.4	0.3	0.3	0.3	0.5	0.5
o-xylene	1.0	1.1	0.8	0.8	0.7	0.7	1.1	1.4
Vinyl chloride	0.7	0.6	0.7	0.6	0.6	0.6	0.8	0.7
Methylene chloride	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.2
1,1-dichloroethene	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Chloroform	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Ethylene dichloride	0.4	0.5	0.9	0.6	0.4	0.4	0.5	0.4
Carbon tetrachloride	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perchloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	8	9	10	11	12	13	14	15
Propane	6.1	5.8	4.2	1.1	0.7	2.6	3.4	3.6
Butane	5.8	5.5	5.6	2.5	1.6	2.0	5.4	4.6
Pentane	3.6	3.6	2.8	3.6	2.9	2.7	2.6	2.2
Hexane	1.3	1.2	1.0	1.0	0.9	0.9	1.2	1.0
Benzene	3.1	2.9	2.2	1.1	0.9	1.3	2.5	2.2
Toluene	2.4	2.0	1.4	1.3	1.3	1.4	1.9	1.5
Ethylbenzene	0.4	0.3	0.2	0.2	0.2	0.6	1.1	0.3
o-xylene	1.0	0.8	0.6	0.5	0.6	0.9	1.1	0.7
Vinyl chloride	1.2	0.8	0.4	0.2	0.1	0.6	0.7	0.7
Methylene chloride	0.1	0.1	0.1	0.0	0.0	0.9	0.4	0.1
1,1-dichloroethene	0.4	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Chloroform	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.0
Ethylene dichloride	0.8	0.4	0.6	0.1	0.5	0.1	0.4	0.2
Carbon tetrachloride	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perchloroethylene	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0

(TABLE 3 Cont.)

	16	17	18	19	20	21	22	23
Propane	3.7	4.1	7.9	8.3	5.9	5.3	6.0	6.6
Butane	4.2	5.2	7.9	7.0	6.8	6.4	6.1	6.4
Pentane	2.1	2.4	3.8	3.8	4.0	5.3	4.0	3.7
Hexane	0.8	0.9	1.9	1.7	2.0	2.5	1.7	1.7
Benzene	2.2	2.2	3.4	3.4	3.8	4.4	3.2	3.2
Toluene	1.5	1.5	2.2	2.4	3.0	2.9	2.6	2.4
Ethylbenzene	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.4
o-xylene	0.7	0.8	1.1	1.1	1.3	1.4	1.2	1.0
Vinyl chloride	0.4	0.7	0.5	0.5	0.6	1.3	0.7	0.6
Methylene chloride	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1,1-dichloroethene	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chloroform	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.0
Ethylene dichloride	0.2	0.3	0.9	0.4	0.8	0.7	0.8	0.7
Carbon tetrachloride	0.0	0.0	0.0	0.2	0.1	0.0	0.1	0.1
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perchloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(TABLE 4)

CAPITOL SITE CONTINUOUS MONITORING STATION
Variation in Concentration by the Day of the Week

(Concentrations in Parts per billion by volume)

Compound	Sun	Mon	Tue	Wed	Thur	Fri	SAT ~~Sun~~
Propane	5.4	7.0	6.3	5.0	5.6	6.3	6.0
Butane	5.2	6.5	7.5	5.4	5.9	6.5	5.7
Pentane	2.8	3.3	4.4	3.0	3.1	3.2	4.3
Hexane	1.2	1.4	1.4	1.3	1.4	1.2	2.2
Benzene	2.4	2.9	2.8	2.6	2.8	2.7	3.9
Toluene	1.9	2.1	2.1	1.9	2.0	2.2	2.5
Ethylbenzene	0.4	0.5	0.4	0.4	0.4	0.4	0.5
o-xylene	0.8	0.9	1.0	0.9	0.9	1.0	1.1
THC	36.4	43.7	49.6	39.2	41.5	43.0	49.5

Compound	Sun	Mon	Tue	Wed	Thur	Fri	SAT ~~Sun~~
Vinyl Chloride	0.6	0.7	0.9	0.5	0.9	0.6	0.6
Meth'ene Chloride	0.1	0.1	0.1	0.1	0.1	0.2	0.1
1,1-dich'ene	0.1	0.3	0.1	0.0	0.0	0.1	0.1
Chloroform	0.0	0.1	0.1	0.0	0.1	0.0	0.2
EDC	0.7	0.6	0.6	0.3	0.4	0.5	0.5
Carbon Tet.	0.0	0.0	0.1	0.0	0.1	0.0	0.1
Trichloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perchloroethylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot. Cl. HC	2.6	3.3	3.6	2.0	2.7	2.8	2.9

(TABLE 5)

COMPARISON OF TAMS DATA BY SITE
MEAN AVERAGE CONCENTRATIONS - 10 HOUR SAMPLES

Compound	BAKER	CAPITOL	PORT ALLEN	GEISMAR
Acrylonitrile	0.01	0.02	0.01	0.00
Allyl Chloride	0.00	0.00	0.00	0.00
Chloroform	0.22	0.14	0.14	0.01
1,2-dichloroethane	0.17	0.51	1.58	0.36
Methyl Chloroform	0.27	0.37	0.30	0.79
Benzene	4.05	1.84	1.81	4.62
Carbon Tet.	0.12	0.15	0.16	0.16
1,2-dichloroprop.	<0.01	<0.01	<0.01	<0.01
Trichloroethylene	0.02	0.02	0.02	0.03
1-Heptene	0.34	0.30	0.35	0.10
n-Heptane	0.76	0.48	0.78	0.19
Toluene	3.27	2.37	2.56	1.95
1,3-dichloroprop.	<0.01	<0.01	<0.01	<0.01
Ethylene Dibromide	0.00	0.00	0.00	0.00
Perchloroethylene	0.03	0.12	0.08	0.05
Chlorobenzene	0.02	0.01	0.01	0.06
Ethylbenzene	0.28	0.38	0.28	1.62
m-Xylene	1.15	1.01	0.78	0.36
p-Xylene	0.26	0.33	0.19	0.10
Bromoform	0.00	0.00	0.00	0.00
o-Xylene	0.35	0.48	0.33	0.17
Cumene	0.04	0.04	0.05	0.02
Bromobenzene	0.00	0.00	0.00	0.00

(TABLE 6)

Volatile Organic Compounds Often Identified in the Baton Rouge Ambient Air by GC/MS Qualitative Analysis

n-butane	1-butene	2-methylbutane
1,3-butadiene	n-pentane	2-butene
2,2-dimethylbutane	3-methyl-1-butene	cyclopentane
1-pentene	2,3-dimethylbutane	2-methyl-1-butene
isoprene	2-methylpentane	3-methylpentane
n-hexane	2-pentene	2-methyl-2-butene
1,3-pentadiene	methylcyclopentane	cyclopentene
cyclohexane	cyclohexene	1-hexene
2-hexene	methylcyclopentane	methylcyclohexane
2-4-dimethylpentane	2-methylhexane	3-methylhexane
alpha-pinene	beta-pinene	limonene
2,2,2-trimethylpentane	2,5-dimethylhexane	2,4-dimethylhexane
2,3,4-trimethylpentane	2-methylheptane	3-methylheptane
n-octane	2-methyloctane	3-methyloctane
n-decane	n-undecane	n-dodecane
ethylcyclopentane	dimethylcyclopentane	dimethylcyclohexane
acetone	2-butanone	Freon -11
Freon -113	styrene	n-propylbenzene
3-ethyltoluene	4-ethyltoluene	1,3,5-trimethylbenzene
2-ethyltoluene	1,2,4-trimethylbenzene	1,2,3-trimethylbenzene
n-butylbenzene	p-cymene	methyl chloride
vinyl chloride	methylene chloride	1,4-dichlorobenzene

(TABLE 7)

CAPITOL SITE DATA COMPARISON

TAMS Samples - Continuous Monitoring System - UATMP Samples
1989 DATA - MEAN AVERAGES FOR ALL SAMPLES

Compound	TAMS DATA * 6-10	TAMS DATA * 0-10	CMS **	UATMP
Chloroform	0.12	0.14	0.08	0.11
EDC	0.33	0.51	0.53	-
Carbon tetrachloride	0.13	0.15	0.05	0.20
Trichloroethylene	0.02	0.02	0.01	0.03
Perchloroethylene	0.22	0.12	0.02	0.09
Benzene	1.88	1.84	2.88	1.62
Toluene	2.51	2.37	2.10	1.88
Ethyl Benzene	0.39	0.38	0.43	0.41
m+p xylene	1.48	1.34	-	1.88
o xylene	0.50	0.48	0.96	0.64

* FROM TABLE 5
** FROM TABLE 1

APPENDIX

BAKER SITE TAMS DATA

4 HOUR SAMPLES (6 - 10 am) - 19 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	<0.01	0.02	0.00	0.00	0.08
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.04	0.03	0.00	0.03	0.10
1,2-dichloroethane	0.10	0.16	0.00	0.03	0.59
Methyl Chloroform	0.16	0.11	0.00	0.14	0.37
Benzene	2.24	2.47	0.33	1.63	11.59
Carbon Tet.	0.08	0.07	0.00	0.09	0.25
1,2-dichloroprop.	<0.01	0.01	0.00	0.00	0.03
Trichloroethylene	<0.01	0.03	0.00	0.01	0.12
1-Heptene	0.17	0.26	0.00	0.13	1.06
n-Heptane	0.42	0.57	0.00	0.25	2.50
Toluene	1.98	2.42	0.25	1.31	11.08
1,3-dichloroprop.	0.00	0.00	0.00	0.00	0.00
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.02	0.03	0.00	0.01	0.10
Chlorobenzene	0.01	0.02	0.00	0.01	0.07
Ethylbenzene	0.16	0.16	0.02	0.10	0.69
m-Xylene	0.71	1.00	0.07	0.37	4.51
p-Xylene	0.18	0.26	0.00	0.10	1.13
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.24	0.29	0.00	0.14	1.26
Cumene	0.02	0.02	0.00	0.01	0.08
Bromobenzene	0.00	0.00	0.00	0.00	0.00

10 HOUR SAMPLES (0 - 10 am) - 21 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	0.01	0.04	0.00	0.00	0.15
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.22	0.76	0.00	0.04	3.54
1,2-dichloroethane	0.17	0.62	0.00	0.20	0.59
Methyl Chloroform	0.27	0.17	0.05	0.23	0.62
Benzene	4.05	3.77	0.26	3.36	16.23
Carbon Tet.	0.12	0.05	0.03	0.12	0.22
1,2-dichloroprop.	<0.01	0.01	0.00	0.00	0.05
Trichloroethylene	0.02	0.02	0.00	0.01	0.09
1-Heptene	0.34	0.42	0.00	0.16	1.41
n-Heptane	0.76	0.82	0.00	0.37	2.65
Toluene	3.27	2.96	0.21	2.45	11.70
1,3-dichloroprop.	<0.01	0.02	0.00	0.00	0.09
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.03	0.03	0.00	0.03	0.12
Chlorobenzene	0.02	0.02	0.00	0.01	0.05
Ethylbenzene	0.28	0.30	0.02	0.16	1.22
m-Xylene	1.15	1.37	0.06	0.73	5.80
p-Xylene	0.26	0.27	0.01	0.14	0.87
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.35	0.37	0.02	0.26	1.43
Cumene	0.04	0.05	0.00	0.02	0.22
Bromobenzene	0.00	0.00	0.00	0.00	0.00

CAPITAL SITE TAMS DATA

4 HOUR SAMPLES (6 - 10 am) - 23 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	0.02	0.07	0.00	0.00	0.31
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.12	0.35	0.00	0.03	1.69
1,2-dichloroethane	0.33	0.88	0.00	0.05	4.21
Methyl Chloroform	0.30	0.17	0.10	0.27	0.87
Benzene	1.88	1.92	0.35	1.34	9.44
Carbon Tet.	0.13	0.08	0.00	0.11	0.42
1,2-dichloroprop.	<0.01	0.01	0.00	0.00	0.07
Trichloroethylene	0.02	0.02	0.00	0.01	0.06
1-Heptene	0.26	0.43	0.00	0.10	1.93
n-Heptane	0.50	0.50	0.13	0.37	1.96
Toluene	2.51	2.82	0.42	1.78	14.08
1,3-dichloroprop.	<0.01	0.01	0.00	0.00	0.03
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.22	0.45	0.00	0.10	2.24
Chlorobenzene	0.01	0.02	0.00	0.01	0.06
Ethylbenzene	0.39	0.62	0.06	0.27	3.20
m-Xylene	1.13	1.76	0.14	0.74	8.98
p-Xylene	0.35	0.59	0.00	0.23	2.99
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.50	0.85	0.04	0.33	4.34
Cumene	0.05	0.10	0.00	0.02	0.45
Bromobenzene	0.00	0.00	0.00	0.00	0.00

10 HOUR SAMPLES (0 - 10 am) - 24 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	<0.01	0.03	0.00	0.00	0.14
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.14	0.31	0.00	0.04	1.53
1,2-dichloroethane	0.51	0.95	0.00	0.11	3.86
Methyl Chloroform	0.37	0.33	0.12	0.29	1.64
Benzene	1.84	1.77	0.29	1.29	7.50
Carbon Tet.	0.15	0.12	0.07	0.11	0.68
1,2-dichloroprop.	<0.01	0.01	0.00	0.00	0.07
Trichloroethylene	0.02	0.02	0.00	0.02	0.10
1-Heptene	0.30	0.44	0.00	0.14	1.67
n-Heptane	0.48	0.45	0.11	0.31	1.65
Toluene	2.37	2.70	0.29	1.33	11.62
1,3-dichloroprop.	<0.01	0.01	0.00	0.00	0.02
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.12	0.21	0.00	0.06	1.08
Chlorobenzene	0.01	0.02	0.00	0.00	0.08
Ethylbenzene	0.38	0.53	0.04	0.22	2.47
m-Xylene	1.01	1.48	0.01	0.53	6.27
p-Xylene	0.33	0.48	0.03	0.20	2.18
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.48	0.73	0.06	0.25	3.02
Cumene	0.04	0.05	0.00	0.02	0.24
Bromobenzene	0.00	0.00	0.00	0.00	0.00

GEISMAR SITE TAMS DATA

4 HOUR SAMPLES (6 - 10 am) - 10 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	0.00	0.00	0.00	0.00	0.00
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.13	0.21	0.00	0.05	0.70
1,2-dichloroethane	0.42	0.74	0.00	0.10	2.37
Methyl Chloroform	0.69	1.05	0.00	0.25	3.53
Benzene	3.15	3.26	0.71	2.02	11.50
Carbon Tet.	0.20	0.16	0.07	0.11	0.54
1,2-dichloroprop.	0.03	0.08	0.00	0.00	0.27
Trichloroethylene	0.02	0.03	0.00	0.01	0.08
1-Heptene	0.15	0.14	0.00	0.11	0.83
n-Heptane	0.19	0.14	0.02	0.16	0.47
Toluene	1.98	1.89	0.35	1.27	5.88
1,3-dichloroprop.	0.01	0.00	0.00	0.00	0.00
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.06	0.08	0.00	0.02	0.22
Chlorobenzene	0.08	0.21	0.00	0.01	0.69
Ethylbenzene	0.30	0.31	0.07	0.20	1.10
m-Xylene	0.37	0.30	0.09	0.24	1.04
p-Xylene	0.11	0.11	0.02	0.08	0.35
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.17	0.16	0.04	0.10	0.52
Cumene	0.03	0.03	0.00	0.01	0.09
Bromobenzene	0.00	0.00	0.00	0.00	0.00

10 HOUR SAMPLES (0 - 10 am) - 10 Sampling Dates

Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	0.00	0.00	0.00	0.00	0.00
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.10	0.06	0.03	0.08	0.24
1,2-dichloroethane	0.36	0.48	0.01	0.11	1.53
Methyl Chloroform	0.79	1.52	0.00	0.36	5.10
Benzene	4.62	8.01	0.86	1.80	26.84
Carbon Tet.	0.16	0.08	0.08	0.14	0.35
1,2-dichloroprop.	<0.01	0.03	0.00	0.00	0.09
Trichloroethylene	0.03	0.04	0.00	0.01	0.11
1-Heptene	0.10	0.10	0.00	0.07	0.29
n-Heptane	0.19	0.14	0.04	0.14	0.43
Toluene	1.95	1.66	0.38	1.55	5.44
1,3-dichloroprop.	<0.01	0.01	0.00	0.00	0.02
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.05	0.05	0.00	0.03	0.15
Chlorobenzene	0.06	0.11	0.00	0.01	0.32
Ethylbenzene	1.62	2.69	0.06	0.31	8.07
m-Xylene	0.36	0.33	0.00	0.17	0.92
p-Xylene	0.10	0.11	0.02	0.05	0.31
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.17	0.17	0.04	0.08	0.52
Cumene	0.02	0.02	0.00	0.01	0.06
Bromobenzene	0.00	0.00	0.00	0.00	0.00

PORT ALLEN SITE TAMS DATA

10 HOUR SAMPLES (0 - 10 am) - 23 Sampling Dates

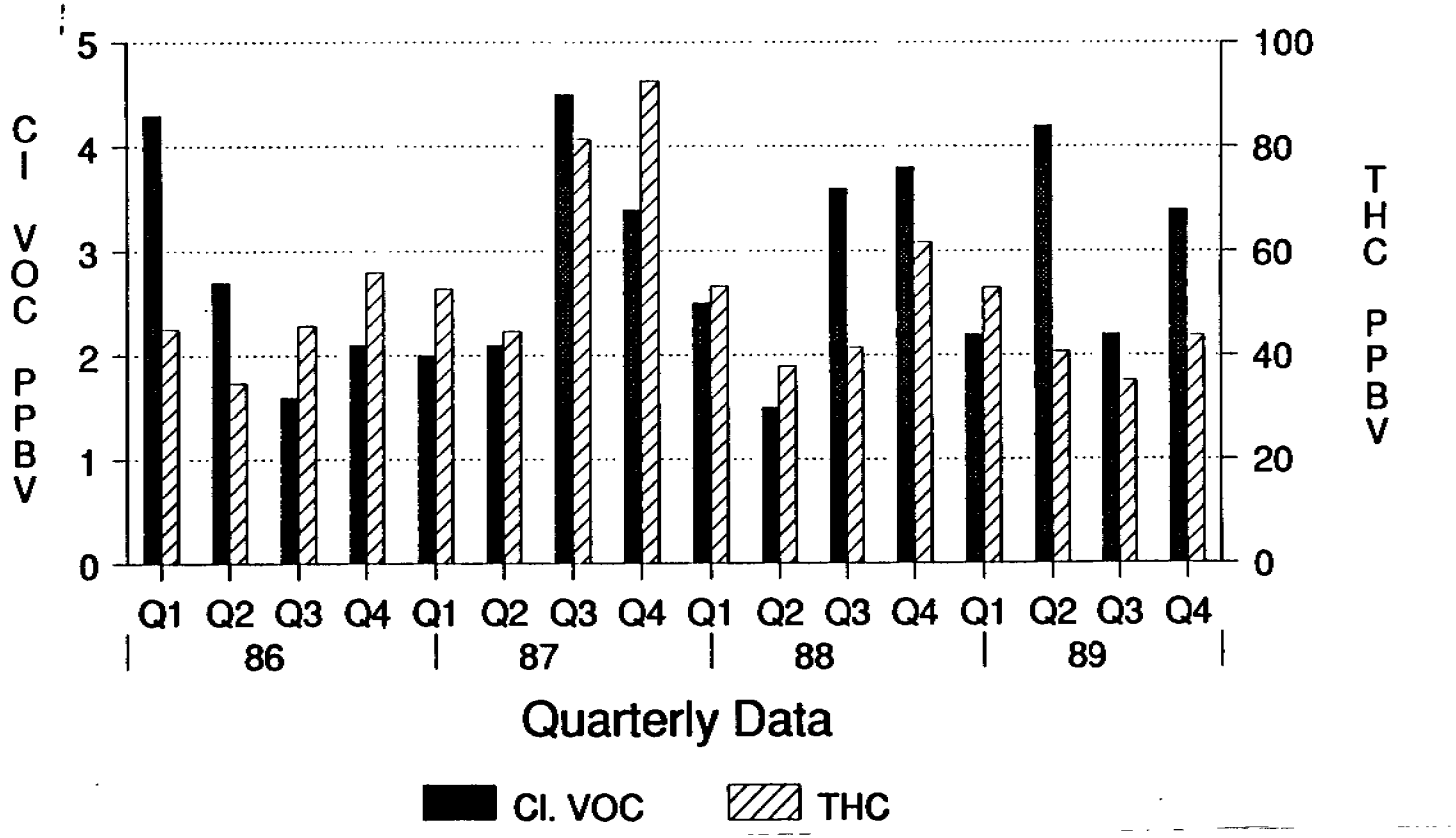
Compound	Mean	Std. Dev.	Minimum	Median	Maximum
Acrylonitrile	0.01	0.04	0.00	0.00	0.19
Allyl Chloride	0.00	0.00	0.00	0.00	0.00
Chloroform	0.14	0.18	0.01	0.07	0.69
1,2-dichloroethane	1.58	2.91	0.00	0.62	13.11
Methyl Chloroform	0.30	0.19	0.00	0.24	0.84
Benzene	1.81	1.10	0.52	1.39	4.55
Carbon Tet.	0.16	0.08	0.09	0.14	0.44
1,2-dichloroprop.	<0.01	0.01	0.00	0.00	0.07
Trichloroethylene	0.02	0.03	0.00	0.01	0.14
1-Heptene	0.35	0.35	0.01	0.20	1.12
n-Heptane	0.78	0.60	0.12	0.73	2.19
Toluene	2.56	2.11	0.55	1.59	7.94
1,3-dichloroprop.	<0.01	0.01	0.00	0.00	0.02
Ethylene Dibromide	0.00	0.00	0.00	0.00	0.00
Perchloroethylene	0.08	0.07	0.00	0.05	0.23
Chlorobenzene	0.01	0.02	0.00	0.01	0.08
Ethylbenzene	0.28	0.26	0.07	0.17	1.20
m-Xylene	0.78	0.72	0.18	0.49	3.27
p-Xylene	0.19	0.17	0.00	0.14	0.77
Bromoform	0.00	0.00	0.00	0.00	0.00
o-Xylene	0.33	0.32	0.00	0.21	1.52
Cumene	0.05	0.05	0.01	0.03	0.18
Bromobenzene	0.00	0.00	0.00	0.00	0.00

ALL SITES COMBINED TAMS DATA

Compound	6-10 Sample Time (52 Samples) Mean	Maximum	0-10 Sample Time (78 Samples) Mean	Maximum
Acrylonitrile	0.01	0.31	0.01	0.19
Allyl Chloride	0.00	0.00	0.00	0.00
Chloroform	0.09	1.69	0.15	3.54
1,2-dichloroethane	0.26	4.21	0.72	13.11
Methyl Chloroform	0.33	3.53	0.38	5.10
Benzene	2.26	11.59	2.78	26.84
Carbon Tet.	0.13	0.54	0.15	0.68
1,2-dichloroprop.	0.01	0.27	0.01	0.09
Trichloroethylene	0.02	0.12	0.02	0.14
1-Heptene	0.21	1.93	0.30	1.67
n-Heptane	0.41	2.50	0.31	2.65
Toluene	2.22	14.08	2.62	11.70
1,3-dichloroprop.	<0.01	0.03	<0.00	0.09
Ethylene Dibromide	0.00	0.00	0.00	0.00
Perchloroethylene	0.11	2.24	0.08	1.08
Chlorobenzene	0.03	0.69	0.02	0.32
Ethylbenzene	0.29	3.20	0.48	8.07
m-Xylene	0.83	8.98	0.90	6.27
p-Xylene	0.24	2.99	0.24	2.18
Bromoform	0.00	0.00	0.00	0.00
o-Xylene	0.34	4.34	0.36	3.02
Cumene	0.03	0.45	0.04	0.24
Bromobenzene	0.00	0.00	0.00	0.00

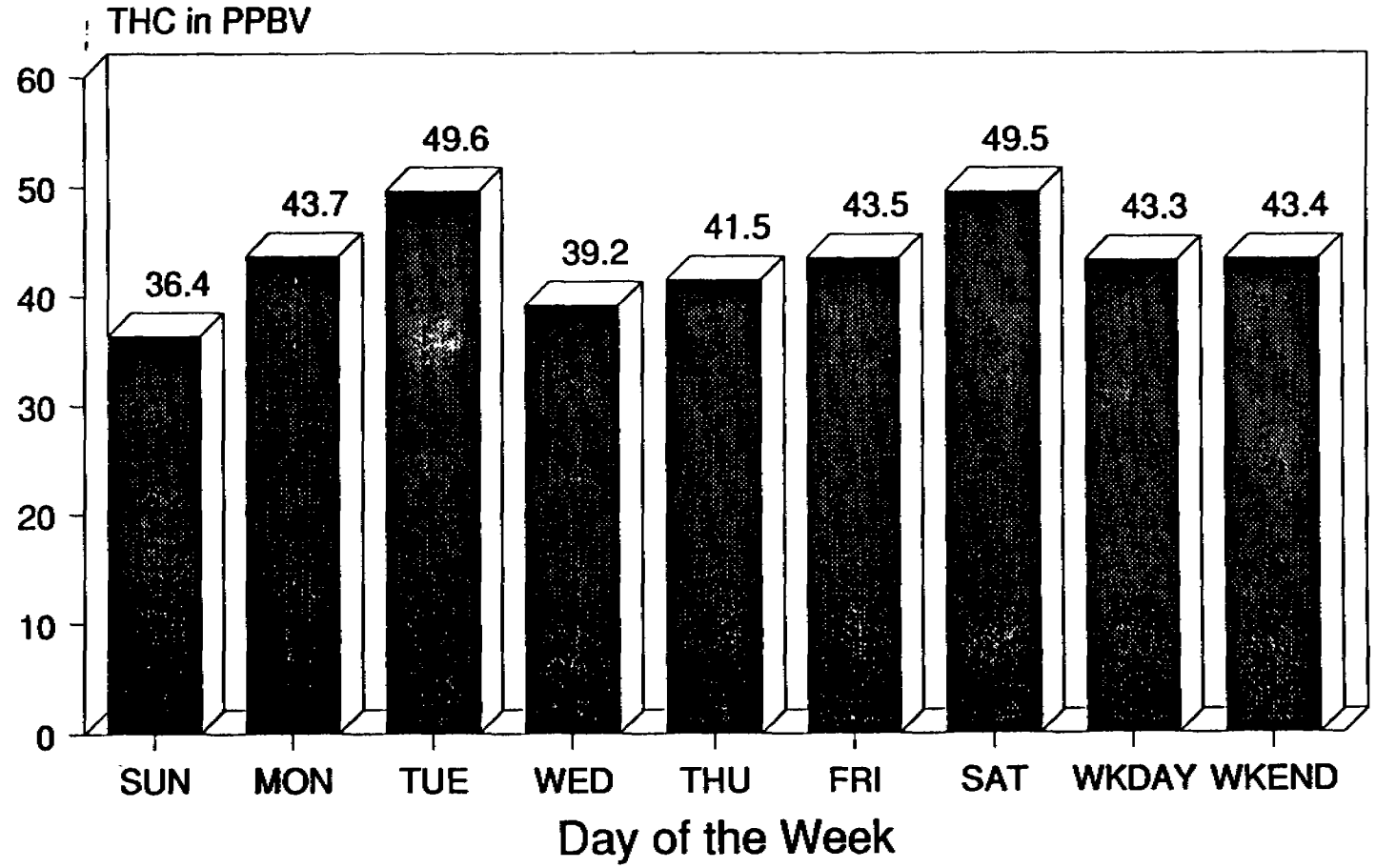
Capitol Site Monitoring Data

Total Hydrocarbons & Total Cl VOC



Mean Average Concentration

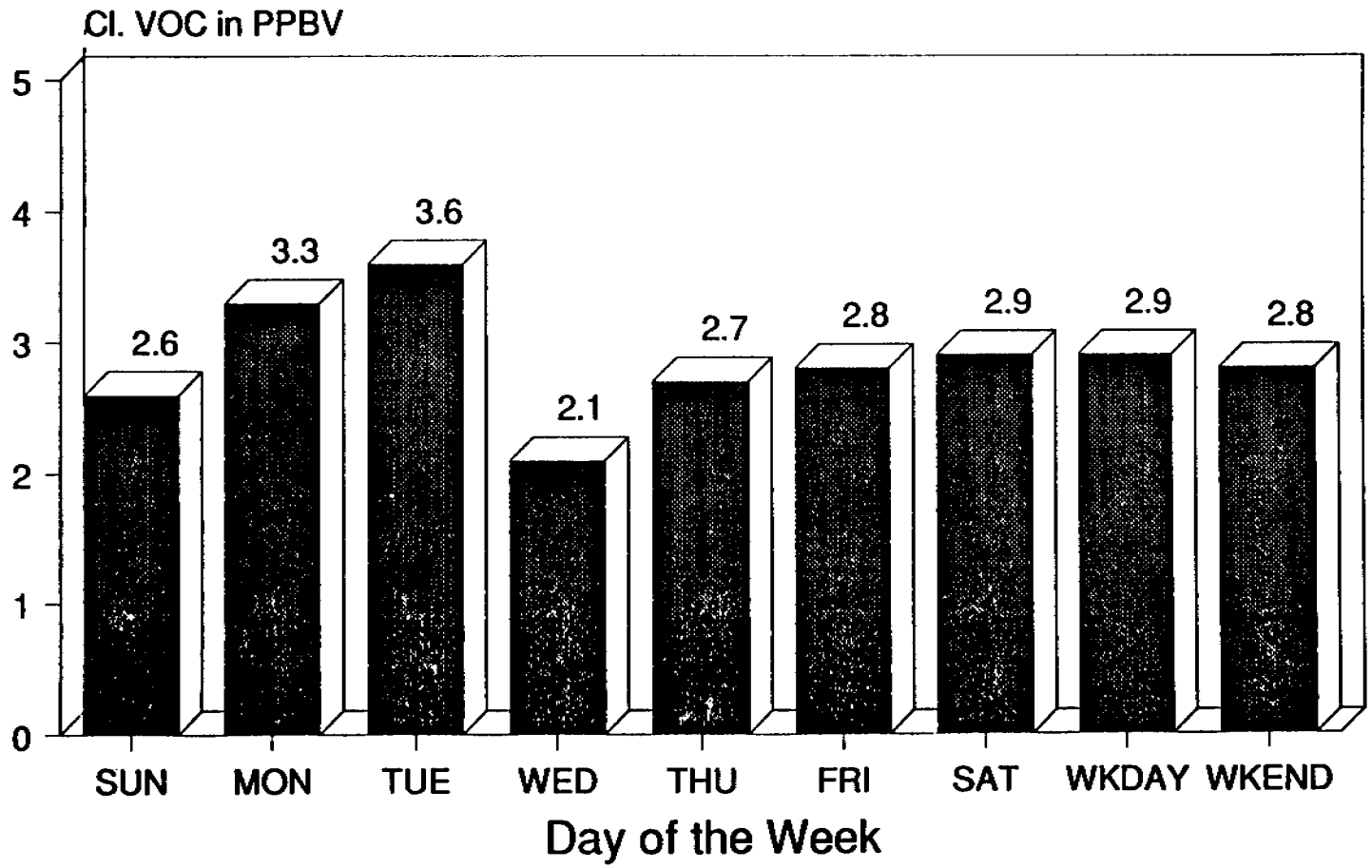
Day of the Week Analysis
Total Hydrocarbons



1989 Monitoring Data

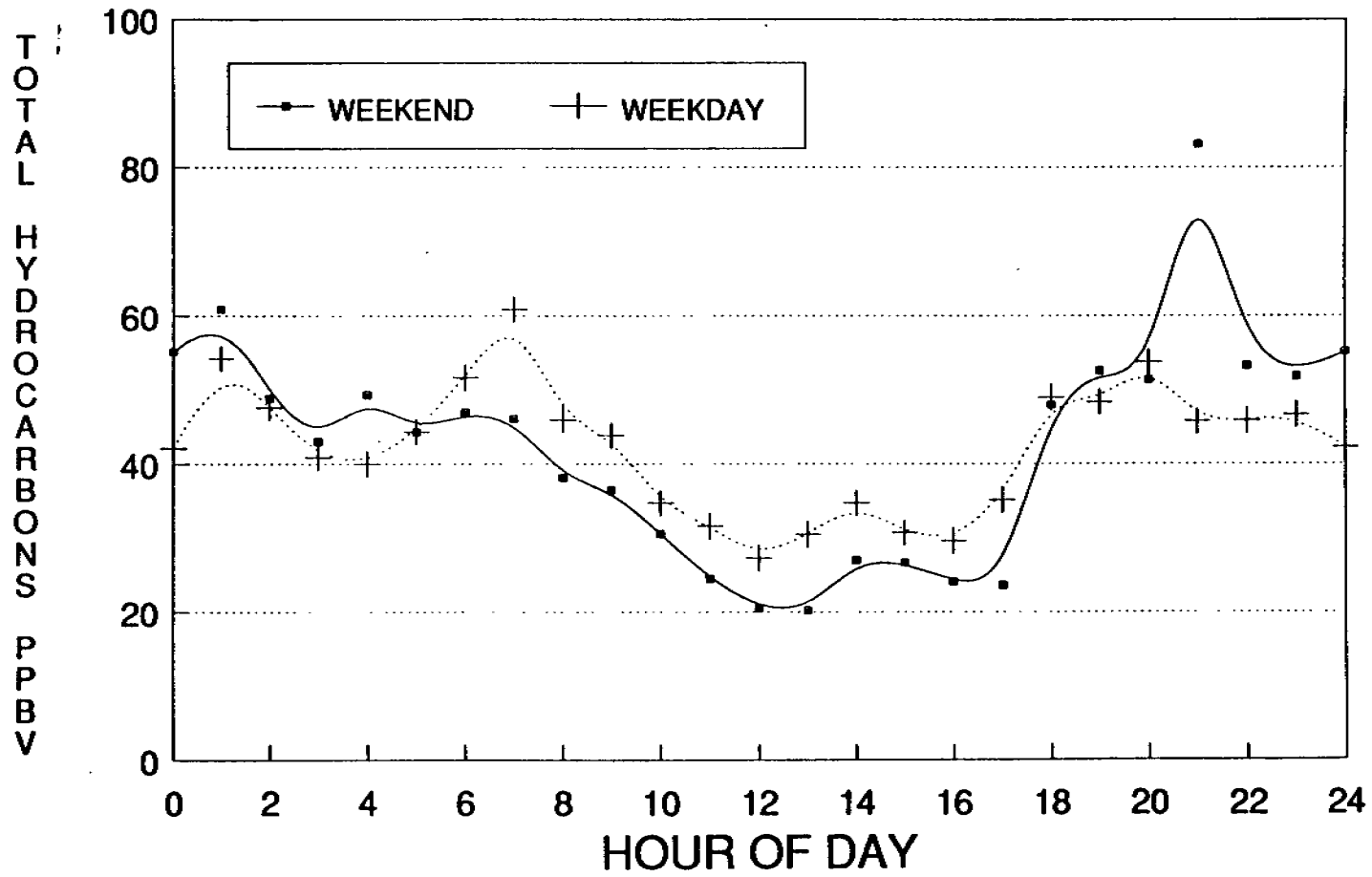
Day of the Week Analysis

Total Cl. VOC



1989 Monitoring Data

CAPITOL SITE HYDROCARBONS
WEEKDAY vs WEEKEND DIURNAL ANALYSIS



DIURNAL AVERAGE CONCENTRATIONS

DATA FROM: 1/01/89 TO 12/31/89