CONTRACT NO. A032-130
FINAL REPORT
AUGUST 1992

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Composition and Concentrations of Semi-Volatile Hydrocarbons

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD
Research Division

COMPOSITION AND CONCENTRATIONS OF SEMI-VOLATILE HYDROCARBONS

Final Report
Contract No. A032-130

Prepared for:

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Research Division
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AUGUST 1992

ABSTRACT

Nonmethane hydrocarbons (NMHC) in ambient air are routinely analyzed for C2 to C10 species. The significance of the >C10 relative to the C2 to C10, and C2 to C12 hydrocarbons was assessed by a study conducted during the summer of 1991 at three locations in California, with different predominant emission sources. The Caldecott Tunnel, located in the San Francisco area, was selected as a site dominated by motor vehicle emissions. The remaining sampling sites were: Los Angeles as a typical urban site, and Oildale as a site dominated by oil production. Whole air samples, analyzed for C2 through C12 hydrocarbons, were collected using the stainless steel canisters. Semi-volatile hydrocarbons, in the range of C8 to C18, were collected using Tenax-TA solid adsorbent. The samples were analyzed using high resolution gas chromatographic separation and Fourier transform infrared/mass spectrometric detection (GC/IRD/MSD) or flame ionization detection (FID) of individual hydrocarbons. The comparison of hydrocarbon concentrations found in the Tenax and canister samples and the assessment of the levels of semivolatile hydrocarbons (C10-C18 range) relative to total non-methane hydrocarbons (C2-C10 or C2-C12), as measured by the canister method, is presented. The results showed that the percent contribution of SVHC to TNMHC ranged from ~1 to ~18% depending on the carbon number arbitrarily selected as a starting point of SVHC range. If the hydrocarbons are quantified only up to C10 from canister samples, the percent contribution of C10 to C18 SVHC, ranged from ~6 to ~18%. The contribution of SVHC in the range of C12 to C18, was considerably lower and ranged from ~1 to ~7%.

DISCLAIMER

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

ACKNOWLEDGEMENTS

The contribution of the California Air Resources Board Project Monitor, Dr. Eric Fujita, is greatly appreciated.

We would like to thank Dr. William Pierson of the Desert Research Institute for his valuable advice and assistance. We also wish to thank Beverly Finley and Susan Grobman for typing and assembling this report and Betty Crockford and Lycia Ronchetti for the fiscal administration of this project.

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1.0 PROJECT SUMMARY

1.1 Statement of the Problem

Hydrocarbons, which are emitted from many naturally occurring and anthropogenic sources, are important contributors to the formation of ozone and organic aerosols. The major anthropogenic sources include petroleum refining, oil and gas production, diesel- and gasoline-engine exhausts and running losses, agricultural burning, and industrial processes. Several natural sources include emissions from vegetation and forest fires. Most of these emission sources are widely represented in California, as reflected by the fact that the total emission of reactive organic gases was estimated recently to range up to 4,100 tons/day (State of California Air Resources Board, 1987 Emission Inventory).

Hydrocarbons emitted from various sources exhibit a wide range of volatility and are hence distributed in the atmosphere between the gas and particle phases. It has been shown for ambient air samples collected in a heavily travelled mountain tunnel that n-alkanes up to C26 could be detected in the gas phase samples (Hampton et al., 1982; 1983). In the same study, the n-alkane series became detectable at C14 in the particle phase. Ambient measurements by Cautreels and van Cauwenberghe (1978), showed significant partitioning to the particle phase beginning at C19. However, this last study did not account for hydrocarbons "blown off" the filter during the high-volume collection period.

Regardless of some ambiguity as to how much of a given hydrocarbon actually exists in the gas phase, there is no doubt that in some airsheds this fraction could be significant for hydrocarbons ranging from C12 to C18 (or higher), so-called semi-volatile hydrocarbons (SVHC). Since gas-phase hydrocarbons contribute to ozone and organic aerosol formation, it is important to determine the composition of SVHC and to estimate their contribution to total gas-phase hydrocarbons. However, the commonly used canister sampling methods for total non-methane hydrocarbon (NMHC) measurements and for hydrocarbon speciation (for example, U.S. EPA Methods TO-12 and TO-14) do not account for SVHC. Currently, only a small fraction of the C9 to C12 compounds have been identified and few attempts have been made to extend U.S. EPA Method TO-14 to analysis of gas-phase hydrocarbons beyond C12. One question which has arisen as a result of a recent San Joaquin Valley Air Quality Study is how to account for these species in order to develop ozone abatement strategies for that region. Without accurately knowing the ambient level of SVHC, it is impossible to perform such an evaluation from a regulatory stand-point.

Clearly, a complete analysis of all gas-phase hydrocarbons is necessary in order to determine the relative importance of SVHC in relation to traditionally measured gas-phase total NMHC. This requirement forms the basis for the present study to determine the composition and concentrations of semi-volatile hydrocarbons at selected locations in California.

1.2 Project Objectives

The specific objectives of this study were as follows:

- To determine the composition and concentrations of ambient semi-volatile hydrocarbons (SVHC, C10 - C18) at three locations in California which are representative of different emission sources.

- To determine the relative contribution of SVHC to total gas-phase NMHC, as measured by U.S. EPA Methods TO-12 and TO-14 and continuous total NMHC analyzer, at these three sites.

- To evaluate the degree to which SVHC are included in current methods used to quantify total gas-phase NMHC.

1.3 Finding and Conclusions

In order to assess the contribution of hydrocarbons in the C10 to C18 range (SVHC), to total gas-phase nonmethane hydrocarbons, sampling was carried out in the summer of 1991 in three locations in California, dominated by different emission sources. The Caldecott Tunnel, located in the San Francisco area, was selected as a site dominated by motor vehicle emissions. The remaining sampling sites were: Los Angeles as a typical urban site, and Oildale as a site dominated by oil production. Whole air samples, analyzed for C2 through C12 hydrocarbons, were collected using the stainless steel canister sampling method. Hydrocarbons, in the range of C8 to C18, were collected using Tenax-TA solid adsorbent. The samples were analyzed using high resolution gas chromatographic separation and Fourier transform infrared/mass spectrometric detection (GC/IRD/MSD) or flame ionization detection (FID) of individual hydrocarbons. Approximately 150 compounds (in the range of C2-C11) were quantified in 44 canister samples and 70 compounds (in the range of C8-C18) in 38 Tenax samples collected at the three sampling locations. These data are presented in Appendix A and B.

The major findings of this study are as follows:

- The composition and concentrations of hydrocarbons in the C10 to C18 range has been determined in the samples collected in three locations in California. In particular, previously poorly characterized hydrocarbons in the range of C9 to C12 were identified from the Tenax samples, using GC/IRD/MSD technique.

- The most abundant compounds found in the C9 to C18 range were aromatic hydrocarbons, especially for the Caldecott Tunnel and Los Angeles samples. C3-, C4-, and C5-substituted benzenes, 1- and 2-methyl- 1,2-dihydroindene, naphthalene, 1- and 2-methylnapthalene, were highly abundant in all Tenax samples collected in the tunnel and in Los Angeles.

- Fractions of paraffinic compounds in samples collected in the Caldecott Tunnel were relatively low. However, the light-duty gasoline vehicles were the main traffic components in the Caldecott Tunnel, and the heavy-duty diesel trucks, which are presumably the main source of paraffinic SVHC, were largely absent in the tunnel.

- The contribution of SVHC to gas-phase TNMHC was found to range from ~1 to ~18% dependent highly on the carbon number arbitrarily selected as a starting point of SVHC range. If the hydrocarbons were quantified only up to C10 from canister samples, the percent contribution of SVHC, in the range of C10 to C18, ranged from ~6 to ~18%. The contribution of SVHC in the range of C12 to C18, was considerably lower and ranged from ~1 to ~7%.

- The percentage of contributions of SVHC to TNMHC, calculated for samples collected in the Caldecott Tunnel and Los Angeles, were very similar. This may indicate the same sources of these hydrocarbons in both sampling sites.

- The agreement between the "total" methods currently used to quantify TNMHC (i.e. PDFID, EPA Method 25, and continuous HC analyzers such as Bendix) and the "speciated" method (EPA Method TO-14) was not very good. This may be due to differences in the response of hydrocarbons and oxygenated or halogenated hydrocarbons with FID detector, and matrix interferences (see Section 5.5 for more detailed discussion). However, more data are needed to draw any definite conclusions.

1.4 Recommendations

In view of the major findings of this study, it is recommended that the speciation of hydrocarbons be extended up to at least C12 hydrocarbon range. If the hydrocarbons are quantified only up to C10 from canister samples, the percent contribution of SVHC, in the range of C10 to C18, could be as high as ~18%. In contrast, the contribution of SVHC in the range of C12 to C18, is considerably lower, ranging from ~1 to ~7% only.

However, it should be noted that the estimated contribution of SVHC to TNMHC is derived from data collected in this study, in which the impact by diesel emissions was light. If an area is impacted significantly by diesel engine emissions, the contribution of gas-phase SVHC in the range of C12 to C18 (or higher) to TNMHC will be much higher. There is insufficient information from this study to determine the extent of this impact. More data are needed to provide such estimates.

In addition, the reasons for discrepancies observed between current methods used to quantify TNMHC need to be addressed in a future study. Sample matrix as one of the important factors that contributes to the disagreements should be investigated. Also, the impact of polar, oxygenated compounds to ambient reactive organic gases (ROGs) should be investigated, as these

compounds could be important in some airsheds, and is suspected to be part of the reasons for the differences seen in TNMHC determined by the three methods.

2.0 SAMPLING SITES AND AMBIENT AIR SAMPLING PROCEDURES

2.1 Sampling Sites

As noted above, the first objective of this program was to determine the composition and concentrations of ambient semi-volatile hydrocarbons at three sites in California which are representative of different emission sources. The locations of these sites were selected in consultation with the ARB staff. The sites, in the order they were sampled are:

- The Caldecott Tunnel located in the San Francisco area (represents motor vehicle emissions).
- ARB monitoring station at Oildale (represents an oil production area).
- The South Coast Air Quality Management District (SCAQMD) monitoring station at downtown Los Angeles (represents a typical urban site).

The locations of the sampling sites within California are shown in Figure 1, and more detailed maps showing the locations of the sites at the Bay Area, Oildale, and Los Angeles are shown in Figures 2 through 4, respectively. The locations of the sampling sites are described in more detail below.

Caldecott Tunnel. Caldecott Tunnel is located on State Route 24, which connects Oakland with mostly residential areas of Contra Costa-Alameda County (see Figure 2). It is a three-bore tunnel with two lanes per bore. The center bore is altered in either direction, which results in four lanes to accommodate peak-hour traffic westbound in the morning and four lanes eastbound in the evening (see Figures 5 and 6). The tunnel length is approximately 3,600 feet from portal to portal, and in 1981 the average daily traffic through the tunnel was ~110,000 vehicles per day. The tunnel has a ~4% grade, with the eastbound traffic running uphill.

The sampling site was located in the overhead exhaust duct, above the eastbound bore. The ventilation in each bore is provided by four adjustable pitch fans. Two fans force the outside air into an intake duct and through sidewall louvers into the tunnel, while the other two fans force the tunnel air out through ceiling louvers into an exhaust duct and outside through the exhaust port. The exhaust fans in the eastbound bore operate only a few hours a day and, during the sampling time, only one out of two fans were running at the lowest speed. In addition, as is the case in other tunnels, most of the tunnel air enters and leaves through the portals under the influence of the piston effect of traffic and prevailing wind direction (see, for example, Pierson, 1992).

Oildale. Ambient air sampling was carried out on the grounds of the local Air Pollution Control District monitoring station, 3315 Manor Street (see Figure 3). The oil fields are located

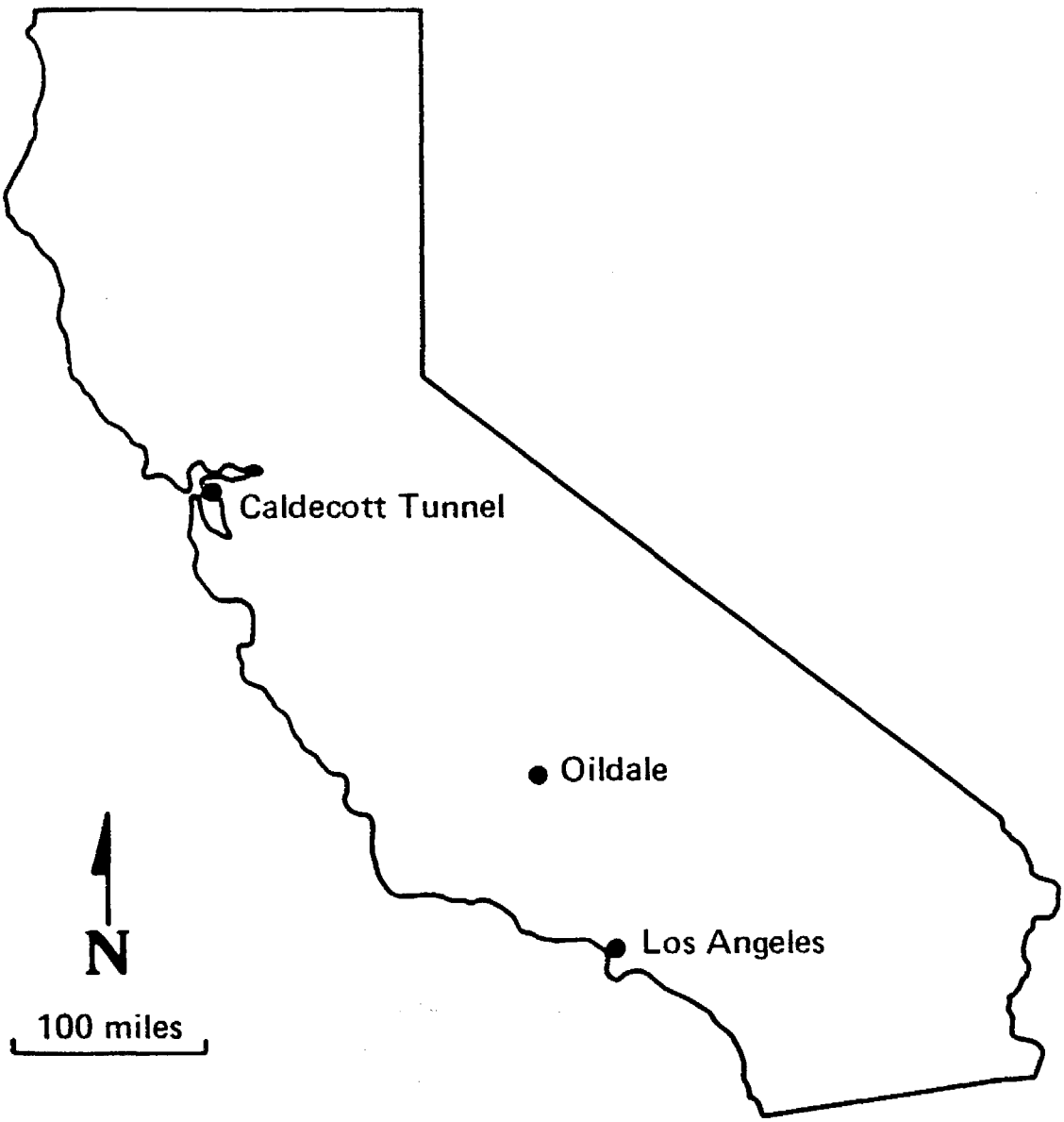

Figure 1. Locations of the sampling sites (•) within California.

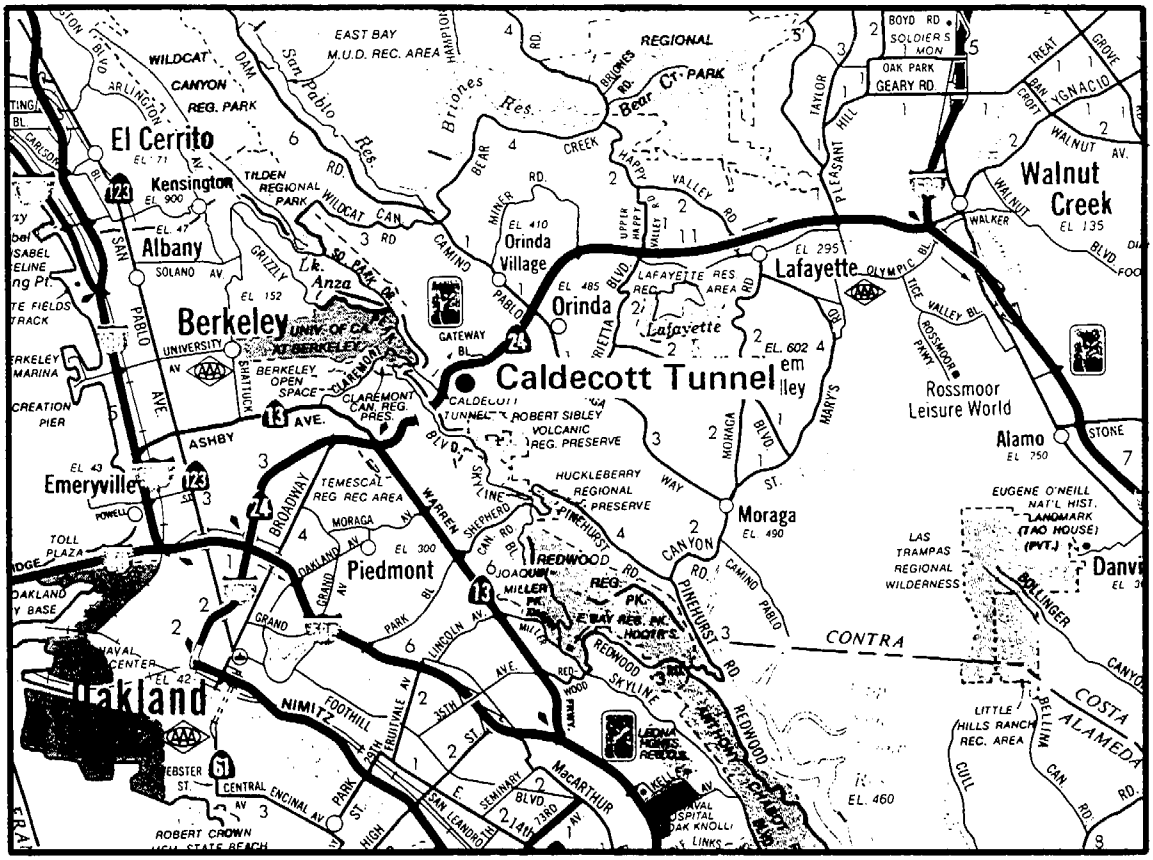

Figure 2. Location of the Caldecott Tunnel.

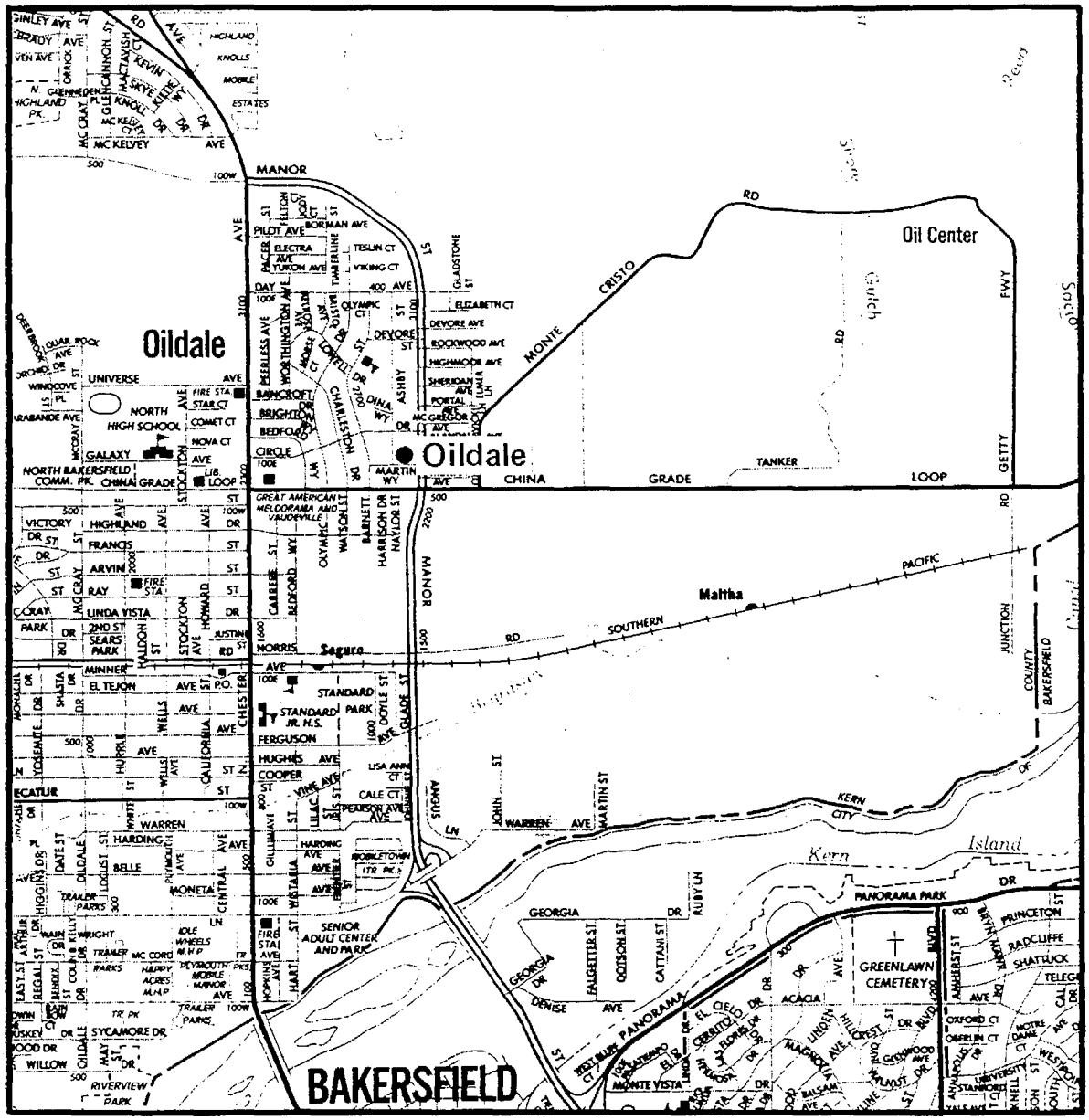

Figure 3. Location of the sampling site (•) in Oildale.

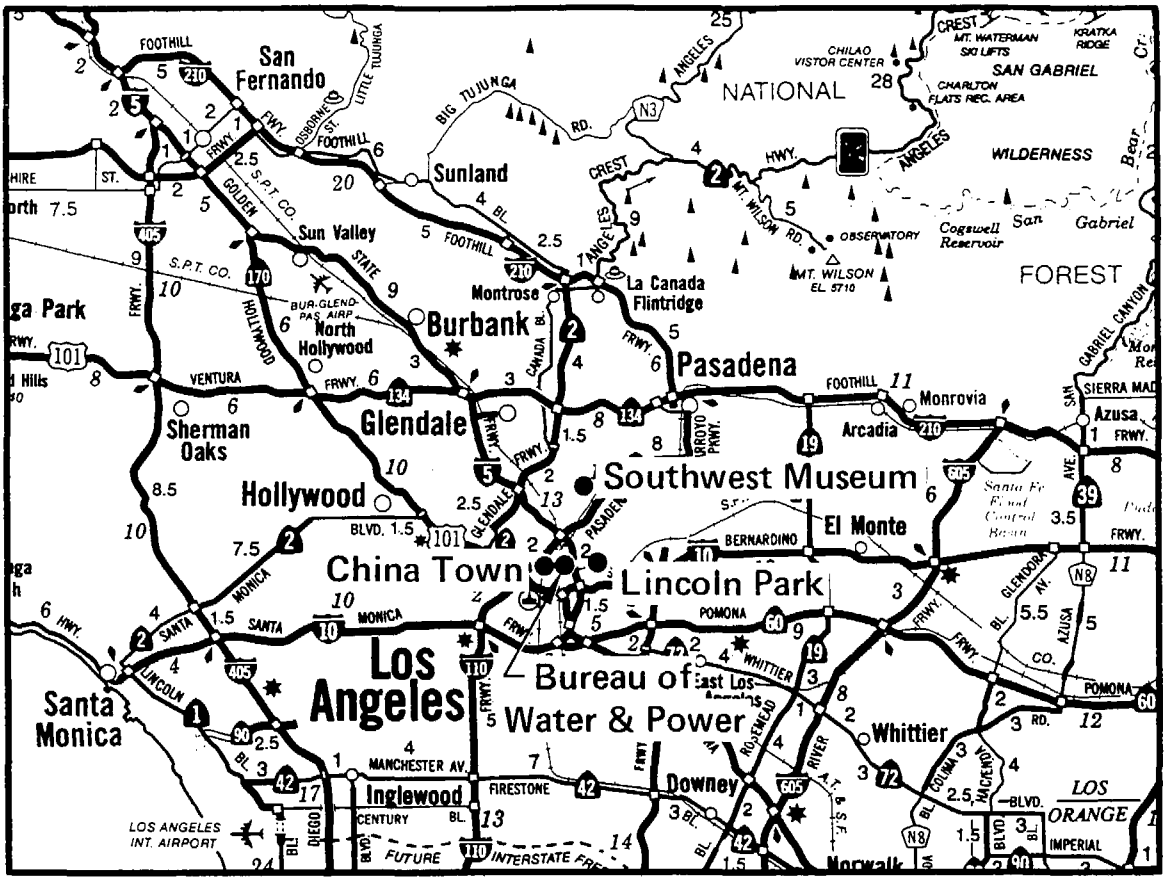

Figure 4. Locations of the sampling sites (•) in Los Angeles.

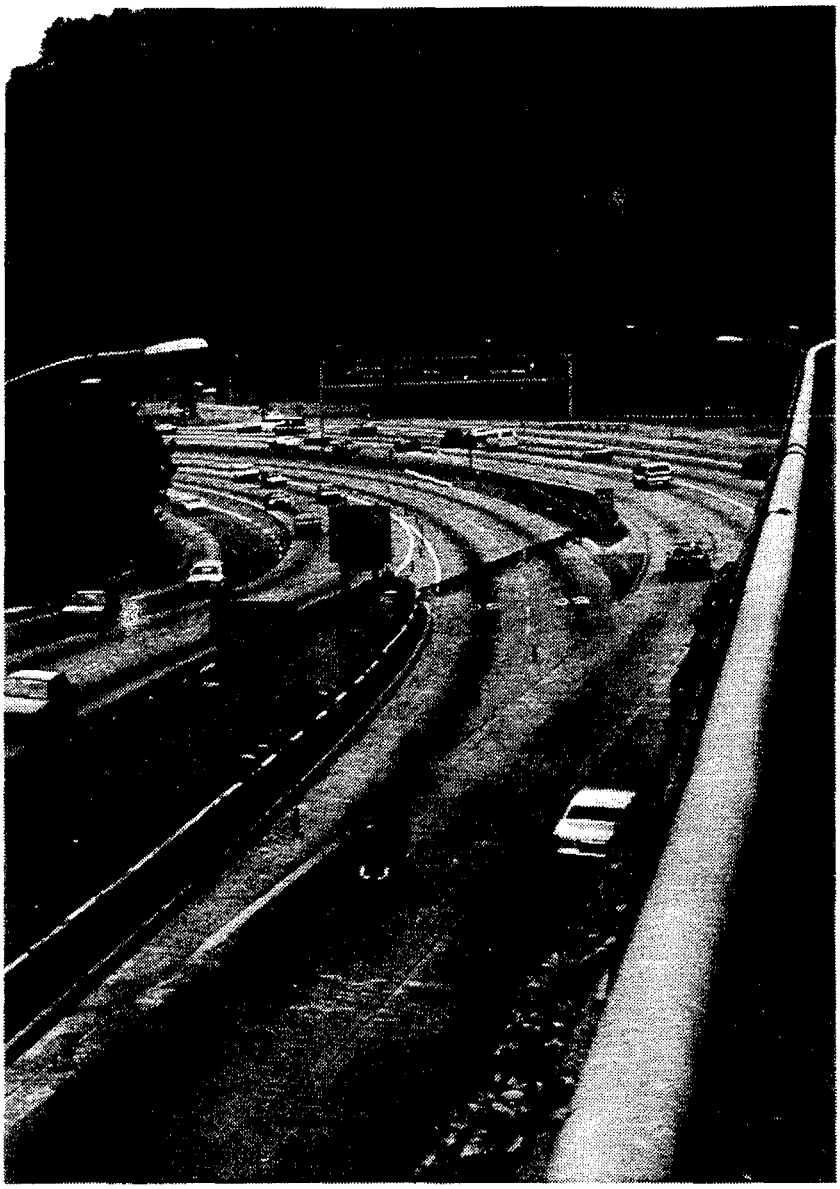

Figure 5. A west portal of Caldecott Tunnel, showing four westbound lanes.

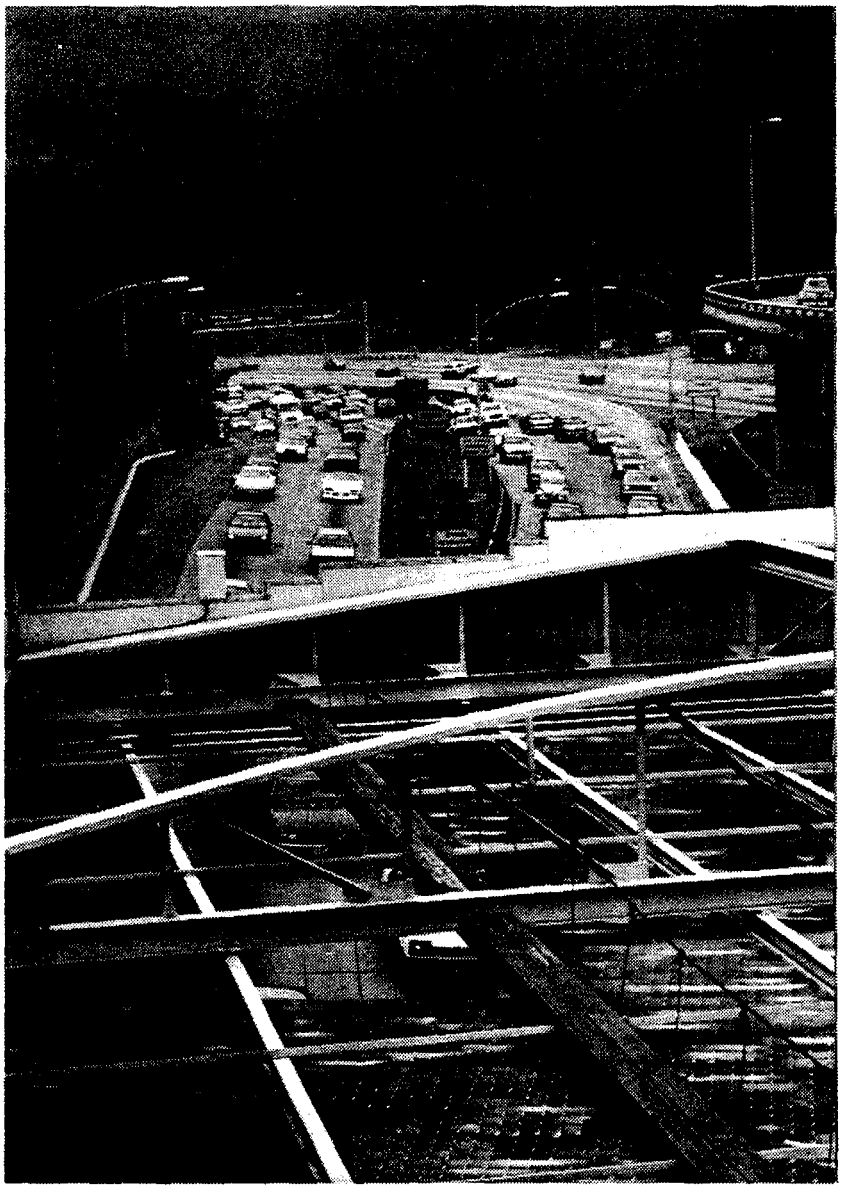

Figure 6. A west portal of Caldecott Tunnel, showing four eastbound lanes.

approximately 2-3 miles northeast of the station. Unfortunately, the prevailing wind direction during the sampling time was usually from the west and southwest.

Los Angeles. Ambient air sampling was carried out at the South Coast Air Quality Management District monitoring station, located at the Water and Power Utility building (see Figure 4). The sampling equipment was located on the second floor with the Teflon sampling lines extending through the window (see Figure 7). In addition, during the last two days of sampling (Friday and Saturday, August 23 and 24, 1991) the canister samples were collected at three other locations, namely (1) in Lincoln Park, (2) on the grounds of Southwest Museum, and (3) on the roof of the Best Western Motel, located in Chinatown (see Figure 4).

2.2 Ambient Air Sampling Procedures

Whole air samples for the measurement of volatile hydrocarbons, in the range of C2 through C12, were collected using the stainless steel canister sampling method. Semi-volatile hydrocarbons, in the range of C9 to C18, were collected using Tenax-GC solid adsorbent. A more detailed description of both procedures follows.

Tenax-GC solid adsorbent sampling. Due to its better adsorption properties, Tenax-TA (Alltech Associates) was used, instead of Tenax-GC. Tenax-TA is designed primarily as a trapping agent, whereas Tenax-GC, the original Tenax, is designed both for GC column packing and for adsorbent traps.

For Tenax-TA cartridges, the safe sampling volume (i.e., the volume of air that may be sampled over a variety of circumstances without significant breakthrough of compounds of interest) can be roughly estimated from data published in the literature (Brown and Purnell, 1979; Krost et al., 1982; U.S. EPA Method TO-1). The most volatile compounds of interest for solid adsorbent collection were, for this study, C8 to C9 aromatic and aliphatic hydrocarbons, such as ethylbenzene (C8, b.p. 136.2 °C), cumene (isopropylbenzene, C9, b.p. 152 °C), and isomeric C9 alkanes and alkenes (b.p. in the range of 140-150 °C). The breakthrough volume for ethylbenzene at 90 °F (32.2 °C) is 334 liters of air per gram of Tenax (Krost et al., 1982). Using a 1.5 safety factor recommended by U.S. EPA Method TO-1, the safe sampling volume for ethylbenzene at 90 °F was calculated to be 44.5 L of air for 0.2 g of Tenax used. That means that a flow rate of ~0.35 L/min could be employed over a sampling time of two hours.

However, due to the great effect of temperature on breakthrough volumes and some differences found between published and observed retention volumes (Walling et al., 1986), it is recommended that two or more Tenax samples be collected in parallel at different flow rates (Walling, 1984; U.S. EPA Method TO-1) or that two Tenax cartridges be used in series (Arey et al., 1987; Atkinson et al., 1988). In this study, two Tenax cartridges connected in series were used, since this method allowed semi-quantitative evaluation of inadequate retention of a given compound.

Figure 7. A sampling site in the Water and Power Utility building in Los Angeles.

To evaluate the contribution of hydrocarbons >C14 present in the particulate phase and collected during Tenax sampling, two Tenax samples were collected in parallel, with and without upstream filtering.

Prior to use, Tenax-TA solid adsorbent was cleaned by Soxhlet extraction in a cellulose thimble for ~5 hrs in a 6/4 (v/v) acetone/hexane mixture. Pyrex cartridges (16 cm x 4 mm i.d.) were packed with 0.2 g of precleaned Tenax (using precleaned glass wool to hold them in place) and thermally conditioned for four hours by heating at 280 °C under nitrogen purge. After heating, the cartridges were placed immediately in clean culture tubes with Teflon-lined screw caps and stored in a clean freezer. Approximately 10% of the precleaned Tenax cartridges were tested by GC/FID for purity prior to sampling.

In summary, the sampling unit drew four parallel streams of air at ~0.35 L/min per stream. Each stream was fitted with two tandem Tenax cartridges (hence, eight cartridges per unit). Two Tenax tandem samples were collected from filtered air, and the remaining two streams were not filtered (one served as a duplicate of the other). Filtering was accomplished by locating a Teflon-coated glass fiber (TIGF) filter upstream of the cartridge. The Volatile Organic Toxic Air (VOTA) collection system (General Metal Works, Inc.,) was used for Tenax sample collection (see Figure 8). The flow rates were measured at the beginning and end of each sampling period, and were adjusted at the beginning of each sampling period using a calibrated flow controller. After sampling, the Tenax cartridges were placed in capped glass test tubes and placed on ice until transported to a laboratory freezer. Figure 9 shows the sampling data sheet used for Tenax cartridges.

Canister sampling. Stainless steel Summa-polished canisters of 6 L capacity were employed for volatile hydrocarbon (C2-C10) collection. Each sampling period was two hours. Prior to sampling, the canisters were cleaned by repeated evacuation and pressurization with humidified zero air while being heated, and certified as described by U.S. EPA Methods TO-12 and TO-14.

The sampling procedure essentially followed the pressurized sampling method described by U.S. EPA Methods TO-12 and TO-14. Briefly, the sampling system works as follows: a metal bellows-type pump draws in ambient air from the sampling manifold to fill and pressurize the sample canisters. A flow control device maintains a constant flow into the canisters over the desired sample period. This flow rate is preset to have filled the canisters to about one atmosphere above ambient pressure at the end of the sampling period (as described by the U.S. EPA Method TO-14). For automatic operation, the timer starts and stops the pump at the appropriate time. The timer also controls the solenoid valve to open when starting the pump and to close when stopping the pump. The use of the Skinner Magnelatch valve prevents any substantial temperature rise that would occur with the conventional solenoid valve. Two such air samplers were constructed at the DRI from the parts recommended by U.S. EPA Method TO-14.

After sampling, an identification tag was attached to each canister with the serial number, sample number, location, date, and time. Figure 10 shows a canister identification tag.

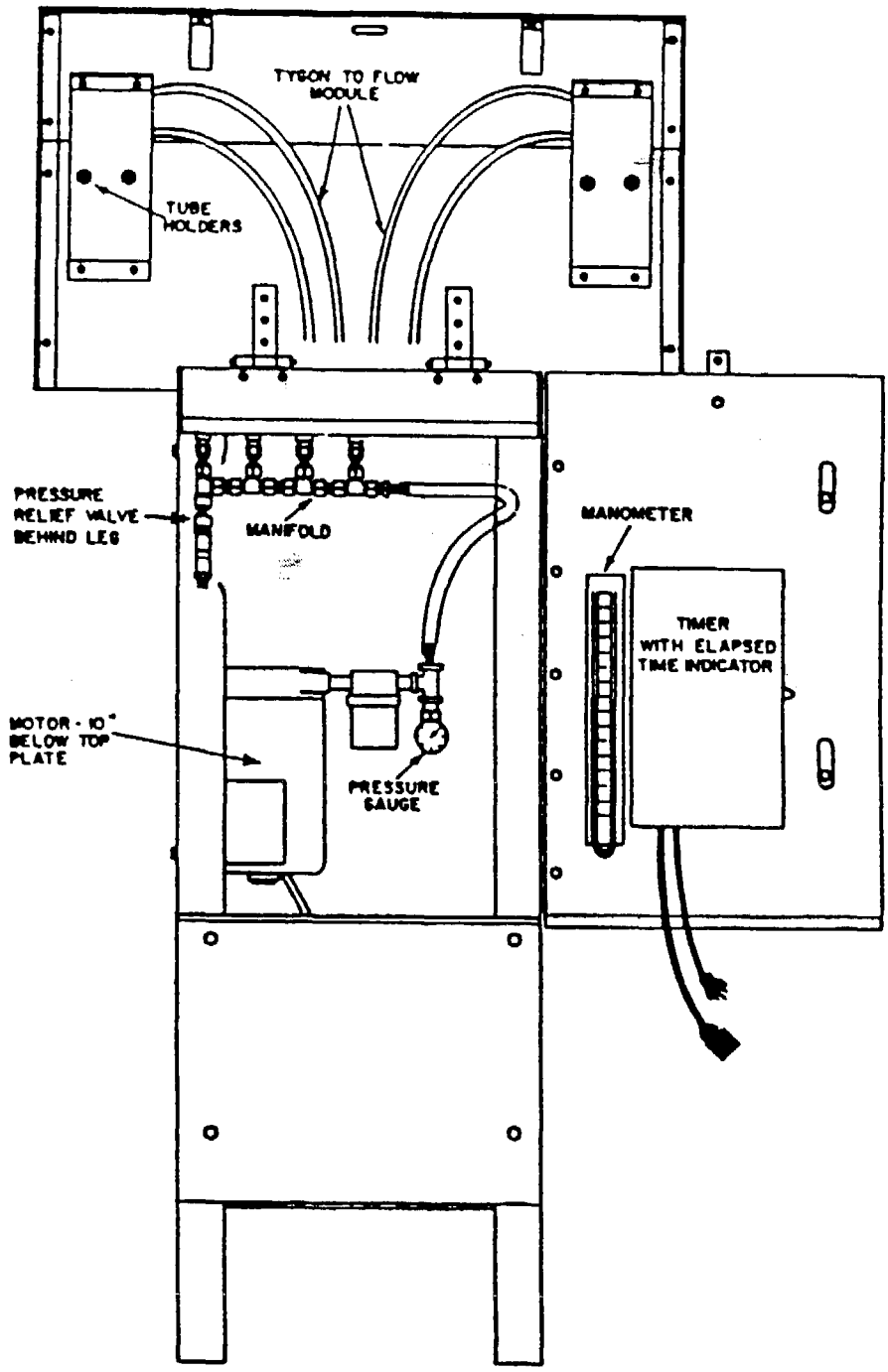

Figure 8. Volatile Organic Toxic Air Sampler (VOTA).

DESERT RESEARCH INSTITUTE
Energy and Environmental Engineering Center
SEMI-VOLATILE HYDROCARBONS STUDY
TENAX SAMPLER

Sampler I.D.: _____ Sample Date: _____

Sample Location: _____

Sample Time: Start: _____ Stop: _____

Elapsed Timer: Start: _____ (Hours) _____ (Minutes)

Stop: _____ (Hours) _____ (Minutes)

Flow Measurement Module I.D.: _____

$$Q_A = 0.375\ LPM = 375\ ccm$$

$$Q_S = Q_A \left(\frac{P_A}{P_S}\ \frac{T_S}{T_A}\right) = (V-B)\ /M$$

$$V = M\ Q_A \left(\frac{P_A}{P_S}\ \frac{T_S}{T_A}\right) + B$$

$$M = 0.0009984$$

$$B = -0.0128$$

VOLTAGE = _____

Port I.D.	Tube I.D.	Voltage Flow:	
		ON	OFF
1-1			
2-0			
3-1			
4-0			

Comments: _____

Operators: Start: _____ Stop: _____

Figure 9. Tenax cartridges sampling data sheet.

DESERT RESEARCH INSTITUTE

"SEMI-VOLATILE HYDROCARBONS"
CANISTER SAMPLERS

Canister I.D. : _____ Sampler I.D. : _____

Sample Location: _____

Sample Date: _____

Sample Time : Start: _____ Stop: _____

Elapsed Time: Start: _____ hrs. _____ mins.

Stop: _____ hrs. _____ mins.

Flow Rate (cc/min) : Start: _____ Stop: _____

Back Pressure (psi) : Start: _____ Stop: _____

Canister Pressure (psi):

Sampler: Before: _____ After: _____

Canister: Before: _____ After: _____

Comments: _____
_____
_____
_____
_____

Operators:: Start: _____ Stop: _____

Figure 10. Canister sampling data sheet.

2.3 Sampling Schedule

Sampling duration was two hours for all Tenax and canister samples collected at three sites. Sampling dates and frequency were as follows:

Caldecott Tunnel. Sampling in the Caldecott Tunnel took place on June 25-28, 1991 (Tuesday, June 25, 1000 - Friday, June 28, 1200). Two canister samplers and one Tenax sampler were located side by side in the exhaust duct directly over the eastbound tube of the tunnel (see Figures 11 and 12). Three daily samples were collected at 0600 to 0800, 1000 to 1200, and 1600 to 1800. In addition, two canister samples were collected at the west clean air intake room on Friday, June 28 (0600-0800 and 1000-1200 hr) to serve as background samples. Also, three collocated canister samples were collected during the sampling period for QA purposes.

As can be seen from Figure 12, Teflon sampling lines were extended from the canister samplers through the ceiling louvers into the tunnel area. In the case of Tenax sampling, the VOTA sampler was placed directly over the ventilation louvers with Tenax cartridges positioned approximately two feet over the ventilation louver (see Figure 13). However, the Teflon sampling lines shown in Figure 13 were not initially present and were first installed on Thursday, June 27, 0600 hr. Unfortunately, the first two days of sampling were characterized by strong winds from the west and the influence of the piston effect of traffic together with the prevailing wind direction resulted in the exhaust air from the tunnel leaving through the exit portal, not through the exhaust duct. As will be discussed later, this was the reason for much lower hydrocarbon concentrations observed from the Tenax cartridges in comparison with the canister samples; different air was sampled onto the Tenax cartridges than into the canisters.

In summary, 15 canister samples (10 samples + 3 collocated samples + 2 background samples), and 80 Tenax samples (20 tunnel samples with and without filtering + 20 duplicate samples + 40 back-up cartridges) were collected at the Caldecott Tunnel.

Oildale. The sampling in Oildale took place on July 30 -August 1, 1991 (Tuesday, 0600 - Thursday, 0600) on the grounds of the local Air Pollution Control District monitoring station, 3315 Manor Street. Two canister samplers and one Tenax sampler were located side by side at the elevated platform (see Figure 14). The oil fields are located approximately 2-3 miles northeast of the station. Unfortunately, the prevailing wind direction during the sampling time was usually from the west and southwest.

Two daily samples were collected at 0600 to 0800 and 1000 to 1200, over a two and a half day period. Two collocated canister samples were collected during this sampling period for QA purposes.

In summary, the number of canister samples collected in Oildale was: 5 samples + 2 collocated samples = 7 canister samples. The number of Tenax samples was: 10 samples (with and without filtering) + 10 duplicate samples + 20 back-up cartridges = 40 Tenax cartridges.

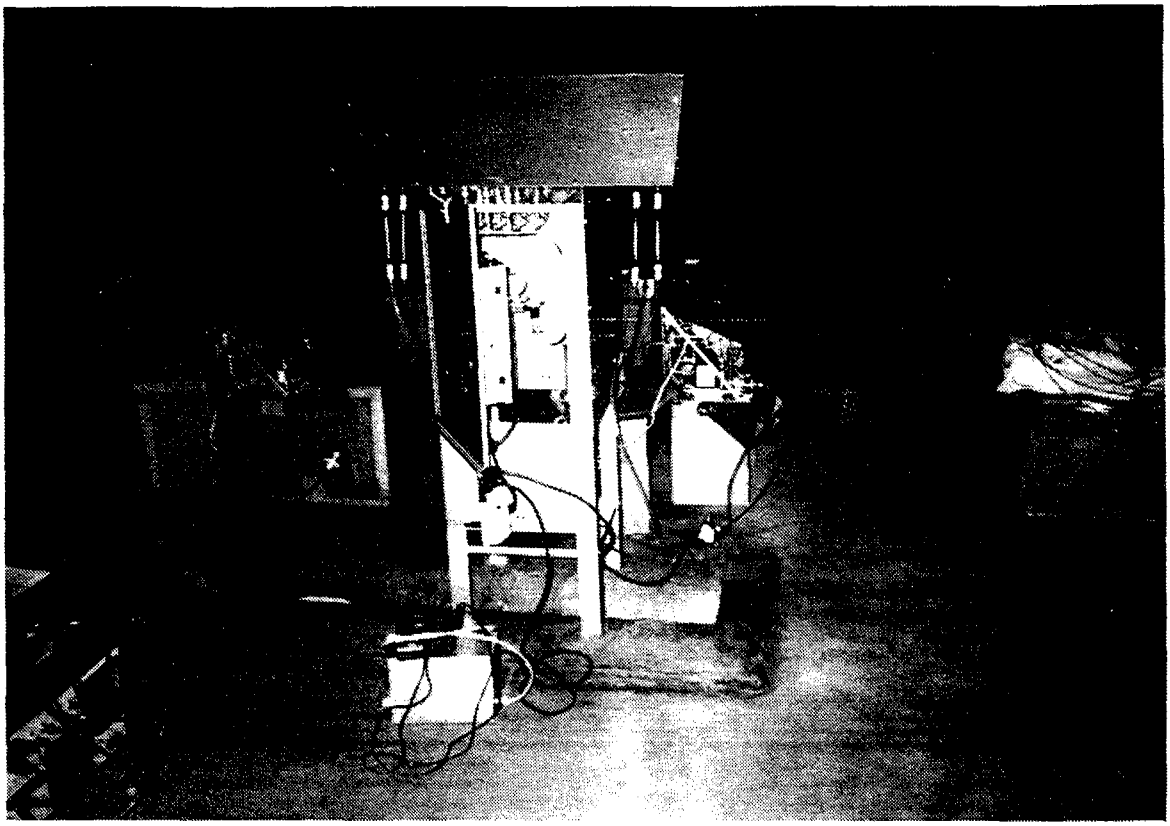

Figure 11. Tenax sampler, located in the exhaust duct over the ventilation louver.

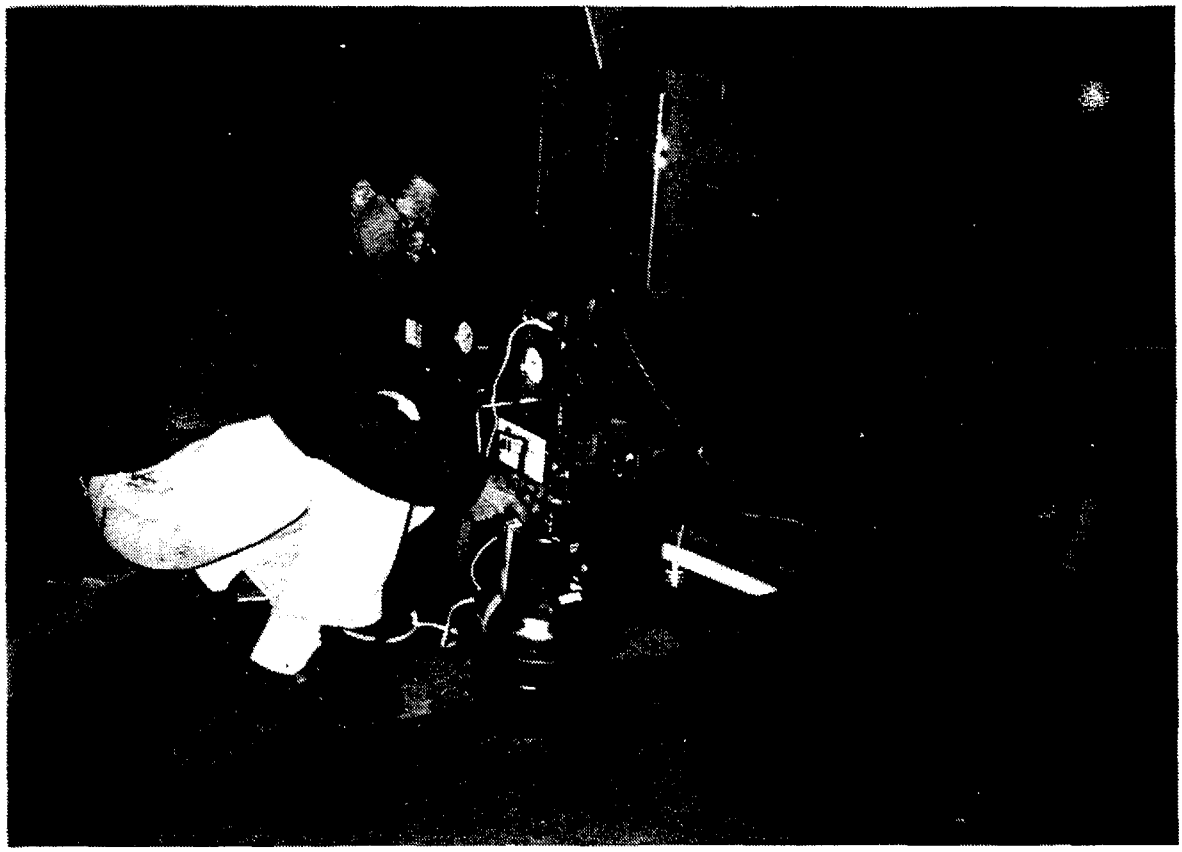

Figure 12. Canister sampler.

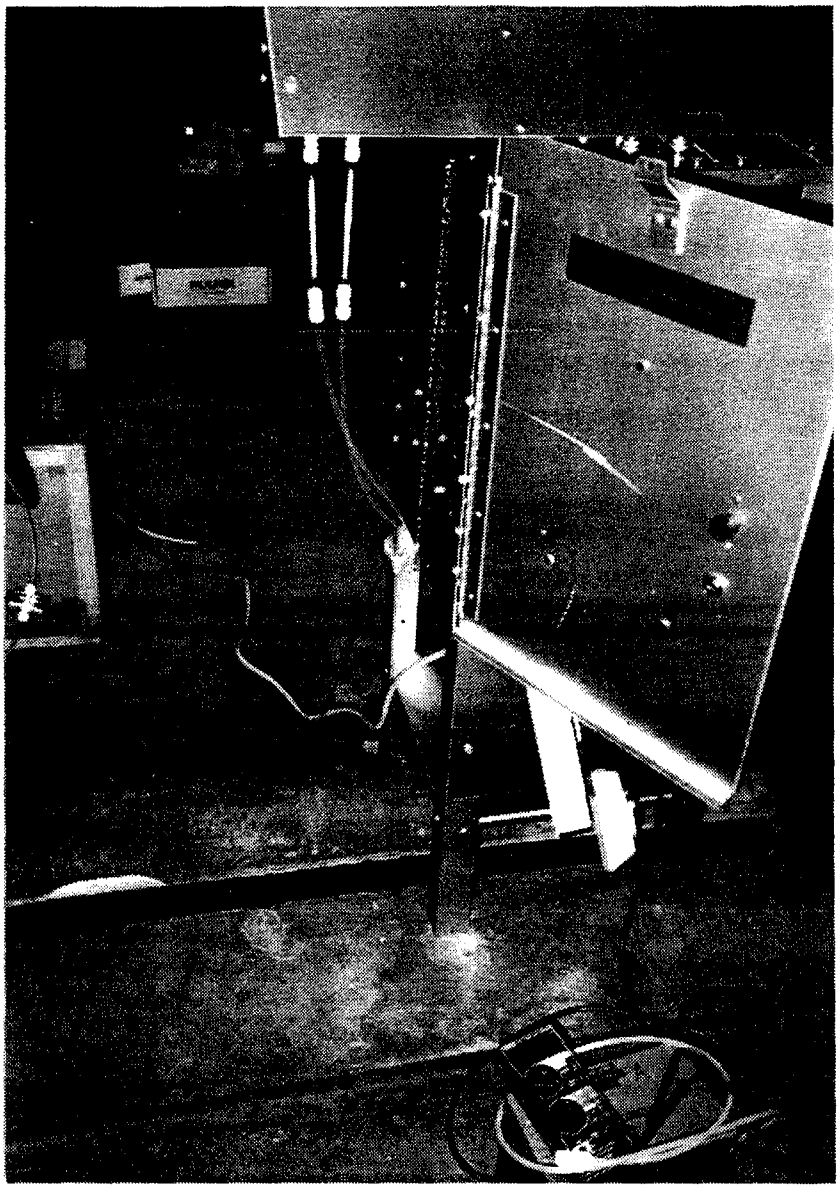

Figure 13. Tenax sampler with Teflon sampling lines.

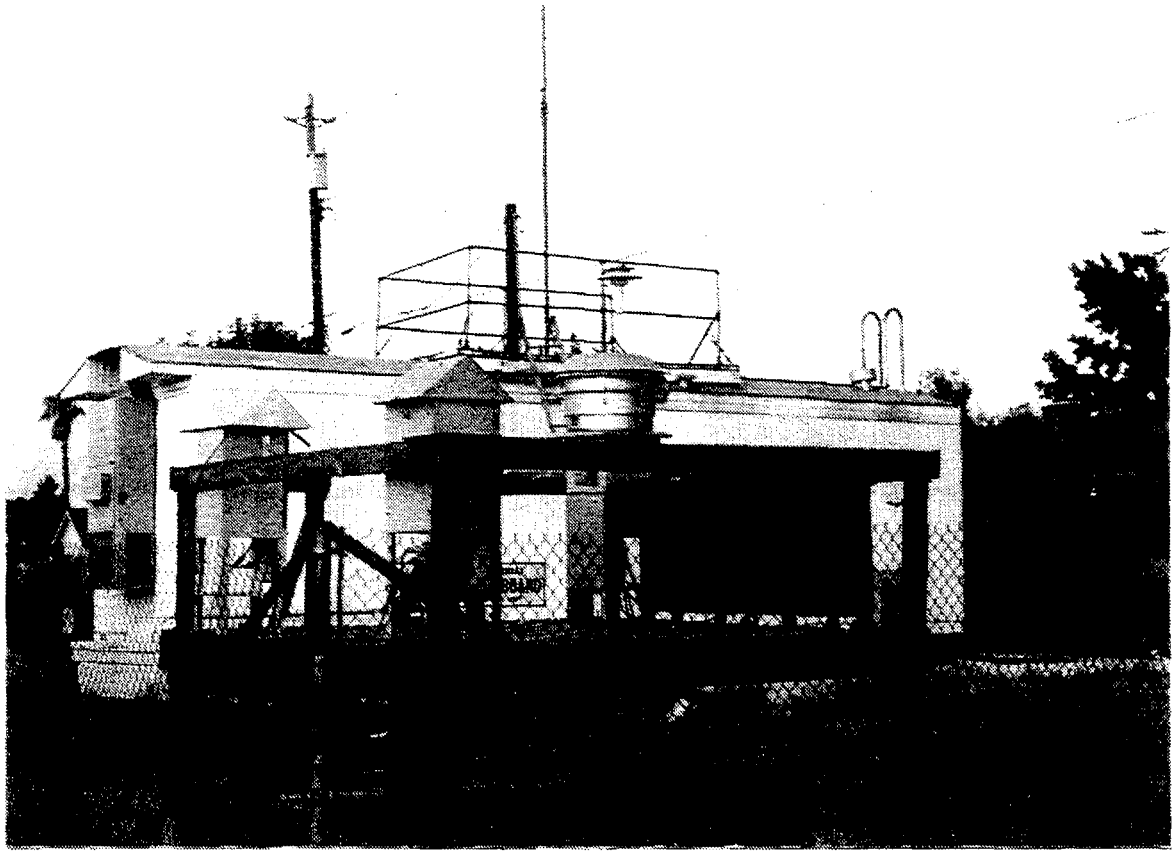

Figure 14. Oildale sampling site.

Los Angeles. The sampling in Los Angeles took place on August 21-24, 1991 (Wednesday, 0600 - Saturday, 1200). Two canister samplers and one Tenax sampler were located side by side at the South Coast Air Quality Management District monitoring station, located in Downtown Los Angeles at the Water and Power Utility building. Ambient Total Non-Methane Hydrocarbons (TNMHC) concentrations were routinely monitored at this station, using a Bendix 8202 instrument. Canister samples were collected by the ARB for TNMHC analysis every third day during the Summer of 1991. The sampling equipment was located on the second floor with the Teflon sampling lines extending through the window (see Figure 7). In addition, during the two last days of sampling (Friday and Saturday, August 23-24, 1991) canister samples were collected at three other locations, namely in Lincoln Park, on the grounds of the Southwest Museum, and on the roof of the Best Western Motel, located in Chinatown, Downtown Los Angeles (see Figure 4).

Two daily samples were collected during the hours of 0600 to 0800 and 1000 to 1200, over the four-day sampling period. Two collocated canister samples were also collected for QA purposes.

In summary, the 22 canister samples (4 days x 2 sampling periods + 2 days x 3 sampling sites x 2 sampling periods + 2 collocated samples) and 64 Tenax samples (16 samples (with and without filtering + 16 duplicate samples + 32 back-up cartridges) were collected in Los Angeles.

In total, 44 canister samples were collected for all sampling periods and sites (15 tunnel samples + 7 Oildale samples + 22 Los Angeles samples). From these 44, six canister samples served as duplicate, collocated samples. In addition, 184 Tenax cartridges were used during this study; half of these cartridges served as back-up cartridges to check for breakthrough and artifact peaks, and most of these were analyzed. From the remaining 92 cartridges, 46 cartridges served as duplicate samples and were analyzed in part by the GC/IRD/MS technique and the others were kept in a freezer until the end of this program.

3.0 CHEMICAL ANALYSIS OF FIELD SAMPLES

3.1 Analysis of Tenax Samples

Tenax samples were analyzed by the thermal desorption-cryogenic preconcentration method, followed by high resolution gas chromatographic separation and Fourier transform infrared/mass spectrometric detection (IRD/MSD) or flame ionization detection (FID) of individual hydrocarbons. The Chrompack Thermal Desorption-Cold Trap Injection (TCT) unit, which could be attached to either the GC/FID or the GC/IRD/MSD system, was used for the purpose of sample desorption and cryogenic preconcentration. Figure 15 shows the schematic of this unit.

Adsorbed compounds are thermally desorbed from a sampling cartridge and are transported by a carrier gas stream to a cold trap (5), typically a piece of fused silica capillary tubing (0.52 mm i.d.). This cold trap is precooled by liquid nitrogen from a Dewar vessel (6) to a minimum -170 °C. The fused silica capillary trap is then flash-heated and the desorbed sample is injected into the analytical column (7) connected to the cold trap by means of a glass-lined stainless steel tube (8) in a hexagonal nut (9). This way, the flow path of the sample is all glass or fused silica. A vent line with solenoid (11) and needle (12) valves is also connected to the hexagonal nut.

The cycle of desorption, trapping, and injection is automated. Before a cartridge is desorbed, the cold trap is cooled automatically for a preset time with the eight-port valve (13) in position I. After this time has elapsed, the system automatically switches to the desorption mode, the oven (4) is heated to a preset temperature, and the eight-port valve switches to position II, where the cooling of the trap continues for a preset time. After this time has elapsed, the system switches to the injection mode. The cooling of the cold trap is stopped, and the surrounding metal capillary is resistance-heated to a preset temperature within seconds. The eight-port valve (13) switches to position I and the carrier gas sweeps the sample into the capillary column (7). The separated components of the sample are then detected by a FID or MSD or combined IRD/MSD technique.

One tandem Tenax cartridge (front and back-up Tenax), from each sampling period and sampling location was analyzed by the GC/IRD/MSD technique (Hewlett Packard 5890II GC, 5970MSD and 5965B IRD) in order to identify individual hydrocarbons. A 60 m DB-1 capillary column (J&W Scientific., Inc) was used and the chromatographic conditions were as follows: initial column temperature 30 °C for 2 minutes followed by programming at 6 °C/min to a final temperature 290 °C and held isothermal for 5 minutes. Identification of individual components was made based on their retention times and mass spectra and infrared spectra matching those of authentic standards. If authentic standards were not available, the National Institute of Standards and Technology (NIST) mass spectral library (containing over 43,000 mass spectra) and U.S. EPA infrared spectra library were used for compound identification.

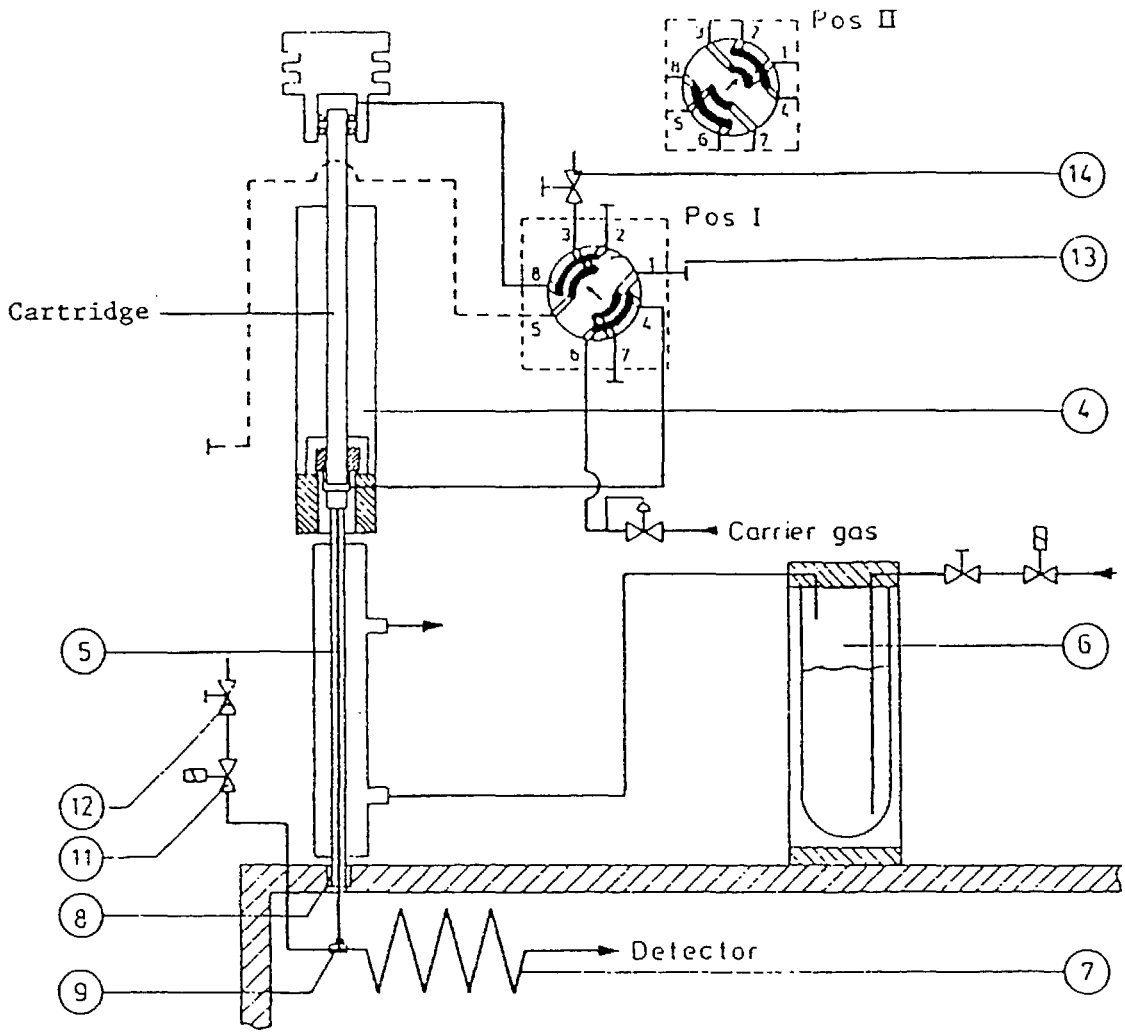

Figure 15. The Chrompack Thermal Desorption Cold Trap (TCT) Unit. See text for description.

The quantification of hydrocarbons collected on all remaining Tenax cartridges was accomplished by the GC/FID technique (HP 5890II GC with 3396A Integrator). The same DB-1 capillary column and the same GC conditions were employed. For calibration of the GC/FID, a set of standard Tenax cartridges was prepared by spiking the cartridges with methanol solution of standard SVHC. High-purity commercially available C9 to C18 aliphatic and aromatic hydrocarbons (Alltech) were employed for system calibrations. Ethylbenzene, 1,3,5-trimethylbenzene, n-dodecane, and n-tetradecane were used in the concentration range from ~7 - 8 ng/Tenax up to 200 - 300 ng/Tenax. The solvent was then removed with a stream of N_2 and the Tenax cartridges were thermally desorbed into the GC system, as described above. At least four concentrations of standard compounds were employed. Area response factors per nanogram of compound were calculated for each concentration and each hydrocarbon and then the response factors were averaged to give one factor for all hydrocarbons measured.

Identification of the species desorbed from Tenax cartridges was based on retention time comparison of the individual components in the chromatogram, identified earlier by the GC/IRD/MS technique.

3.2 Analysis of Canister Samples

The stainless steel canister samples were analyzed for volatile (< C12) hydrocarbons using the GC/FID technique, following U.S. EPA Method TO-14. These analyses were done in part by the AtmAA, Inc., laboratory (12 canisters from additional sampling sites in Los Angeles, namely from Lincoln Park, Southwest Museum, and Chinatown) and in part by the DRI laboratory (the remaining 30 canisters). Three canisters were analyzed by both laboratories, for QA purposes. Both laboratories analyzed canister samples by using high resolution capillary gas chromatography after cryogenic sample concentration.

3.2.1 Canister Analysis by the DRI Laboratory

The DRI laboratory uses the modified Chrompack Purge and Trap Injector (PTI), shown schematically in Figure 16, as a cryogenic trapping unit (the TCT unit described above is a part of this PTI unit and the switching between the two different methods of operation can be done in a matter of minutes). The modification of the original PTI unit involved the addition of a three-way solenoid valve for drawing gaseous samples into the injector, and another identical solenoid valve for line flushing before sampling (not shown in the Figure 1). Also, the purge vessel (1) with the frit (2) was replaced by a piece of glass tubing.

During the precool mode, the cold trap (5) is cooled with liquid nitrogen to the desired temperature (as described above for TCT) and the sampling line is flushed with the sample to be analyzed. When the PTI switches into purging mode, the extra added solenoid valve switches on and the gaseous sample can stream into the injector via the sample inlet. It passes through a glass tube fitted in the heated oven (4) and the cold trap (5). Organic compounds are trapped in this cold trap and the air escapes the system through the solenoid valve (11, open in the purge mode) and the needle valve (12). A pump is attached to this valve (kept in the fully open

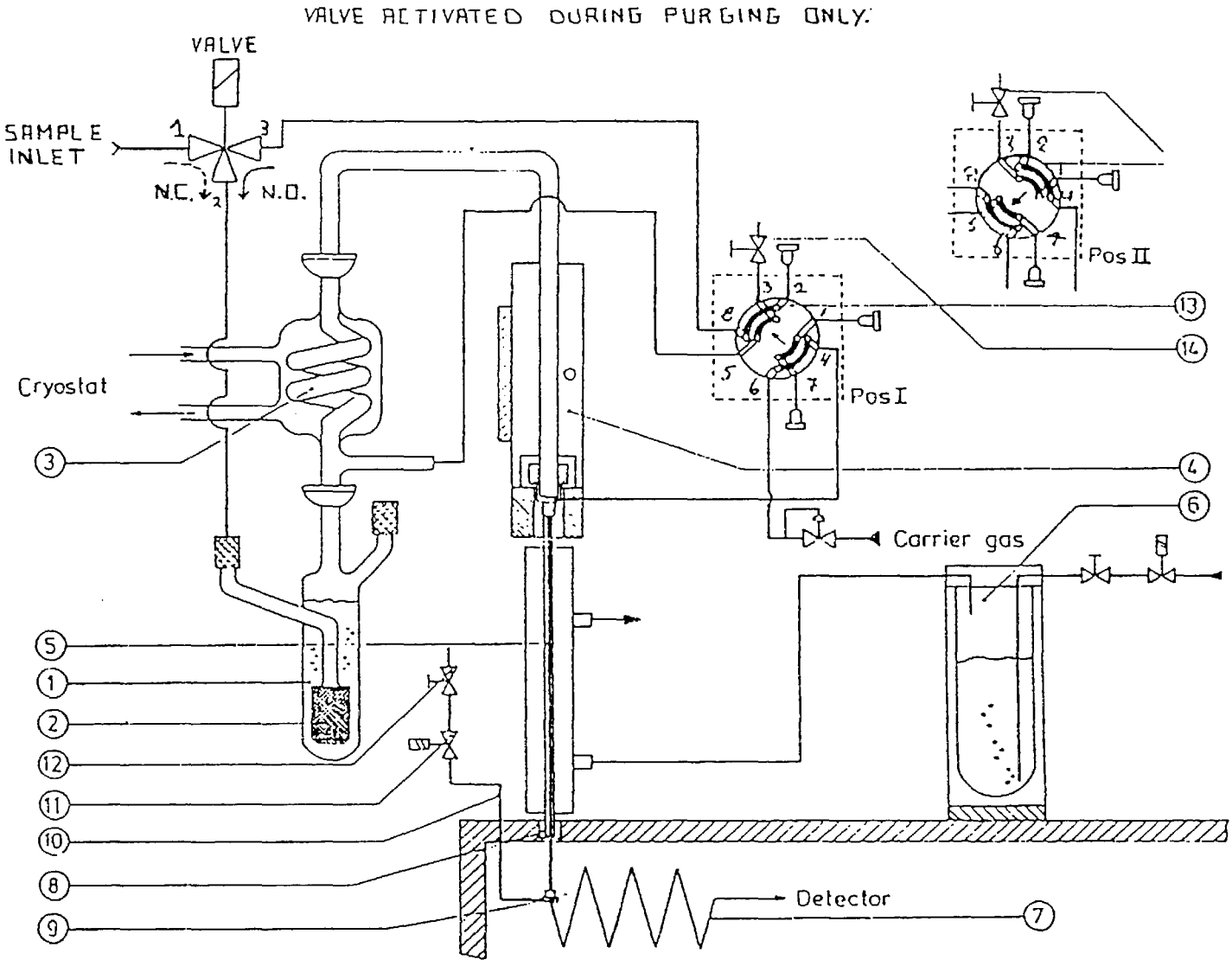

Figure 16. The Chrompack Purge and Trap Injector (PTI) unit with the modification for canister sampling.

position) and the flow is regulated by a mass flow controller, as shown in Figure 17. Next, the added solenoid valve switches to the "normally open" (N.O.) position and the PTI switches back to precool to allow the carrier gas to stream into the column and flush the system from the residual air through the needle valve (14). At the end of this time, the system switches to the injection mode, as described above for the TCT unit.

The piece of capillary column serving as a cold trap (approximately 30 mm long, 0.52 cm i.d.) can be easily replaced. A deactivated fused silica capillary tubing packed with glass wool was used as a cold trap for analysis of C4 to C12 hydrocarbons. Since this trap does not retain C2 and C3 hydrocarbons quantitavely, a piece of PoraPLOT Q capillary column (Chrompack) was used as a cold trap for analysis of these light hydrocarbons.

Figure 17 shows the schematic of the analytical system for canister sample analysis used by the DRI laboratory. As a detector, GC/FID, GC/ECD, GC/MSD, or GC/IRD/MSD can be used. Figure 18 shows the schematic of the calibration system for performing dynamic calibrations. Both systems shown in Figures 17 and 18 are recommended by U.S. EPA Method TO-14.

Stainless steel canister samples were analyzed by GC/FID only. A 50 m (0.32 id, 1.2 μm film thickness) CP-Sil 5 CB (Chrompack) capillary column was used and the chromatographic conditions were as follows: initial column temperature -30 °C held for two minutes followed by programming at 6 °C/min to 220 °C and at 10 °C/min to a final temperature of 260 °C and held isothermal for five minutes.

For C4 to C12 hydrocarbons, calibration was performed using Standard Reference Material 1805, i.e., 254 ppb benzene in air, purchased from NIST. Ultra high purity air was mixed with SRM 1805 in the calibration system shown in Figure 18 above, in an appropriate proportion to obtain benzene concentrations in the range of 5 to 200 ppbC. Measured volumes of this diluted standard were then injected into the system as described above (at least three points and humidified zero air), and an average area response factor for 1 ppbC of benzene was calculated. This response factor was then employed for calculating the concentrations of all C4 to C12 hydrocarbons detected.

For C2 to C3 hydrocarbons, an ethane and propane mixture in nitrogen (1 ppm each, Scott Specialty Gases) was employed for system calibration. The concentration of ethane and propane was verified against SRM 1805 and the calibration was performed as described above.

All analytical systems (i.e., GC/FID, GC/MSD, and GC/IRD/MSD) were checked for purity prior to analysis with humidified zero air and were certified clean (less than 0.2 ppbv of targeted VOC).

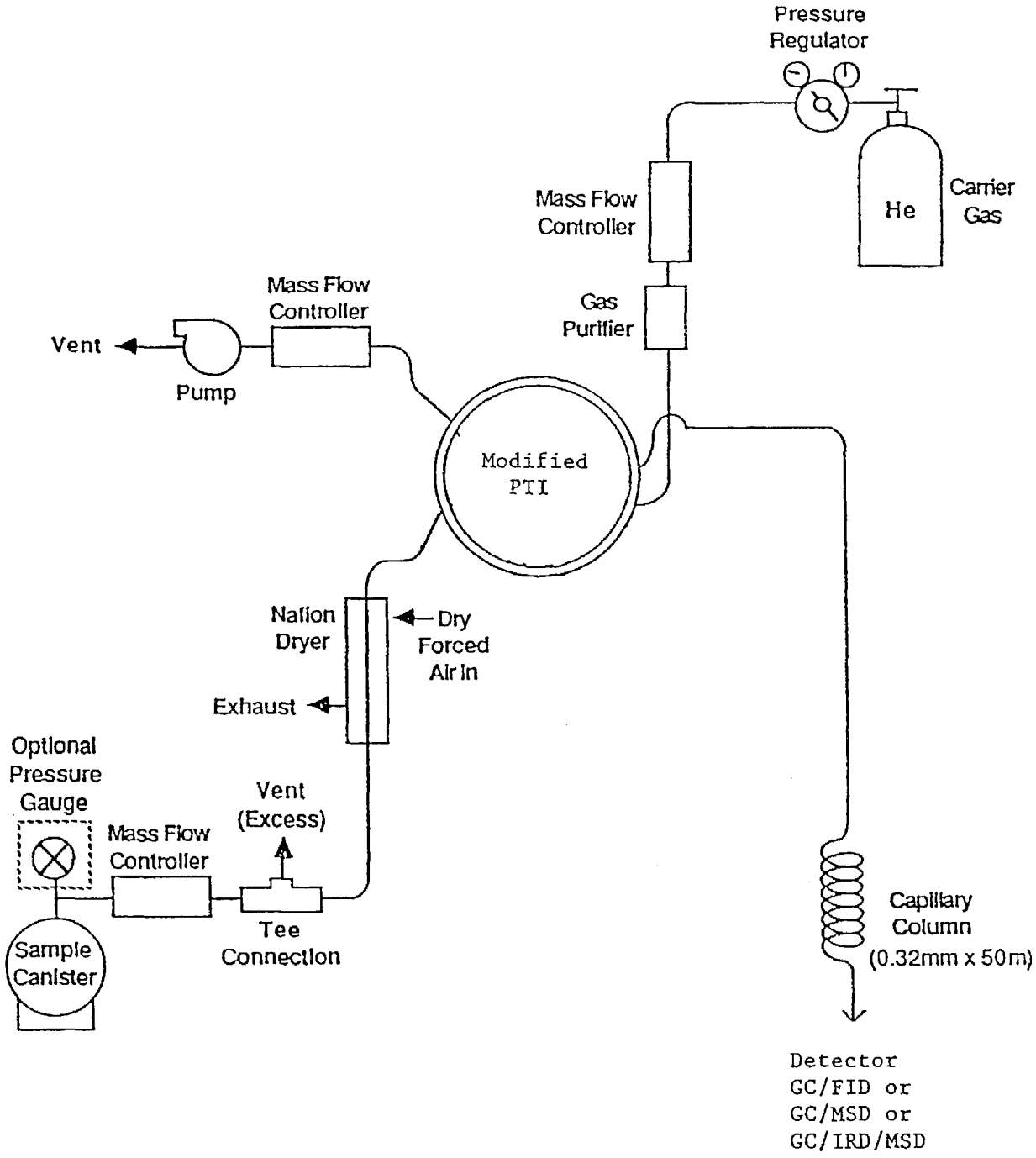

Figure 17. Schematic of analytical system for canister sample analysis.

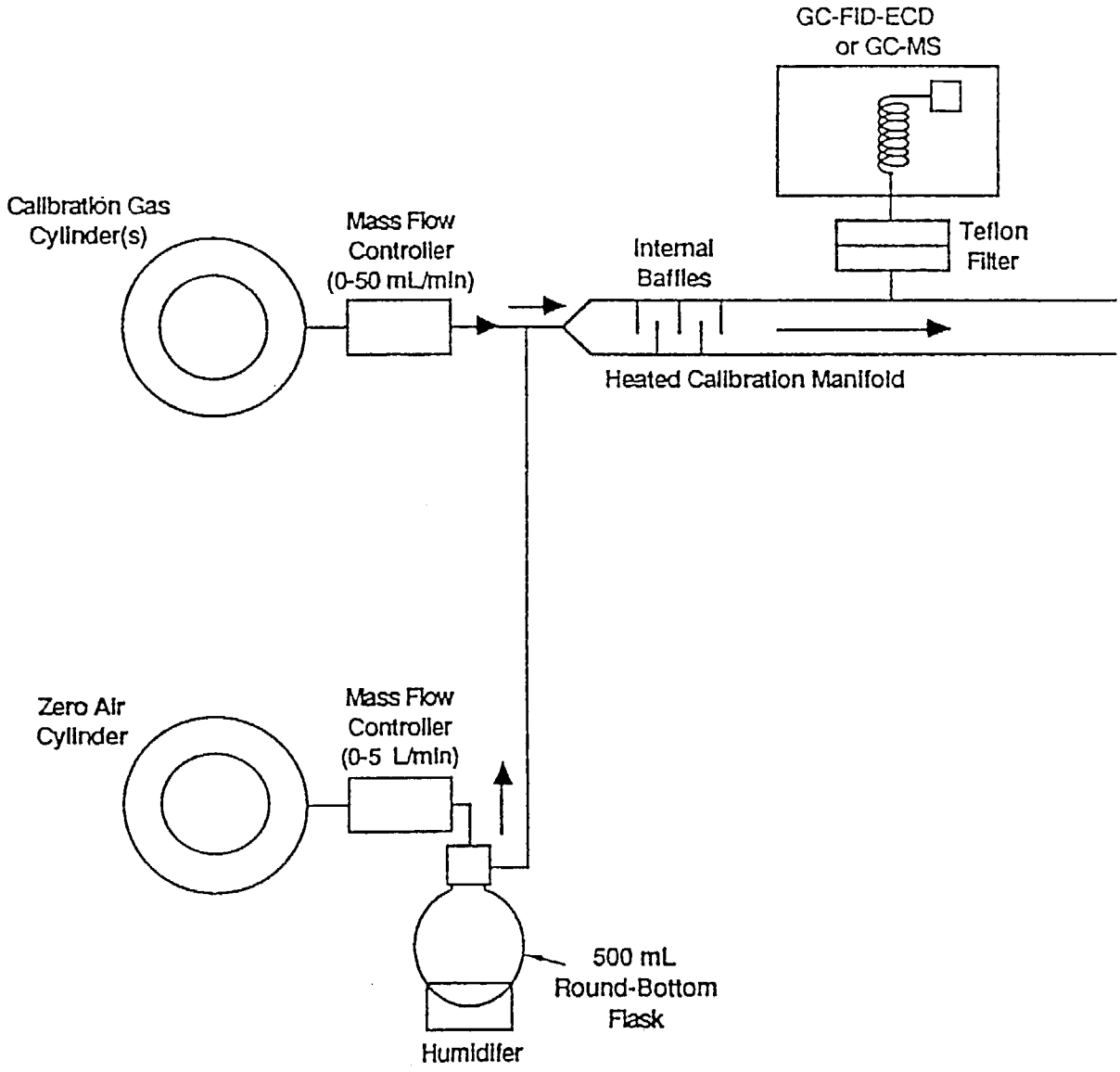

Figure 18. Schematic of calibration system and manifold for analytical system calibration.

3.2.2 Canister Analysis by AtmAA

Hydrocarbon speciation of whole air samples were analyzed by high resolution gas chromatography with cryogenic sample concentration. The sample concentration technique utilizing a freeze-out loop in conjunction with a rotary sampling valve followed the conventional approach (Singh, 1980; Grosjean and Fung, 1984). A sample aliquot in the range of 100 to 150 ml was transferred from the canister to an evacuated vessel with a known volume through a stainless steel freeze-out loop immersed in liquid argon. The exact sample volume was determined from the pressure change of the vessel using Ideal Gas Law. The trap was flash-heated with hot water, and via a valve switch the condensed NMHC were transfered into the gas chromatograph for analysis.

The analysis was accomplished using a new approach under development and evaluation at AtmAA for approximately three years. From a single sample aliquot, C2 to C8 hydrocarbons were separated with a 50-meter 0.32mm ID Al_2O_3/KC1 PLOT (Chrompack, Raritan, NJ), simultaneously with the separation of >C8 hydrocarbons using a 40-meter 0.18mm ID methyl silicone bonded capillary column (DB-1, J & W Scientific, Folsom, CA). This was accomplished by splitting the DB-1 column into two sections of approximately 10-m and 30-m in lengths. Using a Valco rotary valve, the effluent from the first (10-m) section of the DB-1 column could be diverted to either the PLOT column, or the second section of the DB-1. The first section provided the initial cut of the sample hydrocarbons. Hydrocarbons in the range of C2 to C8 eluting from the first section of the DB-1 column underwent further separation by the PLOT column. The valve was then switched at 4.7 min to allow the remaining hydrocarbons eluting from the first DB-1 column to continue on with the separation by the second DB-1 column. Separate flame ionization detectors monitored the species eluting from the columns. The GC operating conditions were:

isothermal at -30 °C for 2 minutes,
temperature programmed at 25 °C/min to 40 °C, then
at 4 °C/min to 100 °C,
at 9 °C/min to 195 °C, and
isothermal at 195 °C for 15 minutes

This analytical approach combines the advantages of Al_2O_3 PLOT column with those of the methyl silicon column. The PLOT column provides excellent separation of C2 to C8 hydrocarbons, with clear classification of alkenes from alkanes. However, its performance on higher molecular weigh hydrocarbons is limited by its low maximum temperature limit of 200 °C. On the other hand, the methyl silicone column can only partially separate the C2 hydrocarbons at -60 °C. Thus traditionally, a complete hydrocarbon speciation requires two separate measurements, one for the C2 components, another for remaining species. The current approach accomplishes the job in one measurement, requiring only approximately 35 minutes of analysis time. Another advantage is that the analysis can be done with the oven starting at an ambient temperature.

The detector response was calibrated with a NIST 254 ppb benzene and cross checked with a NIST 9.7 ppm propane standard. However, all data were reported on a ppbC basis based on the benzene calibration, as are commonly done.

During September, 1991, AtmAA participated in an interlaboratory comparison conducted by William Lonneman of the U.S. EPA, Gas Kinetics and Photochemistry Research Branch using an audit mixture with 18 certified compounds (15 alkanes from C2 to C8: ethane, propane, isobutane, n-butane, isopentane, n-pentane, 3-methylpentane, n-hexane, n-heptane, and n-octane; and three aromatics: benzene, toluene, and o-xylene) in a canister prepared from a NIST traceable mixture in cylinder CC83778. The excellent agreements in the results indicated that there were no deficiencies with AtmAA's approach. Except for n-octane, which the method yielded a lower value, all other reported values compared well with the designated concentrations and Lonneman's own analyses, which were performed before and after AtmAA's.

3.3 Additional Analysis

All canister samples collected during field work were analyzed for total NMHC and for CO/CO_2. The U.S. EPA Methods 25 and TO-12 (PDFID technique) were used for these analyses and they were performed by AtmAA.

For PDFID technique, a modified gas chromatograph with flame ionization detector with a restrictor consisting of 2 m blank fuse silica capillary tubing in place of the regular GC column (to prevent the detector flame from blowing out during sample introduction via valve switching) was used. The analysis requires drawing a fixed-volume portion of the sample air (~100 ml) at a low flow rate through a trap cooled to approximately -180 °C with liquid argon. The cryogenic trap collects and concentrates the NMHC while allowing methane, nitrogen, oxygen, and other non condensable trace gases to pass through the trap into an evacuated vessel. The volume of sample passing through the trap was determined from the pressure change of the vessel using Ideal Gas Law. Next, the helium (He) carrier gas flow at ~ 1 ml/min is diverted to pass through the trap to flush the residual air and methane. When the FID baseline restabilizes, the cryogen is removed and the temperature of the trap is raised to ~90 °C with hot water. The organic compounds revolatilize from the trap and are carried into the FID, resulting in a response peak. The area of the peak is integrated and this value is translated to concentration units via a previously obtained calibration curve, using the NIST benzene standard (254 ppb). In the analysis, AtmAA used hydrogen carrier. Nitrogen and helium carriers were evaluated and found to produce the same results. The reason was that low hydrogen carrier flow was used and that the detector response was optimized with hydrogen carrier.

The U.S. EPA Method 25 requires the catalytic conversion of volatile organic compounds to CO_2, followed by the catalytic reduction of CO_2 to CH_4 and detection of CH_4 by the FID. The process of oxidation followed by reduction is used to account for any differences that may exist in the detector response to the components of the real ambient sample (for example, oxygenated or halogenated compounds versus alkanes or alkenes). To eliminate the interferences from CH_4 and CO_2, a column is used to trap the NMHC while CH_4 and CO_2 are being separated. The column temperature is then raised and the column is backflushed to the detector for quantification of the total NMHC trapped. A typical chromatogram from this analysis is shown in Figure 19. Thus, in addition to TNMHC values, the concentrations of CH_4, CO, and CO_2 are also determined by this technique.

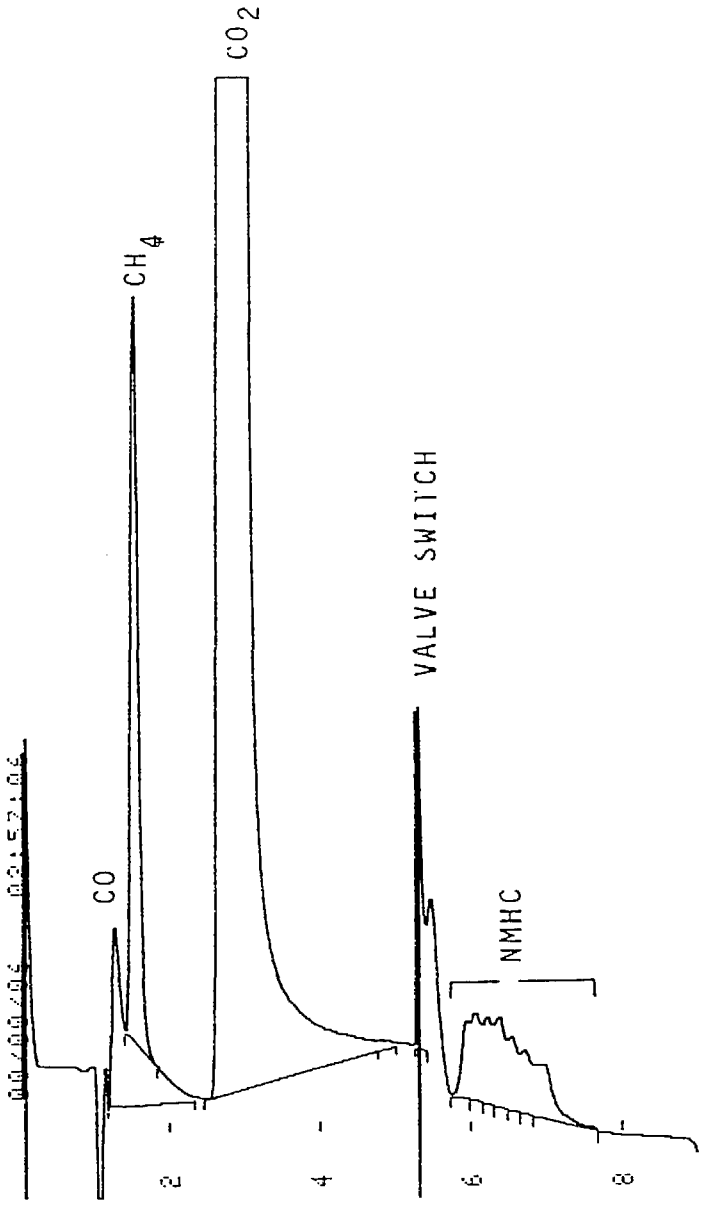

Figure 19. Determination of Nonmethane Hydrocarbon using EPA Method 25.

4.0 RESULTS

4.1 Compound Identifications

4.1.1 Canister Samples

The results from the GC/FID analysis of canister samples collected at the Caldecott Tunnel, Oildale, and Los Angeles are shown in Appendix A. Tables A1 through A32 show the volume concentrations of individual hydrocarbons in parts per billion (ppbv) and in ppbC (ppb value was obtained by dividing the ppbC value by the number of carbon atoms in the hydrocarbon compound). Identification of the individual species was based on the comparison of the linear retention time indices (RI) with those RI values calculated from the data obtained on ambient air samples by other laboratories, mostly with Dr. William Lonneman's data (U.S. EPA, Atmospheric Research and Exposure Assessment Laboratory). The respective retention indices were calculated from the relationship suggested by Van Den Dool and Kratz (1963):

$$RI = 100z + 100 \left[\frac{t_{rx} - t_{rz}}{t_{rz+1} - t_{rz}} \right]$$

where t_{rx} is the measured retention time of the substance for which the retention index is to be determined, t_{rz} and t_{rz+1} are the measured retention times of the bracketing standards that elute before and after the compound of interest, and z is the number of carbon atoms in the hydrocarbon bracketing standard that elutes prior to the compound of interest. Normal paraffins, starting from n-butane up to n-undecane, present in almost all chromatograms, were used as bracketing standards.

The RI values calculated from Dr. Lonneman data are obtained from the analysis of a typical urban sample (Azusa-Fresno-Sacramento composite sample, SJVAQS/AUSPEX hydrocarbon comparison sample) and are shown in Table A33. Although the agreement between the EPA RI values and the DRI RI values is not ideal (typically within ± 2 units), these RI values are very helpful in compound identification. The discrepancies are most likely due to the different capillary columns used by both laboratories (the Chrompack CP-Sil 5, used by the DRI laboratory, although supposedly equivalent to the DB-1 used by the EPA laboratory, has different phase thickness, length, and inside diameter), as well as slightly different chromatographic conditions. The agreement between RI calculated solely from the DRI data is, as can be seen from Tables A2 through A32, much better (within ± 1 unit).

In addition, the identity of compounds eluting between ethylbenzene and naphthalene was confirmed by comparison with retention times of standard compounds and by comparison of mass spectral and infrared data obtained from the analysis of Tenax cartridges.

Tables A1 through A32, in addition to showing the concentrations of individual hydrocarbons, show the concentration of total non-methane hydrocarbons (TNMHC), obtained by summing the concentrations of individual components. Also, the total concentrations of aromatic compounds, paraffins, and olefins is shown as well as the sum of concentrations of individual compounds past 1,2,3-trimethylbenzene (for comparison with Tenax data). Tables A34 through A46 show the results of analysis of canister samples collected at Lincoln Park, Southwest Museum, and the Best Western (Chinatown) in Los Angeles.

4.1.2 Tenax Cartridges

As mentioned above in Section 3.1, one tandem of Tenax cartridges (a front cartridge and a back-up cartridge) from each sampling period and sampling location was analyzed by the GC/IRD/MSD technique in order to identify individual hydrocarbons. The other two Tenax tandem cartridges (one collecting filtered and one unfiltered air) were analyzed by the GC/FID technique in order to quantify individual hydrocarbons. Since, as will be discussed later, no significant difference was observed between filtered and unfiltered Tenax samples, these pairs of Tenax samples are treated as collocated samples.

The analysis of back-up cartridges indicated no significant breakthrough of ethylbenzene (C8-aromatic with the lowest retention time) and higher eluting hydrocarbons. However, the concentrations of toluene and n-octane on the back-up Tenax were usually significant. Thus, ethylbenzene is the first hydrocarbon for which a concentration is reported from Tenax.

The analysis of back-up cartridges, in addition to the evaluation of breakthrough, allowed for the assessment of the contribution of Tenax artifact peaks and background peaks to the concentrations of quantified compounds. Since both front and back-up Tenax were treated exactly the same way during storage and transport time (each front and back-up pair was stored together in one culture tube) and since no significant concentrations of compounds eluting past ethylbenzene were observed on back-up Tenax, any peak quantified on the back-up Tenax was treated as a background peak and its concentration was subtracted from the concentration of the corresponding compound present on the front Tenax. In addition, all background compounds present on back-up cartridges were identified by the GC/IRD/MSD technique.

The identification of individual hydrocarbons by the GC/IRD/MSD technique was based on the comparison of mass spectra and infrared (ir) spectra with those of authentic standards (when available) or with mass and spectra libraries. Figures 20 and 21 below show the total ion chromatogram (TIC) obtained from the analysis of a Tenax cartridge spiked with a mixture of aromatic and aliphatic hydrocarbon standard compounds. A procedure used for compound identification in collected Tenax samples is described in greater detail below, using a Caldecott Tunnel Tenax sample as an example.

Caldecott Tunnel. Figure 22 shows a fragment of the total ion chromatogram (TIC), from 9 minutes to 15 minutes, of the Tenax sample collected in Caldecott Tunnel on Thursday, June

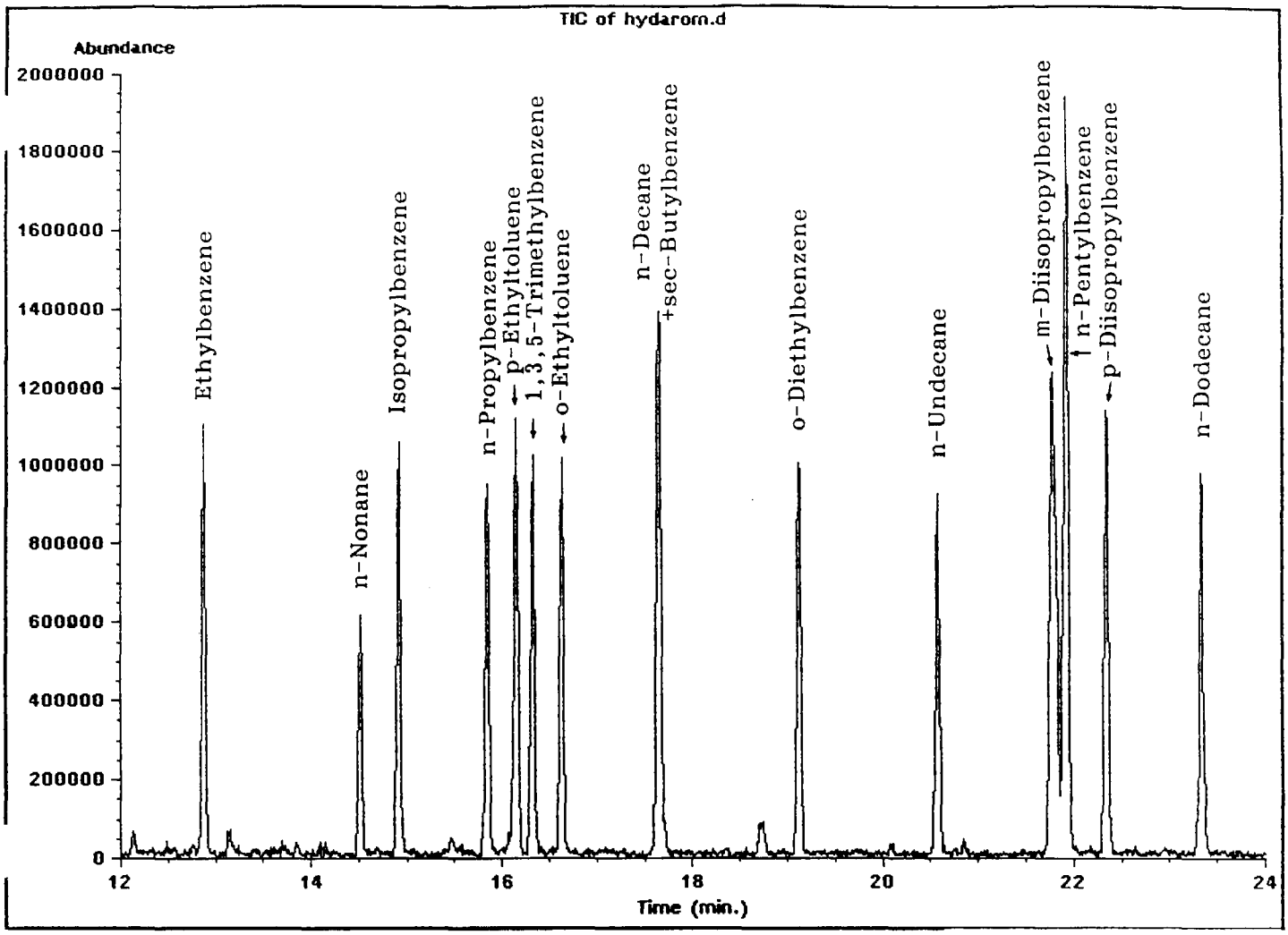

Figure 20. A fragment of the TIC, from 12 to 24 minutes of the mixture of aromatic and aliphatic hydrocarbon standards.

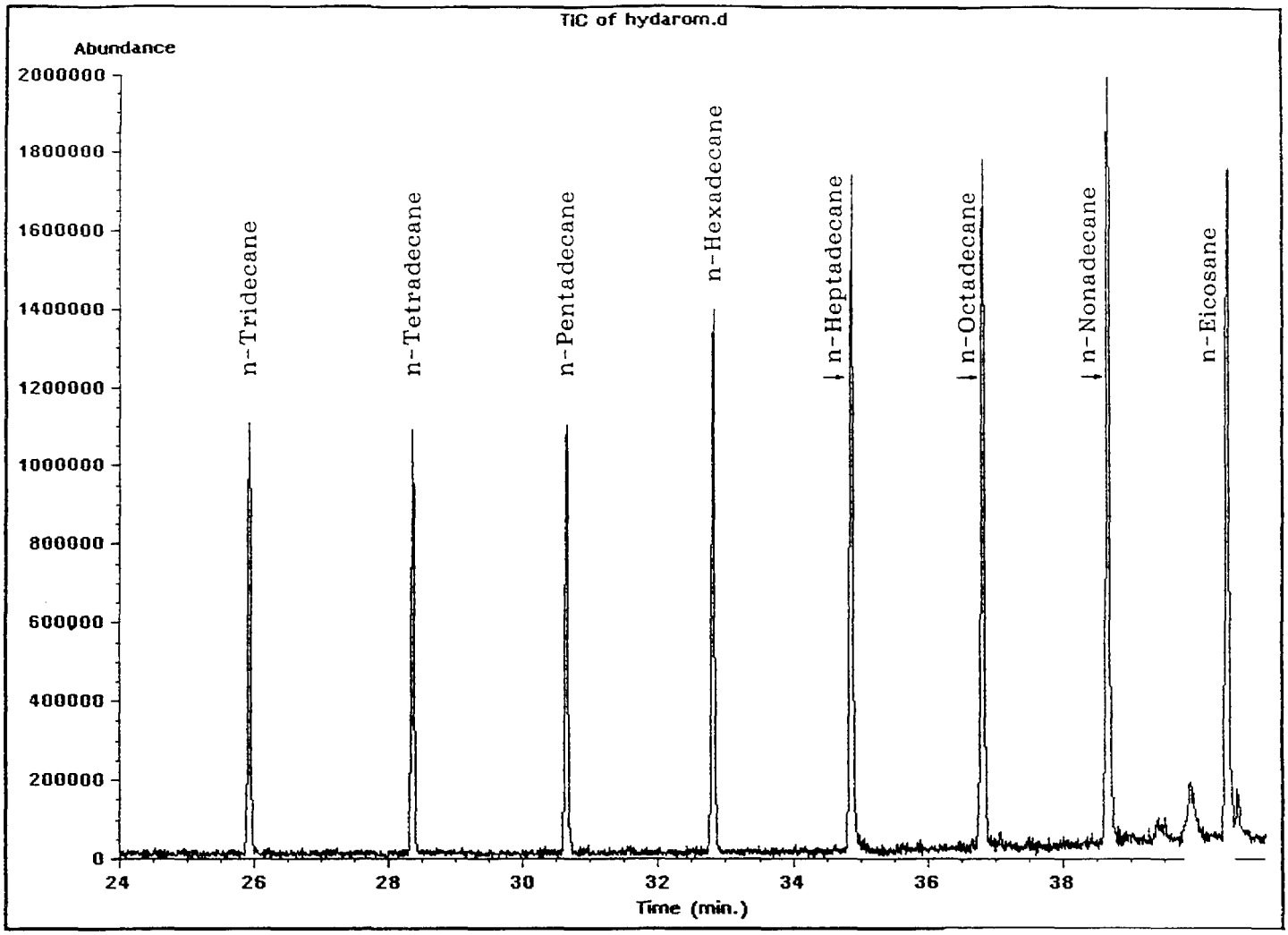

Figure 21. A fragment of the TIC, from 24 to 41 minutes of the mixture of aromatic and aliphatic hydrocarbon standards.

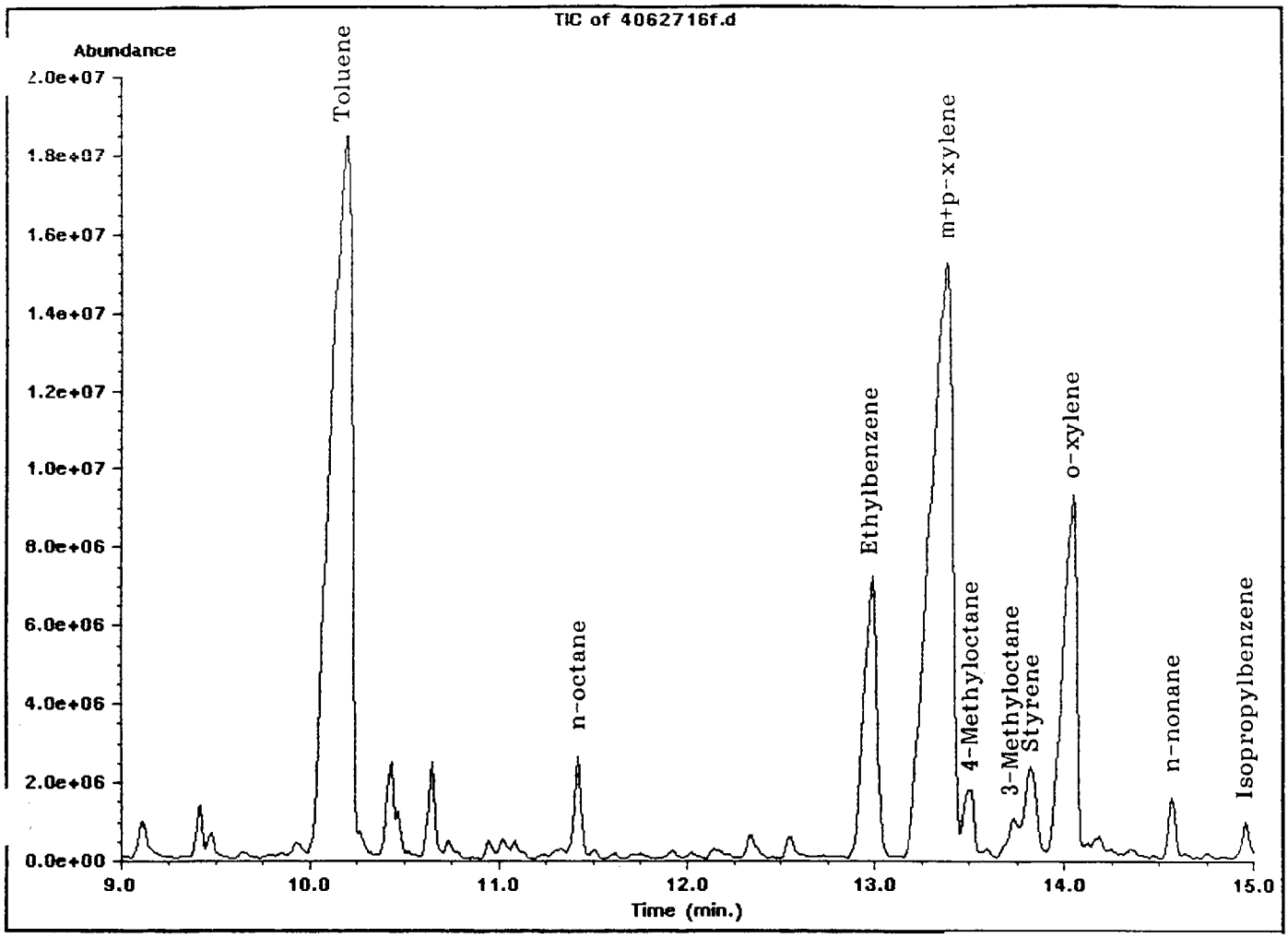

Figure 22. A fragment of the TIC, from 9 to 15 minutes, of the Tenax sample collected in the Caldecott Tunnel on June 27, 1600-1800 hours.

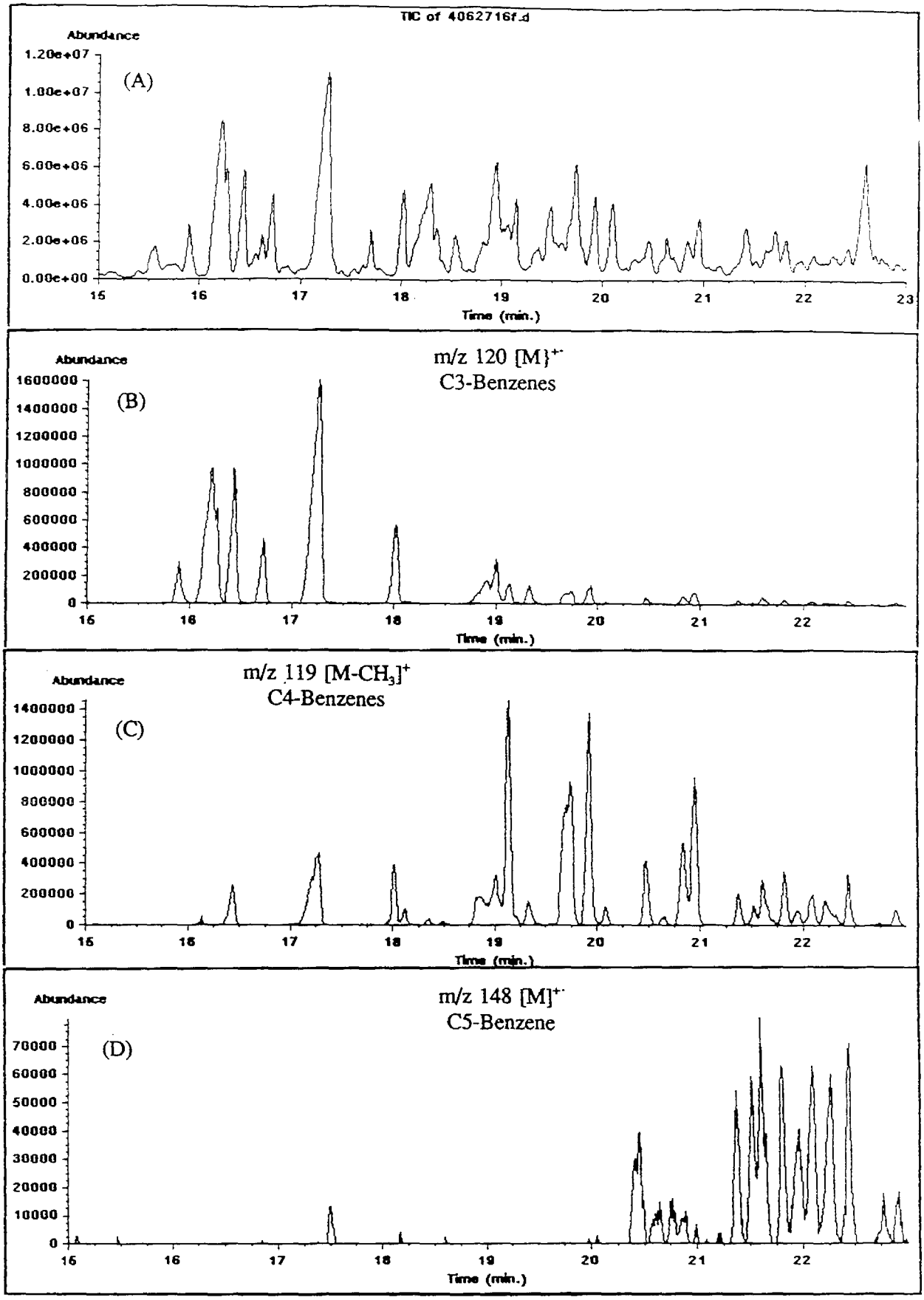

Figure 23. A fragment of the TIC (A) from 15 to 23 minutes and corresponding ion fragmentograms for: (B) molecular ion $[M]^{+\cdot}$ of C3 substituted benzene isomers; (C) $[M\text{-}CH_3]^+$ fragment ion of C4-benzene isomers; and, (D) $[M]^{+\cdot}$ ion of C5-benzene isomers.

27, from 1600 to 1800 hours (without filtering). As mention above, ethylbenzene is the first-eluting quantified compound. Figure 23 shows a fragment of the TIC from 15 to 23 minutes (Figure 23A) and corresponding ion fragmentograms for the following ions: m/z 120, the molecular ion ($[M]^{+\cdot}$) for C3-substituted benzene isomers (Figure 23B); m/z 119, the $[M\text{-}CH_3]^+$ fragment ion characteristic for C4-substituted benzene isomers (Figure 23C); and m/z 148 $[M]^{+\cdot}$ ion for C5 substituted benzene isomers. Figure 24 shows the same portion of the TIC (Figure 24A) and ion fragmentograms for m/z 132 $[M]^{+\cdot}$ ion for 2,3-dihydromethylindene isomers (Figure 24B); m/z 117, $[M\text{-}CH_3]^+$ fragment ion characteristic for these compounds and $[M\text{-}H]^+$ fragment ion characteristic for propenylbenzene or 2,3-dihydroindene; m/z 115, $[M\text{-}H]^+$ characteristic for indene or propynylbenzene (Figure 24C); and m/z 128, molecular ion of naphthalene (Figure 24D). The full mass spectra and FTIR spectra corresponding to all these peaks were carefully examined and compared with both mass spectral and infrared library data.

For example, Figure 25 shows mass spectra of two C4-substituted benzene isomers, eluted at 20.84 and 20.95 minutes. The mass spectra are essentially identical, and although the comparison with the mass spectral library shows only that these compounds are tetramethylbenzene isomers, the FTIR data, shown in Figure 26, allowed for these isomers' identification as 1,2,4,5- and 1,2,3,5-tetramethylbenzene, respectively. Figure 27 shows the mass spectra of compounds eluted at 18.35, 18.52, and 21.71 minutes, identified as propenylbenzene (or 2,3-dihydroindene), indene, and 2,3-dihydromethylindene, respectively. Figure 28 shows the comparison of the mass spectra from Figure 27 with mass spectral library data. However, it has to be emphasized that the identification of most of these compounds is tentative only, because it is based on comparison with mass spectral and, in some cases, infrared library data, and not on the comparison with authentic standards. In addition, the infrared spectral library is much more limited than the mass spectral library (~3000 entries as opposed to ~40,000 entries).

Figure 29 shows the same fragment of the TIC from 15 to 23 minutes, but with peak assignments, done as discussed above.

Figure 30 shows the next fragment of the TIC, from 23 to 39 minutes (Figure 30A) and corresponding ion fragmentograms for the following ions: m/z 142, the molecular ion ($[M]^{+\cdot}$) for 2- and 1-methylnaphthalene (Figure 30B); m/z 156, the $[M]^{+\cdot}$ ion for dimethylnaphthalene isomers (Figure 30C); and m/z 154 $[M]^{+\cdot}$ ion for biphenyl (Figure 30D). Figure 31 shows the same portion of the TIC (Figure 31A) and ion fragmentograms for m/z 57 fragment ion, characteristic of saturated aliphatic hydrocarbons (paraffins) (Figure 31B); m/z 178, molecular ion of phenanthrene (Figure 31C); and m/z 146 $[M]^{+\cdot}$ ion for dihydrodimethylindene isomers. Figure 32 shows the mass spectra of compounds eluting at 21.52 minutes, 24,79 minutes and 27.47 minutes, identified as 1,3-diethyl-5-methylbenzene, 2,3-dihydrodimethylindene and biphenyl, respectively. Figure 33 shows the comparison of these mass spectra with mass spectral library matches.

Figure 34 shows the same portion of the TIC, from 23 to 39 minutes with peak assignments. The assignment for normal paraffins (from C15 to C18) was based mostly on the comparison of corresponding retention times (RT) with those RT of authentic standards, since

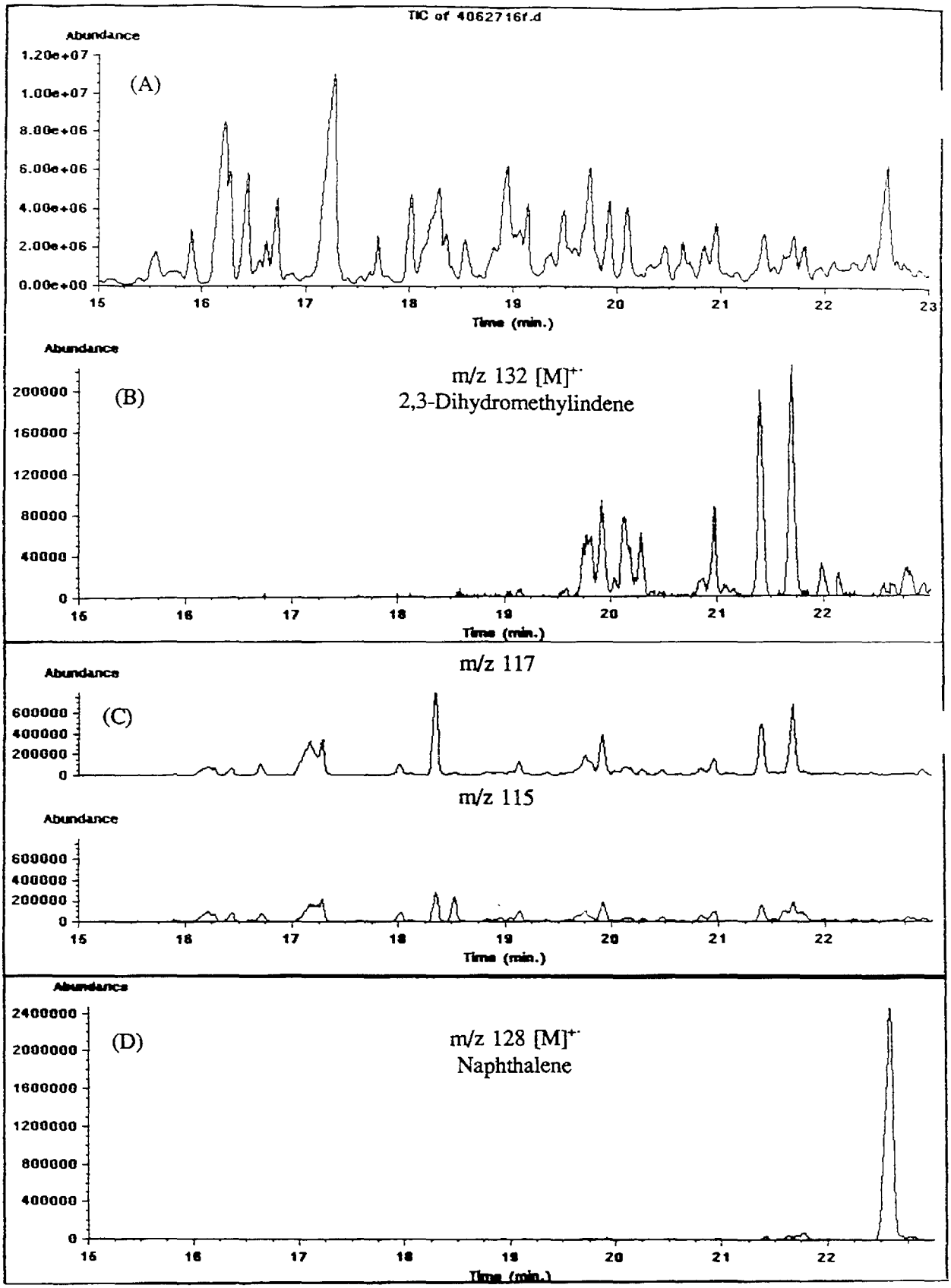

Figure 24. A fragment of the TIC (A) from 15 to 23 minutes and corresponding ion fragmentograms for: (B) $[M]^{+\cdot}$ of 2,3-dihydromethylindene isomers; (C) m/z 117 and m/z 115 fragment ions; and, (D) $[M]^{+\cdot}$ of naphthalene.

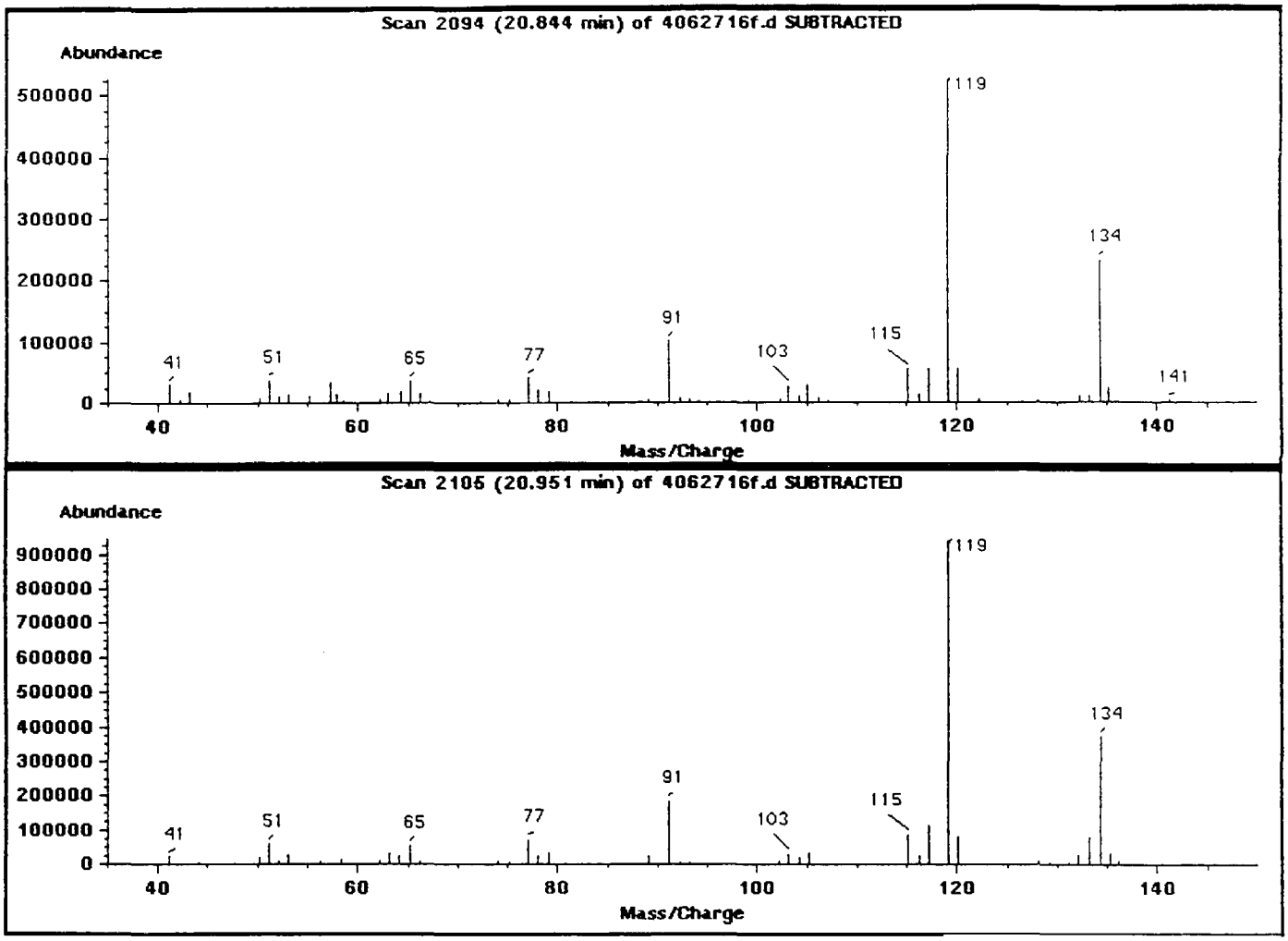

Figure 25. Mass spectra of two C-4 substituted benzene isomers eluting at 20.84 minutes and 20.95 minutes.

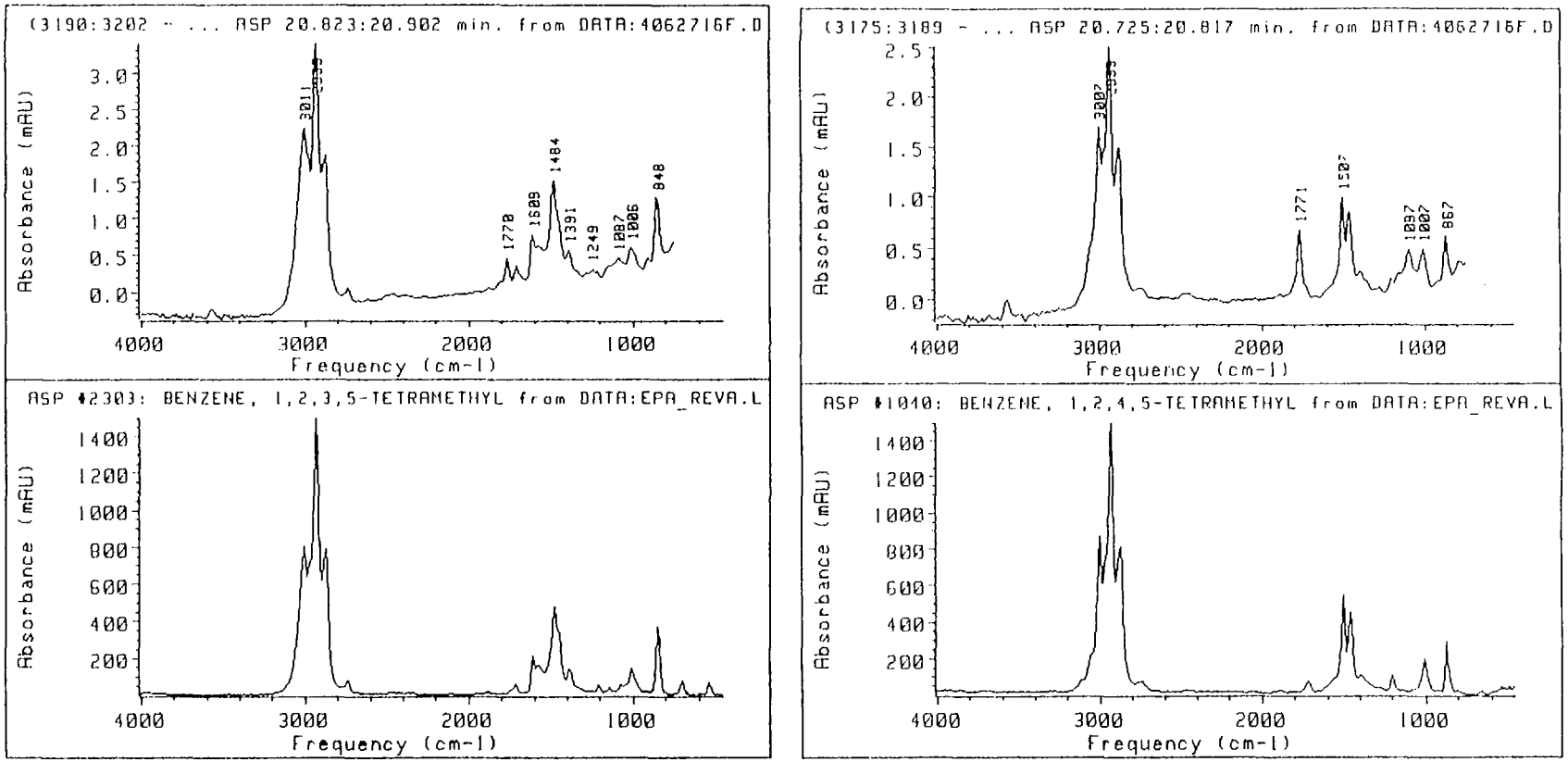

Figure 26. IR spectra of two C-4 substituted benzene isomers, shown in Figure 25.

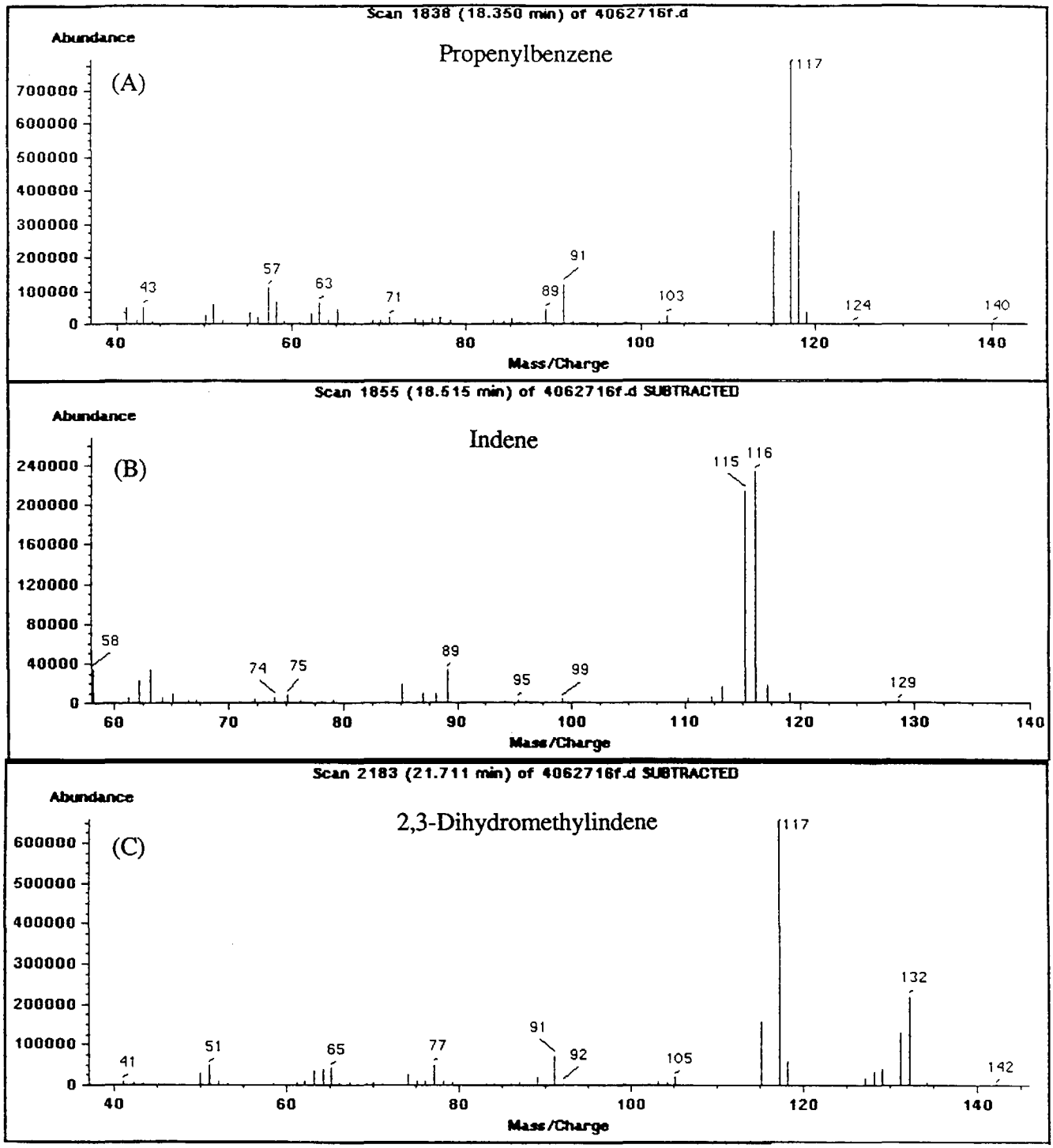

Figure 27. Mass spectra of compounds identifial as propenylbenzene, indene, and 2,3-dihydromethylindene.

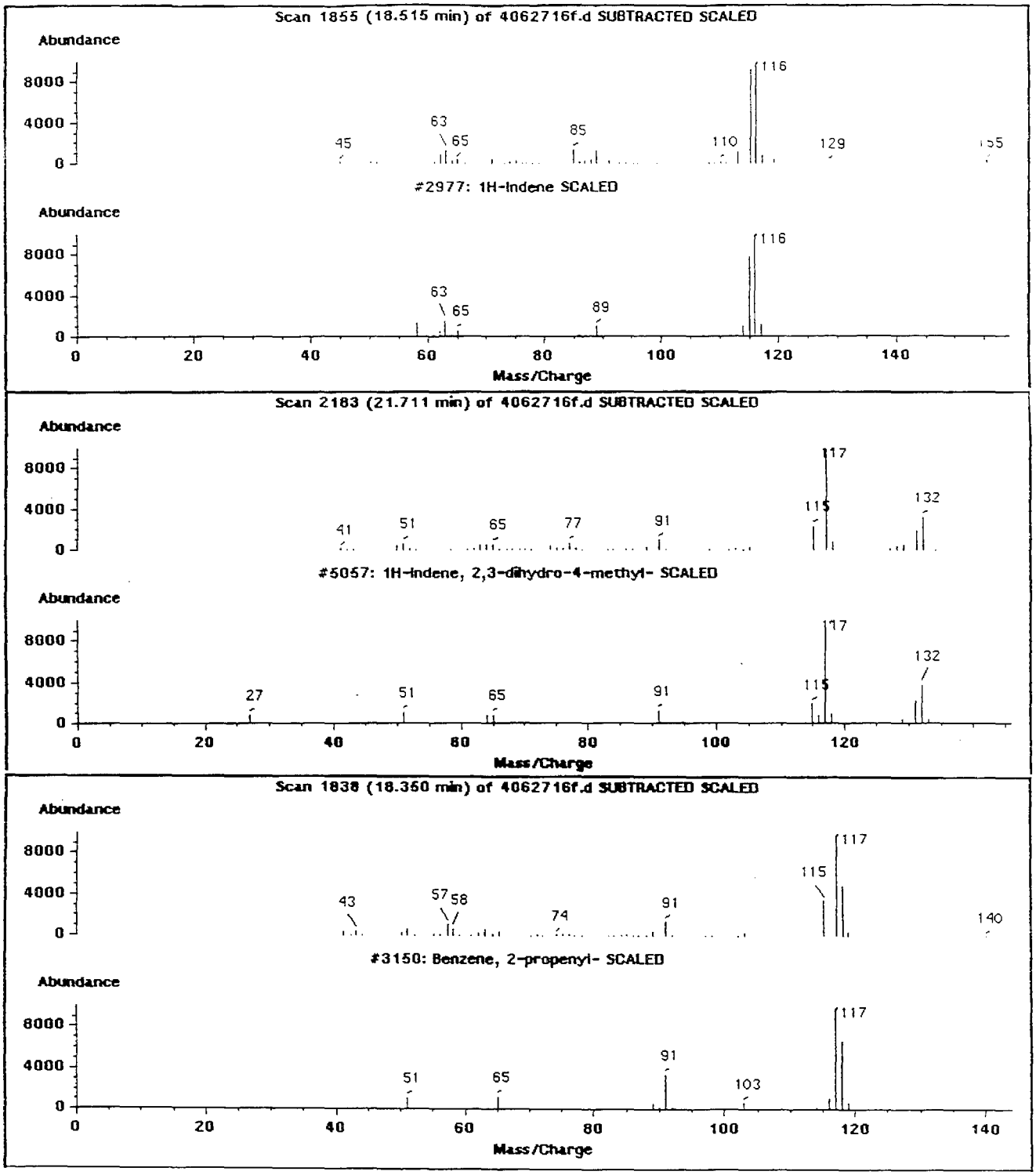

Figure 28. The comparison of mass spectra from previous figure (Figure 27) with mass spectral library matches.

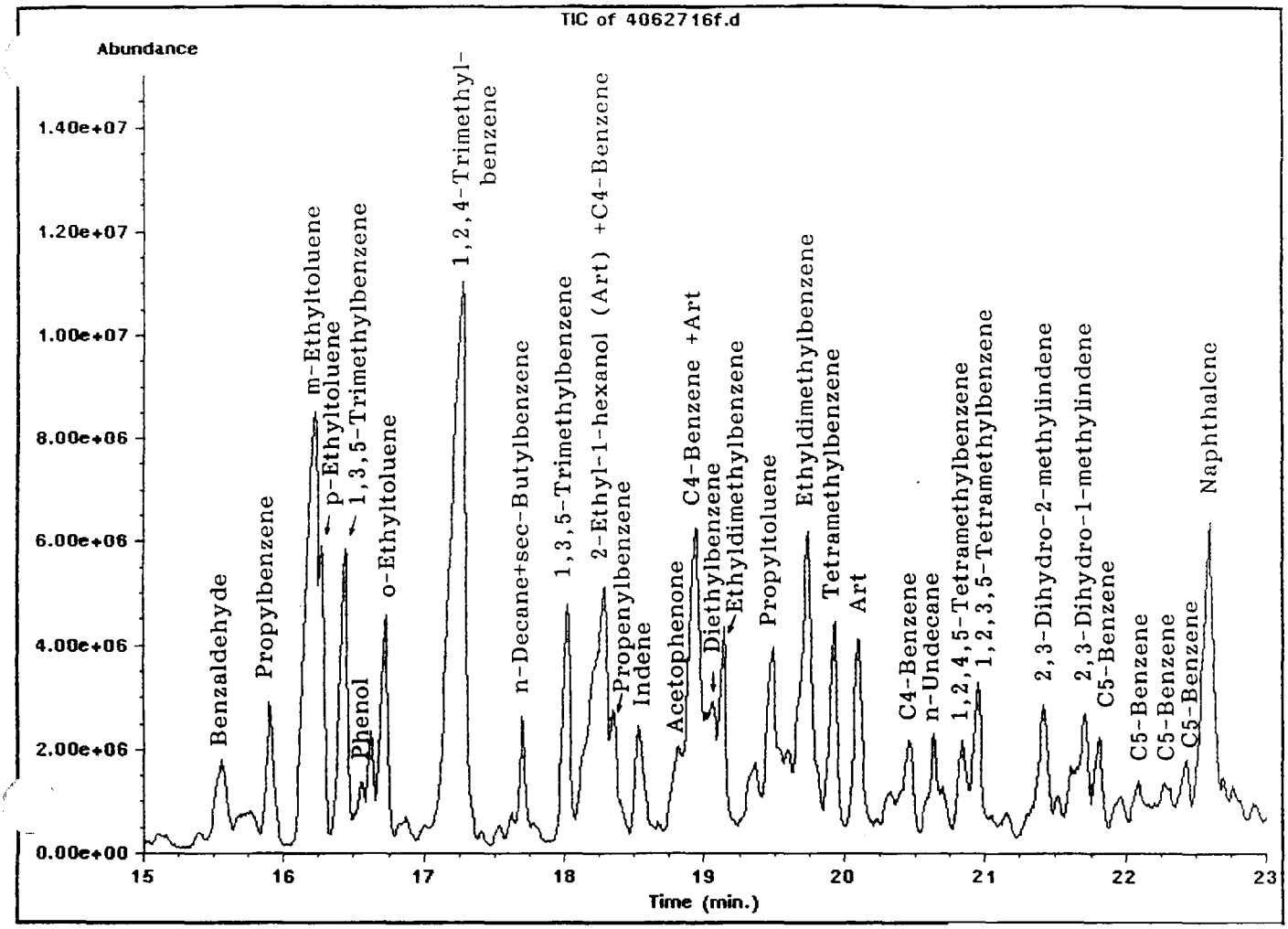

Figure 29. A fragment of the TIC, from 15 to 23 minutes, of Tenax sample collected in the Caldecott Tunnel on June 27, 1600-1800 hours.

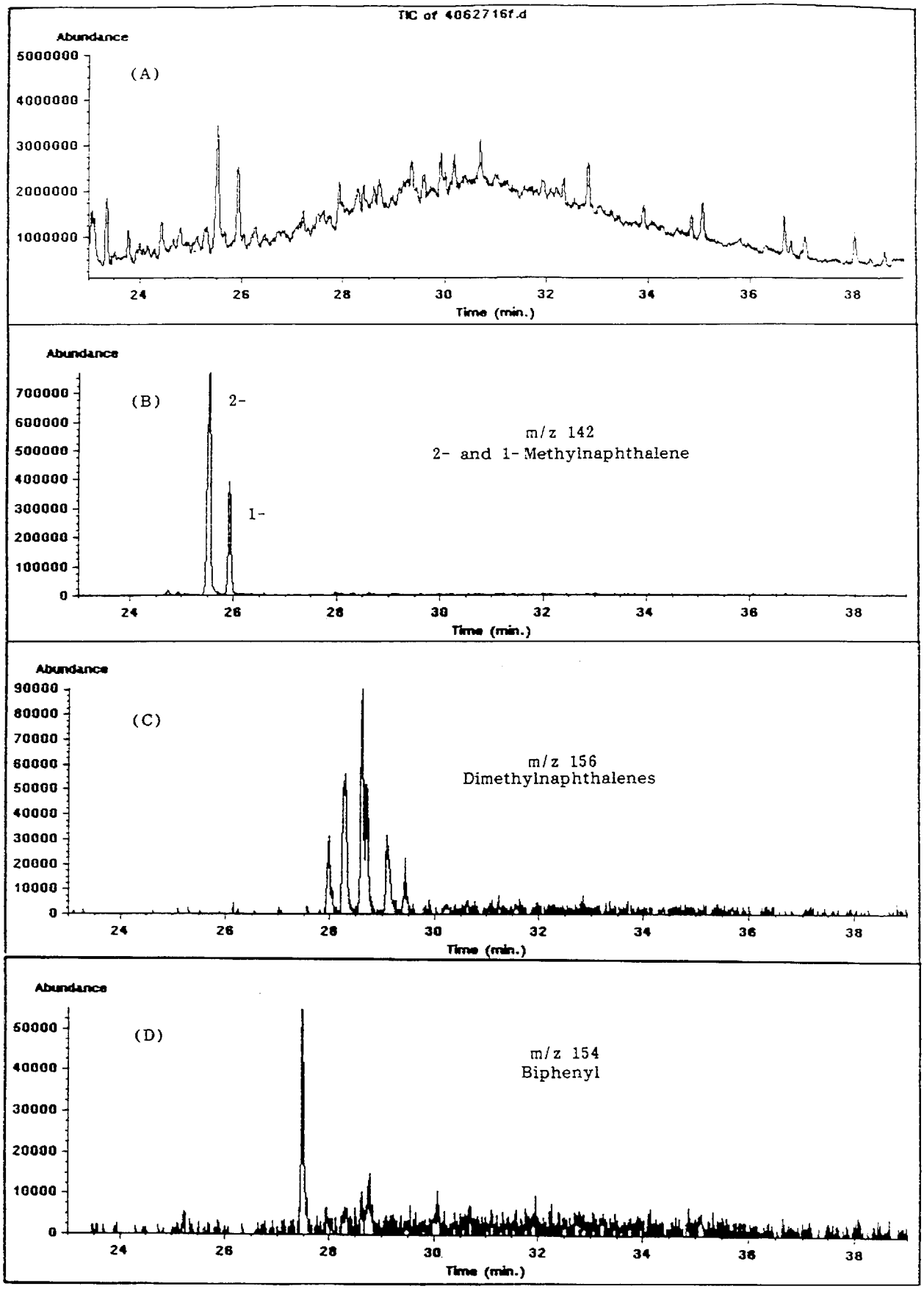

Figure 30. A fragment of the TIC (A) from 23 to 39 minutes and corresponding ion fragment grams for: (B) $[M]^{+\cdot}$ of 1- and 2-methylnaphthalenes; (C) $[M]^{+\cdot}$ dimethylnaphthalene isomers; (C) $[M]^{+\cdot}$ of biphenyl.

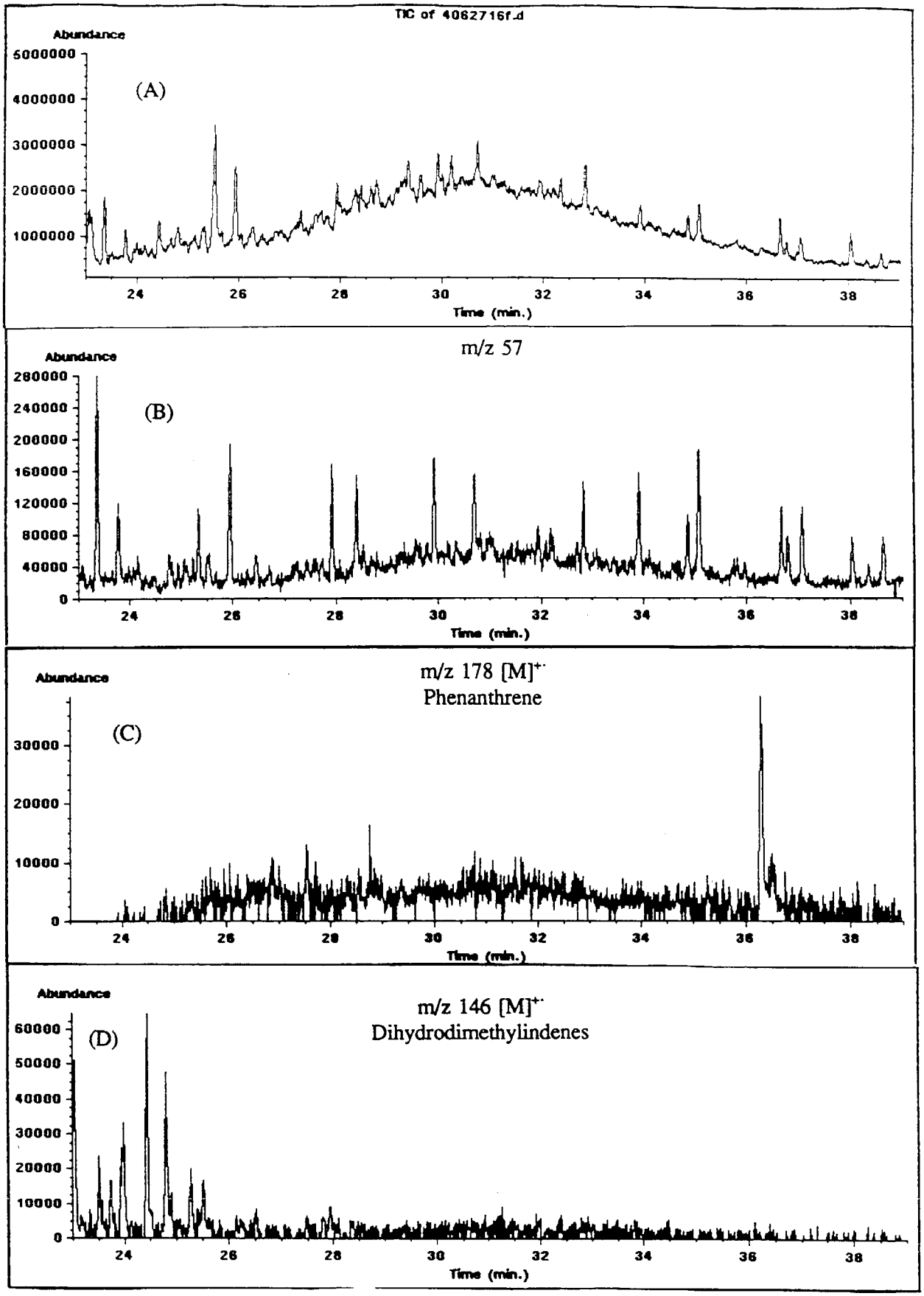

Figure 31. A fragment of the TIC (A) from 23 to 39 minutes, and corresponding ion fragmentograms for: (B) m/z 57 fragment ion; (C) $[M]^{+\cdot}$ of phenanthrene; (D) $[M]^{+\cdot}$ of dihydrodimethylindene isomers.

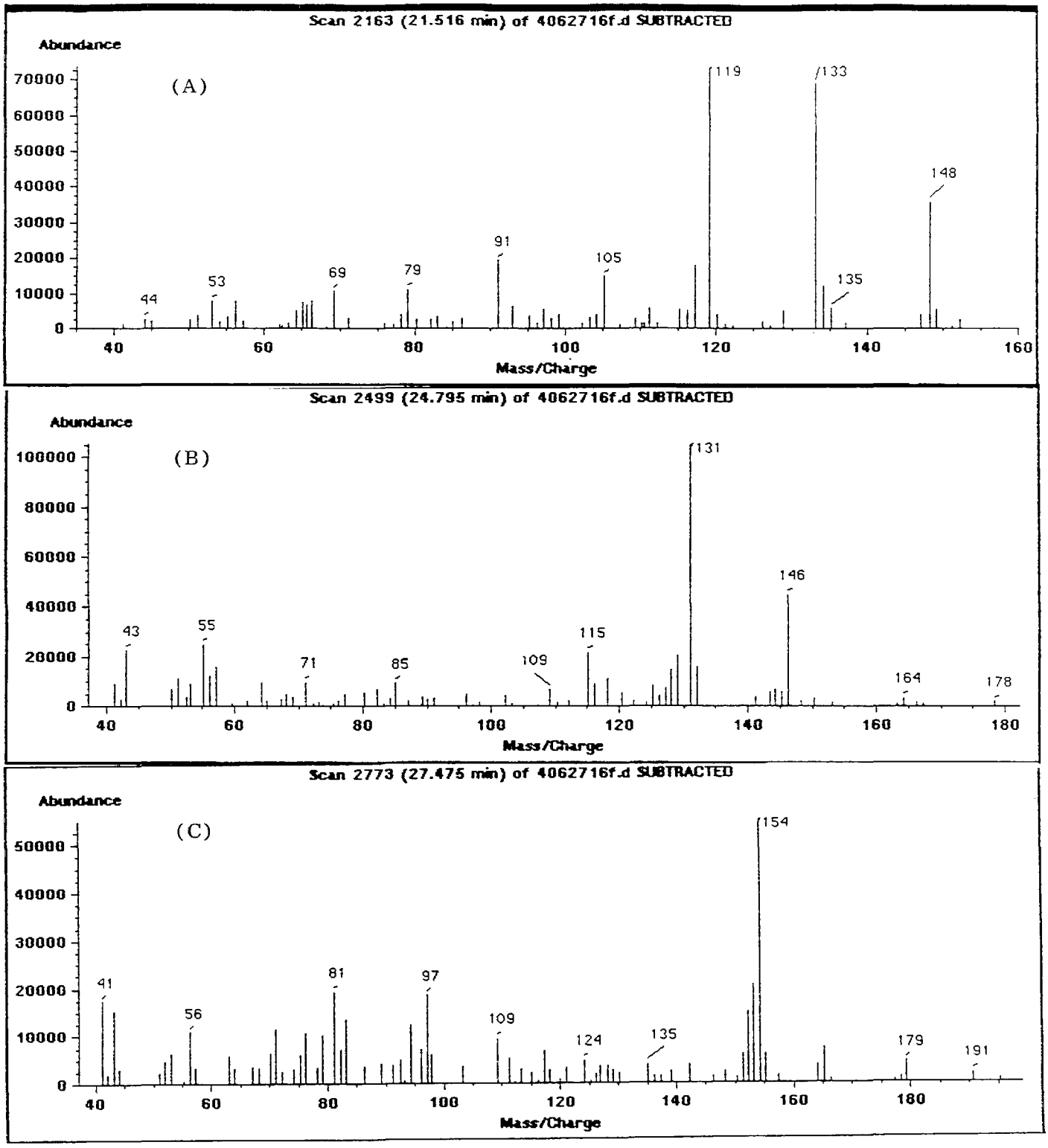

Figure 32. Electron impact mass spectra of compounds identified as: 1,3-diethyl-5-methylbenzene (A); 2,3-dihydrodimethylindene (B); and biphenyl (C).

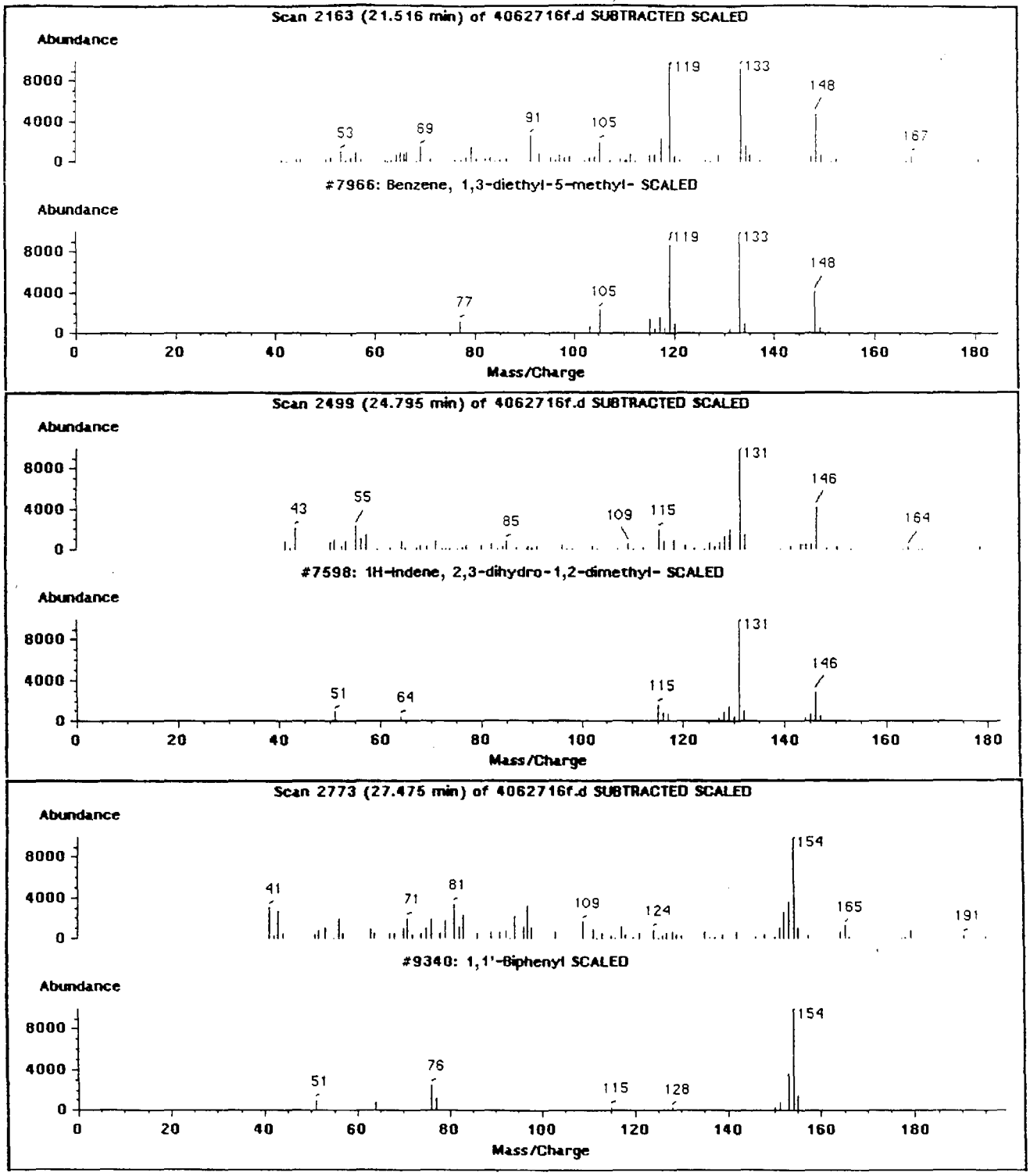

Figure 33. The comparison of mass spectra from Figure 31 with mass spectral library matches.

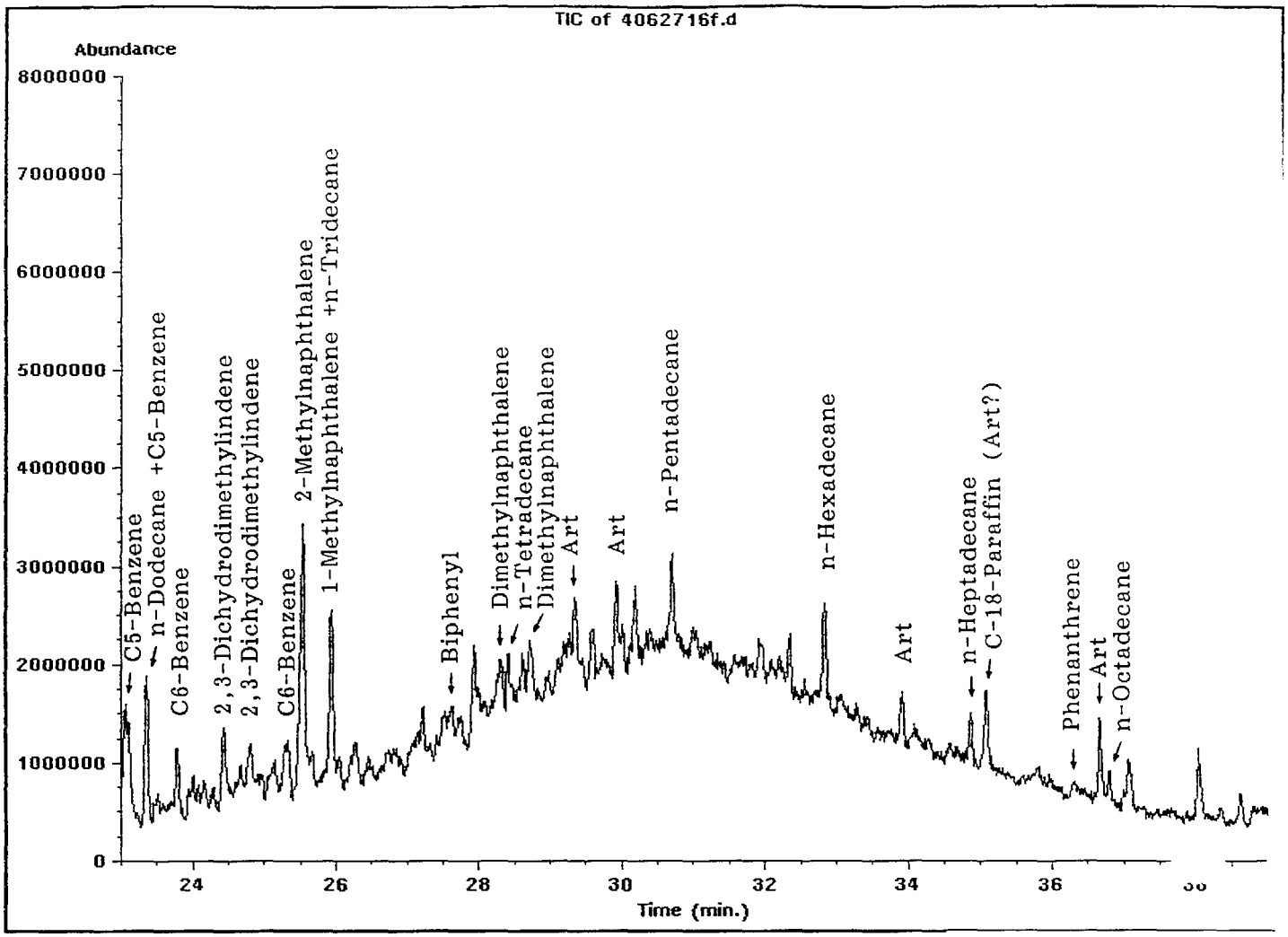

Figure 34. A fragment of the TIC from 23 to 39 minutes for Tenax sample collected in the Caldecott Tunnel on June 27 from 1600-1800 hours.

the molecular peak of these compounds is usually too weak to be identified and their mass spectra as well as infrared spectra are virtually identical. The peaks marked as "Art" are background peaks or artifact peaks from Tenax material, found on back-up Tenax. The most intense of these peaks were identified as 2-ethyl-1-hexanol, α,α-dimethylbenzenemethanol, a C11 branched paraffin, and acetophenone. Benzaldehyde and methylbenzaldehyde were not present on back-up cartridges and their artifactual formation from Tenax material is rather unlikely, since the concentration of ozone in the Caldecott Tunnel cannot be significant (high NO level).

In addition, in some Tenax samples collected in the Caldecott Tunnel, a compound eluting between o-xylene and n-nonane was present. The mass spectrum and FTIR spectrum of this species is shown in Figure 35. Based on mass spectral and infrared spectral data, this compound was tentatively identified as 2-butoxyethanol.

An extended list of compounds identified in all Tenax cartridges collected in the Caldecott Tunnel is presented in Tables B1 through B18 (Appendix B).

Oildale. The identification of individual compounds in the Tenax samples collected in Oildale was performed in the same way as described above in Section 4.1.1. Figures 36, 37, and 38 show fragments of total ion chromatograms (TIC), from 9 to 15 minutes, 15 to 23 minutes, and 23 to 39 minutes, respectively, of the Tenax sample collected on July 30, from 0600 to 0800 hours (note different abundance scale in each of these figures). Peak assignment was made after careful examination of mass spectra and infrared spectra of each compound. However, as noted above, for many of these compounds the assignment must be viewed as tentative only, due to the lack of authentic standards. For a more detailed list of compounds present in Oildale samples see Tables B19 through B34.

In general, Oildale Tenax sample chromatograms contain many more unidentified peaks than Caldecott Tunnel or Los Angeles samples. Many of these peaks are probably of biogenic origin. The mass and infrared spectra of these compounds are generally not present in corresponding libraries, and authentic standards, with the exception of α- and ß-pinene, are hard to find. Figure 39 shows the mass spectra of a compound tentatively identified as α-pinene (very weak peak) and possibly menthol (by comparison with published spectrum, Winer et al., 1989). The other peaks, which could have a biogenic origin (based on the presence of characteristic peaks), are marked as "biogenic hydrocarbons" in corresponding tables or as "unknown."

In addition, samples collected from 1000 to 1200 are different in the sense that they contain more oxygenated compounds of probably secondary origin (from the reaction of biogenic and anthropogenic hydrocarbons with ozone and OH radicals). These compounds are even more difficult to identify and they are generally marked as "unknown" in corresponding tables.

Some of the oxygenated compounds are clearly artifact peaks, most probably from the reaction of Tenax material with ozone. The concentration of ozone during the 1000 to 1200 collection period was usually in the range of 80-110 ppb, as measured by the local air quality monitoring station. Compounds such as benzaldehyde, acetophenone, or benzoic acid can be

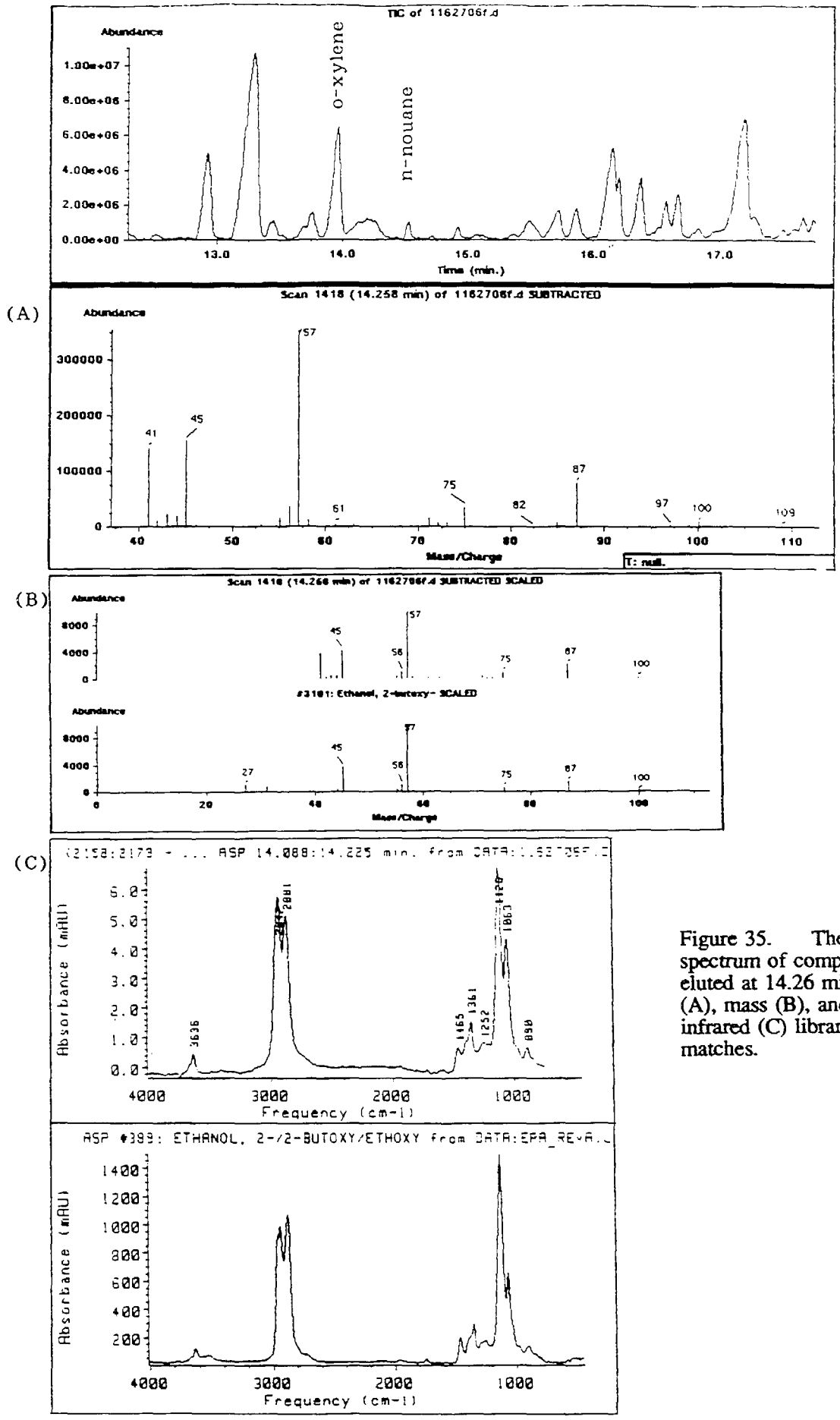

Figure 35. The mass spectrum of compound eluted at 14.26 minutes (A), mass (B), and infrared (C) library matches.

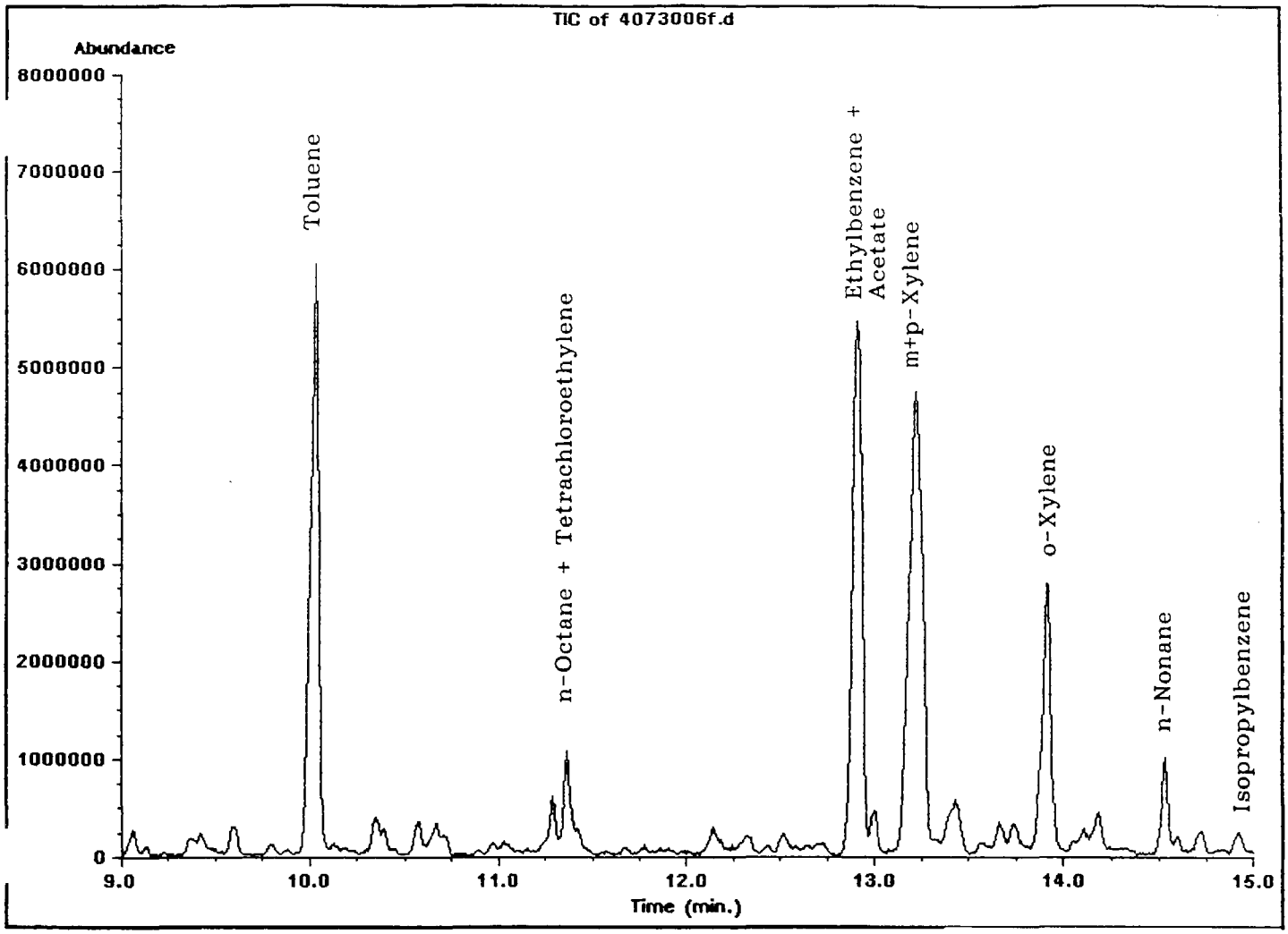

Figure 36. A fragment of the TIC, from 9 to 15 minutes, of a Tenax sample collected in Oildale on July 30, 0600-0800 hours.

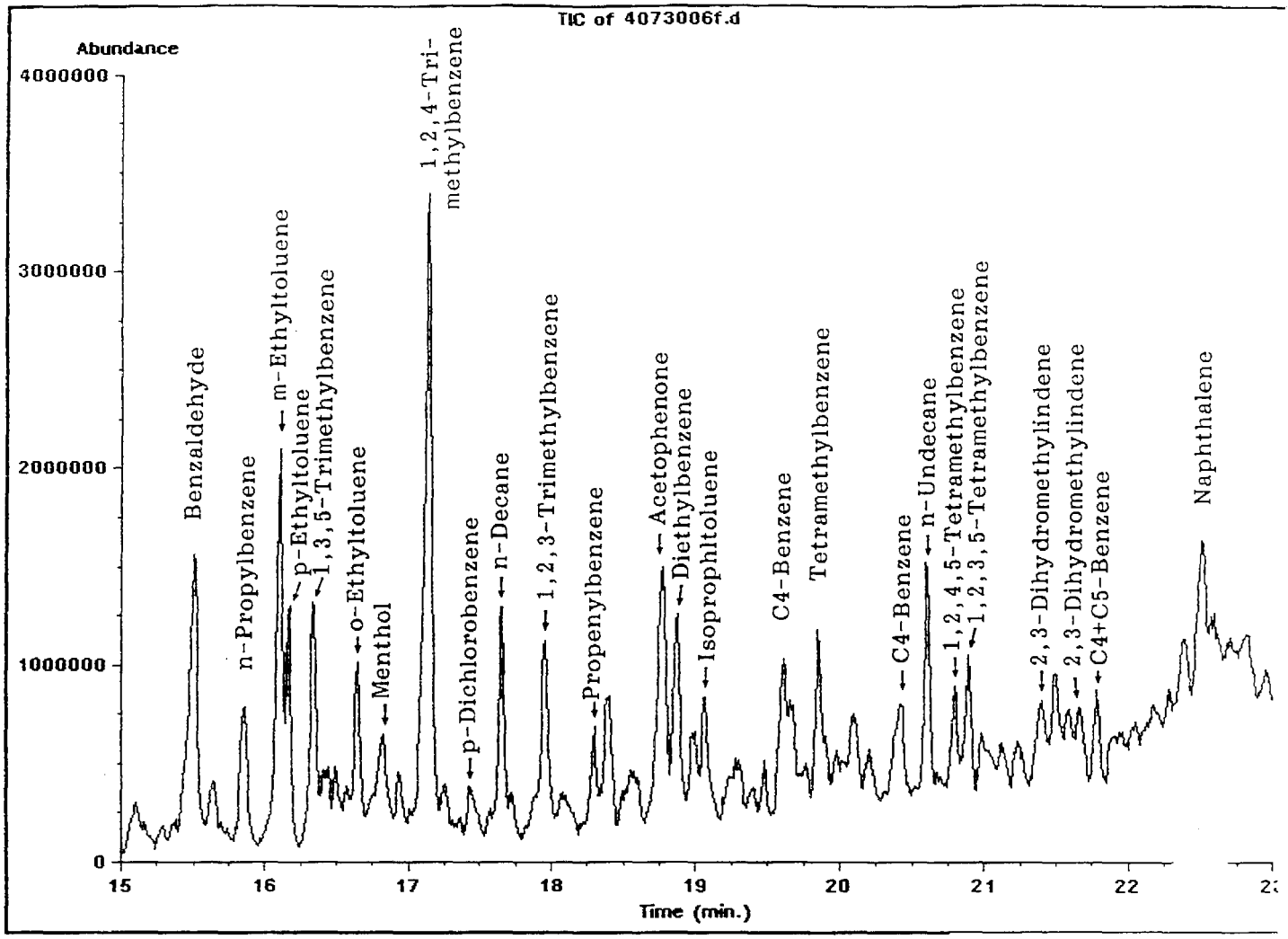

Figure 37. A fragment of the TIC, from 15 to 23 minutes, of Oildale Tenax sample (July 30, 0600-0800).

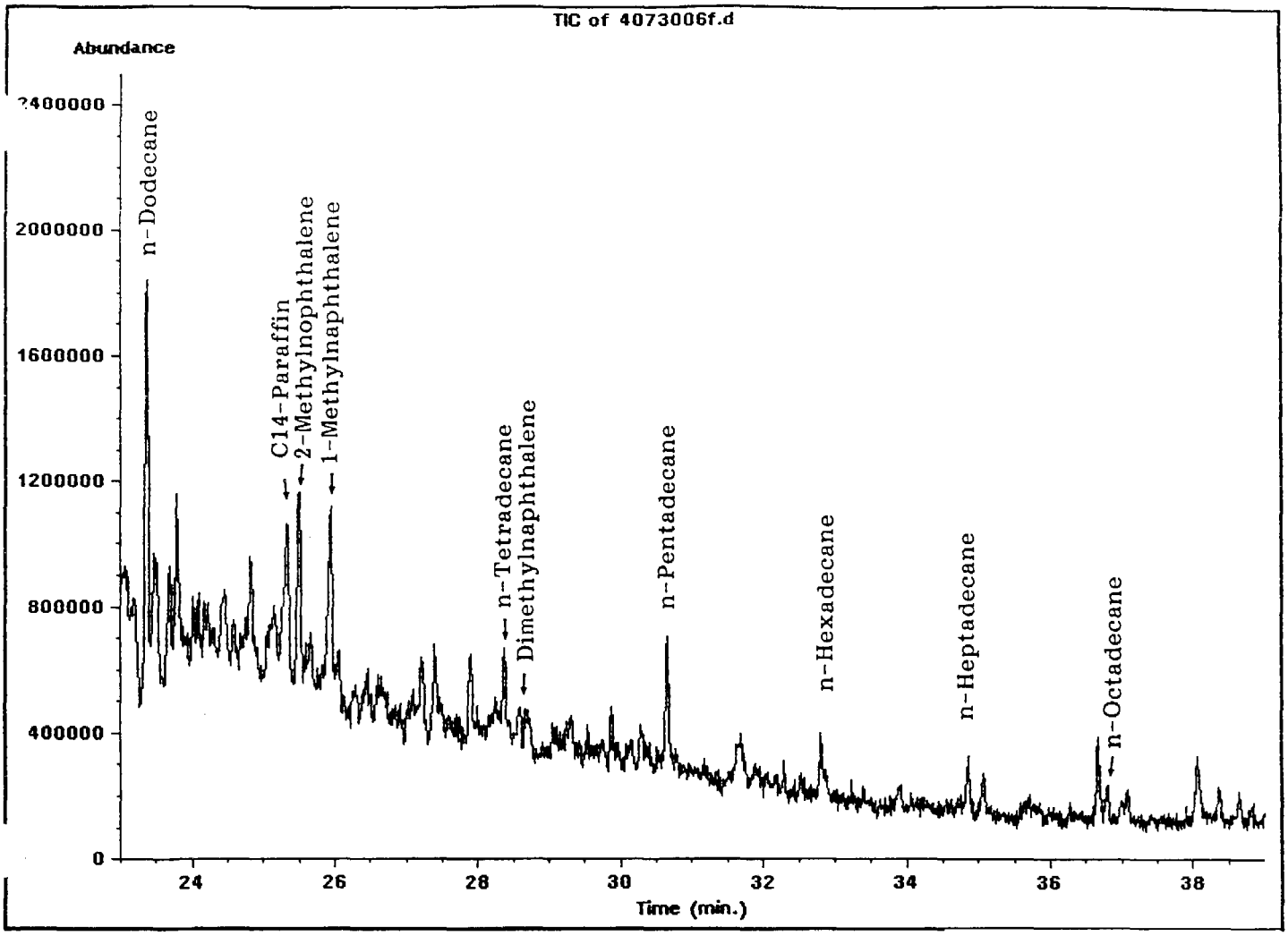

Figure 38. A fragment of the TIC, from 23 to 39 minutes, of Oildale Tenax sample (July 30, 0600-0800).

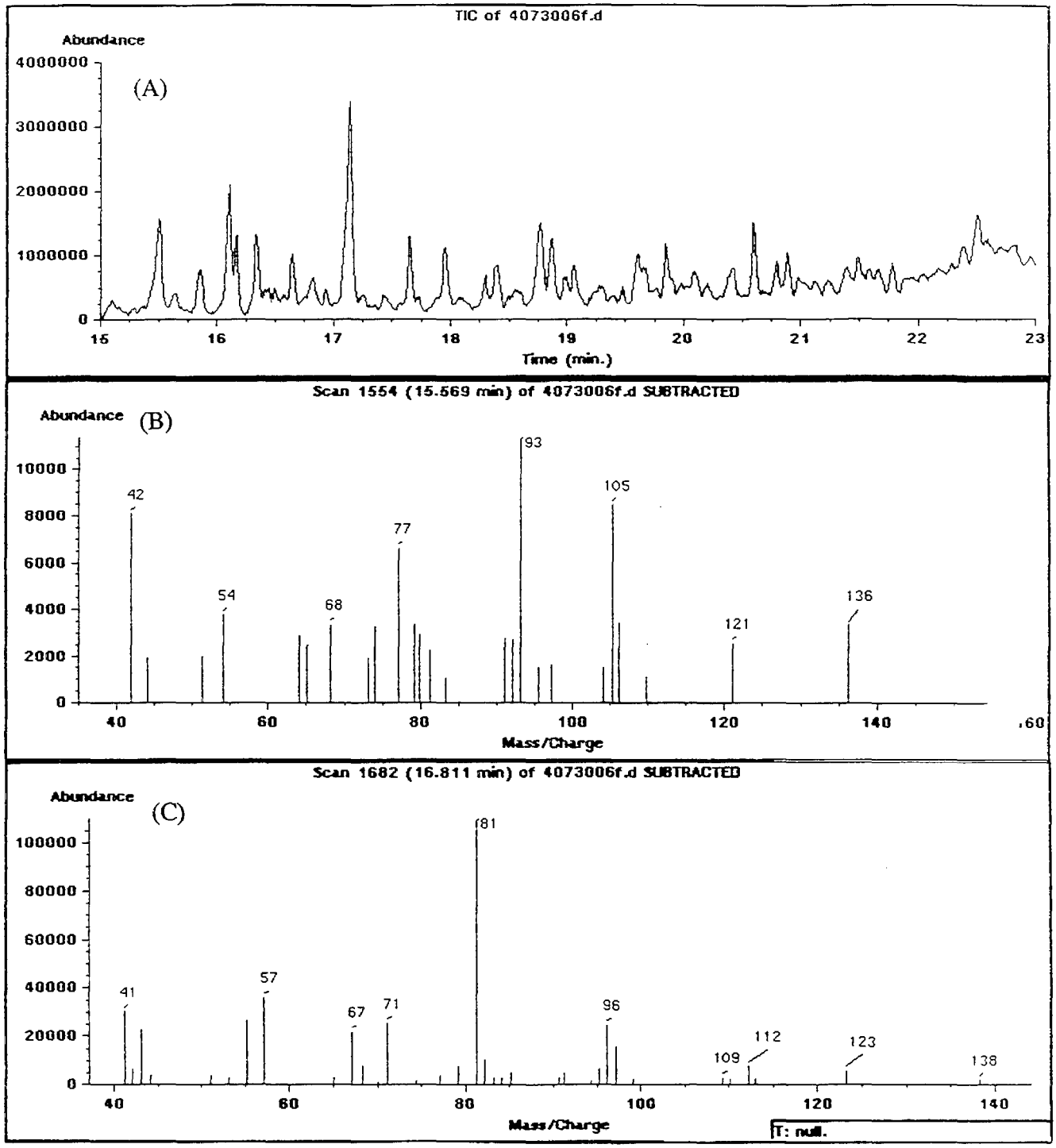

Figure 39. A fragment of the TIC from 15 to 23 minutes (A) and mass spectra of compounds eluting at 15.57 minutes and 16.81 minutes, tentatively identified as α-pinene (B) and menthol (C), respectively.

produced from Tenax material (a polymer of 2,6-diphenyl-p-phenylene oxide) upon its reaction with ozone. These compounds are marked as artifact (Art) in corresponding tables.

All Oildale samples contain a compound which co-elutes with (or elutes very close to) ethylbenzene. Based on mass and ir spectra, this compound was identified as an acetic acid ester, probably amyl acetate. However, due to the lack of an authentic standard and an exact match in both libraries, this acetate cannot be further identified.

Los Angeles. The identification of individual compounds in the Tenax samples collected in Los Angeles was performed in the same way as described above in Section 4.1.1. Figures 40, 41, and 42 show fragments of total ion chromatograms (TIC), from 9 to 15, 15 to 23, and 23 to 38 minutes, respectively, of a Tenax sample collected on August 22, from 1000 to 1200 hours (note different abundance scale in each of these figures). Peak assignment was made after careful examination of mass and infrared spectra of each compound. For a more detailed list of compounds present in the Los Angeles samples see Tables B27 through B38.

In general, the Los Angeles samples are qualitatively similar to the Caldecott Tunnel samples and the same compounds are observed in all samples from these two locations. There are a few additional compounds present in Los Angeles samples, such as tetrachloroethylene (coeluted with n-octane), dichlorobenzene, some C10 to C14 paraffins, and (probably) C4-substituted cyclohexane. Oxygenated compounds, such as 4-methyl-3-hepten-2-one, 5-methyl-3-heptanone (tentative identification) and benzaldehyde, might be formed from Tenax material during sampling under the influence of ozone. However, since they are not present on back-up cartridges, their concentrations were reported in corresponding tables.

4.2 Quantitative Analysis

4.2.1 Canister Samples

Caldecott Tunnel. Tables A1 through A13 (Appendix A) give the concentrations of volatile C2 to C11 hydrocarbons collected in stainless steel canisters in the Caldecott Tunnel. Tables A14 and A15 show the concentrations of these hydrocarbons in the background samples, collected in a west intake room. A typical chromatogram obtained from a tunnel canister sample (collected on Thursday, June 27, from 1600-1800 hours) is shown in Figure 43. GC/FID traces for C2 to C4 hydrocarbons are shown in the inset of the Figure.

Table 1 shows the mean, minimum, and maximum concentrations (in ppbc and in weight percent of TNMHC) for the representative (usually most abundant) hydrocarbons found in all canister samples collected in the Caldecott Tunnel. Table 2 shows these data for canister samples collected during six last sampling periods (for comparison with the Tenax data).

Three replicate samples were collected during sampling in the Caldecott Tunnel (on Tuesday, June 25, 1600-1800 hours, and on Thursday, June 27, 1000-1200 and 1600-1800 hours). The collocated samples were collected using two separate sampling units. The first two

TABLE 1. MEAN, MINIMUM AND MAXIMUM CONCENTRATIONS (IN ppbC AND IN PERCENT OF TNMHC) OF 29 MOST ABUNDANT COMPOUNDS FOUND IN ALL CANISTER SAMPLES COLLECTED IN THE CALDECOTT TUNNEL

PK #	NAME	MEAN ppbC	RANGE (ppbC) MIN	RANGE (ppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
1	ACETYLENE	49.04	26.90	86.64	2.23	0.95	3.43
2	ETHYLENE	141.85	94.30	240.50	6.37	4.14	7.78
3	ETHANE	19.77	8.54	62.80	0.90	0.34	2.96
4	PROPENE	60.09	31.60	95.40	2.69	1.72	3.28
5	PROPANE	10.55	3.70	18.70	0.46	0.20	0.88
6	n-BUTANE	62.57	39.00	122.25	2.76	1.88	3.62
7	ISOPENTANE	176.87	87.37	289.27	7.62	6.32	8.56
8	n-PENTANE	62.49	31.27	97.37	2.70	2.33	2.88
9	2,3-DIMETHYLBUTANE	20.97	9.30	31.32	0.91	0.75	1.48
10	2-METHYLPENTANE	72.40	35.46	112.11	3.13	2.88	3.51
11	3-METHYLPENTANE	42.15	19.47	62.63	1.83	1.58	1.96
12	n-HEXANE	38.74	20.73	55.25	1.72	1.38	2.70
13	METHYLCYCLOPENTANE	43.56	20.22	63.49	1.90	1.64	2.23
14	BENZENE	132.91	88.28	203.79	5.92	4.83	7.97
15	2-METHYLHEXANE	27.77	12.95	44.63	1.20	1.05	1.45
16	3-METHYLHEXANE	29.62	14.55	46.57	1.28	1.17	1.58
17	2,2,4-TRIMETHYLPENTANE	36.81	20.76	63.51	1.61	1.37	1.99
18	n-HEPTANE	19.33	9.43	35.50	0.93	0.62	2.88
19	2,3,4-TRIMETHYLPENTANE	14.92	7.58	26.32	0.65	0.53	0.82
20	TOLUENE	208.78	115.92	322.60	9.12	8.03	10.09
21	ETHYLBENZENE	37.51	21.31	61.25	1.63	1.40	[illegible]
22	m&p-XYLENE	147.82	83.61	237.48	6.42	5.49	
23	STYRENE	21.81	9.83	36.73	1.00	0.46	[illegible]
24	o-XYLENE	59.47	30.67	87.25	2.62	2.08	2.91
25	m-ETHYLTOLUENE	40.39	22.81	65.26	1.76	1.57	2.04
26	p-ETHYLTOLUENE	21.08	10.39	30.69	0.93	0.82	1.10
27	1,2,4-TRIMETHYLBENZENE	56.46	30.77	92.96	2.44	2.12	2.91
28	1,2,3-TRIMETHYLBENZENE	15.75	6.73	23.32	0.69	0.55	0.94
29	1,4(OR 1,3)-DIETHYLBENZENE	19.75	12.14	31.98	0.88	0.61	1.14
	TOTAL	2283.21	1232.76	3378.98			

TABLE 2. MEAN, MINIMUM AND MAXIMUM CONCENTRATIONS (IN ppbC AND IN PERCENT OF TNMHC) OF 29 MOST ABUNDANT COMPOUNDS FOUND IN CANISTER SAMPLES COLLECTED IN THE CALDECOTT TUNNEL ON JUNE 26, 1600–1800 HR, JUNE 27 AND JUNE 28, 1991

PK #	NAME	MEAN ppbC	RANGE (ppbC) MIN	MAX	MEAN WT%	RANGE (WT%) MIN	MAX
1	ACETYLENE	65.16	51.00	86.64	2.75	2.02	3.43
2	ETHYLENE	164.90	102.80	240.50	6.63	5.26	7.78
3	ETHANE	27.98	15.80	62.80	1.21	0.63	2.96
4	PROPENE	71.48	52.60	95.40	2.95	2.69	3.28
5	PROPANE	14.61	10.60	18.70	0.61	0.45	0.88
6	n–BUTANE	72.94	44.77	122.25	2.90	2.33	3.62
7	ISOPENTANE	190.25	119.08	289.27	7.64	6.32	8.56
8	n–PENTANE	66.66	44.36	97.37	2.69	2.33	2.88
9	2,3–DIMETHYLBUTANE	22.56	13.63	31.32	0.94	0.80	1.48
10	2–METHYLPENTANE	75.51	51.48	105.19	3.08	2.90	3.20
11	3–METHYLPENTANE	45.15	30.27	59.88	1.85	1.77	1.93
12	n–HEXANE	42.36	27.50	55.25	1.78	1.38	2.70
13	METHYLCYCLOPENTANE	46.98	30.40	61.32	1.95	1.67	2.23
14	BENZENE	130.66	88.28	175.16	5.35	4.83	6.53
15	2–METHYLHEXANE	28.28	19.43	37.07	1.16	1.10	1.20
16	3–METHYLHEXANE	30.35	20.34	40.18	1.24	1.17	1.34
17	2,2,4–TRIMETHYLPENTANE	35.98	26.08	50.59	1.48	1.37	1.61
18	n–HEPTANE	17.16	12.14	22.71	0.71	0.62	0.79
19	2,3,4–TRIMETHYLPENTANE	14.61	10.19	20.68	0.60	0.53	0.67
20	TOLUENE	214.46	146.40	294.10	8.76	8.03	9.68
21	ETHYLBENZENE	37.10	24.76	51.39	1.52	1.40	1.67
22	m&p–XYLENE	148.04	99.72	206.82	6.03	5.49	6.77
23	STYRENE	24.60	9.83	36.73	1.02	0.46	1.69
24	o–XYLENE	61.79	44.06	87.25	2.53	2.08	2.82
25	m–ETHYLTOLUENE	40.45	27.95	55.55	1.66	1.57	1.79
26	p–ETHYLTOLUENE	22.72	16.45	30.69	0.94	0.82	1.10
27	1,2,4–TRIMETHYLBENZENE	56.49	35.45	78.66	2.30	2.12	2.56
28	1,2,3–TRIMETHYLBENZENE	17.30	10.73	23.32	0.72	0.55	0.94
29	1,4(OR 1,3)–DIETHYLBENZENE	20.15	13.03	30.48	0.84	0.61	1.14
	TOTAL	2447.46	1621.70	3378.98	0.00	0.00	0.00

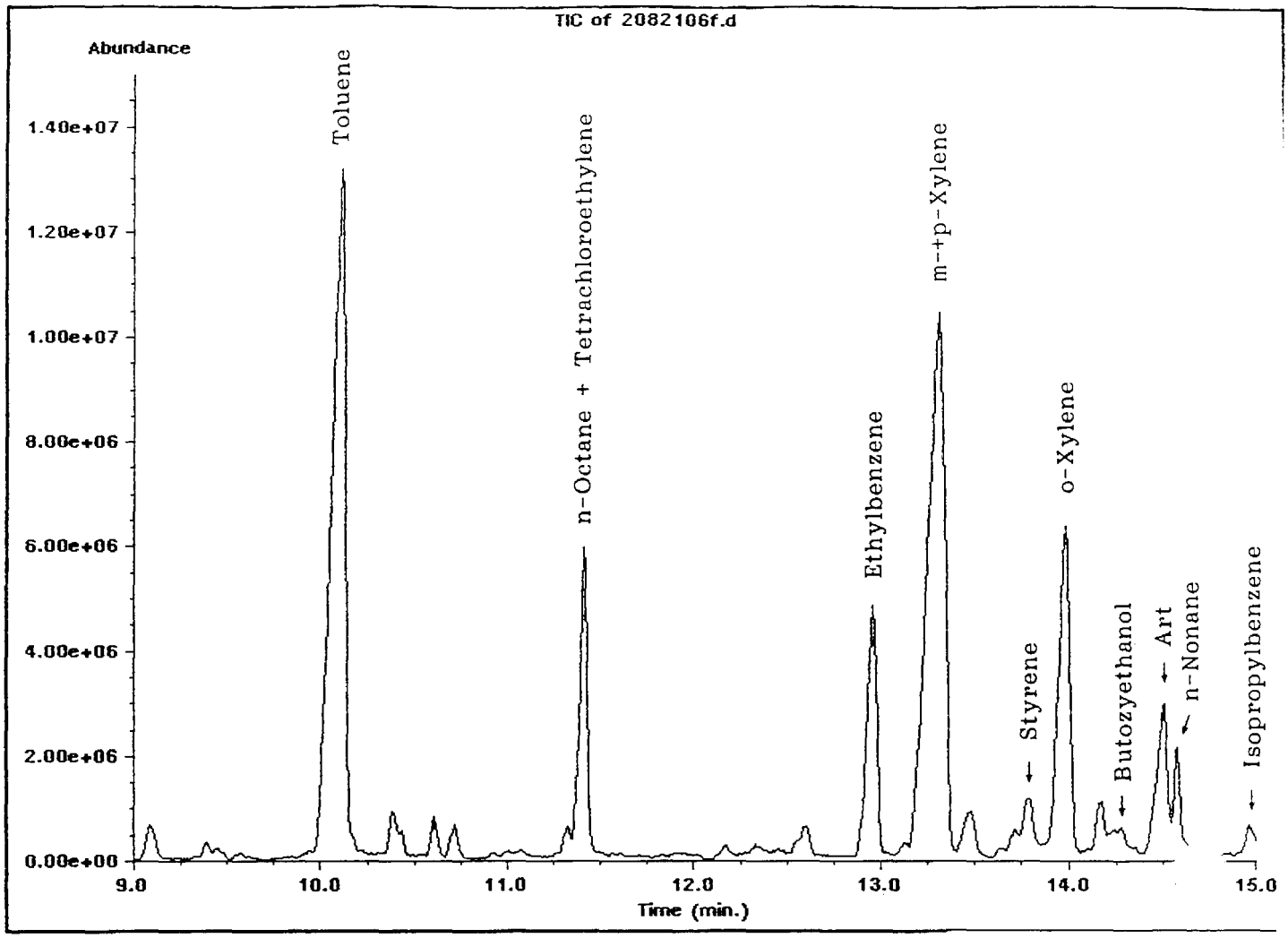

Figure 40. A fragment of the TIC, from 9 to 15 minutes of Tenax sample collected in Los Angeles on August 21, 0600-0800 hours.

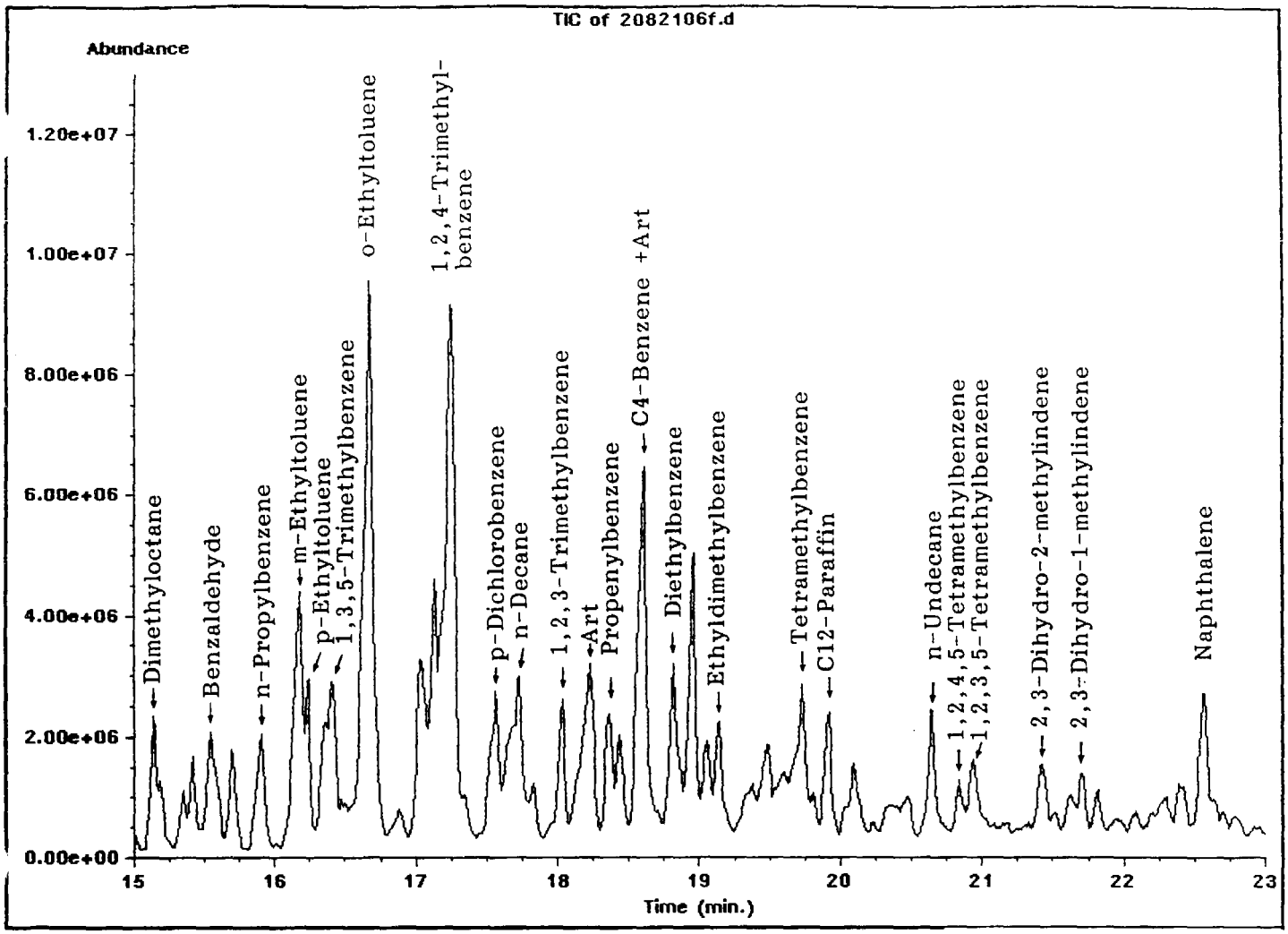

Figure 41. A fragment of the TIC from 15 to 23 minutes of the sample from Figure 40.

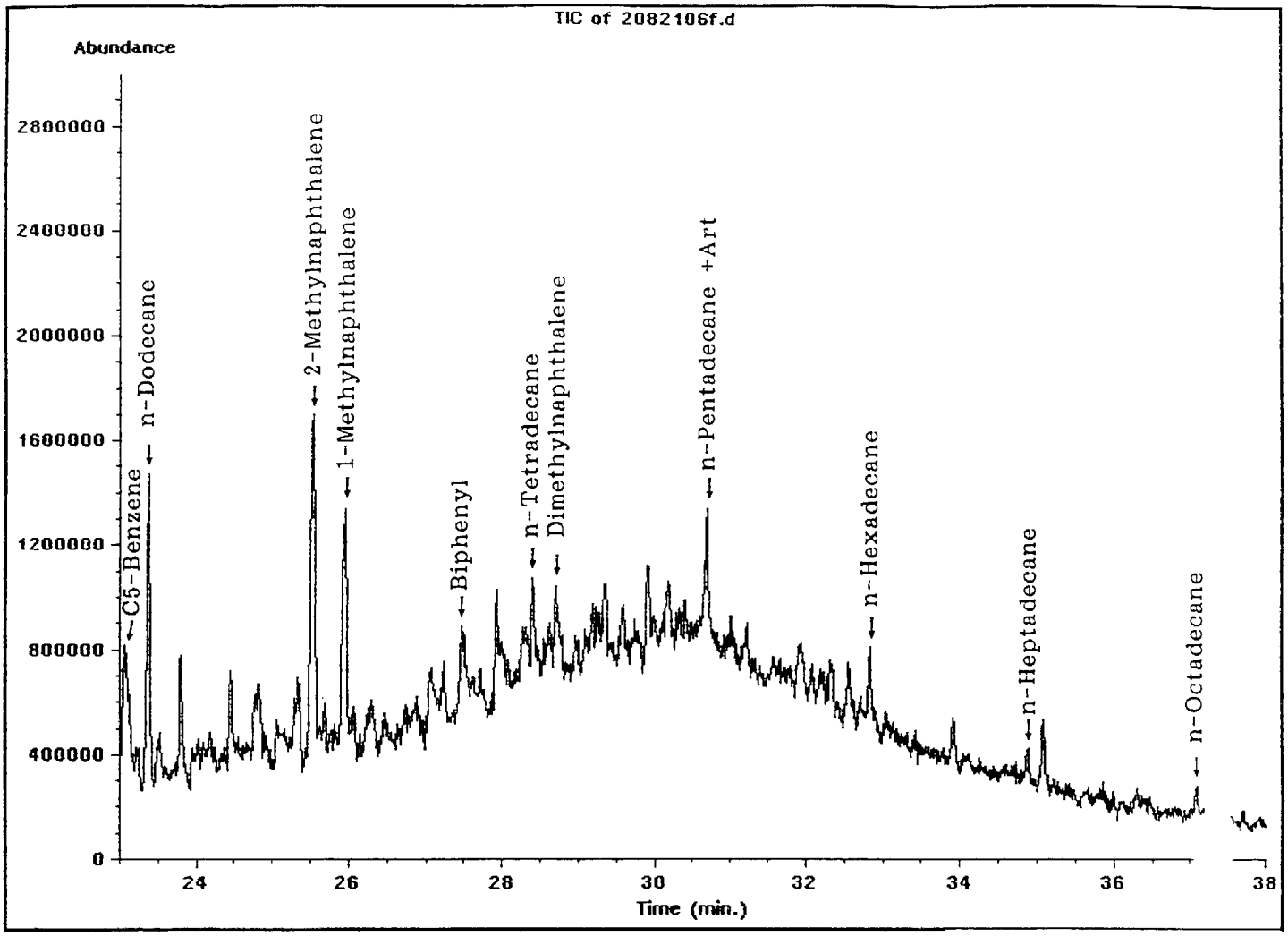

Figure 42. A fragment of the TIC from 23 to 38 minutes of the sample from Figure 40.

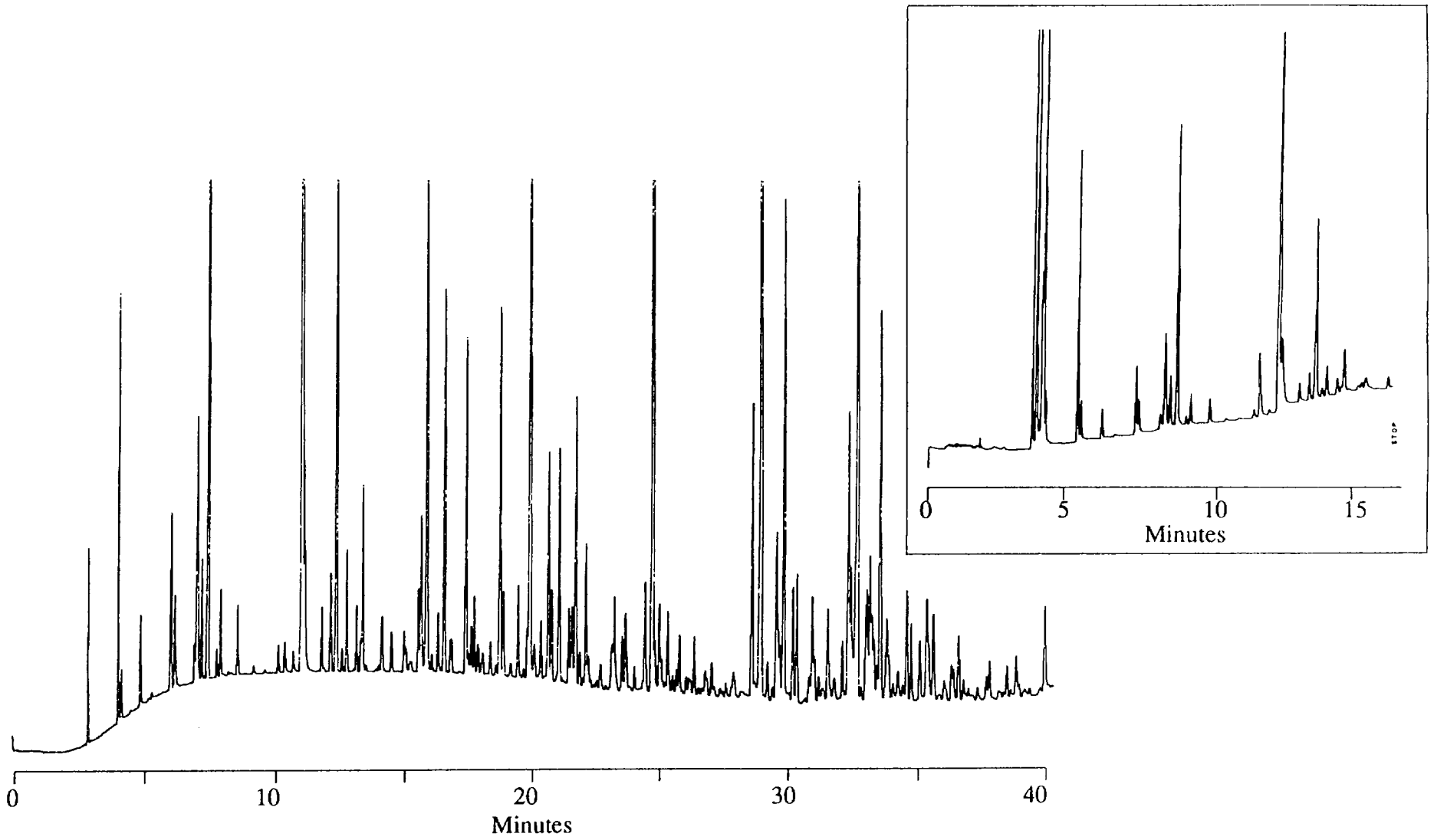

Figure 43. GC/FID traces of C4-C11 hydrocarbons from Caldecott Tunnel cannister samples collected on 6/27/91 (1600-1800 hr). Inset: GC/FID traces for C2-C4 hydrocarbons. See Table A10 for peak assignments.

collocated samples (Tables A3 and A4), collected on Tuesday, June 25, 1600 to 1800 hours, show some discrepancies due to the malfunction of one flow controller, caused by very high humidity and low temperature (15 °C) in the Tunnel. The remaining collocated samples (Table A8 - A11), collected on Thursday, June 27, 1000 to 1200 and 1600 to 1800 hours, show much better agreement, as will be discussed in greater detail later.

Oildale. Tables A16 through A22 list the concentrations of volatile C2 to C11 hydrocarbons, collected in stainless steel canisters in Oildale. Figure 44 shows the chromatogram from the analysis of the Oildale sample collected on Tuesday, June 30, 0600 to 0800 hours for C4 to C11 hydrocarbons. Table 3 shows the mean, minimum and maximum concentrations for representative, most abundant hydrocarbons.

The canister sample collected on July 30, from 0600 to 0800 hours, contains much higher hydrocarbon concentrations than the remaining samples. During this particular collection period, the favorable meteorological conditions (light wind from the northeast) allowed us to collect the only sample characteristic of the oil production area (as noted above in Section 2.1, the oil fields were located northeast of the sampling site). Samples collected during the remaining collection periods, when the light wind was usually from southeast, are less concentrated and are rather typical for an urban-suburban area.

Two collocated samples were collected during the sampling period, namely on July 31, from 0600 to 0800 and 1000 to 1200 hours (Tables A21 and A22).

Los Angeles. Tables A23 through A32 give the concentrations of volatile C2 to C11 hydrocarbons, collected in stainless steel canisters in Downtown Los Angeles at the Water and Power Utility facilities. Tables A34 through A37, A38 through A41, and A42 through A45 list the concentrations of hydrocarbons collected on the roof of the Best Western Motel (Chinatown), in Lincoln Park, and at the Southwest Museum, respectively. Figure 45 shows the chromatogram from the analysis of the Los Angeles sample collected on Thursday, August 22, at 1000 to 1200 hours for C4 to C11 hydrocarbons. Table 4 shows the mean, minimum and maximum concentrations for representative, most abundant hydrocarbons found in the canister samples collected in Downtown Los Angeles.

Two collocated samples were collected during the sampling period, namely on August 23, from 0600 to 0800 and 1000 to 1200 hours.

4.2.2 Tenax Samples

Caldecott Tunnel. Tables B1 through B18 (Appendix B) show the concentrations of individual hydrocarbons identified in Tenax samples collected in the Caldecott Tunnel. The identification of all hydrocarbons was based on comparison with mass spectral and infrared data, as described above. The concentrations of individual compounds are shown in ng/Tenax, μ/m3, ppbv (calculated from μ/m3), and ppbC (obtained by multiplying ppbv by the number of carbon

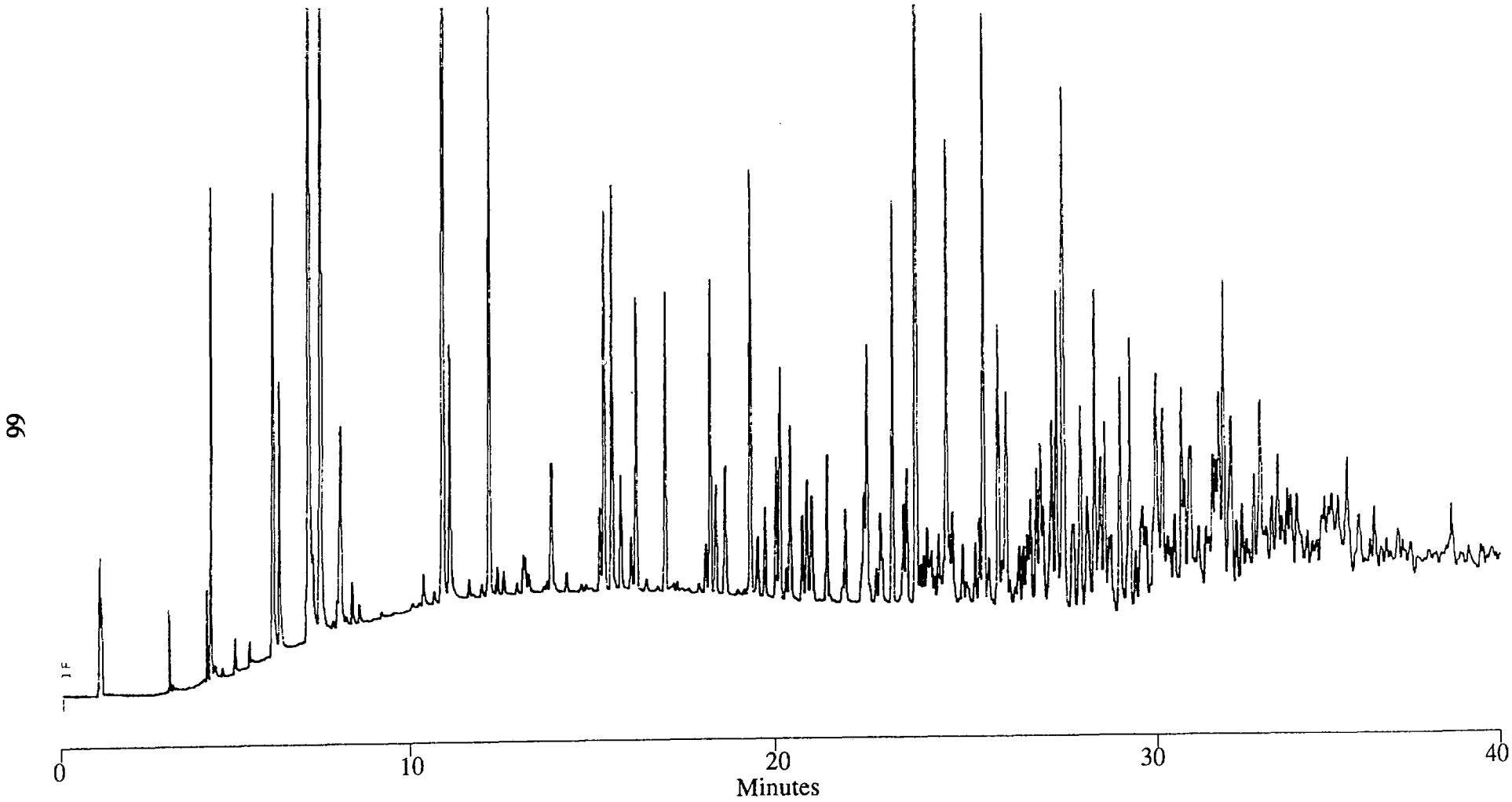

Figure 44. GC/FID traces of C4-C11 hydrocarbons from Oildale canister sample collected on 7/30/91 (0600-0800 hr). See Table A16 for peak assignments.

TABLE 3. MEAN, MAXIMUM AND MINIMUM CONCENTRATIONS (IN ppbC AND IN PERCENT OF OF TNMHC) OF 31 MOST ABUNDANT HYDROCARBONS FOUND IN CANISTER SAMPLES COLLECTED IN OILDALE (CA)

PK #	NAME	MEAN ppbC	RANGE (ppbC) MIN	MAX	MEAN WT%	RANGE (WT%) MIN	MAX
1	ACETYLENE	5.24	2.14	14.30	1.20	0.98	1.38
2	ETHYLENE	20.39	7.45	63.58	4.17	3.27	5.49
3	ETHANE	17.24	4.06	50.20	3.42	1.54	5.65
4	PROPENE	2.46	0.87	6.27	0.59	0.43	0.75
5	PROPANE	23.58	6.22	59.02	5.10	2.80	9.84
6	n-BUTANE	22.40	6.76	45.55	5.34	2.89	12.24
7	ISOPENTANE	30.26	12.90	45.90	8.98	3.97	14.87
8	n-PENTANE	13.23	6.11	23.80	3.57	2.06	5.69
9	2,3-DIMETHYLBUTANE	4.44	1.14	15.78	0.78	0.47	1.36
10	2-METHYLPENTANE	7.75	4.24	15.24	2.09	1.32	2.71
11	3-METHYLPENTANE	6.56	2.92	11.51	1.88	0.99	2.85
12	n-HEXANE	5.67	3.08	10.60	1.54	0.92	2.19
13	METHYLCYCLOPENTANE	6.06	2.82	12.10	1.57	1.05	2.38
14	BENZENE	8.51	4.46	16.20	2.41	1.40	3.30
15	2-METHYLHEXANE	2.60	1.41	5.28	0.71	0.46	0.86
16	2,3-DIMETHYLPENTANE	2.98	0.98	9.38	0.60	0.45	0.81
17	3-METHYLHEXANE	4.32	2.95	7.39	1.27	0.64	1.86
18	2,2,4-TRIMETHYLPENTANE	4.26	2.18	6.74	1.39	0.48	3.04
19	n-HEPTANE	3.19	1.35	5.34	0.92	0.46	1.39
20	METHYLCYCLOHEXANE	3.25	1.37	5.43	0.91	0.47	1.41
21	TOLUENE	21.21	12.19	40.96	6.07	3.54	8.40
22	ETHYLBENZENE	4.55	2.20	11.59	1.12	0.89	1.44
23	m&p-XYLENE	14.32	7.57	31.44	3.90	2.61	5.60
24	STYRENE	12.07	1.46	46.49	4.11	0.46	17.59
25	o-XYLENE	6.35	3.73	14.33	1.72	1.24	2.36
26	m-ETHYLTOLUENE	4.04	1.94	10.63	0.99	0.59	4
27	p-ETHYLTOLUENE	1.64	0.00	5.29	0.33	0.00	.97
28	1,3,5-TRIMETHYLBENZENE	3.76	0.00	14.13	0.67	0.00	1.22
29	1,2,4-TRIMETHYLBENZENE	5.62	2.23	14.91	1.36	0.78	1.86
30	n-DECANE	4.27	1.04	14.59	0.81	0.44	1.26
31	1,2,3-TRIMETHYLBENZENE	4.24	1.26	13.51	0.89	0.36	1.28
	TOTAL	435.92	163.53	1157.68			

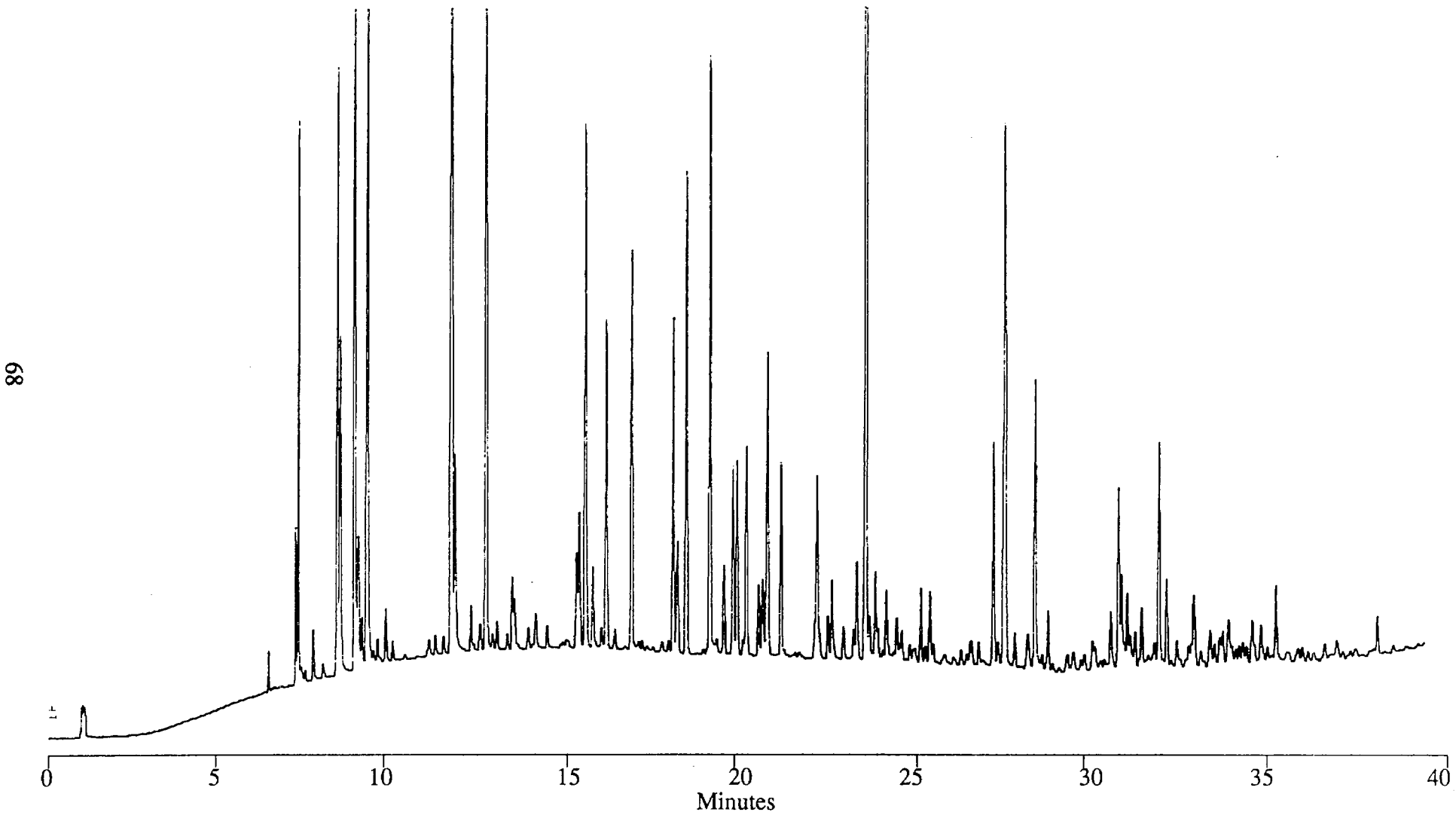

Figure 45. GC/FID traces of C4-C11 hydrocarbons from Los Angeles Canister samples collected on 8/22/91 (1000 to 1200 hr). See Table A26 for peak assignments.

TABLE 4. MEAN, MINIMUM AND MAXIMUM CONCENTRATIONS (ppbC AND WEIGHT % OF TNMHC) OF 29 MOST ABUNDANT HYDROCARBONS FOUND IN CANISTER SAMPLES COLLECTED IN LOS ANGELES

PK #	NAME	MEAN ppbC	RANGE (ppbC) MIN	MAX	MEAN WT%	RANGE (WT%) MIN	MAX
1	ACETYLENE	25.19	11.20	45.00	1.95	1.68	2.70
2	ETHYLENE	73.15	17.40	116.80	5.26	3.05	6.84
3	ETHANE	45.77	24.40	72.16	3.59	2.61	4.39
4	PROPENE	17.85	4.50	32.70	1.30	0.71	1.62
5	PROPANE	75.39	31.70	138.80	5.77	3.33	8.13
6	n-BUTANE	68.50	29.96	92.10	5.46	3.60	7.13
7	ISOPENTANE	105.45	46.22	150.18	8.27	6.97	9.81
8	n-PENTANE	53.90	26.57	71.66	4.27	3.50	4.88
9	2,3-DIMETHYLBUTANE	10.38	4.37	16.17	0.80	0.72	0.88
10	2-METHYLPENTANE	36.19	14.51	55.98	2.77	2.44	3.14
11	3-METHYLPENTANE	23.09	9.74	34.27	1.79	1.59	1.98
12	n-HEXANE	23.41	9.97	32.81	1.81	1.62	1.94
13	METHYLCYCLOPENTANE	21.98	9.87	31.15	1.71	1.49	1.83
14	BENZENE	42.25	16.65	66.86	3.24	2.92	3.63
15	2-METHYLHEXANE	12.61	5.32	19.57	0.96	0.89	1.06
16	2,3-DIMETHYLPENTANE	13.85	5.93	21.16	1.06	1.00	1.18
17	3-METHYLHEXANE	15.27	7.17	22.36	1.20	1.07	1.38
18	2,2,4-TRIMETHYLPENTANE	24.73	9.41	39.92	1.87	1.65	2.32
19	n-HEPTANE	10.59	4.83	14.97	0.82	0.74	0.90
20	METHYLCYCLOHEXANE	12.50	5.94	18.03	0.97	0.79	1.24
21	TOLUENE	104.73	46.81	157.07	8.03	6.80	8.96
22	ETHYLBENZENE	16.44	6.42	26.77	1.25	1.13	0
23	m&p-XYLENE	61.35	26.03	110.75	4.63	3.99	8
24	o-XYLENE	22.68	9.44	39.33	1.72	1.53	1.95
25	m-ETHYLTOLUENE	17.60	7.45	38.80	1.31	1.03	1.92
26	p-ETHYLTOLUENE	8.60	3.96	17.10	0.66	0.54	0.85
27	1,3,5-TRIMETHYLBENZENE	7.44	3.21	11.67	0.58	0.45	0.73
28	1,2,4-TRIMETHYLBENZENE	21.40	9.17	38.63	1.64	1.27	1.91
29	1,2,3-TRIMETHYLBENZENE	9.57	4.86	14.42	0.76	0.50	0.94
	TOTAL	1544.35	1120.85	2020.56			

atoms). The total concentration of all quantified species, aromatics, and paraffins is also calculated. The concentrations of all oxygenated compounds are only approximate, since no calibration was performed for these compounds, and the same response factor is used for calculating their concentrations as for calculating hydrocarbon concentrations.

As mentioned in Section 2.3 Teflon sampling lines, extended from each Tenax cartridge through the ceiling louvers into the tunnel area, were not initially present and were first installed on Thursday, June 27, 0600 hours. Unfortunately, the first two days of sampling were characterized by strong winds from the west and the influence of the piston effect of traffic together with the prevailing wind direction resulted in the exhaust air from the tunnel leaving through the exit portal, not through the exhaust duct. This is the reason for much lower hydrocarbon concentrations observed from the Tenax cartridges for the first four sampling periods in comparison with the canister samples; different air was sampled onto the Tenax cartridges and into the canisters. Before the last sampling period on June 26 (1600-1800 hr), the conditions changed and the wind calmed down. Although the Teflon sampling lines were not yet installed, the concentrations of hydrocarbons found in Tenax samples (Tables B7 and B8) are comparable to those found in canister samples (Table A6).

The Tenax sample code is shown on the front of each table. The first number indicates sampling port (#1 to 4), the second number indicates the presence (1) or absence (0) of a filter in front of the Tenax, the third through seventh numbers show sampling date and time, and the last letter indicates front (F) or back-up (B) Tenax. For example, Tenax:4062706F means that the front Tenax cartridge was on the sampling port #4, was sampling unfiltered air, and was collected on 6/27 from 0600 to 0800 hours.

In most cases the concentrations of species found in unfiltered and filtered Tenax samples is reported, with the exception of the samples collected on June 25 (1000-1200 and 1600-1800). For these two sampling periods, data from only one Tenax sample are presented, since the analysis of the parallel sample was not valid. However, as can be seen from the comparison of filtered and unfiltered samples (and as will be discussed later), there is no significant difference between them, and they can be treated as duplicates.

Table 5 shows the mean, minimum and maximum concentrations (in ppbC and in weight percent of TNMHC) for all hydrocarbons found in Tenax cartridges collected in the Caldecott Tunnel. The reason discussed above explains why only samples collected during the last six sampling periods (6/26/92, 1600-1800 to 6/28/92, 1000-1200) are included in the summary tables.

Figure 46 shows a typical GC/FID trace for front (A) and back-up (B) Tenax of the Caldecott Tunnel sample collected on June 27, from 1600 to 1800 hours. As can be seen from this figure, the artifact peaks are present mainly between 18 and 24 minutes elution time.

Oildale. Tables B19 through B26 show the concentrations of individual hydrocarbons, identified in Tenax samples collected in Oildale. The identification of all hydrocarbons was

Table 5. Mean Minimum and Maximum Concentrations (ppbc and Weight % of TNMHC) of Hydrocarbons Found in Tenax Samples Collected in the Caldecott Tunnel (CA). – Page 1

File: CAL–ALL

	COMPOUND	MEAN ppbC	RANGE (ppbC) MIN	RANGE (ppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
1	ETHYLBENZENE	33.76	21.19	48.78	5.36	5.12	5.66
2	m+p–XYLENE	134.21	81.40	198.48	21.21	19.68	22.17
3	4–METHYLOCTANE	6.12	4.51	7.80	1.00	0.80	1.24
4	3–METHYLOCTANE	3.55	2.43	4.93	0.57	0.48	0.65
5	STYRENE	10.84	7.12	14.70	1.73	1.62	1.94
6	o–XYLENE	48.61	29.64	70.18	7.69	7.17	8.11
7	C9 OLEFIN	2.12	0.48	8.13	0.30	0.10	1.08
8	n–NONANE	3.35	2.32	4.61	0.55	0.45	0.67
9	ISOPROPYLBENZENE (CUMENE)	2.55	1.57	3.38	0.41	0.37	0.49
10	DIMETHYLOCTANE	1.82	0.02	4.46	0.26	0.00	0.62
11	n–PROPYLBENZENE	9.23	5.63	12.54	1.47	1.36	1.59
12	m–ETHYLTOLUENE	41.79	23.21	63.06	6.56	5.61	6.93
13	p–ETHYLTOLUENE	11.56	8.03	15.61	1.86	1.72	2.08
14	1,3,5–TRIMETHYLBENZENE	18.80	10.93	27.51	2.97	2.64	3.12
15	PHENOL + C11 PARAFFIN	2.60	0.63	6.95	0.44	0.09	0.92
16	C10 PARAFFIN	5.46	2.72	11.40	0.85	0.56	1.58
17	o–ETHYLTOLUENE	15.29	8.33	25.59	2.41	2.01	2.81
18	C10 PARAFFIN	1.93	0.95	3.52	0.31	0.17	0.47
19	1,2,4–TRIMETHYLBENZENE	70.58	42.34	100.74	11.21	10.24	11.84
20	n–DECANE+secBUTYLBENZENE	5.01	3.74	7.46	0.82	0.59	1.06
21	1,2,3–TRIMETHYLBENZENE + C4–BENZENE	14.14	8.61	20.03	2.24	2.08	2.44
22	C4–BENZENE	8.12	0.00	15.43	1.28	0.00	2.33
23	PROPENYLBENZENE	10.03	2.27	18.13	1.56	0.46	2.99
24	INDENE	4.18	0.00	7.27	0.66	0.00	0.99
25	C4–BENZENE + M–METHYLBENZALDEHYDE	14.51	3.35	24.16	2.38	0.44	3.13
26	DIETHYLBENZENE	5.96	1.71	8.76	0.96	0.35	1.70
27	2–ETHYL–1,4–DIMETHYLBENZENE	9.04	5.28	14.43	1.42	1.28	1.59
28	p–METHYLBENZALDEHYDE + C11 OLEFIN	3.51	1.73	7.79	0.57	0.24	0.86
29	o–PROPYLTOLUENE	2.40	0.00	5.87	0.41	0.00	1.04
30	ETHYLDIMETHYLBENZENE	12.04	2.80	20.17	1.89	0.57	3.22
31	TETRAMETHYLBENZENE	11.54	6.64	19.19	1.80	1.61	2.11

Table 5. Mean Minimum and Maximum Concentrations (ppbc and Weight % of TNMHC) of Hydrocarbons Found in Tenax Samples Collected in the Caldecott Tunnel (CA). – Page 2

	COMPOUND	MEAN ppbC	RANGE (ppbC) MIN	RANGE (ppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
32	ETHYLDIMETHYLBENZENE	3.63	1.02	6.37	0.56	0.21	0.88
33	n–UNDECANE	2.20	1.64	3.11	0.39	0.18	0.64
34	1,2,4,5–TETRAMETHYLBENZENE	5.20	2.26	8.52	0.80	0.46	0.95
35	1,2,3,5–TETRAMETHYLBENZENE	8.14	5.20	12.28	1.29	1.06	1.46
36	2,3–DIHYDRO–2–METHYLINDENE	5.25	2.99	7.88	0.83	0.61	1.00
37	1,3–DIETHYL–5–METHYLBENZENE	1.12	0.88	1.50	0.18	0.16	0.22
38	C5–BENZENE+METHYLINDENE	1.38	0.33	3.57	0.24	0.07	0.73
39	2,3–DIHYDRO–1–METHYLINDENE	3.09	1.90	4.63	0.50	0.36	0.61
40	C5– + C4–BENZENE	3.38	1.16	5.69	0.52	0.24	0.64
41	C5–BENZENE	1.60	0.79	2.45	0.25	0.19	0.33
42	DIETHYLMETHYLBENZENE	1.36	0.59	2.36	0.22	0.12	0.32
43	DIETHYLMETHYLBENZENE	0.71	0.00	1.76	0.13	0.00	0.42
44	C5–BENZENE	1.67	0.39	2.43	0.26	0.08	0.33
45	NAPHTHALENE	18.79	9.42	28.55	2.88	2.17	3.46
46	DIMETHYLINDANE	0.78	0.42	1.17	0.13	0.09	0.24
47	DIMETHYLCUMENE	1.33	0.88	1.90	0.21	0.19	0.25
48	n–DODECANE + C5–BENZENE	2.40	1.33	4.67	0.37	0.31	0.51
49	DIPROPYLBENZENE + C13 PARAFFIN	1.67	0.62	2.47	0.27	0.15	0.45
50	2,3–DIHYDROETHYLINDENE + C6–BENZENE	0.62	0.00	1.95	0.13	0.00	0.47
51	2,3,–DIHYDRODIMETHYLINDENE	1.57	0.99	3.53	0.24	0.16	0.39
52	2,3–DIHYDRODIMETHYLINDENE	1.06	0.31	1.75	0.16	0.06	0.21
53	C6–BENZENE + C14 OLEFIN + 2,3–DIHYDRODIMETHY	1.30	0.42	2.96	0.19	0.09	0.33
54	2–METHYLNAPHTHALENE	8.97	5.41	13.87	1.41	1.31	1.52
55	1–METHYLNAPHTHALENE + N–TRIDECANE	5.31	3.42	7.86	0.85	0.74	0.97
56	BIPHENYL	0.07	0.00	0.30	0.01	0.00	0.03
57	DIMETHYLNAPHTHALENE	0.51	0.13	1.00	0.09	0.03	0.24
58	n–TETRADECANE	0.57	0.41	0.74	0.09	0.07	0.12
59	DIMETHYLNAPHTHALENE	0.87	0.47	1.27	0.14	0.10	0.24
60	n–PENTADECANE	0.42	0.20	0.69	0.06	0.04	0.08
61	n–HEXADECANE	0.55	0.25	1.32	0.08	0.05	0.15
62	n–HEPTADECANE	0.72	0.54	0.95	0.12	0.10	0.14
63	PHENANTHRENE	0.14	0.00	0.53	0.02	0.00	0.07
64	n–OCTADECANE	0.49	0.28	0.73	0.08	0.06	0.13

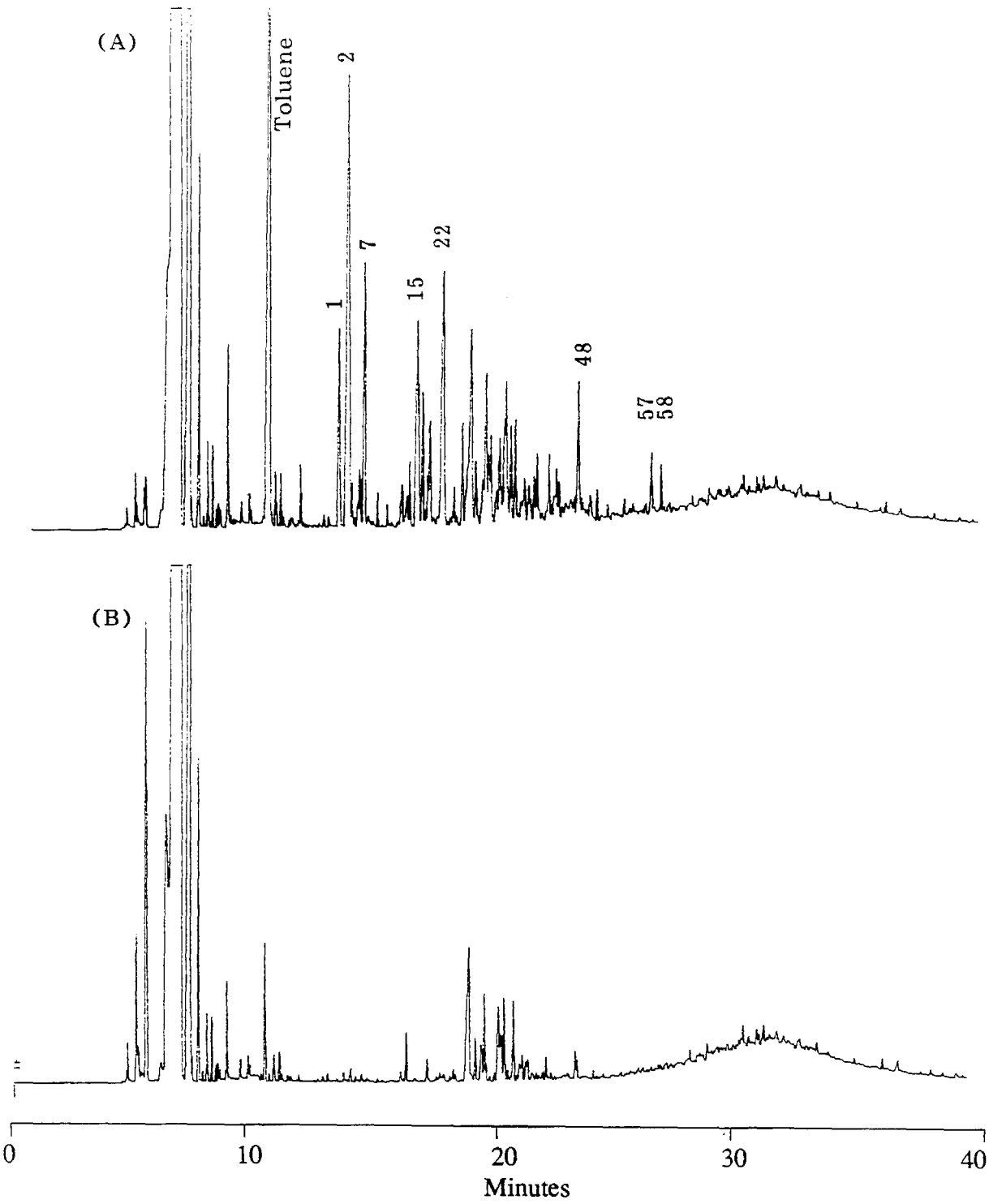

Figure 46. GC/FID traces from a Tenax sample collected in the Caldecott Tunnel on 6/27/9[illegible] from 1600 to 1800 hours. (A) Front Tenax, (B) back-up Tenax. See Table B. for peak identifications.

based on comparison with mass spectral and infrared data, as noted above. The concentration of individual compounds is shown in ng per Tenax cartridge, µ/m3, ppbv (calculated from µ/m3), and ppbC (obtained by multiplying ppbv by the number of carbon atoms). The total concentration of all quantified species, aromatics, and paraffins is also calculated. Table 6 shows the mean, minimum and maximum concentrations for hydrocarbons found in Tenax samples collected in Oildale.

It has to be noted that concentrations of all oxygenated and chlorinated compounds, such as acetate, phenol, benzaldehyde, acetophenone, chlorobenzene, etc., are approximate only, since no calibration was performed for these compounds, and the same response factor is used for calculating their concentrations as for calculating hydrocarbon concentrations. Since compounds containing heteroatoms have different response factors than hydrocarbons (usually lower), the concentration of these compounds is probably underestimated.

Figures 47 and 48 show the GC/FID traces for the Tenax sample collected on July 30, from 0600 to 0800 and 1000 to 1200 hours, respectively. As noted in Section 4.1.2 above, canister samples collected on July 30, from 0600 to 0800 hours, contain much higher hydrocarbon concentrations than the remaining samples. The same is true for Tenax samples. During this first collection period, the favorable meteorological conditions (light wind from the northeast) allowed us to collect the only sample characteristic of the oil production area. Samples collected during the remaining collection periods, when a light wind was usually from the southeast, are less concentrated and typical for urban-suburban areas.

Since, as noted in Section 4.2.1 above, no significant difference was observed between filtered and unfiltered samples, and they are treated as duplicates, only three parallel Tenax sampling trains were quantified, namely samples collected on July 30 (0600-0800 and 1000-1200) and August 1 (0600-0800).

Los Angeles. Tables B27 through B38 show the concentrations of individual hydrocarbons, identified in the Tenax samples collected in Los Angeles. The identification of all hydrocarbons was based on comparison with mass and infarared spectra, as noted above. The concentration of individual compounds is shown in ng/Tenax, µ/m3, ppbv (calculated from µ/m3), and ppbC (obtained by multiplying ppbv by number of carbon atoms). The total concentration of all quantified species, aromatics, and paraffins is also calculated. Table 7 shows the mean, minimum and maximum concentrations for hydrocarbons found in Tenax samples collected in Los Angeles.

As noted above, the concentrations of all oxygenated and chlorinated compounds are only approximate, since no calibration was performed for these compounds, and the same response factor is used for calculating their concentrations as for calculating hydrocarbon concentrations.

Figure 49 shows the GC/FID traces for the Tenax sample collected in Los Angeles on August 22, from 1000 to 1200 hours. Both, front (A) and back-up (B) cartridges are shown.

Table 6. Mean, Minimum and Maximum Concentrations (ppbc and Weight % of TNMHC) of Hydrocarbons Found in Tenax Samples Collected in Oildale (CA). – Page 1

File: OIL–ALL

	COMPOUNDS	MEAN pppbC	RANGE (pppbC) MIN	RANGE (pppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
1	ETHYLBENZENE+ AMYL ACETATE ?	7.72	2.83	17.74	5.69	4.26	8.16
2	1,3,5–TRIMETHYLCYCLOHEXANE	0.42	0.00	1.13	0.21	0.00	0.52
3	m+p–XYLENE	14.36	4.22	32.56	10.33	7.85	14.98
4	4–METHYLOCTANE	1.23	0.33	2.86	0.88	0.59	1.32
5	5–METHYL–3–HEPTANONE	0.08	0.00	0.23	0.14	0.00	0.43
6	3–METHYLOCTANE	0.42	0.00	0.85	0.38	0.36	0.39
7	STYRENE	4.78	0.00	17.24	4.08	0.00	14.74
8	o–XYLENE	5.85	2.46	12.09	4.52	3.54	5.56
9	C9–OLEFIN+ C3–CYCLOHEXANE	0.91	0.50	1.33	0.79	0.61	0.94
10	n–NONANE	1.59	0.62	2.85	1.28	0.90	1.77
11	ISOPROPYLBENZENE (CUMENE)	0.41	0.10	0.93	0.29	0.18	0.43
12	2,3–DIMETHYLOCTANE	0.37	0.00	1.30	0.19	0.00	0.60
13	4–ME–3–HEPTEN–2–ONE+ C10 PARAFFIN	0.07	0.00	0.27	0.06	0.00	0.23
14	a–PINENE	0.81	0.00	1.63	0.75	0.75	0.75
15	n–PROPYLBENZENE	1.80	0.33	3.71	1.29	0.61	1.71
16	m–ETHYLTOLUENE	3.69	0.88	8.71	2.56	1.64	4.00
17	p–ETHYLTOLUENE	1.68	0.40	3.85	1.18	0.74	1.77
18	1,3,5–TRIMETHYLBENZENE	1.96	0.41	4.76	1.32	0.52	2.19
19	C10 PARAFFIN	0.70	0.00	1.31	0.70	0.00	1.49
20	C11–OLEFIN	0.53	0.53	0.53	0.45	0.45	0.45
21	o–ETHYLTOLUENE	1.84	0.80	3.47	1.51	0.77	1.90
22	C5–CYCLOPENTANE	0.73	0.00	1.60	0.60	0.00	1.03
23	1,2,4–TRIMETHYLBENZENE	6.99	2.12	17.01	4.92	3.23	7.82
24	C5–CYCLOPENTANE	0.59	0.19	1.14	0.46	0.19	0.77
25	n–DECANE	1.90	0.74	3.67	1.49	1.20	1.73
26	1,2,3–TRIMETHYLBENZENE	2.37	1.02	4.96	1.83	1.50	2.28
27	PROPENYLBENZENE	0.91	0.27	1.79	0.69	0.50	0.82
28	C10–OLEFIN	1.06	0.37	2.47	0.77	0.49	1.14
29	DIETHYLBENZENE	1.82	0.51	4.18	1.29	0.66	1.92
30	DIETHYLBENZENE	0.71	0.00	1.89	0.48	0.00	0.87
31	ISOPROPYLTOLUENE	0.88	0.00	2.41	0.56	0.00	1.11
32	C4–BENZENE	1.05	0.26	2.52	0.74	0.31	1.16
33	C11 PARAFFIN	[illegible]3	0.41	0.98	0.66	0.43	0.94
34	C4–BENZENE + PARAFFIN	[illegible]5	0.25	3.21	0.74	0.25	1.48

Table 6. Mean, Minimum and Maximum Concentrations (ppbc and Weight % of TNMHC) of Hydrocarbons Found in Tenax Samples Collected in Oildale (CA). – Page 2

	COMPOUNDS	MEAN ppbC	RANGE (ppbC) MIN	RANGE (ppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
35	C4–BENZENE + PARAFFIN	0.92	0.20	1.88	0.67	0.37	0.96
36	TETRAMETHYLBENZENE	1.05	0.00	2.90	0.88	0.37	1.34
37	C4 BENZENE	0.92	0.00	2.40	0.57	0.00	1.10
38	n–UNDECANE	1.62	0.69	3.67	1.26	0.59	1.69
39	1,2,4,5–TETRAMETHYLBENZENE	0.60	0.00	1.94	0.32	0.00	0.89
40	1,2,3,5–TETRAMETHYLBENZENE	0.84	0.00	2.44	0.53	0.00	1.12
41	2,3–DIHYDROMETHYLINDENE	0.85	0.17	1.98	0.60	0.32	0.91
42	BIOGENIC HYDR	0.57	0.00	2.01	0.29	0.00	0.92
43	BIOGENIC HYDR	0.54	0.00	1.64	0.42	0.00	0.92
44	2,3–DIHYDRO–1–METHYLINDENE	0.88	0.00	1.53	0.63	0.00	1.15
45	C5– + C4–BENZENE	0.47	0.00	1.56	0.25	0.00	0.72
46	C5–BENZENE	0.06	0.00	0.25	0.05	0.00	0.21
47	DIETHYLMETHYLBENZENE	0.20	0.00	0.78	0.09	0.00	0.36
48	DIETHYLMETHYLBENZENE	0.63	0.00	1.25	0.29	0.00	0.58
49	NAPHTHALENE	1.23	0.31	2.89	0.87	0.58	1.33
50	C5–BENZENE	0.35	0.00	1.05	0.16	0.00	0.48
51	C5–BENZENE	0.25	0.00	0.83	0.13	0.00	0.38
52	n–DODECANE	1.65	0.25	3.81	1.43	0.21	2.69
53	C13 PARAFFIN	0.72	0.08	1.38	0.57	0.07	1.14
54	C14 PARAFFIN	0.63	0.00	2.10	0.42	0.00	0.97
55	2–METHYLNAPHTHALENE	0.97	0.00	2.31	0.53	0.00	1.06
56	1–METHYLNAPHTHALENE + N–TRIDECANE	1.07	0.31	2.28	0.80	0.47	1.10
57	BIOGENIC HYDROCARBON	0.42	0.00	1.25	0.40	0.00	1.20
58	n–TETRADECANE	0.04	0.00	0.11	0.05	0.00	0.09
59	DIMETHYLNAPHTHALENE	0.01	0.00	0.02	0.01	0.00	0.02
60	DIMETHYLNAPHTHALENE	0.07	0.00	0.22	0.09	0.00	0.19
61	n–PENTADECANE	0.23	0.00	0.68	0.29	0.00	0.58
62	C15 PARAFFIN	0.31	0.00	0.92	0.21	0.00	0.42
63	n–HEXADECANE	0.05	0.00	0.14	0.06	0.00	0.12
64	n–HEPTADECANE	0.00	0.00	0.01	0.00	0.00	0.01
65	PHENANTHRENE	0.01	0.00	0.03	0.01	0.00	0.03
66	n–OCTADECANE	0.05	0.00	0.14	0.06	0.00	0.12

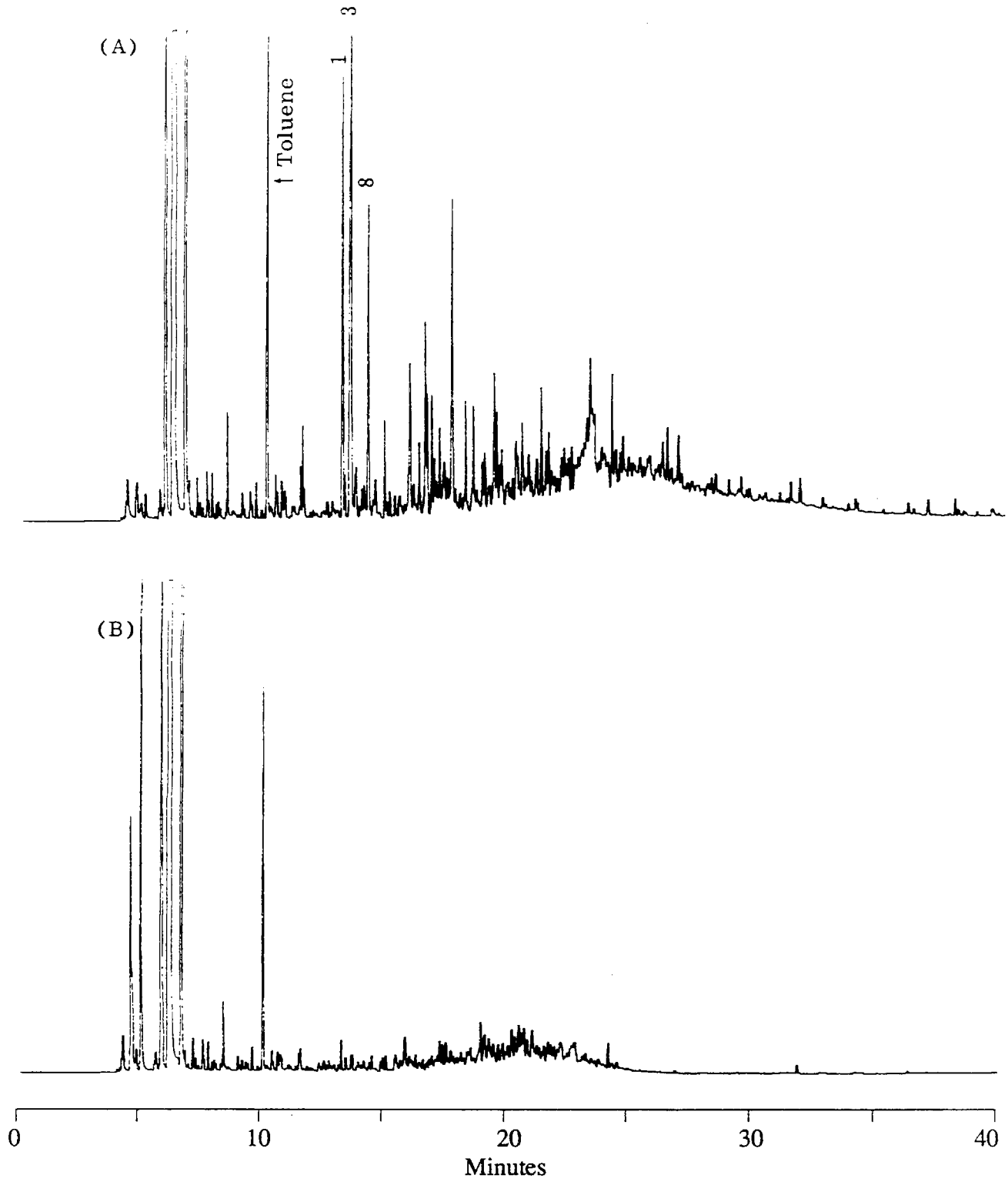

Figure 47. GC/FID traces from a Tenax sample collected in Oildale on 7/30/91, from 0600 to 0800 hours. (A) Front Tenax, (B) back-up Tenax. See Table B19 for p[illegible] identification.

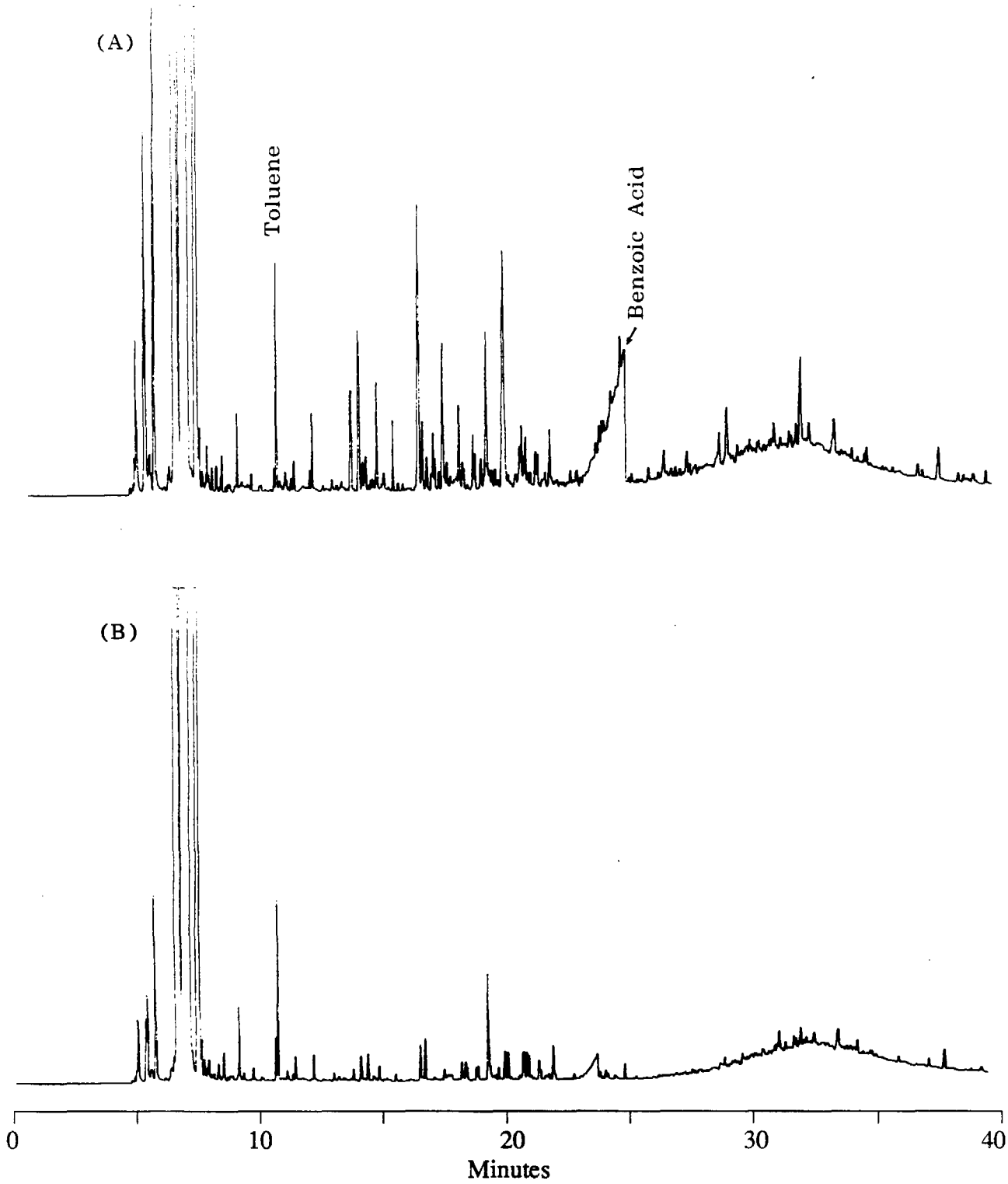

Figure 48. GC/FID traces from a Tenax sample collected in Oildale on 7/30/91, from 1000 to 1200 hours. (A) Front Tenax, (B) back-up Tenax. See Table B21 for peak identification.

Table 7. Mean, Minimum and Maximum Concentrations (ppbc and Weight % of TNMHC) of Hydrocarbons Found in Tenax Samples Collected in Los Angeles (CA). – Page 1

File: LA–ALL

	COMPOUND	MEAN ppbC	RANGE (ppbC) MIN	MAX	MEAN WT%	RANGE (WT%) MIN	MAX
1	ETHYLBENZENE	16.72	6.77	31.16	4.24	3.30	6.17
2	m+p–XYLENE	61.06	25.47	136.35	14.98	11.92	17.53
3	4–METHYLOCTANE	4.66	1.96	8.02	1.19	0.93	1.45
4	3–METHYLOCTANE	1.96	0.69	4.88	0.47	0.31	0.66
5	STYRENE	3.28	1.39	5.58	0.88	0.44	1.51
6	o–XYLENE	24.30	10.48	49.02	6.09	5.11	7.00
7	C9 OLEFIN	3.18	1.63	4.47	0.87	0.49	1.29
8	n–NONANE	9.95	2.86	39.51	2.06	1.33	4.56
9	ISOPROPYLBENZENE (CUMENE)	2.86	1.09	7.14	0.69	0.50	0.82
10	2,3–DIMETHYLOCTANE	3.99	0.59	15.55	0.85	0.22	1.80
11	4–ME–3–HEPTEN–2–ONE+C10 PARAFFIN	3.65	1.25	14.57	0.77	0.36	1.68
12	DIMETHYLOCTANE	4.35	0.37	12.67	0.98	0.18	1.46
13	n–PROPYLBENZENE	7.11	3.86	9.85	1.91	1.05	2.29
14	m–ETHYLTOLUENE	16.94	7.32	34.59	4.20	3.54	4.87
15	p–ETHYLTOLUENE	6.47	3.09	10.72	1.67	1.24	2.03
16	C10 PARAFFIN	5.23	1.87	14.38	1.23	0.73	1.87
17	1,3,5–TRIMETHYLBENZENE	6.85	2.31	16.50	1.68	1.08	2.13
18	C10–PARAFFIN	0.56	0.00	3.72	0.18	0.00	1.08
19	o–ETHYLTOLUENE	12.35	2.62	23.60	3.11	1.22	5.45
20	C10 PARAFFIN	5.40	2.79	8.31	1.45	0.75	2.17
21	1,2,4–TRIMETHYLBENZENE	32.19	17.92	60.93	8.35	7.04	9.69
22	n–DECANE	9.75	5.63	17.14	2.63	1.93	4.03
23	1,2,3–TRIMETHYLBENZENE + C4–BENZENE	6.78	3.85	13.11	1.74	1.51	1.96
24	C4–BENZENE	8.28	0.00	24.23	1.81	0.00	3.20
25	PROPENYLBENZENE	6.66	3.33	17.87	1.61	1.18	2.06
26	METHYLISOPROPENYLCYCLOHEXENE	3.63	1.82	7.45	0.95	0.80	1.34
27	C4–BENZENE	3.53	0.00	7.28	0.98	0.00	3.41
28	DIETHYLBENZENE	9.03	5.61	16.95	2.42	1.31	3.28
29	ETHYLDIMETHYLBENZENE	12.69	7.35	26.29	3.27	2.30	4.48
30	ISOPROPYLTOLUENE	5.21	2.59	11.12	1.31	1.00	1.60
31	ETHYLDIMETHYLBENZENE	4.82	1.92	13.16	1.13	0.84	1.52
32	TETRAMETHYLBENZENE	9.60	3.59	23.79	2.34	1.68	3.36

Table 7. Mean, Minimum and Maximum Concentrations (ppbc) and Weight % of TNMHC) of Hydrocarbons Found in Samples Collected in Los Angeles (CA). – Page 2

	COMPOUND	MEAN ppbC	RANGE (ppbC) MIN	RANGE (ppbC) MAX	MEAN WT%	RANGE (WT%) MIN	RANGE (WT%) MAX
33	ETHYLDIMETHYLBENZENE	5.46	2.28	11.98	1.35	1.07	1.46
34	C12 PARAFFIN	3.06	0.34	7.76	0.72	0.17	1.09
35	C4 BENZENE	2.99	1.24	8.97	0.77	0.38	1.35
36	n–UNDECANE	6.96	4.37	11.12	1.87	1.28	2.50
37	1,2,4,5–TETRAMETHYLBENZENE	2.43	0.00	7.37	0.53	0.00	0.85
38	1,2,3,5–TETRAMETHYLBENZENE	3.32	0.98	10.53	0.75	0.46	1.22
39	2,3–DIHYDRO–2–METHYLINDENE	1.07	0.00	3.07	0.27	0.00	0.43
40	1,3–DIETHYL–5–METHYLBENZENE	1.72	0.00	6.96	0.33	0.00	0.80
41	C5–BENZENE+METHYLINDENE	2.40	0.60	4.77	0.73	0.14	1.20
42	2,3–DIHYDRO–1–METHYLINDENE	1.62	0.95	2.82	0.44	0.26	0.65
43	C5– + C4–BENZENE	1.87	1.37	2.79	0.53	0.23	0.71
44	C5–BENZENE	1.11	0.00	1.97	0.33	0.00	0.53
45	DIETHYLMETHYLBENZENE	0.73	0.00	2.08	0.15	0.00	0.34
46	DIETHYLMETHYLBENZENE	0.27	0.00	0.83	0.05	0.00	0.19
47	C5–BENZENE	0.55	0.00	1.40	0.18	0.00	0.53
48	NAPHTHALENE	5.65	2.39	12.25	1.39	1.12	1.73
49	DIMETHYLINDANE	0.89	0.00	1.77	0.24	0.00	0.48
50	DIMETHYLCUMENE	0.44	0.00	1.66	0.09	0.00	0.35
51	n–DODECANE	3.23	1.93	4.29	0.88	0.48	1.15
52	DIPROPYLBENZENE + C13 PARAFFIN	1.28	0.89	1.78	0.36	0.21	0.51
53	2,3–DIHYDROETHYLINDENE + C6–BENZENE	0.08	0.00	0.49	0.01	0.00	0.06
54	2,3,–DIHYDRODIMETHYLINDENE	1.16	0.84	1.79	0.32	0.21	0.41
55	2,3–DIHYDRODIMETHYLINDENE	0.74	0.00	3.29	0.16	0.00	0.76
56	C6–BENZENE+C14 OLEFFIN	0.92	0.00	1.38	0.24	0.00	0.37
57	2–METHYLNAPHTHALENE	3.13	1.37	6.91	0.79	0.61	1.07
58	1–METHYLNAPHTHALENE + N–TRIDECANE	2.88	1.64	4.92	0.76	0.57	0.88
59	BIPHENYL	0.53	0.00	2.20	0.19	0.00	1.03
60	DIMETHYLNAPHTHALENE	0.38	0.00	0.93	0.08	0.00	0.22
61	n–TETRADECANE	0.47	0.00	1.15	0.14	0.00	0.34
62	DIMETHYLNAPHTHALENE	0.53	0.00	1.15	0.16	0.00	0.47
63	DIMETHYLNAPHTHALENE	0.70	0.00	1.16	0.19	0.00	0.36
64	n–PENTADECANE	1.06	0.41	2.01	0.30	0.13	0.58
65	n–HEXADECANE	0.30	0.00	1.15	0.07	0.00	0.34
66	n–HEPTADECANE	0.36	0.00	1.58	0.08	0.00	0.46
67	PHENANTHRENE	0.14	0.00	1.10	0.02	0.00	0.13
68	n–OCTADECANE	0.15	0.00	0.69	0.03	0.00	0.20

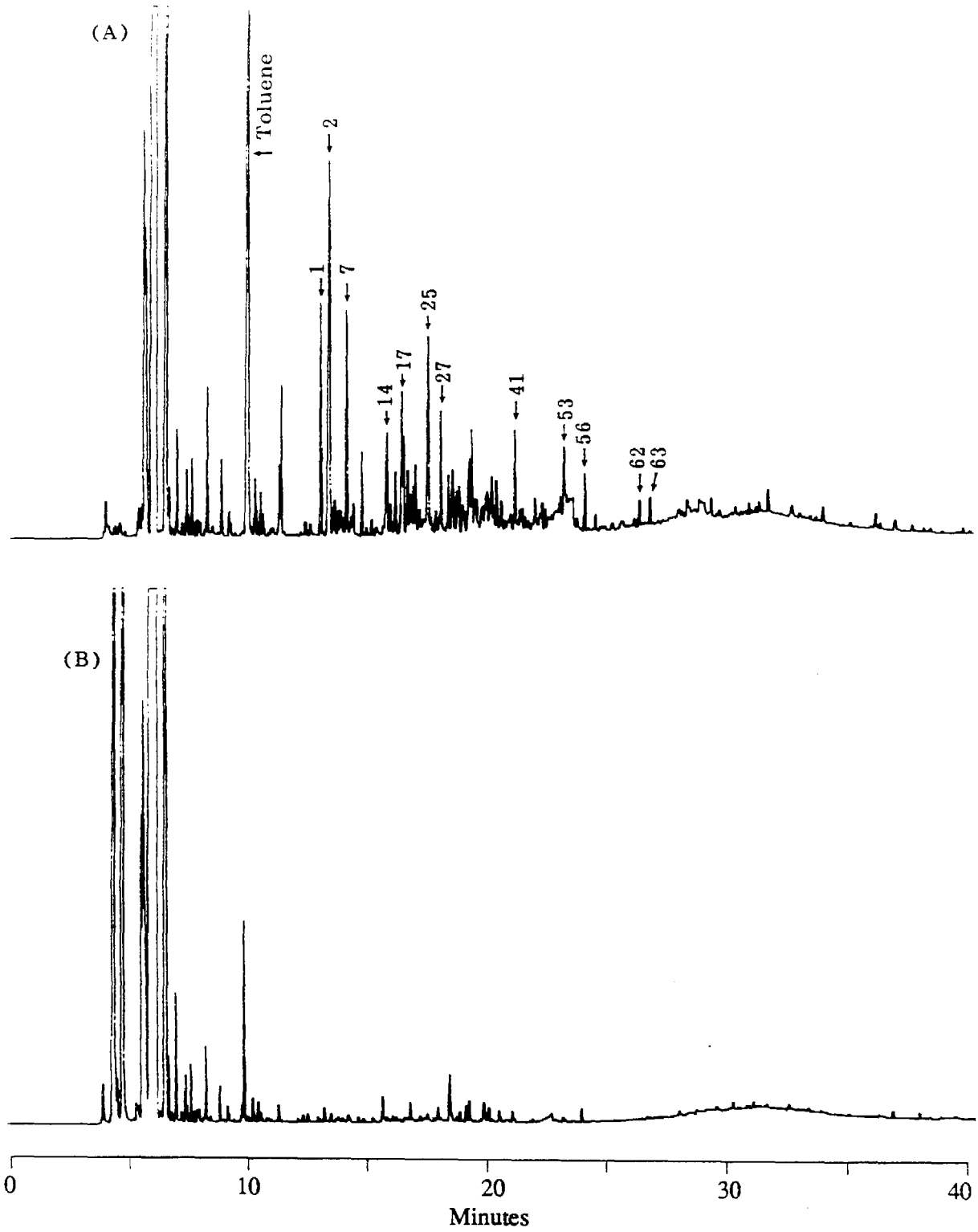

Figure 49. GC/FID traces from a Tenax sample collected in Los Angeles on 8/22/91, from 1000 to 1200 hours. (A) Front Tenax, (B) back-up Tenax. See Table B31 for peak identification.

Since, as noted in Section 4.2.1 above, no significant difference was observed between filtered and unfiltered samples, not all parallel Tenax sampling trains were quantified. The concentrations of hydrocarbons found on parallel filtered and unfiltered Tenax samples collected on August 21 (0600-0800), August 22 (1000-1200), and August 23 (0600-0800 and 1000-1200) are reported and they can be regarded as collocated samples.

5.0 DATA ANALYSIS

5.1 Comparison of Collocated Measurements

5.1.1. Collocated Canister Samples

Caldecott Tunnel. Three collocated canister samples were collected during sampling in the Caldecott Tunnel, namely on June 25, from 1600 to 1800 hours (Appendix A, Tables A2 and A3) and on June 27, from 1000 to 1200 hours, and from 1600 to 1800 hours (Tables A8 and A9, and Tables A10 and A11, respectively). Table 8 shows the comparison between two collocated canister samples collected on June 27 from 1000 to 1200 hours and, as can be seen from this table, the agreement between these two measurements is good for all quantified compounds. The collocated samples collected on June 25, 1600 to 1800 hours, are excluded from the comparison because of the malfunction of one flow controller caused by very high humidity and low temperature (15 °C) in the Tunnel.

For TNMHC concentration, obtained by summing the concentrations of all quantified hydrocarbons, the overall precision calculated for these two collocated measurements is 1% for samples collected on June 27, 1000 to 1200 hours, and 3.7% for samples collected on 6/27, 1600 to 1800 hours. The overall precision is calculated from the formula:

$$\% P = \frac{A_1 - A_2}{(A_1 + A_2)/2} \times 100$$

where: A1 = TNMHC from canister #1
A2 = TNMHC from canister #2

Oildale. One collocated canister sample was collected during sampling in Oildale, namely on August 1, from 0600 to 0800 hours (Appendix A, Tables A21 and A22). Table 9 shows the comparison between these two collocated canister samples and, as can be seen from this table, the agreement between these two measurements is, in general, good for all quantified compounds. The only exception is isopentane; its concentration, obtained from these two canister samples, differs from each other by ~30%. The overall precision for TNMHC concentration (calculated as shown above) is 22%.

Los Angeles. Two collocated canister samples were collected during sampling in Los Angeles, namely on August 23, from 0600 to 0800 hours and from 1000 to 1200 hours (Appendix A, Tables A27 and A28, and Tables A29 and A30, respectively). Table 10 shows the comparison between two collocated canister samples collected from 1000 to 1200 hours. As can be seen from this table, the agreement between these two measurements is good for all quantified compounds. The overall precision for TNMHC concentration, calculated (as shown above) for

Table 8
Comparison of Collocated Canister Samples (Caldecott Tunnel)

Caldecott Can #000276 6/27/91 1600-1800 - Page 1 CAN#00276 VS CAN#00271

PK #	NAME	00276 C(ppbC)	00271 C(ppbC)
1	ACETYLENE	93.60	86.64
2	ETHYLENE	241.30	240.50
3	ETHANE	28.47	27.90
4	PROPENE	110.90	95.40
5	PROPANE	19.30	15.30
6	ISOBUTANE	37.42	29.00
7	BUTENE-1	46.00	55.43
8	1,3-BUTADIENE	16.30	12.88
9	n-BUTANE	118.15	122.25
10	trans-2-BUTENE	11.39	12.41
11	cis-2-BUTENE	10.03	10.30
12	C4 OLEFIN	4.55	4.73
13	C4 OLEFIN	5.29	6.69
14	3-METHYL-1-BUTENE	3.65	3.50
15	ISOPENTANE	293.21	289.27
16	1-PENTENE	10.57	9.58
17	2-METHYL-1-BUTENE	15.71	14.83
18	n-PENTANE	100.50	97.37
19	C5 HYDROCARBON	3.51	
20	t-2-PENTENE	17.91	17.48
21	c-2-PENTENE	10.25	9.65
22	C5 OLEFIN		
23	2-METHYL-2-BUTENE	29.15	31.28
24	C6 PARAFFIN		4.28
25	2,2-DIMETHYLBUTANE	10.94	13.50
26	C6 HYDROCARBON	6.17	
27	CYCLOPENTENE	6.50	6.45
28	4-METHYL-1-PENTENE		
29	CYCLOPENTANE	13.35	13.04
30	2,3-DIMETHYLBUTANE	28.77	28.66
31	2-METHYLPENTANE	106.71	105.19
32	C6 OLEFIN		3.90
33	UNKNOWN	9.39	12.33
34	3-METHYLPENTANE	62.50	59.88
35	2-METHYL-1-PENTENE +		
	1-HEXENE	9.06	9.13
36	C6 OLEFIN		
37	n-HEXANE	50.43	46.55
38	t-3-HEXENE	5.46	7.61
39	t-2-HEXENE	10.62	11.46
40	C6 OLEFIN	5.70	6.24

Table 8 (continued)

PK #	NAME	C(ppbC)	C(ppbC)
41	C6 OLEFIN	4.74	4.69
42	C6 OLEFIN	5.53	5.40
43	METHYLCYCLOPENTANE	60.34	56.50
44	2,4–DIMETHYLPENTANE	14.75	13.77
	2,3,3–TRIMETHYLBUTANE		
	+TRICHLOROETHANE		
45	C7 PARAFFIN	15.11	6.48
46	BENZENE	177.01	175.16
47	3,3–DIMETHYLPENTANE	5.46	
48	CYCLOHEXANE	10.21	9.54
49	2–METHYLHEXANE	37.15	37.07
50	2,3–DIMETHYLPENTANE	14.77	14.37
51	3–METHYLHEXANE	40.97	40.18
52	C7 OLEFIN		
53	1,3–DIMETHYLCYCLOPENTANE	12.95	12.58
54	3–ETHYLPENTANE	16.10	15.60
55	2,2,4–TRIMETHYLPENTANE	53.17	50.59
56	C8 HYDROCARBON	5.71	
57	n–HEPTANE	23.51	20.92
58	C8 HYDROCARBON	5.03	
59	C8 OLEFIN	10.95	
60	METHYLCYCLOHEXANE	19.91	13.80
61	C8 PARAFFIN		18.65
62	2,5–DIMETHYLHEXANE	9.86	9.20
63	2,4–DIMETHYLHEXANE	19.13	17.97
64	C8 PARAFFIN	4.17	4.19
65	C8 PARAFFIN		
66	2,3,4–TRIMETHYLPENTANE	21.05	20.68
67	TOLUENE	293.66	294.10
68	2,3–DIMETHYLHEXANE		
69	2–METHYLHEPTANE	15.50	14.05
70	3–METHYLHEPTANE		
71	3–ETHYLHEXANE	15.83	14.80
72	C8 PARAFFIN	4.40	3.94
73	2,2,5–TRIMETHYLHEXANE	11.11	10.24
74	DIMETHYLCYCLOHEXANE +		
	1–OCTENE	3.01	
75	C8 PARAFFIN		
76	n–OCTANE	9.67	9.61
77	PERCHLOROETHYLENE		
78	C9 PARAFFIN		
79	DIMETHYLHEPTANE		
80	C9 PARAFFIN	2.06	

Table 8 (continued)

PK #	NAME	C(ppbC)	C(ppbC)
81	C9 PARAFFIN	6.06	6.54
82	2,5-DIMETHYLHEPTANE		
83	C9 PARAFFIN	9.53	8.68
84	ETHYLBENZENE	50.33	51.39
85	C9 OLEFFIN		
86	m&p-XYLENE	204.52	206.82
87	4-METHYLOCTANE		
88	3-METHYLOCTANE		
89	C9 PARAFFIN	6.93	6.35
90	STYRENE	40.00	33.64
91	o-XYLENE	90.35	87.25
92	1-NONENE	19.98	17.72
93	n-NONANE	22.69	18.06
94	C9 PARAFFIN	6.01	5.04
95	ISOPROPYLBENZENE	19.85	15.53
96	C10 PARAFFIN	4.20	4.10
97	CYCLOOCTANE		
98	C10 PARAFFIN		
99	C10 PARAFFIN	20.28	16.15
100	a-PINENE		
101	C10 PARAFFIN	6.23	
102	n-FROPYLBENZENE	9.80	11.04
103	m-ETHYLTOLUENE	54.70	55.55
104	p-ETHYLTOLUENE	31.52	30.69
105	1,3,5-TRIMETHYLBENZENE	173.09	139.41
106	C10 PARAFFIN	31.78	29.44
107	o-ETHYLTOLUENE	28.68	22.08
108	C10 PARAFFIN	6.29	5.40
109	1,2,4-TRIMETHYLBENZENE	75.65	78.66
110	C10 PARAFFIN		
111	n-DECANE	27.42	17.16
112	SEC-BUTYLBENZENE	8.29	7.31
113	C10 OLEFIN		
114	1,2,3-TRIMETHYLBENZENE	22.19	23.32
115	1-METHYL-4-ISOPROPYLBENZENE		13.45
116	C10 AROMATIC	13.92	
117	C10 AROMATIC	11.46	14.66
118	n-BUTYLCYCLOHEXANE		
119	1,3-DIETHYLBENZENE	30.37	22.76
120	C10 AROMATIC		
121	1,4-DIETHYLBENZENE	18.64	21.90
122	C10 AROMATIC	6.49	5.77
123	C11 PARAFFIN		0.00

Table 8 (continued)

PK #	NAME	C(ppbC)	C(ppbC)
124	2,6-DIMETHYLSTYRENE		
125	1,3-DIMETHYL-4-ETHYLBENZENE	6.97	7.82
126	C10 AROMATIC	15.06	18.16
127	C10 AROMATIC	3.09	6.01
128	C10 AROMATIC		
129	n-UNDECANE		4.79
130	C10 AROMATIC		
131	1,2,4,5-TETRAMETHYLBENZENE	5.03	6.18
132	1,2,3,5-TETRAMETHYLBENZENE	7.70	8.53
133	C11 PARAFFIN		
134	C10 AROMATIC		
135	C10 AROMATIC	5.85	6.98
136	C11 PARAFFIN		
137	m-DIISOPROPYLBENZENE		
138	C11 AROMATIC	9.66	10.85
139	1,2,3,4,-TETRAMETHYLBENZENE		
140	C11 AROMATIC		
141	C11 AROMATIC		
142	NAPHTHALENE	18.75	26.84
143	C11 AROMATIC		
144	n-DODECANE		
	TOTAL	3624.91	3491.88

Table 9
Comparison of Collocated Canister Samples (Oildale)

OILDALE CAN #00294 vs #00298 8/1/91 0600–0800 -- Page 1

PK #	NAME	00294 C(ppbC)	00298 C(ppbC)
1	ACETYLENE	2.60	2.37
2	ETHYLENE	8.64	7.77
3	ETHANE	4.06	3.63
4	PROPENE	1.98	1.74
5	PROPANE	8.78	9.07
6	ISOBUTANE	1.23	3.01
7	BUTENE–1	1.25	2.02
8	1,3–BUTADIENE		
9	n–BUTANE	7.63	7.98
10	trans–2–BUTENE	0.53	0.70
11	cis–2–BUTENE	2.18	1.31
12	C4 OLEFIN		
13	C4 OLEFIN	1.21	1.11
14	3–METHYL–1–BUTENE	0.64	
15	ISOPENTANE	39.29	22.68
16	1–PENTENE		
17	2–METHYL–1–BUTENE		
18	n–PENTANE	8.04	7.08
19	ISOPRENE		
20	t–2–PENTENE		
21	c–2–PENTENE		
22	C5 OLEFIN	1.01	1.11
23	2–METHYL–2–BUTENE	1.21	
24	C6 PARAFFIN		
25	C6 PARAFFIN	1.17	
26	CYCLOPENTENE	0.53	
27	4–METHYL–1–PENTENE		
28	CYCLOPENTANE	0.77	0.81
29	2,3–DIMETHYLBUTANE	1.24	1.21
30	2–METHYLPENTANE	4.66	4.72
31	C6 OLEFIN	4.94	3.27
32	UNKNOWN	1.89	2.48
33	3–METHYLPENTANE	4.74	3.34
34	2–METHYL–1–PENTENE +		
	1–HEXENE		
35	C6 OLEFIN		
36	n–HEXANE	3.33	3.30
37	t–3–HEXENE		
38	t–2–HEXENE		
39	C6 OLEFIN		
40	C6 OLEFIN		

PK #	NAME	C(ppbC)	C(ppbC)
41	C6 OLEFIN		
42	METHYLCYCLOPENTANE	3.24	3.32
43	2,4-DIMETHYLPENTANE	1.00	0.77
44	C8PARAFFIN+TRICHLOROETHANE	2.00	1.65
45	BENZENE	6.27	6.21
46	3,3-DIMETHYLPENTANE		
47	CYCLOHEXANE	0.71	-0.75
48	2-METHYLHEXANE	1.67	1.73
49	2,3-DIMETHYLPENTANE	1.19	1.15
50	3-METHYLHEXANE	3.03	2.83
51	C7 OLEFIN		
52	1,3-DIMETHYLCYCLOPENTANE		0.51
53	3-ETHYLPENTANE	0.59	0.69
54	2,2,4-TRIMETHYLPENTANE	2.18	2.45
55	n-HEPTANE	3.67	1.55
56	C8 HYDROCARBON	1.99	3.58
57	METHYLCYCLOHEXANE	1.37	1.39
58	C8 PARAFFIN		
59	2,5-DIMETHYLHEXANE		
60	2,4-DIMETHYLHEXANE	0.96	0.71
61	C8 PARAFFIN		
62	C8 PARAFFIN	0.91	
63	2,3,4-TRIMETHYLPENTANE		
64	TOLUENE	15.90	15.31
65	2,3-DIMETHYLHEXANE		
66	2-METHYLHEPTANE	1.30	0.66
67	3-METHYLHEPTANE	1.05	0.79
68	3-ETHYLHEXANE		
69	C8 PARAFFIN	1.24	0.97
70	2,2,5-TRIMETHYLHEXANE		
71	DIMETHYLCYCLOHEXANE +		
	1-OCTENE		
72	C8 PARAFFIN		
73	n-OCTANE	0.80	0.68
74	PERCHLOROETHYLENE		
75	C9 PARAFFIN	0.66	
76	DIMETHYLHEPTANE		
77	C9 PARAFFIN		
78	C9 PARAFFIN		
79	2,5-DIMETHYLHEPTANE		

Table 9 (continued)

PK #	NAME	C(ppbC)	C(ppbC)
80	C9 PARAFFIN		
81	ETHYLBENZENE	2.44	2.64
82	C9 OLEFFIN		
83	m&p–XYLENE	10.41	10.36
84	4–METHYLOCTANE		
85	3–METHYLOCTANE		
86	C9 PARAFFIN		
87	STYRENE	46.49	32.02
88	o–XYLENE	3.73	3.62
89	1–NONENE		
90	n–NONANE	0.56	0.51
91	C9 PARAFFIN		
92	ISOPROPYLBENZENE		
93	C10 PARAFFIN		
94	CYCLOOCTANE		
95	C10 PARAFFIN		
96	C10 PARAFFIN		
97	a–PINENE		
98	C10 PARAFFIN	0.93	
99	n–PROPYLBENZENE	0.64	0.66
100	m–ETHYLTOLUENE	2.67	2.70
101	p–ETHYLTOLUENE	1.45	1.41
102	1,3,5–TRIMETHYLBENZENE	1.57	1.40
103	C10 PARAFFIN	4.10	
104	o–ETHYLTOLUENE	1.12	0.74
105	C10 PARAFFIN	1.86	1.30
106	1,2,4–TRIMETHYLBENZENE	3.93	4.39
107	C10 PARAFFIN		
108	n–DECANE	1.57	1.30
109	SEC–BUTYLBENZENE		
110	C10 OLEFIN		
111	1,2,3–TRIMETHYLBENZENE	2.27	2.02
112	1–METHYL–4–ISOPROPYLBENZENE		
113	C10 PARAFFIN	2.08	
114	C10 AROMATIC	1.08	
115	n–BUTYLCYCLOHEXANE		
116	1,3–DIETHYLBENZENE		
117	C10 AROMATIC	2.47	
118	1,4–DIETHYLBENZENE	1.20	1.35
119	C10 AROMATIC		

PK #	NAME	C(ppbC)	C(ppbC)
120	C11 PARAFFIN		
121	2,6–DIMETHYLSTYRENE		
122	1,3–DIMETHYL–4–ETHYLBENZENE	0.80	0.90
123	C10 AROMATIC	1.32	1.34
124	C10 AROMATIC		
125	C10 AROMATIC		
126	n–UNDECANE	1.70	1.76
127	C10 AROMATIC		
128	1,2,4,5–TETRAMETHYLBENZENE	0.78	0.81
129	1,2,3,5–TETRAMETHYLBENZENE	0.60	0.81
130	C11 PARAFFIN		
131	C10 AROMATIC		
132	C10 AROMATIC		
133	C11 PARAFFIN		
134	m–DIISOPROPYLBENZENE		
135	C11 AROMATIC		
136	1,2,3,4,–TETRAMETHYLBENZENE		
137	C11 AROMATIC		
138	C11 AROMATIC		
139	NAPHTHALENE	1.19	1.19
140	C11 AROMATIC		
141	n–DODECANE		
	TOTAL	264.24	211.64

Table 10
Comparison of Collocated Canister Samples (Los Angeles)

LOS ANGELES CAN #00344 VS #00342 8/23/91 0600–0800 Sampler #2 -- Page 1

PK #	NAME	00344 C(ppbC)	00342 C(ppbC)
1	ACETYLENE	21.10	19.80
2	ETHYLENE	61.30	62.70
3	ETHANE	30.20	29.30
4	PROPENE	14.70	16.90
5	PROPANE	54.80	53.60
6	ISOBUTANE	27.06	26.90
7	BUTENE–1	12.30	10.70
8	1,3–BUTADIENE	3.90	
9	n–BUTANE	61.00	61.50
10	trans–2–BUTENE	4.53	4.67
11	cis–2–BUTENE	3.78	3.86
12	C4 OLEFIN	2.21	1.70
13	C4 OLEFIN	4.89	2.21
14	3–METHYL–1–BUTENE		0.87
15	ISOPENTANE	98.29	99.78
16	1–PENTENE	4.10	4.02
17	2–METHYL–1–BUTENE	4.30	3.28
18	n–PENTANE	53.09	54.75
19	ISOPRENE	1.68	1.77
20	t–2–PENTENE	5.55	5.95
21	c–2–PENTENE	3.12	3.11
22	C5 OLEFIN	2.71	9.41
23	2–METHYL–2–BUTENE	11.43	2.51
24	C6 PARAFFIN	1.01	1.93
25	UNKNOWN	1.87	2.60
26	2,2–DIMETHYLBUTANE	3.06	1.44
27	C6 HYDROCARBON	0.87	1.47
28	CYCLOPENTENE	1.05	
29	4–METHYL–1–PENTENE		
30	CYCLOPENTANE	5.78	5.72
31	2,3–DIMETHYLBUTANE	9.01	8.98
32	2–METHYLPENTANE	33.15	31.27
33	C6 OLEFIN	8.01	6.95
34	UNKNOWN	2.32	1.57
35	3–METHYLPENTANE	20.39	20.53
36	2–METHYL–1–PENTENE + 1–HEXENE	2.15	2.23
37	C6 OLEFIN		
38	n–HEXANE	21.65	21.45
39	t–3–HEXENE	2.06	1.69
40	t–2–HEXENE	1.91	1.83
41	C6 OLEFIN	1.67	
42	C6 OLEFIN	1.34	2.02

PK #	NAME	C(ppbC)	
43	C6 OLEFIN	2.22	
44	METHYLCYCLOPENTANE	19.90	19.82
45	2,4–DIMETHYLPENTANE	7.11	7.06
46	2,3,3–TRIMETHYL–1–BUTENE + 1,1,1–TRICHLOROETHANE	11.59	11.96
47	BENZENE	36.70	38.10
48	3,3–DIMETHYLPENTANE		
49	CYCLOHEXANE	5.43	5.73
50	2–METHYLHEXANE	10.73	10.91
51	2,3–DIMETHYLPENTANE	11.44	11.52
52	3–METHYLHEXANE	13.34	13.08
53	C7 OLEFIN		
54	1,3–DIMETHYLCYCLOPENTANE	4.12	3.66
55	3–ETHYLPENTANE	5.35	4.67
56	2,2,4–TRIMETHYLPENTANE	19.42	19.08
57	n–HEPTANE	9.04	9.00
58	C8 HYDROCARBON	2.11	2.65
59	METHYLCYCLOHEXANE	11.14	9.86
60	C8 PARAFFIN		
61	2,5–DIMETHYLHEXANE	2.28	2.43
62	2,4–DIMETHYLHEXANE	5.00	5.07
63	C8 PARAFFIN	1.75	1.82
64	C8 PARAFFIN	1.45	1.47
65	2,3,4–TRIMETHYLPENTANE	6.42	6.40
66	TOLUENE	79.94	85.05
67	2,3–DIMETHYLHEXANE	3.16	3.40
68	2–METHYLHEPTANE	4.28	4.56
69	3–METHYLHEPTANE	3.98	4.60
70	UNKNOWN	0.96	1.22
71	C8 PARAFFIN	1.42	2.43
72	2,2,5–TRIMETHYLHEXANE	1.06	1.85
73	DIMETHYLCYCLOHEXANE + 1–OCTENE	0.84	
74	C8 PARAFFIN		
75	n–OCTANE	4.10	4.24
76	PERCHLOROETHYLENE	1.66	1.68
77	C9 PARAFFIN		1.59
78	DIMETHYLHEPTANE		
79	C9 PARAFFIN	1.53	
80	C9 PARAFFIN		
81	2,5–DIMETHYLHEPTANE	2.31	2.44
82	C9 PARAFFIN	1.41	1.44

PK #	NAME	C(ppbC)	
83	ETHYLBENZENE	13.59	13.61
84	C9 OLEFFIN	1.30	1.32
85	m&p–XYLENE	53.55	53.66
86	4–METHYLOCTANE		
87	3–METHYLOCTANE		
88	C9 PARAFFIN	1.79	2.01
89	STYRENE	4.57	4.48
90	o–XYLENE	19.12	18.93
91	1–NONENE		
92	n–NONANE	3.12	3.09
93	C9 PARAFFIN	1.52	1.55
94	ISOPROPYLBENZENE	2.06	1.89
95	C10 PARAFFIN		
96	CYCLOOCTANE		
97	C10 PARAFFIN	1.96	1.93
98	C10 PARAFFIN		
99	a–PINENE		
100	C10 PARAFFIN		
101	n–PROPYLBENZENE	5.12	3.68
102	m & p–ETHYLTOLUENE	14.71	14.18
103	2,3–DIMETHYLOCTANE	7.05	6.86
104	1,3,5–TRIMETHYLBENZENE	7.73	7.46
105	C10 PARAFFIN	2.41	2.56
106	o–ETHYLTOLUENE	4.94	4.27
107	C10 PARAFFIN	5.65	3.27
108	1,2,4–TRIMETHYLBENZENE	20.05	19.34
109	C10 PARAFFIN		
110	n–DECANE	5.05	4.28
111	SEC–BUTYLBENZENE	2.34	2.69
112	C10 OLEFIN	4.04	1.05
113	1,2,3–TRIMETHYLBENZENE	9.92	8.16
114	1–METHYL–4–ISOPROPYLBENZENE		
115	C10 PARAFFIN	1.53	1.64
116	C10 AROMATIC	3.45	3.47
117	n–BUTYLCYCLOHEXANE		
118	1,3–DIETHYLBENZENE	3.31	3.15
119	C10 AROMATIC	3.18	2.98
120	1,4–DIETHYLBENZENE	6.02	5.84
121	C10 AROMATIC		
122	C11 PARAFFIN	1.76	1.48

PK #	NAME	C(ppbC)	C(ppbC)
123	2,6-DIMETHYLSTYRENE		
124	1,3-DIMETHYL-4-ETHYLBENZENE	7.13	3.35
125	C10 AROMATIC	4.87	4.53
126	C10 AROMATIC	1.26	1.20
127	C10 AROMATIC		
128	n-UNDECANE	6.14	5.85
129	C10 AROMATIC		
130	1,2,4,5-TETRAMETHYLBENZENE	2.31	2.27
131	1,2,3,5-TETRAMETHYLBENZENE	2.27	2.21
132	C11 PARAFFIN		
133	C10 AROMATIC		
134	C10 AROMATIC	2.66	2.60
135	C11 PARAFFIN		
136	m-DIISOPROPYLBENZENE		
137	C11 AROMATIC	3.50	3.34
138	1,2,3,4,-TETRAMETHYLBENZENE		
139	C11 AROMATIC		
140	C11 AROMATIC	3.46	3.25
141	NAPHTHALENE	3.99	3.66
142	C11 AROMATIC		
143	n-DODECANE		
	TOTAL	1144.96	1120.85

these two collocated measurements, is 2.1% for samples collected from 0600 to 0800 hours and 2.5% for samples collected from 1000 to 1200 hours.

5.1.2 Collocated Tenax Samples

Tables 11, 12, and 13 (pages 97-102) show the comparison between filtered (X1 where X = sampling port number, 1 to 4) and unfiltered (X0) Tenax samples collected in Caldecott Tunnel, Oildale, and Los Angeles, respectively. As can be seen from these Tables, there is no significant difference between these pairs of Tenax cartridges (numbers for C14-C18 hydrocarbons are not significantly higher for unfiltered samples), therefore these pairs of Tenax cartridges are treated as duplicate samples. Since it is not practical to calculate the overall precision of measurement for each individual compound, this precision was calculated for total hydrocarbon concentrations, obtained by summing the concentrations of all quantified compounds. Tables 14, 15, and 16 show the precicion of measurements for Caldecott Tunnel, Oildale and Los Angeles, respectively.

Table 14
The Overall Precision of Measurement for Duplicate Tenax Cartridges Collected in Caldecott Tunnel

Cartridge #	2062606 1162606	2062616 3162616	2062706 3162706	2062710 1162710	2062716 3162716	4062806 1162806	2062810 1162810
Precision (%)	6	14.6	10.5	0.8	5.8	8.6	3.3

Table 15
The Overall Precision of Measurement for Duplicate Tenax Cartridges Collected in Oildale

Cartridge #	1173006 3173006	4073010 3173010	2080106 1180106
Precision (%)	9.3	6.4	3.4

Table 16
The Overall Precision of Measurement for Duplicate Tenax Cartridges Collected in Los Angeles

Cartridge #	4082106 1182106	2082210 1182210	4082306 3182306	2082310 3182310
Precision (%)	3.6	4.4	1.5	9.8

Table 11

Comparison of Filtered and Unfiltered Tenax Samples (Caldecott Tunnel)

Caldecott ...nel -- Tenax Data -- 6/27/91 -- 1000-1200 -- page 1 TENAX:1162710F vs 2062710F

			1162710F		2062710F	
	RT	COMPOUND	C(NG/TENAX)	CppbC	C(NG/TENAX)	CppbC
1	13.37	ETHYLBENZENE	903.07	40.64	937.66	41.79
2	13.77	m+p-XYLENE	3615.06	162.70	3751.47	167.21
3	13.89	4-METHYLOCTANE	188.29	7.90	187.90	7.80
4	13.97	5-METHYL-3-HEPTANONE	40.21	1.47		0.00
5	14.13	3-METHYLOCTANE	110.36	4.63	118.71	4.93
6	14.21	STYRENE	276.33	12.68	289.51	13.15
7	14.45	o-XYLENE	1332.19	59.96	1372.00	61.15
8	14.66	C9 OLEFIN	187.28	7.98	192.82	8.13
9		2-BUTOXYETHANOL		0.00		0.00
10	14.98	n-NONANE	101.43	4.25	111.06	4.61
11	15.37	ISOPROPYLBENZENE (CUMENE)	66.46	2.97	71.53	3.17
12	16.00	BENZALDEHYDE	260.81	10.27	290.15	11.32
13	16.10	DIMETHYLOCTANE	36.98	1.55	83.26	3.46
14	16.33	n-PROPYLBENZENE	249.47	11.16	271.02	12.00
15	16.65	m-ETHYLTOLUENE	1144.80	51.20	1170.23	51.83
16	16.70	p-ETHYLTOLUENE	301.45	13.48	316.21	14.01
17	16.87	1,3,5-TRIMETHYLBENZENE	516.65	23.11	530.51	23.50
18	16.99	PHENOL + C11 PARAFFIN	169.48	6.45	184.46	6.95
19	17.05	C10 PARAFFIN	119.41	5.01	108.84	4.53
20	17.16	o-ETHYLTOLUENE	372.68	16.67	382.36	16.94
21	17.27	C10 PARAFFIN	74.97	3.15	84.69	3.52
22	17.72	1,2,4-TRIMETHYLBENZENE	1963.84	87.83	1962.08	86.91
23	18.15	n-DECANE+secBUTYLBENZENE	166.01	6.97	179.39	7.46
24	18.48	1,2,3-TRIMETHYLBENZENE + C4-BENZENE	416.00	18.61	415.50	18.40
25	18.73	C4-BENZENE	ART	0.00	ART	0.00
26	18.82	PROPENYLBENZENE	244.88	11.14	277.32	12.49
27	18.99	INDENE	53.24	2.46	56.92	2.61
28	19.40	C4-BENZENE + m-METHYLBENZALDEHYDE	395.87	17.62	76.12	3.35
29	19.47	DIETHYLBENZENE	84.54	3.76	198.83	8.76
30	19.60	2-ETHYL-1,4-DIMETHYLBENZENE	243.04	10.82	240.65	10.61
31	19.84	p-METHYLBENZALDEHYDE + C11 OLEFIN	50.95	2.03	56.88	2.24
32	19.95	o-PROPYLTOLUENE	ART	0.00	ART	0.00
33	20.21	ETHYLDIMETHYLBENZENE	472.56	21.03	375.00	16.53

Caldecott Tunnel -- Tenax Data -- 6/27/91 -- 1000-1200 -- page 2

TENAX:1162710F vs 2062710F

	RT	COMPOUND	1162710F		2062710F	
			C(NG/TENAX)	CppbC	C(NG/TENAX)	CppbC
34	20.40	TETRAMETHYLBENZENE	333.64	14.85	291.93	12.87
35	20.94	ETHYLDIMETHYLBENZENE	120.11	5.35	106.23	4.68
36	21.11	n-UNDECANE	140.04	5.89	58.28	2.43
37	21.32	1,2,4,5-TETRAMETHYLBENZENE	162.80	7.24	160.83	7.09
38	21.43	1,2,3,5-TETRAMETHYLBENZENE	238.94	10.63	249.71	11.01
39	21.91	2,3-DIHYDRO-2-METHYLINDENE	189.24	8.55	147.27	6.59
40	22.00	1,3-DIETHYL-5-METHYLBENZENE	29.61	1.31	28.61	1.26
41	22.10	C5-BENZENE+METHYLINDENE	35.44	1.57	38.16	1.67
42	22.20	2,3-DIHYDRO-1-METHYLINDENE	99.88	4.51	103.56	4.63
43	22.30	C5- + C4-BENZENE	110.58	4.90	95.50	4.19
44	22.44	C5-BENZENE	55.64	2.47	55.89	2.45
45	22.58	DIETHYLMETHYLBENZENE	33.61	1.49	53.82	2.36
46	22.76	DIETHYLMETHYLBENZENE	16.70	0.74	33.51	1.47
47	22.92	C5-BENZENE	50.40	2.23	55.27	2.43
48	23.10	NAPHTHALENE	555.75	25.89	555.39	25.62
49	23.27	DIMETHYLINDANE	15.19	0.68	17.36	0.77
50	23.56	DIMETHYLCUMENE	31.55	1.40	33.22	1.46
51	23.85	n-DODECANE + C5-BENZENE	62.56	2.63	61.40	2.56
52	24.28	DIPROPYLBENZENE + C13 PARAFFIN	36.28	1.60	33.44	1.46
53	24.67	2,3-DIHYDROETHYLINDENE + C6-BENZENE		0.00	10.53	0.47
54	24.95	2,3,-DIHYDRODIMETHYLINDENE	25.63	1.15	26.98	1.20
55	25.32	2,3-DIHYDRODIMETHYLINDENE	30.58	1.37	29.74	1.32
56	25.84	C6-BENZENE + C14 OLEFIN + 2,3-DIHYDRODIMETHYLINDENE	45.79	2.02	43.93	1.92
57	26.07	2-METHYLNAPHTHALENE	240.26	11.10	248.80	11.38
58	26.46	1-METHYLNAPHTHALENE + N-TRIDECANE	141.09	6.52	143.75	6.58
59	28.04	BIPHENYL	3.30	0.15	2.9	0.13
60	28.85	DIMETHYLNAPHTHALENE	5.13	0.24	8.96	0.41
61	28.94	n-TETRADECANE	15.51	0.65	17.70	0.74
62	29.17	DIMETHYLNAPHTHALENE	26.72	1.23	27.94	1.27
63	31.25	n-PENTADECANE	10.54	0.44	13.66	0.57
64	33.39	n-HEXADECANE	11.91	0.50	13.03	0.54
65	35.43	n-HEPTADECANE	19.91	0.84	19.40	0.81
66	36.91	PHENANTHRENE		0.00		0.00
67	37.37	n-OCTADECANE	12.59	0.53	12.96	0.54
		TOTAL		760.19		754.27

Comparison of Filtered and Unfiltered Tenax Samples (Oildale)

OILDALE -- TENAX DATA -- 8/01/91 -- 0600-0800 -- page 1 TENAX:1180106F vs 2080106F

	RT	COMPOUND	1180106F		2080106F	
			C(NG/TENAX)	CppbC	C(NG/TENAX)	CppbC
1	13.15	ETHYLBENZENE+AMYL ACETATE ?	103.67	4.74	109.41	4.98
2	13.24	1,3,5-TRIMETHYLCYCLOHEXANE	9.52	0.41	3.30	0.14
3	13.45	m+p-XYLENE	264.22	12.07	272.69	12.42
4	13.68	4-METHYLOCTANE	8.42	0.36	16.34	0.69
5	13.82	BUTYROLACTONE	8.11	0.23	18.72	0.53
6	13.92	3-METHYLOCTANE	18.89	0.80	9.89	0.42
7	14.02	STYRENE	338.16	15.74	371.35	17.24
8	14.16	o-XYLENE	124.77	5.70	113.24	5.16
9	14.36	C9-OLEFIN+C3-CYCLOHEXANE	12.71	0.55	25.60	1.10
10	14.43	2-BUTOXYETHANOL		0.00		0.00
11	14.78	n-NONANE	10.14	0.43	24.83	1.05
12	14.96	ISOPROPYLBENZENE (CUMENE)	13.15	0.60	9.34	0.42
13	15.17	2,3-DIMETHYLOCTANE	5.81	0.24	4.21	0.18
14	15.64	4-ME-3-HEPTEN-2-ONE+C10PARAFFIN	6.86	0.26	7.02	0.27
15	15.82	BENZALDEHYDE (ART?)	477.57	19.09	461.54	18.40
16	15.89	ETHYLHEXANAL	1.38	0.05	3.60	0.14
17	16.11	n-PROPYLBENZENE	25.97	1.18	36.63	1.66
18	16.35	m-ETHYLTOLUENE	67.89	3.08	74.08	3.35
19	16.41	p-ETHYLTOLUENE	30.27	1.37	34.06	1.54
20	16.59	1,3,5-TRIMETHYLBENZENE	40.64	1.84	46.71	2.11
21	16.67	PHENOL	45.27	1.75	38.00	1.46
22	16.75	C10-PARAFFIN	11.78	0.50	12.33	0.53
23	16.89	o-ETHYLTOLUENE	66.39	3.01	45.78	2.07
24	17.04	MENTHOL?	14.84	0.58	23.51	0.91
25	17.20	C5-CYCLOPENTANE	20.66	0.89	17.42	0.75
26	17.38	1,2,4-TRIMETHYLBENZENE	124.20	5.64	120.65	5.46
27	17.50	C5-CYCLOPENTANE	3.84	0.17	5.23	0.23
28	17.69	P-DICHLOROBENZENE	5.34	0.13	8.06	0.20
29	17.90	n-DECANE	39.84	1.70	32.90	1.40
30	18.21	1,2,3-TRIMETHYLBENZENE	36.62	1.66	42.73	1.93
31	18.55	PROPENYLBENZENE	14.84	0.68	17.15	0.79
32	18.63	C10-OLEFIN	30.83	1.33	13.23	0.57
33	19.04	C4-BENZENE + ACETOPHENONE (ART)	116.56	5.26	98.19	4.42
34	19.13	DIETHYLBENZENE	47.25	2.13	42.18	1.90
35	19.24	DIETHYLBENZENE	16.54	0.75	16.56	0.75
36	19.32	ISOPROPYLTOLUENE	19.50	0.88	21.46	0.97
37	19.57	C4-BENZENE	4.92	0.22	8.09	0.36
38	19.70	C11-PARAFFIN	29.11	1.24	14.23	0.61

OILDALE -- TENAX DATA -- 8/01/91 -- 0600-0800 -- page 2

	RT	COMPOUND	1180106F C(NG/TENAX)	1180106F CppbC	2080106F C(NG/TENAX)	2080106F CppbC
39	19.88	C4-BENZENE	16.79	0.76	20.50	0.92
40	19.93	C4-BENZENE	10.19	0.46	12.99	0.59
41	20.12	TETRAMETHYLBENZENE	24.73	1.12	23.92	1.08
42	20.31	UNKNOWN	1.49	0.07	3.86	0.17
43	20.39	UNKNOWN	1.90	0.08	3.18	0.14
44	20.70	C4 BENZENE	15.16	0.68	14.50	0.65
45	20.87	n-UNDECANE	15.53	0.66	17.12	0.69
46	21.06	1,2,4,5-TETRAMETHYLBENZENE	9.30	0.42	10.30	0.46
47	21.16	1,2,3,5-TETRAMETHYLBENZENE	17.33	0.78	16.27	0.73
48	21.26	CAMPHOR?	6.14	0.24	6.48	0.26
49	21.66	2,3-DIHYDROMETHYLINDENE	12.79	0.58	11.08	0.50
50	21.76	BIOGENIC HYDROCARBON	5.51	0.25	5.74	0.26
51		BIOGENIC HYDROCARBON		0.00		0.00
52	21.93	2,3-DIHYDRO-1-METHYLINDENE	28.53	1.31	17.28	0.79
53	22.06	C5- + C4-BENZENE	7.50	0.34	7.36	0.33
54	22.36	C5-BENZENE	8.42	0.38	5.64	0.25
55	22.50	DIETHYLMETHYLBENZENE	3.94	0.18		0.00
56	22.66	SILOXANE (ART)	ART		ART	
57	22.80	NAPHTHALENE	26.43	1.25	20.40	0.96
58	23.21	BENZOIC ACID (ART)	146.61	5.09	169.93	5.89
59	23.34	C5-BENZENE	5.01	0.23	3.51	0.16
60	23.65	n-DODECANE	3.33	0.14	5.76	0.25
61		BIOGENIC HYDROCARBON		0.00		0.00
62	24.07	C13 PARAFFIN	1.96	0.08	1.77	0.08
63	24.65	BIOGENIC HYDROCARBON	4.11	0.18	3.52	0.15
64	25.13	BIOGENIC HYDROCARBON	28.87	1.26	17.09	0.75
65	25.63	C14 PARAFFIN	6.26	0.27	0.86	0.04
66	25.80	2-METHYLNAPHTHALENE	14.97	0.70	12.96	0.61
67	26.25	1-METHYLNAPHTHALENE + N-TRIDECANE	11.53	0.54	11.75	0.55
68	27.42	BIOGENIC HYDROCARBON	9.84	0.43	0.38	0.02
69	27.73	HYDROCARBON	33.84	1.48	28.18	1.23
70	28.53	DIMETHYLNAPHTHALENE		0.00		0.00
71	28.69	n-TETRADECANE	6.03	0.26	2.69	0.11
72	28.93	DIMETHYLNAPHTHALENE		0.00	0.50	0.02
73	29.65	DIMETHYLNAPHTHALENE	4.01	0.19	4.75	0.22
74	30.66	n-PENTADECANE	48.84	2.09	16.00	0.68
75	30.99	C15 PARAFFIN	4.19	0.18		0.00
76	33.25	n-HEXADECANE	13.61	0.58	3.32	0.14
77		C16 PARAFFIN		0.00		0.00
78	35.23	n-HEPTADECANE	3.26	0.14	0.20	0.01
79	36.82	PHENANTHRENE	4.03	0.19	0.53	0.03
80	37.18	n-OCTADECANE	3.74	0.16	3.39	0.14
		TOTAL		121.03		116.99
		Total Aromatics		73.28		73.66
		Total Paraffins		9.85		7.02
		Total Olefins		1.88		1.67
		Other		36.02		34.64
		Total from #58		14.19		11.06

Comparison of Filtered and Unfiltered Tenax Samples (Los Angeles)

Los Angele - Tenax Data -- 8/22/91 -- 1000-1200 -- page 1 TENAX:1182210F vs 2082210F

			1182210F		2082219F	
	RT	COMPOUND	C(NG/TENAX)	CppbC	C(NG/TENAX)	CppbC
1	13.38	ETHYLBENZENE	408.21	18.39	471.53	21.21
2	13.72	m+p-XYLENE	1383.89	62.35	1339.34	60.25
3	13.91	4-METHYLOCTANE	113.71	4.77	119.12	4.99
4	14.06	5-METHYL-3-HEPTANONE	47.36	1.74	51.48	1.88
5	14.14	3-METHYLOCTANE	46.72	1.96	54.25	2.27
6	14.21	STYRENE	20.81	0.96	46.86	2.15
7	14.41	o-XYLENE	567.76	25.58	534.57	24.05
8	14.53	C9 OLEFIN	18.82	0.80	39.22	1.67
9	14.60	2-BUTOXYETHANOL	70.47	2.14	75.87	2.30
10	14.92	n-NONANE	160.83	6.75	136.96	5.74
11	15.41	ISOPROPYLBENZENE (CUMENE)	42.82	1.92	38.49	1.72
12	15.62	2,3-DIMETHYLOCTANE	34.73	1.44	18.09	0.75
13	15.86	4-ME-3-HEPTEN-2-ONE+C10 PARAFFIN	57.43	2.18	32.97	1.25
14	16.05	BENZALDEHYDE	395.95	15.61	259.11	10.20
15	16.15	DIMETHYLOCTANE	92.86	3.90	80.30	3.37
16	16.37	n-PROPYLBENZENE	154.22	6.90	152.47	6.82
17	16.63	m-ETHYLTOLUENE	387.58	17.35	371.63	16.61
18	16.69	p-ETHYLTOLUENE	161.68	7.24	156.20	6.98
19	16.86	C10 PARAFFIN	123.86	5.21	152.95	6.42
20	16.98	1,3,5-TRIMETHYLBENZENE	82.21	3.68	89.14	3.99
21	17.11	PHENOL	57.72	2.20	58.91	2.24
22		C10-PARAFFIN	ART	0.00	88.60	3.72
23	17.17	o-ETHYLTOLUENE	112.06	5.02	141.98	6.35
24	17.31	C10 PARAFFIN	82.61	3.47	91.04	3.82
25	17.69	1,2,4-TRIMETHYLBENZENE	595.47	26.66	541.08	24.19
26	18.02	P-DICHLOROBENZENE	57.28	1.41	58.65	1.44
27	18.19	n-DECANE	300.06	12.61	244.63	10.27
28	18.49	1,2,3-TRIMETHYLBENZENE + C4-BENZENE	160.40	7.18	129.76	5.80
29	18.68	C4-BENZENE	226.28	10.08	71.24	3.17
30	18.83	PROPENYLBENZENE	105.98	4.83	88.95	4.04
31	18.91	METHYLISOPROPENYLCYCLOHEXENE	53.37	2.34	80.94	3.55
32	19.28	C4-BENZENE	76.25	3.40	43.22	1.92
33	19.35	DIETHYLBENZENE	176.06	7.84	171.39	7.62
34	19.43	ETHYLDIMETHYLBENZENE	212.02	9.44	177.42	7.89
35	19.53	ISOPROPYLTOLUENE	86.17	3.84	80.92	3.60
36	19.60	ETHYLDIMETHYLBENZENE	85.26	3.80	65.12	2.90

Los Angeles -- Tenax Data -- 8/22/91 -- 1000-1200 -- page 2

TENAX:1182210F vs 2082210F

	RT	COMPOUND	1182210F C(NG/TENAX)	1182210F CppbC	2082219F C(NG/TENAX)	2082219F CppbC
37	20.21	TETRAMETHYLBENZENE	164.29	7.32	150.28	6.68
38	20.40	ETHYLDIMETHYLBENZENE	117.20	5.22	109.73	4.88
39	20.58	C12 PARAFFIN	14.80	0.62	51.36	2.16
40	20.97	C4 BENZENE	69.33	3.09	66.68	2.97
41	21.14	n-UNDECANE	179.52	7.56	184.12	7.32
42	21.33	1,2,4,5-TETRAMETHYLBENZENE	32.98	1.47	51.07	2.27
43	21.43	1,2,3,5-TETRAMETHYLBENZENE	45.76	2.04	45.75	2.04
44	21.53	2,3-DIHYDRO-2-METHYLINDENE	22.10	1.00	29.10	1.31
45	21.66	1,3-DIETHYL-5-METHYLBENZENE	20.67	0.92	26.11	1.16
46	21.93	C5-BENZENE+METHYLINDENE	71.36	3.17	66.21	2.93
47	22.21	2,3-DIHYDRO-1-METHYLINDENE	39.58	1.79	33.92	1.53
48	22.32	C5- + C4-BENZENE	39.73	1.76	39.28	1.74
49		C5-BENZENE		0.00		0.00
50	22.45	DIETHYLMETHYLBENZENE	19.52	0.87	23.50	1.04
51		DIETHYLMETHYLBENZENE		0.00		0.00
52	22.93	C5-BENZENE	45.66	2.03		0.00
53	23.08	NAPHTHALENE	114.83	5.35	115.38	5.37
54		DIMETHYLINDANE		0.00	27.83	1.25
55		DIMETHYLCUMENE		0.00	26.79	1.19
56	23.90	n-DODECANE	77.44	3.26	89.78	3.78
57	24.31	DIPROPYLBENZENE + C13 PARAFFIN	30.03	1.33	26.81	1.18
58		2,3-DIHYDROETHYLINDENE + C6-BENZENE		0.00		0.00
59	24.98	2,3,-DIHYDRODIMETHYLINDENE	19.78	0.89	25.63	1.15
60	25.56	2,3-DIHYDRODIMETHYLINDENE	27.06	1.22		0.00
61	25.87	C6-BENZENE+C14 OLEFFIN	23.02	1.02	20.67	0.91
62	26.07	2-METHYLNAPHTHALENE	55.82	2.58	54.44	2.51
63	28.00	1-METHYLNAPHTHALENE + N-TRIDECANE	51.21	2.37	58.74	2.71
64		BIPHENYL		0.00	19.06	0.89
65	28.96	DIMETHYLNAPHTHALENE	26.14	1.20		0.00
66	29.28	n-TETRADECANE	25.69	1.08	27.23	1.15
67	29.92	DIMETHYLNAPHTHALENE	17.16	0.79		0.00
68		DIMETHYLNAPHTHALENE		0.00	21.70	0.99
69	31.26	n-PENTADECANE	42.55	1.80	47.60	2.01
70	33.42	n-HEXADECANE	18.20	0.77	27.35	1.15
71	35.47	n-HEPTADECANE	17.12	0.72	37.51	1.58
72		PHENANTHRENE		0.00		0.00
73	37.29	n-OCTADECANE	25.70	1.08	16.45	.69
		TOTAL		359.27		343.69

5.2 Intercomparison of AtmAA and DRI Laboratory Measurements

Three canister samples, one from each sampling location, were analyzed by AtmAA and DRI laboratories for intercomparison purposes. Tables 17, 18, and 19 show the comparison of results obtained by both laboratories on compounds definitively identified by name. Figures 50 through 55 show these results in a graphical form, using a log-log scale. Figures 50, 52, and 54 show the scatter charts and Figures 51, 53, and 55 show compound-by-compound comparisons using bargraphs.

As can be seen from these intercomparisons, the DRI numbers are usually somewhat lower for lighter hydrocarbons (C2-C6) and higher for C8 to C10 hydrocarbons than AtmAA numbers. This may be due to different systems used for the measurement of volumes of analyzed samples (static system used by AtmAA laboratory versus dynamic system used by the DRI) as well as different calibration methods (area response factor for 1 ppbC, employed by the DRI laboratory, and area response factor for 1 ng/m^3, as employed by the AtmAA). Also, as it was suggested recently (International Symposium, "Measurement of Toxic and Related Air Pollutants," May 3-8, 1992, Durham, NC) that the most volatile hydrocarbons (C2-C4) may penetrate through the Nafion membrane. Since the DRI laboratory was using Nafion dryer, whereas the AtmAA was not, this may be the reason for lower C2 to C4 hydrocarbon concentrations obtained by the DRI laboratory. The C2 isomers are not baseline-resolved in the DRI chromatograms; however, the sum of C2 species, measured by both laboratories, is in good agreement (~20%). In addition, the acetylene peak coeluted with n-butane in some of AtmAA's analyses (due to the presence of water) and concentrations for the pair were reported as the sum of the two. Comparison of acetylene and n-butane was not possible under these conditions. The TNMHC concentrations, calculated by both laboratories by summing the concentration of all quantified compounds, are in good agreement (5%, 0.2%, and ~20% for the Caldecott Tunnel, Los Angeles, and Oildale, respectively).

5.3 Comparison of Canister and Tenax Data

Since it is not practically possible to compare the concentration of every compound quantified in the Tenax and canister samples, several representative compounds were selected to check the agreement between these two methods of sampling and analysis. The selected compounds had to fulfill several criteria, namely:

- to be relatively abundant to assure good measurement precision;
- to be baseline-resolved from neighboring peaks, i.e., no co-eluting species;
- to be clearly identified by chemical name; and
- to be present in both Tenax and canister samples and to have no breakthrough for Tenax samples.

5.3.1 Caldecott Tunnel

For samples collected in the Caldecott Tunnel, the following compounds were selected for comparison purposes: ethylbenzene, m- & p-xylene, o-xylene, n-propylbenzene, 1,2,4-

Table 17

Intercomparison Between the DRI and AtmAA Laboratories (Caldecott Tunnel)

Caldecott Can #00271 6/27/91, 1600–1800

NAME	DRI C(ppbC)	AtmAA C(ppbC)
ACETYLENE	86.64	114.89
ETHYLENE	240.50	269.49
ETHANE	27.90	50.10
TOTAL C2	355.04	434.50
PROPENE	95.40	114.80
PROPANE	15.30	15.94
ISOBUTANE	29.00	39.51
BUTENE–1	55.43	18.10
1,3–BUTADIENE	12.88	2.28
n–BUTANE	122.25	205.97
trans–2–BUTENE	12.41	13.07
3–METHYL–1–BUTENE	3.50	4.67
ISOPENTANE	289.27	353.66
2–METHYL–1–BUTENE	14.83	15.61
n–PENTANE	97.37	113.27
t–2–PENTENE	17.48	18.00
2,3–DIMETHYLBUTANE	28.66	29.91
2–METHYLPENTANE	105.19	104.15
3–METHYLPENTANE	59.88	66.05
2–METHYL–1–PENTENE +		
1–HEXENE	9.13	5.93
n–HEXANE	46.55	48.60
METHYLCYCLOPENTANE	56.50	70.01
2,4–DIMETHYLPENTANE	13.77	14.64
BENZENE	175.16	191.47
CYCLOHEXANE	9.54	10.21
2,3–DIMETHYLPENTANE	14.37	16.86
3–METHYLHEXANE	40.18	37.65
n–HEPTANE	20.92	19.86
METHYLCYCLOHEXANE	13.80	18.31
2,5–DIMETHYLHEXANE	9.20	6.73
2,4–DIMETHYLHEXANE	17.97	10.62
2,3,4–TRIMETHYLPENTANE	20.68	13.81
TOLUENE	294.10	265.27
2–METHYLHEPTANE	14.05	8.12
n–OCTANE	9.61	6.07
ETHYLBENZENE	51.39	43.71
m&p–XYLENE	206.82	180.29
o–XYLENE	87.25	60.61
m–ETHYLTOLUENE	55.55	36.41
p–ETHYLTOLUENE	30.69	18.40
1,3,5–TRIMETHYLBENZENE	26.20	17.02
o–ETHYLTOLUENE	22.08	11.93
1,2,3–TRIMETHYLBENZENE	23.32	13.24
n–UNDECANE	4.79	8.26
TOTAL	3378.98	3203.24

Table 18
Intercomparison Between the DRI and AtmAA Laboratories (Oildale)

OILDALE CAN #00300 7/30/91 0600-0800 Sampler #1 -- Page 1

PK #	NAME	DRI C(ppbC)	AtmAA C(ppbC)	
1	ETHYLENE	14.30	35.28	
2	ACETYLENE	63.58	112.20	(+n-BUTANE)*
3	ETHANE	50.20	95.89	
	TOTAL C2	128.08		
4	PROPENE	6.27	8.63	
5	PROPANE	59.02	82.19	
6	ISOBUTANE	20.10	30.38	
7	BUTENE-1	2.17	1.45	
8	n-BUTANE	44.01	112.20	(+ACETHYLENE)*
9	trans-2-BUTENE	0.76	0.58	
10	ISOPENTANE	45.90	69.99	
11	n-PENTANE	23.80	31.73	
12	t-2-PENTENE	0.85	0.79	
13	CYCLOPENTANE	3.22	4.15	
14	2,3-DIMETHYLBUTANE	15.78	20.25	
15	2-METHYLPENTANE	15.24	17.97	
16	3-METHYLPENTANE	11.51	13.37	
17	n-HEXANE	10.60	10.32	
18	METHYLCYCLOPENTANE	12.10	7.17	
19	2,4-DIMETHYLPENTANE	4.30	6.73	
20	BENZENE	16.20	18.84	
21	CYCLOHEXANE	3.64	4.35	
22	2,3-DIMETHYLPENTANE	9.38	9.67	
23	3-METHYLHEXANE	7.39	4.65	
24	n-HEPTANE	5.34	2.35	
25	2,3,4-TRIMETHYLPENTANE	5.49	4.13	
26	TOLUENE	40.96	31.73	
27	2,3-DIMETHYLHEXANE	1.68	3.11	
28	C9 PARAFFIN	24.13	20.54	
29	2,5-DIMETHYLHEPTANE	3.58	5.64	
30	ETHYLBENZENE	11.59	7.91	
31	m&p-XYLENE	31.44	22.26	
32	o-XYLENE	14.33	14.25	
33	n-NONANE	4.00	5.82	
34	ISOPROPYLBENZENE	2.50	2.84	
35	n-PROPYLBENZENE	5.58	4.14	
36	m-ETHYLTOLUENE	10.63	5.67	
37	p-ETHYLTOLUENE	5.29		
38	1,3,5-TRIMETHYLBENZENE	14.13	1.35	
39	o-ETHYLTOLUENE	3.36	4.29	
40	1,2,3-TRIMETHYLBENZENE	13.51	4.27	
	TOTAL	1157.68	942.10	

* The acetylene and n-butane peaks coelute in the AtmAA chromatogram.

Table 19
Intercomparison Between the DRI and AtmAA Laboratories (Los Angeles)

LOS ANGELES CAN #00297 8/21/91 1000-1200 -- Page 1

PK #	NAME	DRI C(ppbC)		AtmAA C(ppbC)	
1	ACETYLENE	34.20		181.00	(+N-BUTANE)*
2	ETYLENE	116.80		87.58	
3	ETHANE	72.16		121.44	
4	PROPENE	21.52		25.72	
5	PROPANE	138.80		167.22	
6	ISOBUTANE	40.00		48.86	
7	n-BUTANE	92.10		181.00	(+ACETHYLENE)*
8	trans-2-BUTENE	1.80		1.70	
9	ISOPENTANE	118.97		160.17	
10	2-METHYL-1-BUTENE	2.13		3.65	
11	n-PENTANE	59.84		75.70	
12	ISOPRENE	1.67		2.28	
13	t-2-PENTENE	2.87		2.87	
14	2,3-DIMETHYLBUTANE	12.25		15.02	
15	2-METHYLPENTANE	41.64		47.60	
16	3-METHYLPENTANE	27.09		32.25	
17	n-HEXANE	28.13		31.24	
18	METHYLCYCLOPENTANE	25.47		33.01	
19	2,4-DIMETHYLPENTANE	10.11		11.90	
20	BENZENE	49.83		56.62	
21	2,3-DIMETHYLPENTANE	17.06		17.97	
22	3-METHYLHEXANE	18.32		14.97	
23	n-HEPTANE	14.36		14.84	
24	2,5-DIMETHYLHEXANE	3.67		2.98	
25	2,4-DIMETHYLHEXANE	7.95		8.89	
26	2,3,4-TRIMETHYLPENTANE	8.77		6.88	
27	TOLUENE	137.31		117.95	
28	2,3-DIMETHYLHEXANE	4.57		2.51	
29	2-METHYLHEPTANE	7.24		4.00	
30	3-METHYLHEPTANE	6.88		4.62	
31	1-OCTENE	1.37		1.53	
32	n-OCTANE	6.15		4.46	
33	ETHYLBENZENE	20.49		14.56	
34	m&p-XYLENE	71.13		57.47	
35	STYRENE	4.89		4.41	
36	o-XYLENE	27.02		22.44	
37	n-NONANE	4.64		3.75	
38	ISOPROPYLBENZENE	3.13		1.42	
39	n-PROPYLBENZENE	7.20		4.48	
40	m-ETHYLTOLUENE	20.52		12.17	
41	p-ETHYLTOLUENE	10.64		7.19	
42	1,3,5-TRIMETHYLBENZENE	9.24		5.17	
43	o-ETHYLTOLUENE	8.25		4.84	
44	1,2,4-TRIMETHYLBENZENE	27.02		19.18	
45	n-DECANE	9.25		5.04	
46	1,2,3-TRIMETHYLBENZENE	13.96		4.22	
47	n-UNDECANE	8.53		5.41	
48	NAPHTHALENE	4.54		4.90	
	TOTAL	1707.56		1704.06	

* The acetylene and n-butane peaks coelute in the AtmAA chromatogram.

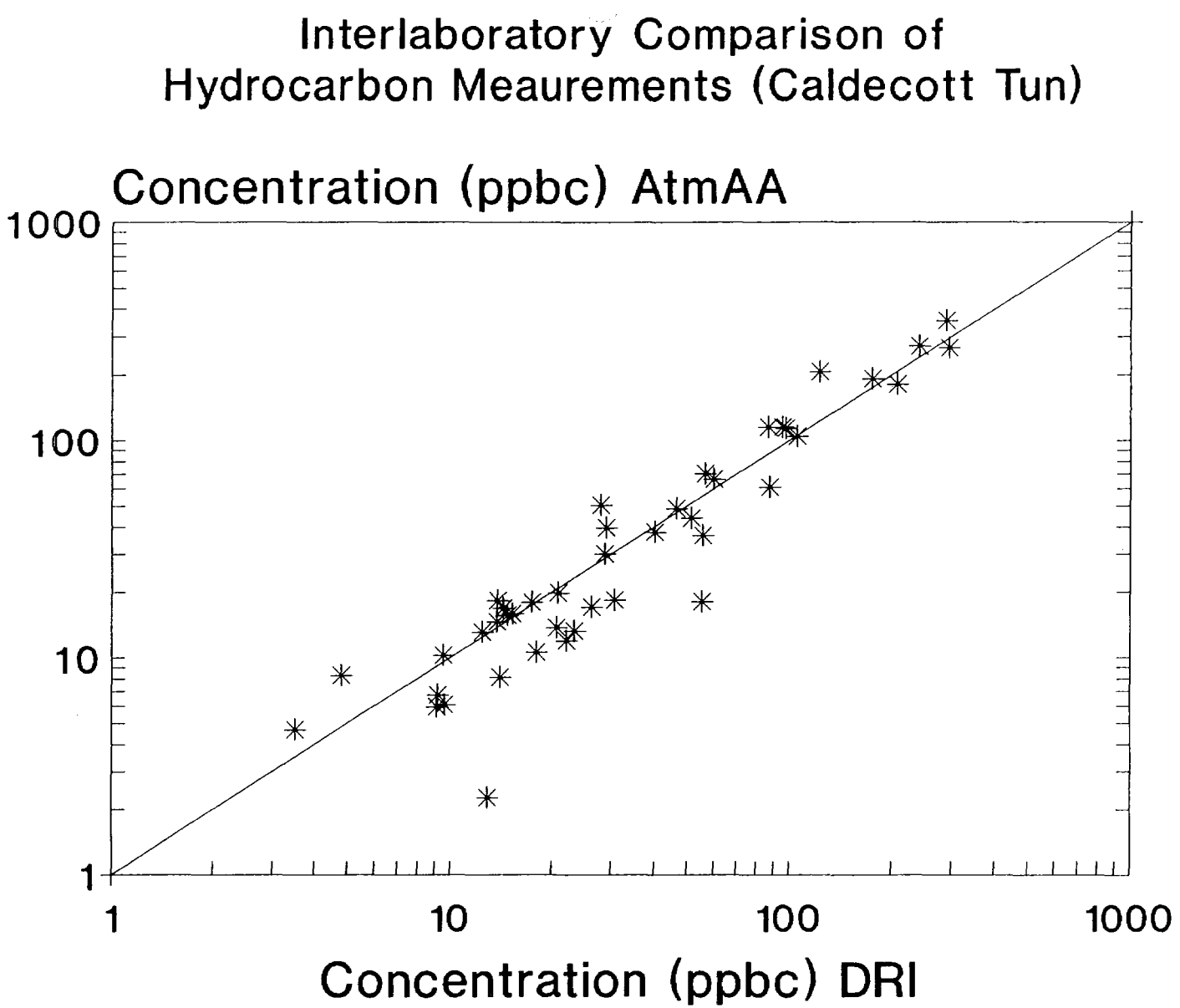
Interlaboratory Comparison of
Hydrocarbon Meaurements (Caldecott Tun)
Concentration (ppbc) AtmAA
1000
100
10
1
1
10
100
1000
Concentration (ppbc) DRI

Figure 50.

Interlaboratory Comparison of Hydrocarbon Measurements (Caldecott Tun)

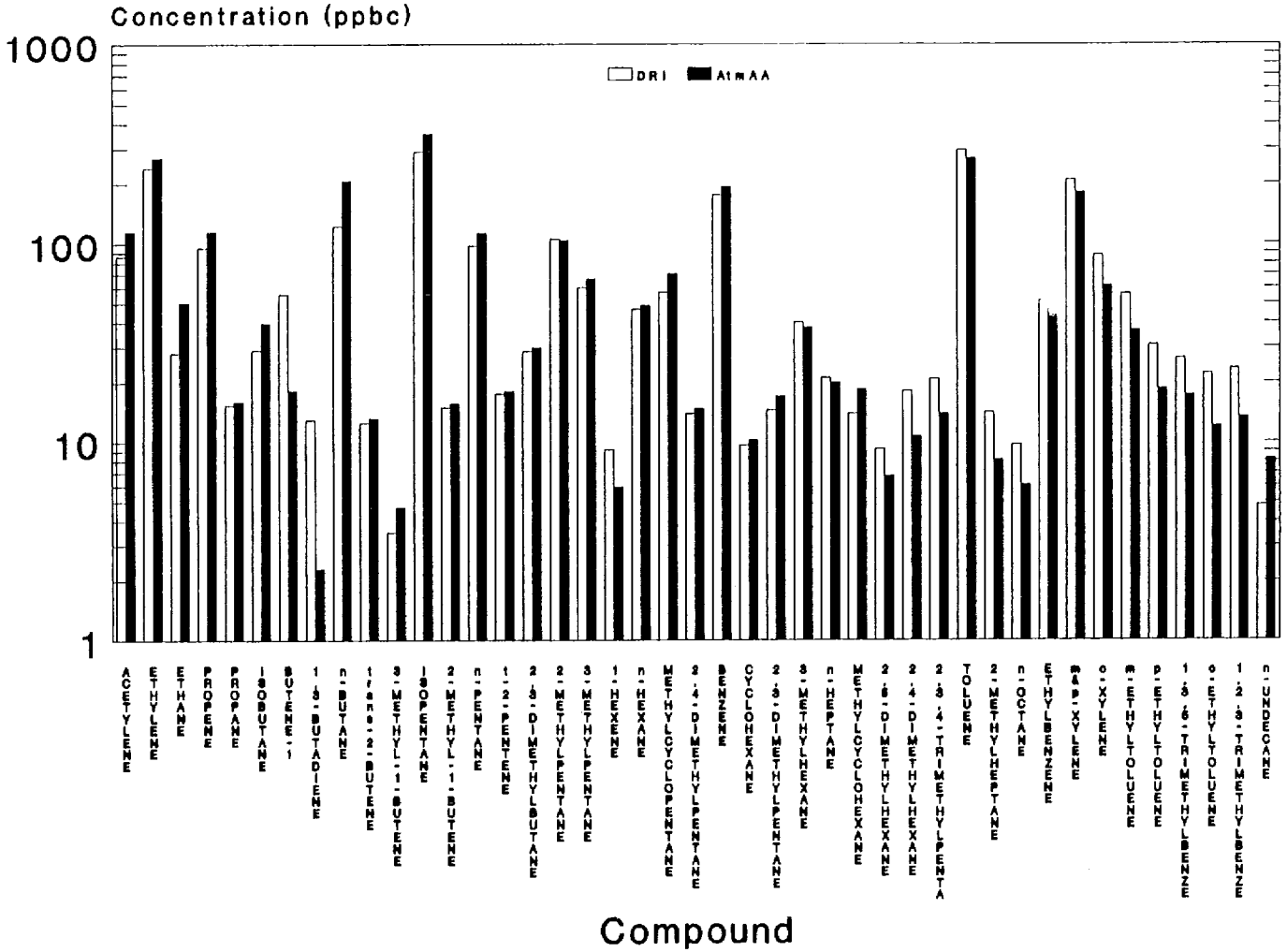

Figure 51.

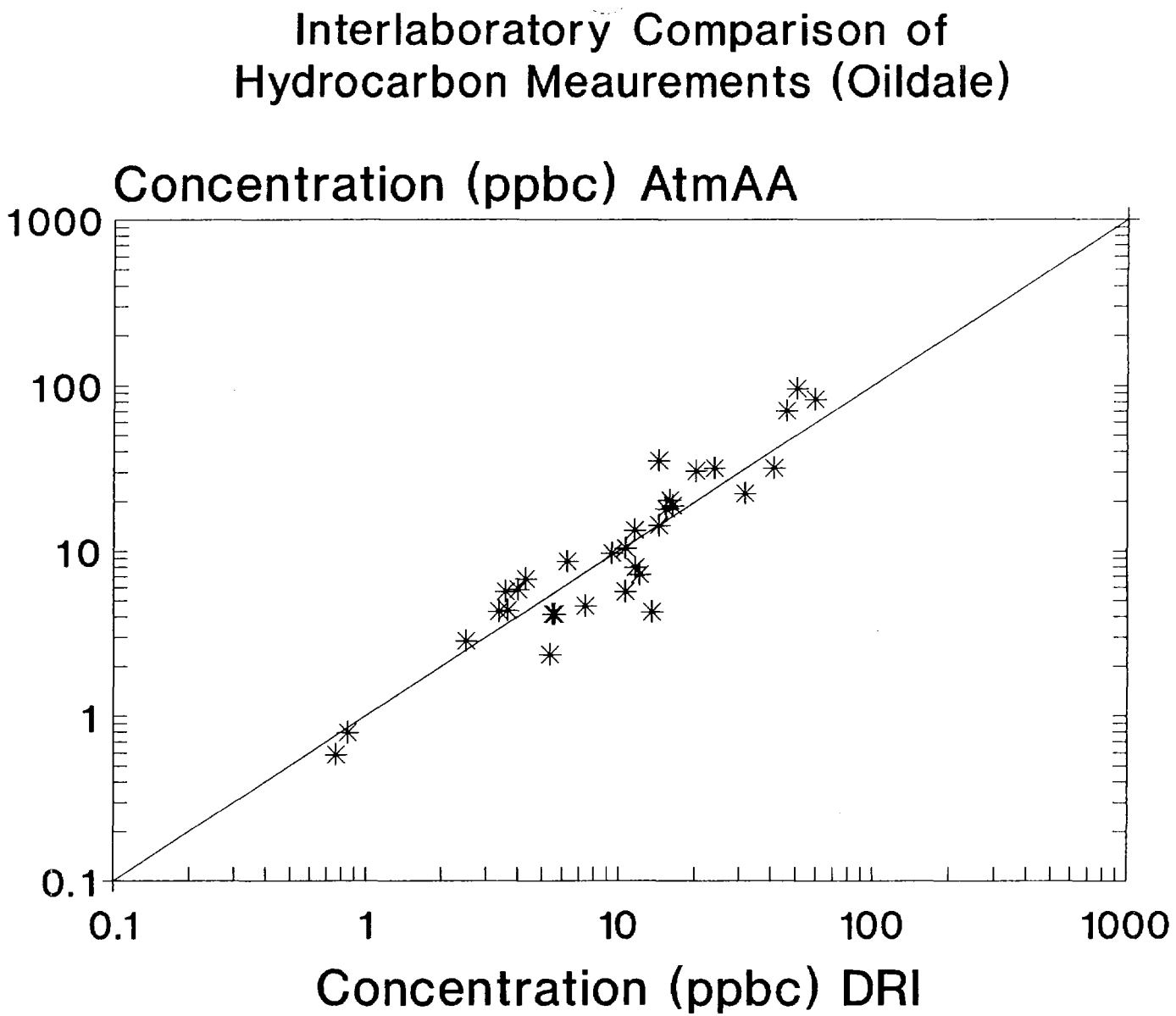
Interlaboratory Comparison of
Hydrocarbon Meaurements (Oildale)
Concentration (ppbc) AtmAA
1000
100
10
1
0.1
0.1
1
10
100
1000
Concentration (ppbc) DRI

Figure 52.

Interlaboratory Comparison of Hydrocarbon Measurements (Oildale)

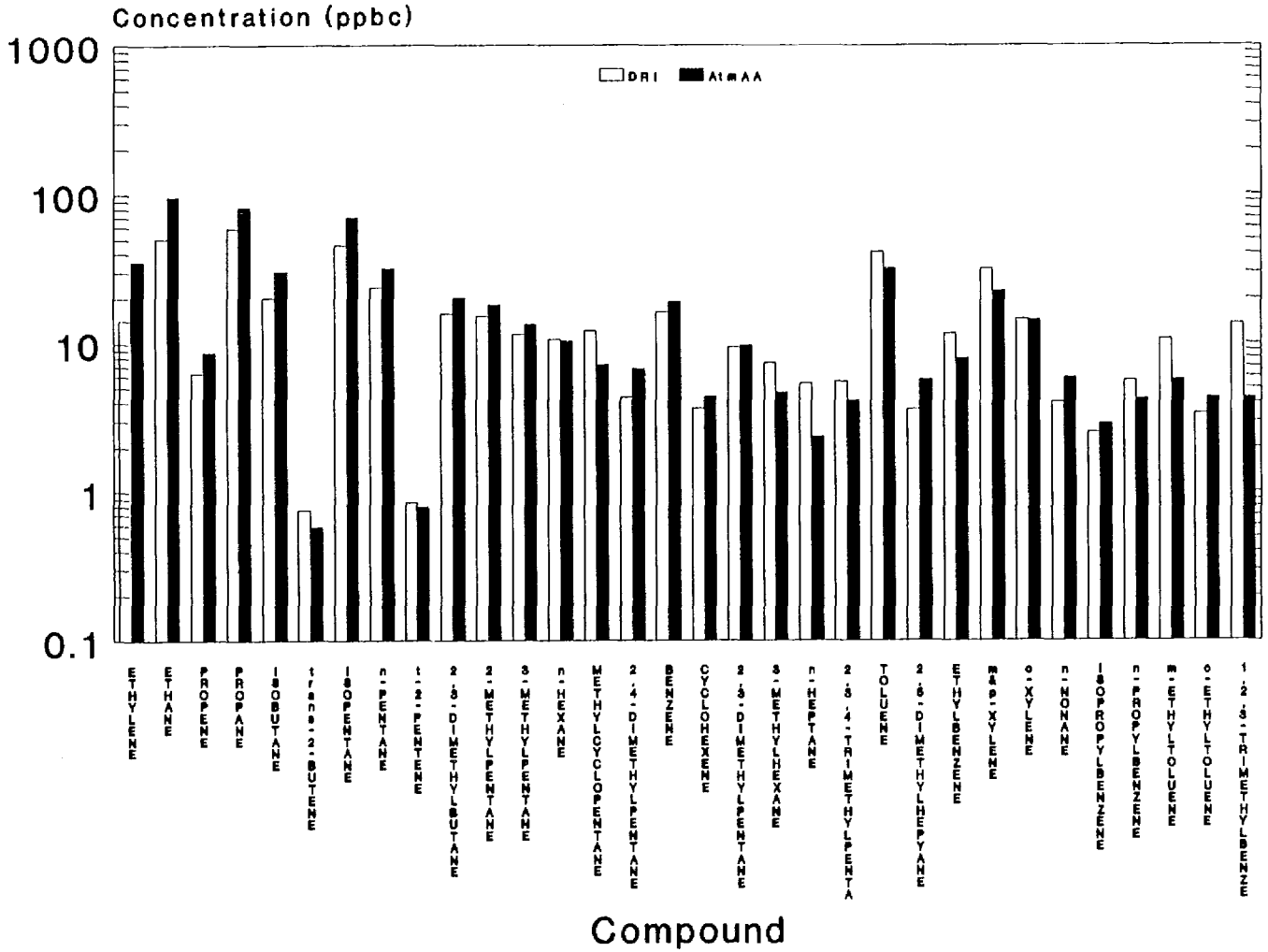

Figure 53.

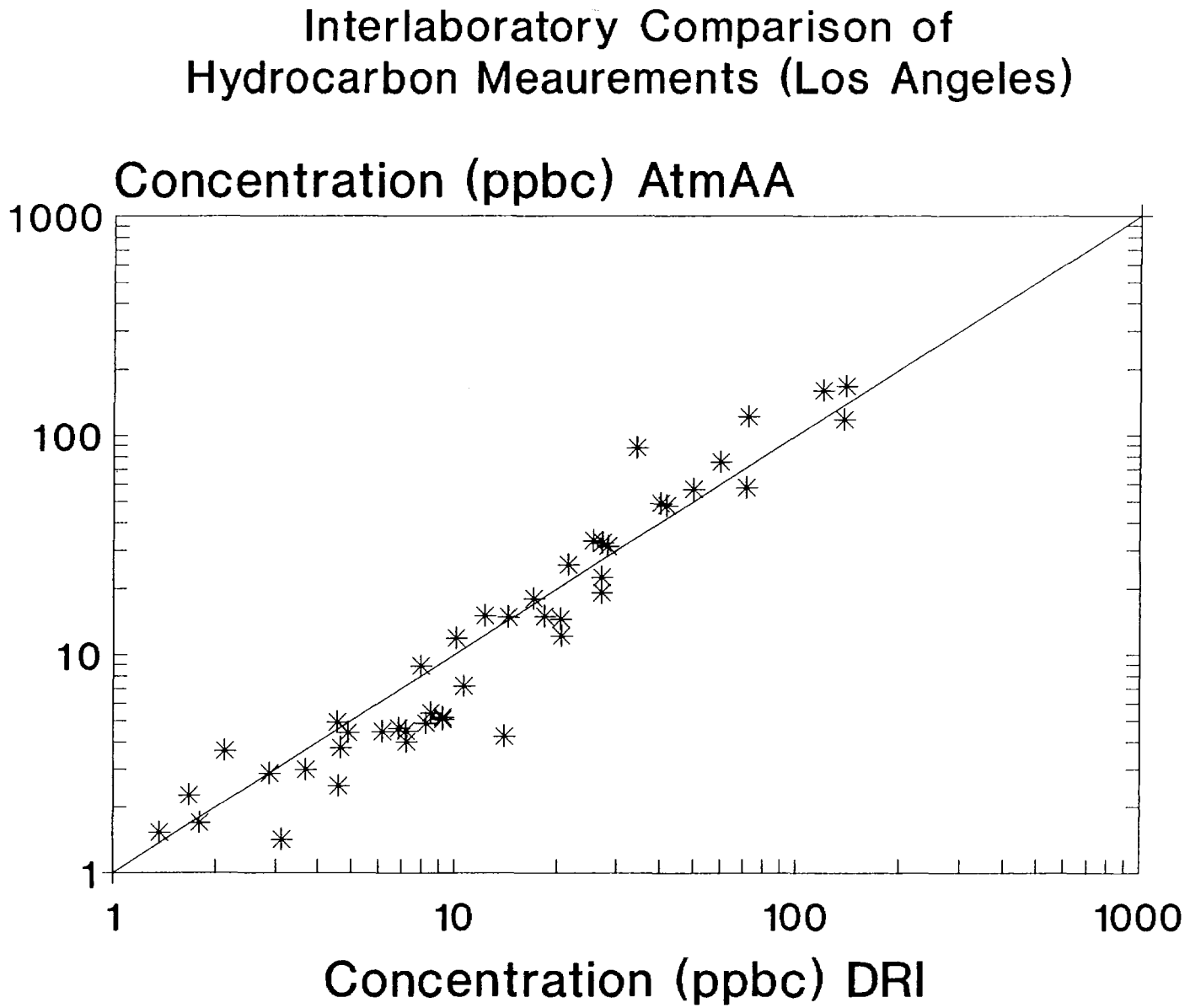
Interlaboratory Comparison of
Hydrocarbon Meaurements (Los Angeles)
Concentration (ppbc) AtmAA
1000
100
10
1
1
10
100
1000
Concentration (ppbc) DRI

Figure 54.

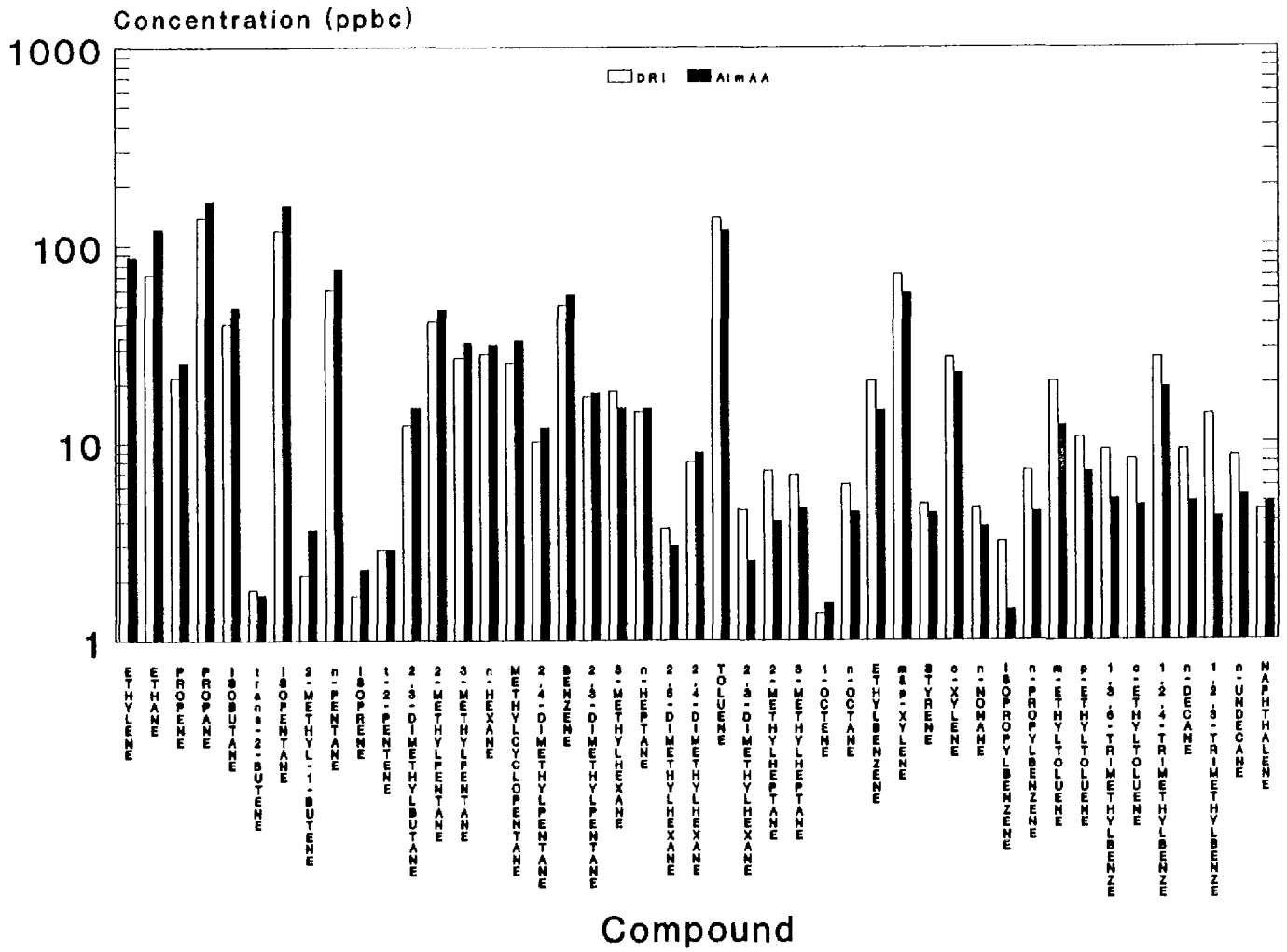
Interlaboratory Comparison of
Hydrocarbon Measurements (Los Angeles)
Concentration (ppbc)
1000
100
10
1
DRI
AtmAA
ETHYLENE
ETHANE
PROPENE
PROPANE
ISOBUTANE
trans-2-BUTENE
ISOPENTANE
2-METHYL-1-BUTENE
n-PENTANE
ISOPRENE
t-2-PENTENE
2,3-DIMETHYLBUTANE
2-METHYLPENTANE
3-METHYLPENTANE
n-HEXANE
METHYLCYCLOPENTANE
2,4-DIMETHYLPENTANE
BENZENE
2,3-DIMETHYLPENTANE
3-METHYLHEXANE
n-HEPTANE
2,6-DIMETHYLHEXANE
2,4-DIMETHYLHEXANE
TOLUENE
2,3-DIMETHYLHEXANE
2-METHYLHEPTANE
3-METHYLHEPTANE
1-OCTENE
n-OCTANE
ETHYLBENZENE
m&p-XYLENE
STYRENE
o-XYLENE
n-NONANE
ISOPROPYLBENZENE
n-PROPYLBENZENE
m-ETHYLTOLUENE
p-ETHYLTOLUENE
1,3,5-TRIMETHYLBENZE
o-ETHYLTOLUENE
1,2,4-TRIMETHYLBENZE
n-DECANE
1,2,3-TRIMETHYLBENZE
n-UNDECANE
NAPHTHALENE
Compound

Figure 55.

trimethylbenzene, and naphthalene. All of these compounds represent the aromatic compound class; however, the concentrations of clearly identified aliphatic compounds present in both samples (such as n-nonane, n-decane, and n-undecane) were relatively low. In addition, the peaks corresponding to these compounds were not baseline-resolved, especially in canister samples. It has to be pointed out that, although both capillary columns used for analysis of Tenax and canister samples are equivalent in terms of liquid phase polarity (DB-1 versus Chrompack CP-Sil 5, see Section 3), the greater film thickness (1.2 μm) for the Chrompack CP-Sil 5 capillary column used for canister sample analysis resulted in poorer resolution of higher molecular weight compounds.

The comparison of canister and Tenax analyses also revealed that the concentration of 1,3,5-trimethylbenzene in most of the canister samples collected in the Caldecott Tunnel was too high. This was most probably due to the Nafion dryer used for removing water vapor from the canister samples prior to GC analysis. It appears that, for some unknown reason, the Nafion dryer selectively adsorbed this compound and released it in subsequent analyses (cross contamination). The concentration of 1,3,5-trimethylbenzene is flagged in appropriate tables in Appendix A and the concentrations found in Tenax samples should be used for this compound.

Table 20 shows the ratios of concentrations of selected compounds found in Tenax and canister samples collected in the Caldecott Tunnel. It seems that compounds having lower vapor pressures (1,2,4-trimethylbenzene and naphthalene) are recovered better from the Tenax than from the canisters. However, the slightly higher concentrations found in Tenax samples for these compounds may also be due to the differences between these two methods of sampling and analysis. In general, the agreement found between these two methods is good for the samples collected in the Caldecott Tunnel.

5.3.2 Oildale

Table 21 shows the ratios of concentrations of selected compounds found in Tenax and canister samples collected in Oildale. The selected compounds are the same as those for the Caldecott Tunnel. In the case of Oildale, the agreement for these two methods of sampling and analysis is worse than for the Caldecott Tunnel. Several factors contribute to this result:

- The concentrations of compounds quantified from Tenax and canister samples collected in Oildale are generally much lower than in the Tunnel.

- In several samples, it was observed that polar, oxygenated compounds coeluted with quantified hydrocarbons (for example, acetate co-elutes with ethylbenzene). The concentrations of these compounds were lower when quantified from canister than from Tenax samples, due to the effect of the Nafion dryer. In addition, several artifact peaks were observed, which originated from the reaction of Tenax material with ozone.

Table 20

Ratios of concentrations of selected compounds found in Tenax and canister samples collected in the Caldecott Tunnel (Tenax/canister)

Date	6/26	6/27			6/28		Mean ± SD
Compound	1600-1800	0600-0800	1000-1200	1600-0800	0600-0800	1000-1200	
Ethylbenzene	0.90	0.93	0.91	0.98	0.87	0.85	0.91 ± 0.05
m- & p-Xylene	0.88	0.94	0.92	0.97	0.82	0.88	0.90 ± 0.05
o-Xylene	0.93	0.67	0.76	0.77	0.68	0.88	0.78 ± 0.10
n-Propylbenzene	0.90	1.11	1.33	1.26	1.19	0.83	1.10 ± 0.20
1,2,4-Trimethylbenzene	1.24	1.34	1.27	1.29	1.20	1.11	1.24 ± 0.07
Naphthalene	1.78	1.02	1.48	1.64	1.04	1.05	1.33 ± 0.34

Table 21

Ratios of concentrations of selected compounds found in Tenax and canister samples collected in Oildale (Tenax/canister)

Date	7/30		7/31		8/01
Compound	0600-0800	1000-1200	0600-0800	1000-1200	0600-0800
Ethylbenzene	1.78[a]	1.45[a]	[c]	0.55[b]	1.89[a]
m- & p-Xylene	1.13	0.85[b]	[c]	0.56[b]	1.12
o-Xylene	0.91	0.76[b]	[c]	0.65[b]	1.42
n-Propylbenzene	0.65	[d]	[c]	[d]	[d]
1,2,4-Trimethylbenzene	1.17	1.62	[c]	0.95	1.24
Naphthalene	0.73	0.55	[c]	0.24	0.81

[a] Ethylbenene peak not resolved from acetate peak on Tenax sample chromotograms.
[b] Breakthrough observed on back-up Tenax.
[c] Too low concentrations observed on all four Tenax front cartridges.
[d] Naphthalene concentration quantified from canisters too high - coeluting peak.

- For the samples collected from 1000 to 1200 hours, a breakthrough of C8 aromatic compounds in the first Tenax cartridge was observed, caused by very high ambient temperatures (~38-40 °C).

- The concentrations of compounds collected on Tenax cartridges on July 31 from 0600 to 0800 were unusually low when compared with canister samples (possible power failure); therefore this sampling period is excluded from the comparison.

Several unusual compounds are observed in Oildale samples; for example, in the samples collected on August 1, 0600 to 0800 hours, a high concentration of styrene was found (in both Tenax and canister samples), indicating some local source of styrene. Also, an abundant acetate (possibly amyl acetate) peak is observed in most of the Tenax sample chromatograms. Biogenic hydrocarbons and oxygenated compounds (possibly of secondary origin) are also relatively abundant, particularly in the samples collected between 1000 and 1200 hours. The compounds such as benzaldehyde, acetophenone, and benzoic acid are clearly artifacts due to the reaction of Tenax material with ozone.

5.3.3 Los Angeles

Table 22 shows the ratios of concentrations of selected compounds found in the Tenax and canister samples collected in Los Angeles. In addition to six aromatic compounds selected for the Caldecott Tunnel and Oildale, two paraffinic compounds, namely n-decane and n-undecane, were selected, since their concentrations were relatively high in the Los Angeles samples and they were usually resolved from neighboring peaks.

As can be seen from this table, there is more scatter in the data than observed for the Caldecott Tunnel samples. This may be due to the generally lower concentrations found in the Los Angeles samples, and to the presence of several artifact peaks in the Tenax sample chromatograms. However, a similar trend can be noticed from these data as from the Caldecott Tunnel data, namely that compounds of lower vapor pressures are recovered better from the Tenax than from the canister samples.

5.4 The Assessment of the SVHC Contribution to the Total Gas-Phase NMHC

Historically, whole air samples were analyzed routinely for hydrocarbons only up to the C10 range using capillary gas chromatography (Singh, 1980; Grosjean and Fung, 1984). In more recent work, hydrocarbons up to C13 were reported (Stump and Dropkin, 1985; Sigsby et al., 1987; Seila and Lonneman, 1988). In the present study, the gas-phase concentration of TNMHC in the range of C2 to C18 can be produced by combining the analytical results from the analysis of canister samples with results obtained from Tenax samples. Thus, the contribution of SVHC at a given carbon number to the total gas-phase NMHC can be assessed. For this purpose we have arbitrarily chosen 1,2,3-trimethylbenzene as the cut point, with compounds eluting thereafter defined as SVHC. This compound was chosen because it represents one of the last eluting hydrocarbons that was usually identified in ambient hydrocarbon data. The SVHC eluting after

Table 22

Ratios of concentrations of selected compounds found in Tenax and canister samples collected in Los Angeles (Tenax/canister)

Date	8/21		8/22		8/23		8/24		Mean ± SD
Compound	0600-0800	1000-1200	0600-0800	1000-1200	0600-0800	1000-1200	0600-0800	1000-1200	
Ethylbenzene	1.16	0.92	0.82	1.08	0.89	0.95	1.05	1.04	0.99 ± 0.11
m- & p-Xylene	1.23	0.91	0.78	1.07	0.87	0.92	1.05	0.96	0.97 ± 0.14
o-Xylene	1.24	1.06	0.90	1.15	1.01	1.00	1.11	1.12	1.07 ± 0.10
n-Propylbenzene	0.32[a]	1.37	1.65	1.21	1.88	2.20	1.87	2.27	1.77 ± 0.40[c]
1,2,4-Trimethylbenzene	1.58	1.30	1.34	1.45	1.65	1.59	1.74	1.96	1.57 ± 0.21
n-Decane	2.07[b]	1.21	1.67	1.69	1.42	1.25	1.56	1.45	1.46 ± 0.19[c]
n-Undecane	1.47	1.03	0.86	1.18	0.62[a]	0.99	0.90	0.7[a]	1.07 ± 0.22
Naphthalene	3.08[b]	1.39	1.47	1.74	1.26	1.31	0.95	1.07	1.27 ± 0.25[c]

[a] Co-eluting peak on canister sample chromatogram.
[b] Co-eluting peak on Tenax sample chromatogram.
[c] Excluding value from 8/21, 0600-0800.
[d] Excluding value from 8/23, 0600-0800 and 8/24, 1000-1200.

1,2,3-trimethylbenzene can be expressed as a fraction of total NMHC up to this compound. To assess the relative importance of SVHC at a higher carbon number, we have also determined the fraction of SVHC eluting after naphthalene, since naphthalene (which elutes just before n-dodecane from the nonpolar capillary columns, such as DB-1) was the last compound quantified from our canister samples. The results are tabulated in Tables 23, 24, and 25 for the Caldecott Tunnel, Oildale, and Los Angeles, respectively.

As can be seen from these tables, the percent contribution of SVHC to TNMHC ranges from ~1 to ~18%. If the hydrocarbons are quantified only up to C10 from canister samples, the percent contribution of SVHC, in the range of C10 to C18, ranges from ~6 to ~18%. In contrast, the contribution of SVHC in the range of C12 to C18, is considerably lower and ranges from ~1 to ~7.7%.

The contribution of SVHC to TNMHC range, determined for the Caldecott Tunnel and Los Angeles, is very similar as can be seen from Tables 23 and 25, suggesting the same sources of hydrocarbons. The highest percentages are observed for Oildale samples (Table 24). However, as discussed in Section 5.3.2, Oildale samples were rather diluted and not typical for the oil production area. In addition, the presence of oxygenated compounds (possibly of secondary origin) and Tenax artifact peaks, in Tenax samples collected in Oildale, makes the comparison of both collection methods rather uncertain.

For the Caldecott Tunnel, the contribution of SVHC defined as compounds in the range of C12 to C18 is rather low and ranges from ~1 to ~1.4% . However, light-duty gasoline vehicles are the main traffic components in the Caldecott Tunnel, and heavy-duty diesel trucks, which are presumably the main source of SVHC, are largely absent in the tunnel. In addition, it has to be pointed out that a contribution of 1.0 to 1.4% as measured in the samples collected in the Caldecott Tunnel, corresponds to approximately 20 to 50 ppbC (or 2-4 ppb of actual compounds). 1- and 2-methyl-naphthalene concentrations account for at least 50% of the total SVHC concentration range, and other aromatic C6-substituted benzene isomers and C2-substituted 1,2-dihydroindene isomers are relatively abundant in this SVHC concentration range, as compared to saturated aliphatic hydrocarbons. These aromatic and polycyclic aromatic hydrocarbons are precursors of nitro-derivatives formed from atmospheric transformations (reaction with OH radicals in the presence of NO_x and with N_2O_5) in ambient air (see, for example, Zielinska et al., 1989; Atkinson et al., 1987; and Arey et al., 1989). Many of these nitro-derivatives are potent mutagens and/or suspected carcinogens.

5.5 Comparison of the TNMHC Measurements by EPA Method 25, PDFID, and Peak Summation of Speciation Data

EPA Method 25 is a carbon counting method in which all forms of carbon are measured as methane. Halogenated or oxygenated species will have the same response as that of a hydrocarbon with the same number of carbons because all compounds are oxidized to CO_2 and detected as CH_4 after catalytic reduction. In contrast, PDFID and summation of speciation data are solely based on FID response to the compounds. So in principle, these last two methods of

Tab. 23

Assessment of the SVHC (Tenax) contribution to the TNMHC (canisters) in the Caldecott Tunnel (ppbC)

Date	6/26	6/27			6/28	
Method	1600-1800	0600-0800	1000-1200	1600-1800	0600-0800	1000-1200
TNMHC, Canister (C2-C10, including 1,2,3-trimethylbenzene)	2417	1858[a]	2955[a]	3264[a]	1344[a]	1978
SVHC, Tenax (C11-C18, excluding 1,2,3-trimethylbenzene)	328	137	181	261.3	120	116
% Contribution	13.6	7.4	6.1	8.0	8.9	9.9
TNMHC, Canister (C2-C11, including naphthalene)	2520	1950[a]	3100[a]	3380[a]	1620[a]	2065
SVHC, Tenax (C12-C18, excluding naphthalene)	29.6	19.2[b]	33.5[b]	46.7[b]	22.0[b]	22.6
% SVHC Contribution	1.2	1.0	1.1	1.4	1.4	1.1

[a] Corrected for too high 1,3,5-trimethylbenzene peak.

[b] Mean value from two replicate measurements.

Table 24
Assessment of the SVHC (Tenax) contribution to the TNMHC (canisters) in Oildale (ppbC)

Date	7/30		7/31		8/01
Method	0600-0800	1000-1200	0600-1080	1000-1200	0600-0800
TNMHC, Canister (C2-C10, including 1,2,3-trimethylbenzene)	1017	362.9	212	153.1	227.2[a]
SVHC, Tenax (C11-C18, past 1,2,3-trimethylbenzene)	78.7	58	[b]	27.6	30.2
% Contribution	7.7	15.9	-	18.0	13.3
TNMHC, Canister (C2-C11, including naphthalene)	1185	372.3	232.3[a]	163.5	237.9[a]
SVHC, Tenax (C12-C18, excluding naphthalene)	20.02[a]	21.03	[b]	12.6	12.6[a]
% SVHC Contribution	1.7	5.6	-	7.7	5.3

[a] Mean value from two replicate samples.
[b] Not valid measurement.

Table 25

Assessment of the SVHC (Tenax) contribution to the TNMHC (canisters) in Los Angeles (ppbC)

Date	8/21		8/22		8/23		8/24	
Method	0600-0800	1000-1200	0600-0800	1000-1200	0600-0800	1000-1200	0600-0800	1000-1200
TNMHC, Canister (C2-C10, including 1,2,3-trimethylbenzene)	1927	1623	1342	1405	1070	1473	529	586
SVHC, Tenax (C11-C18, past 1,2,3-trimethylbenzene)	296[a]	130.0	114.8	101.2	102.1	133.9	78	74
% Contribution	15.4	8.01	8.6	7.2	9.5	9.1	14.7	12.6
TNMHC, Canister (C2-C11, including naphthalene)	2020	1708	2115	1454	1120	1527	570	637
SVHC, Tenax (C12-C18, excluding naphthalene)	33.7[a]	23.2	21.4	21.6[a]	15.5[a]	21.2	9.3	13.3
% SVHC Contribution	1.7	1.4	1.0	1.5	1.3	1.4	1.6	2.1

[a] Mean value from two replicate measurements.

assessing total NMHC should give similar values. However, PDFID does not involve any separation process. Compounds such as water, CO_2 and other gases that are condensed, adsorbed, or frozen in the cryogenic concentration process can interact with other compounds in the FID, even though they, themselves, do not have direct FID response (matrix effect). This effect may produce positive or negative biases. The speciation data would not be subjected to this type of interference due to the chromatographic process. On the other hand, the analysis time for speciation is many times longer than PDFID. Baseline fluctuations during the run and settings of the parameters for peak integration can contribute to the disagreement between the two techniques.

To illustrate how these processes can affect the results, shown in Figure 56 is a chromatogram of the >C8 hydrocarbons from Canister 349 taken at Southwest Museum, which is representative of several of the samples from Los Angeles. There were notable baseline changes due to elution of some unknown compounds in the sample. In addition, there was a big peak which started at around 20 minutes and ended abruptly at approximately 27 minutes. By adjusting the integration parameters, the integrator was able to integrate the hydrocarbon peaks riding on top of this large peak successfully without imparting significant error in the process. The TNMHC of this sample base on peak summation was 1.46 ppmC, excluding the big peak, which accounted for 0.25 ppmC (totalling 1.71 ppmC). The PDFID value of this sample was 1.64 ppmC, while Method 25 gave 2.29 ppmC. It is suspected that these broad peaks were polar compounds containing oxygen or nitrogen eluting off from the column. These polar compounds have lower FID responses than corresponding hydrocarbons but would respond equally in Method 25, thus accounting for the higher value observed by that method.

Similar observations were made with samples from Oildale collected in 1989 (Fung et al., 1991). Good agreements on TNMHC between Method 25 and speciation data were seen with some samples, but poor agreements were seen with others. The TNMHC data are being reviewed to determine the uncertainties due to the presence of these compounds or artifacts.

5.6 Comparison of TNMHC by Hydrocarbon Speciation, Method 25, PDFID, and Measured On-Site Air Quality Data

Table 26 shows the TNMHC data measured by hydrocarbon speciation (GC/FID), PDFID, and EPA Method 25, as well as data obtained from continuous TNMHC analyzers (Bendix), present in Oildale and Los Angeles. In addition, CH_4, CO, and CO_2 concentrations measured from all canisters and NO_x concentrations measured in the Caldecott Tunnel are also given in this table. Figures 57 through 62 show the correlations between all these data in graphical form. Figure 57 shows the correlation between PDFID and GC/FID data for all canister samples, except those collected in Los Angeles Chinatown (on the roof of the Best Western Motel). As discussed in Section 5.5, these samples show the presence of a broad, unidentified peak, which was excluded from GC/FID results but was integrated by PDFID method. This explains much higher TNMHC values obtained for these sets of samples from the PDFID method in comparison with GC/FID measurements. In general, the agreement between

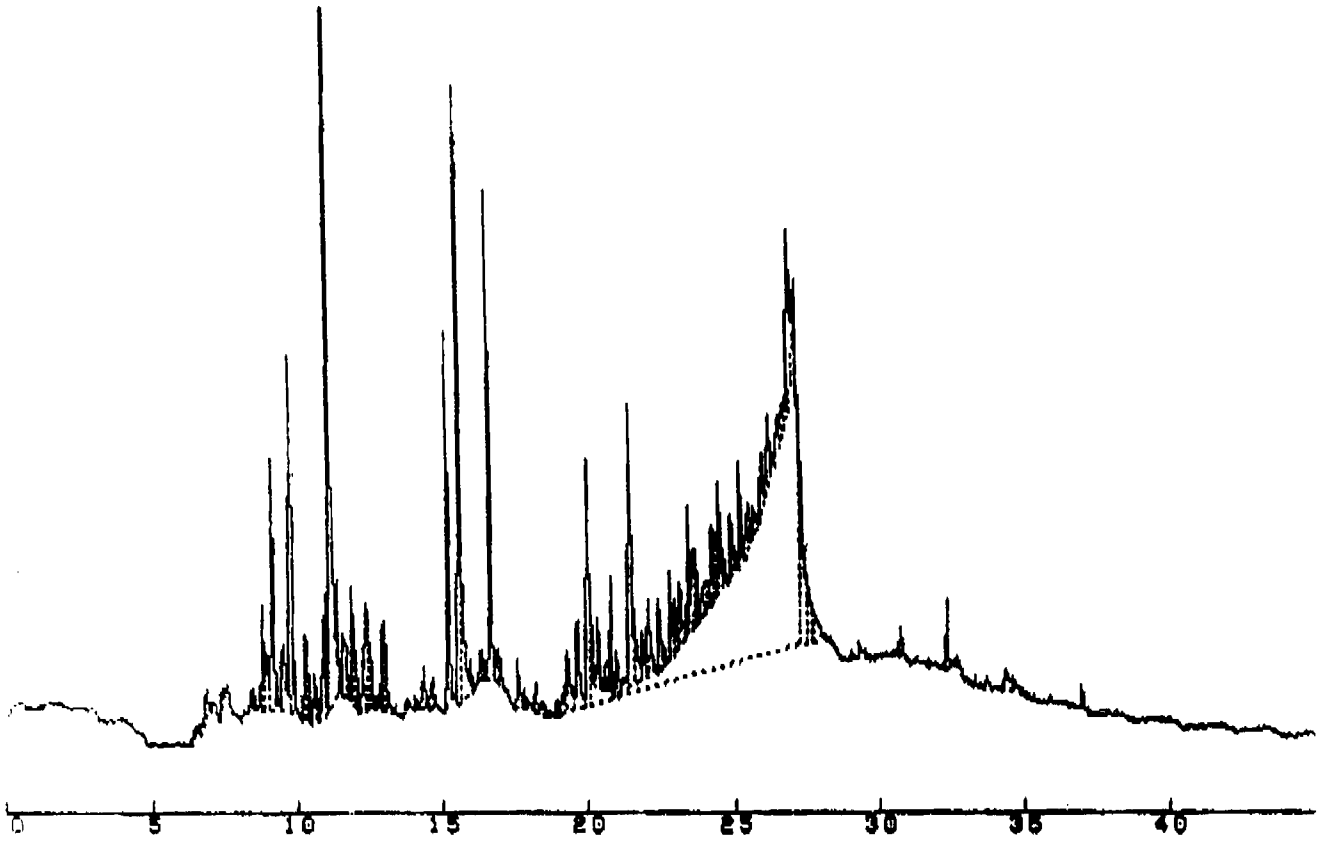

Figure 56. A chromatogram of a canister sample collected at Southwest Museum, Los Angeles (>C8 range).

Table 26

Comparison of TNMHC by GC/FID, PDFID, Method 25 and On-site Data

Site	Canister Number	Date	Sampling Time	GC/FID TNMHC (ppmC)	PDFID TNMHC (ppmC)	Cryo, 30ml Method 25 TNMHC (ppmC)	AQ[c] Data (Bendix)	Method 25 CH4 (ppm)	Method 25 CO2 (ppm)	Method 25 CO (ppm)	NO_x ppm
Caldecott Tunnel	00284	6/25/91	1000 - 1200	1.67[a]	1.51	0.89	-	1.78	491.19	6.23	0.15
	00282	6/25/91	1600 - 1800	1.36[a]	1.33	1.74	-	1.63	483.11	7.21	0.25
	00285	6/25/91	1600 - 1800	1.23[a]	1.28	1.11	-	1.60	480.71	6.98	0.22
	00270	6/26/91	0600 - 0800	3.2	2.24	2.01	-	1.78	481.59	6.61	0.22
	00283	6/26/91	1000 - 1200	2.93	1.73	1.24	-	1.74	499.72	6.97	0.27
	00272	6/26/91	1600 - 1800	2.52	2.39	1.16	-	1.75	610.92	13.65	-
	00277	6/27/91	0600 - 0800	1.95[a]	1.69	1.71	-	1.80	466.75	5.22	0.41
	00275	6/27/91	1000 - 1200	3.10[a]	2.62	1.40	-	1.87	569.91	11.92	1.0
	00274	6/27/91	1000 - 1200	3.10[a]	2.59	1.25	-	1.90	575.58	11.85	1.0
	00271	6/27/91	1600 - 1800	3.38[a]	2.99	1.40	-	1.81	655.84	15.68	1.2
	00276	6/27/91	1600 - 1800	3.47[a]	3.11	2.18	-	1.78	669.32	16.22	1.2
	00281	6/28/91	0600 - 0800	1.62[a]	1.61	1.41	-	1.71	489.04	5.44	0.3
	00280	6/28/91	1000 - 1200	2.07	1.79	1.55	-	1.71	528.36	7.87	0.8
	00278	6/28/91	0600 - 0800[b]	0.09	0.31	1.11	-	1.67	381.19	0.19	-
	00279	6/28/91	1000 - 1200[b]	0.17	0.38	1.21	-	1.69	369.24	0.23	-
Oildale	00300	7/30/91	0600 - 0800	1.16	1.81	1.36	1.19	7.44	395.51	0.15	
	00299	7/30/91	1000 - 1200	0.37	0.77	0.81	0.77	2.10	386.96	<0.1	
	00291	7/31/91	0600 - 0800	0.24	0.54	0.84	0.49	3.08	374.41	0.30	
	00292	7/31/91	0600 - 0800	0.22	0.52	1.19	0.44	3.06	358.30	<0.1	
	00293	7/31/91	1000 - 1200	0.16	0.35	1.15	0.56	1.78	361.10	0.13	
	00294	8/1/91	0600 - 0800	0.21	0.52	1.09	0.35	1.79	373.70	0.40	
	00298	8/1/91	0600 - 0800	0.25	0.42	1.11	0.35	1.80	371.51	<0.1	

Table 2b continued

Comparison of TNMHC by GC/FID, PDFID, Method 25 and On-site Data

Site	Canister Number	Date	Sampling Time	GC/FID TNMHC (ppmC)	PDFID TNMHC (ppmC)	Cryo, 30ml Method 25 TNMHC (ppmC)	AQ[c] Data (Bendix)	Method 25 CH4 (ppm)	Method 25 CO2 (ppm)	Method 25 CO (ppm)
Los Angeles	00296	8/21/91	0600 - 0800	2.02	2.13	1.58	1.68	2.62	470.92	4.20
	00297	8/21/91	1000 - 1200	1.70	1.87	1.58	1.47	2.34	427.71	2.35
	00295	8/22/91	0600 - 0800	1.42	1.56	2.03	0.98	2.81	422.44	1.97
	00341	8/22/91	1000 - 1200	1.45	1.79	1.52	1.26	2.20	431.56	1.73
	00342	8/23/91	0600 - 0800	1.12	1.27	0.87	0.56	2.12	423.08	1.66
	00344	8/23/91	0600 - 0800	1.14	1.29	0.78	-	2.04	414.51	1.47
	00343	8/23/91	1000 - 1200	1.53	1.76	1.74	-	2.50	444.21	2.93
	00339	8/23/91	1000 - 1200	1.48	1.70	1.08	1.26	2.47	438.15	2.48
	00340	8/24/91	0600 - 0800	0.57	1.14	1.89	0.63	1.96	370.68	<1[b]
	00338	8/24/91	1000 - 1200	0.63	1.39	2.11	-	2.70	553.78	<1[b]
LA/Best Western	00345	8/23/91	0600-0800	0.37	4.85	5.30	-	-	-	2.02
	00346	8/23/91	1000-1200	1.29	4.10	4.13	-	2.50	564.88	2.67
	00348	8/24/91	0600-0800	0.86	9.17	10.11	-	-	-	0.66
	00347	8/24/91	1000-1200	0.92	5.02	4.97	-	2.27	763.03	0.49
LA/Lincoln Park	00357	8/23/91	0600-0800	0.72	1.29	2.92	-	2.04	406.82	<0.1
	00359	8/23/91	1000-1200	1.89	2.62	3.40	-	2.32	426.54	2.42
	00358	8/24/91	0600-0800	0.66	1.15	1.83	-	2.06	571.54	<0.1
	00356	8/24/91	1000-1200	0.53	0.86	2.14	-	2.01	396.26	<0.1

Table 26 continued

Comparison of TNMHC by GC/FID, PDFID, Method 25 and On-site Data

Site	Canister Number	Date	Sampling Time	GC/FID TNMHC (ppmC)	PDFID TNMHC (ppmC)	Cryo, 30ml Method 25 TNMHC (ppmC)	AQ[c] Data (Bendix)	Method 25 CH4 (ppm)	Method 25 CO2 (ppm)	Method 25 CO (ppm)
LA/ Southwest Museum	00352	8/23/91	0600-0800	1.10	1.35	6.93	-	2.21	406.27	0.12
	00349	8/23/91	1000-1200	1.46	1.64	2.29		2.39	418.88	1.78
	00350	8/24/91	0600-0800	0.91	1.03	1.25		2.15	384.51	<0.1
	00351	8/24/91	1000-1200	0.69	0.89	2.36		1.92	388.95	<0.1

[a] Corrected for too high concentration of 1,3,5-trimethylbenzene.
[b] Background sample, collected in clean air intake room.
[c] Multiply by 1.4 to adjust for different calibration methods.

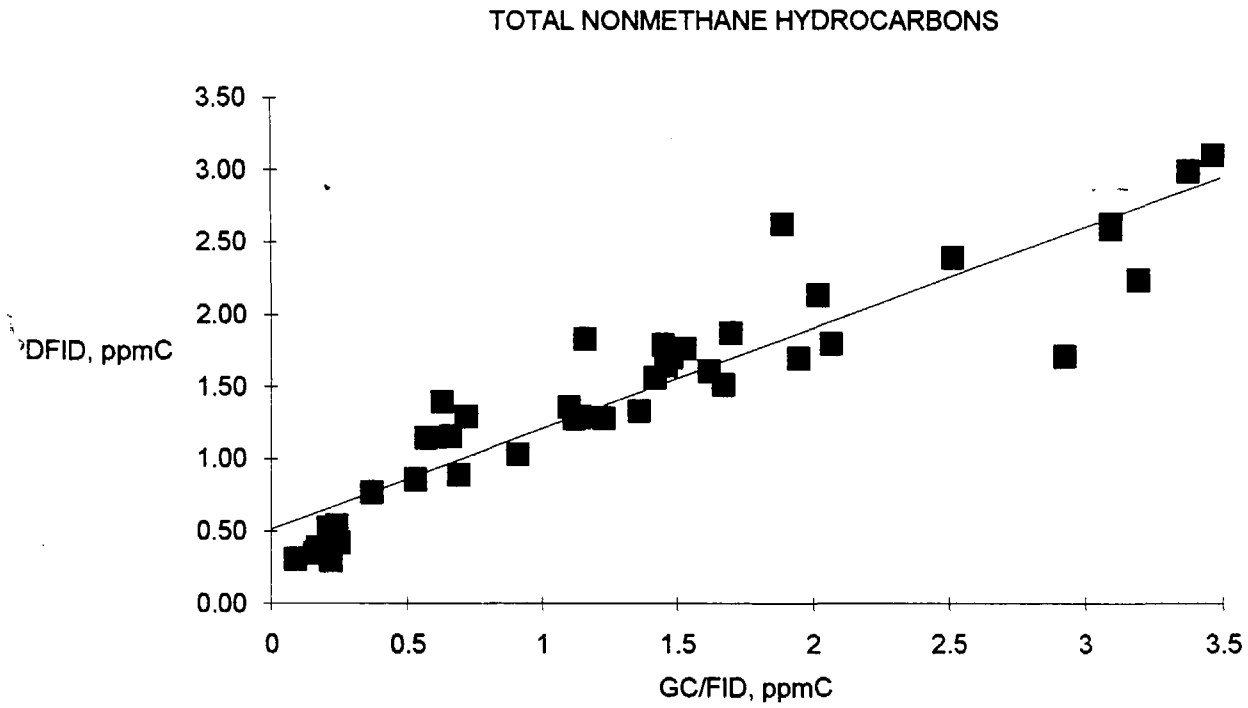

Figure 57. TNMHC comparison: PDFID versus GC/FID for the Caldecott Tunnel, Oildale, and Los Angeles (excluding LA/Best Western) canister samplers.

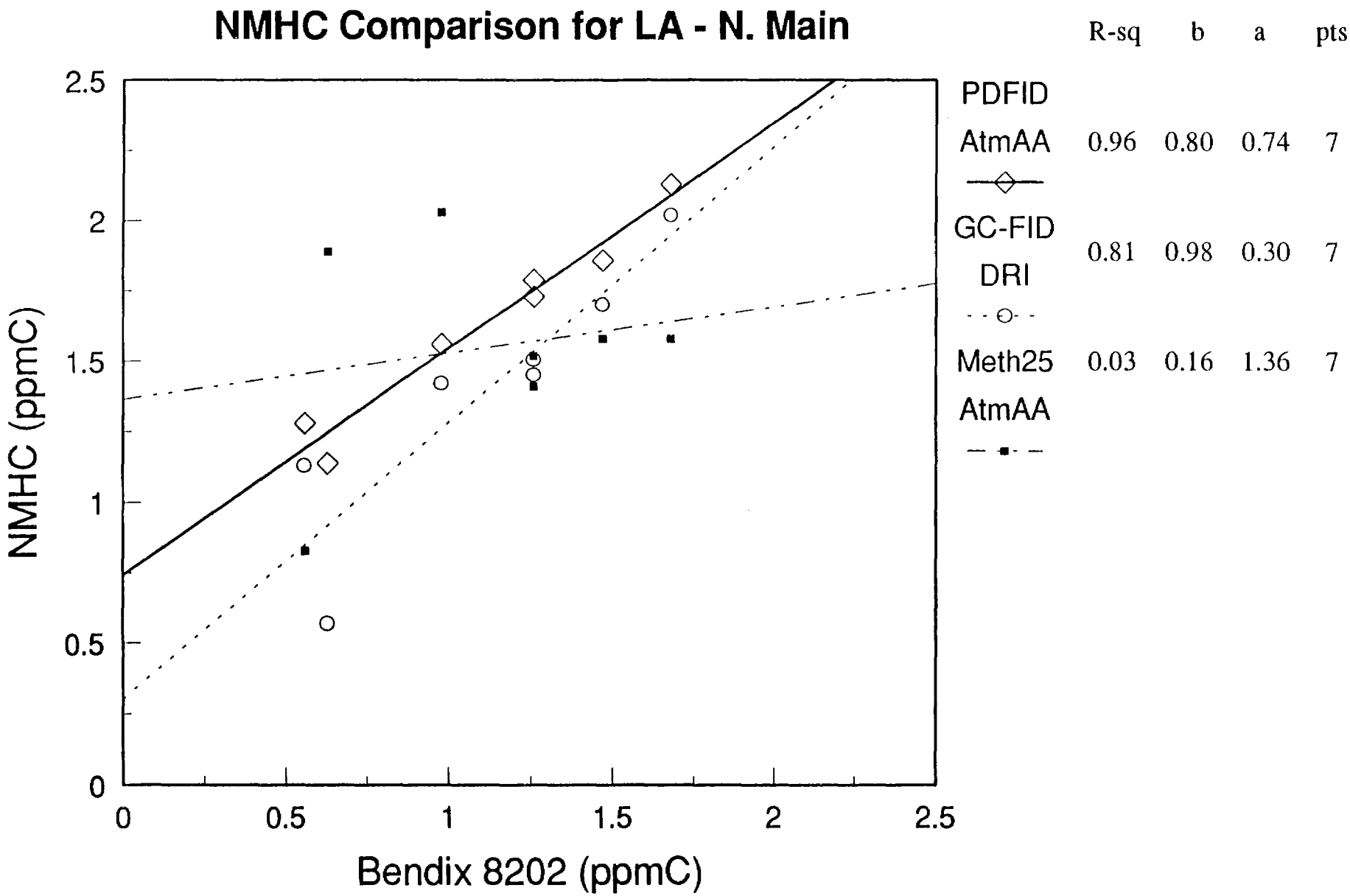

Figure 58. TNMHC comparison of continuous me ements versus canister samples.

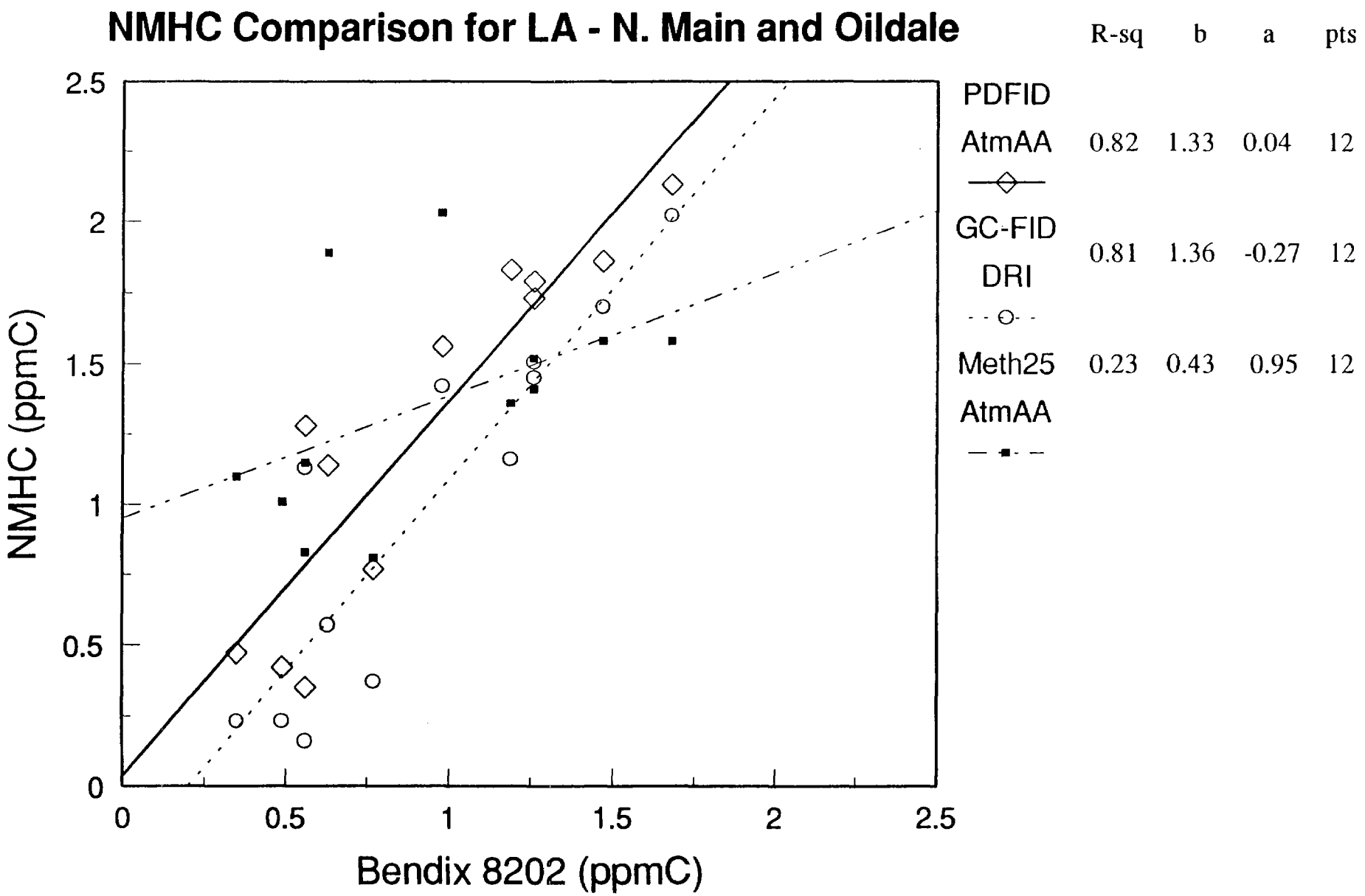

Figure 59. TNMHC comparison of continuous measurements versus canister samples.

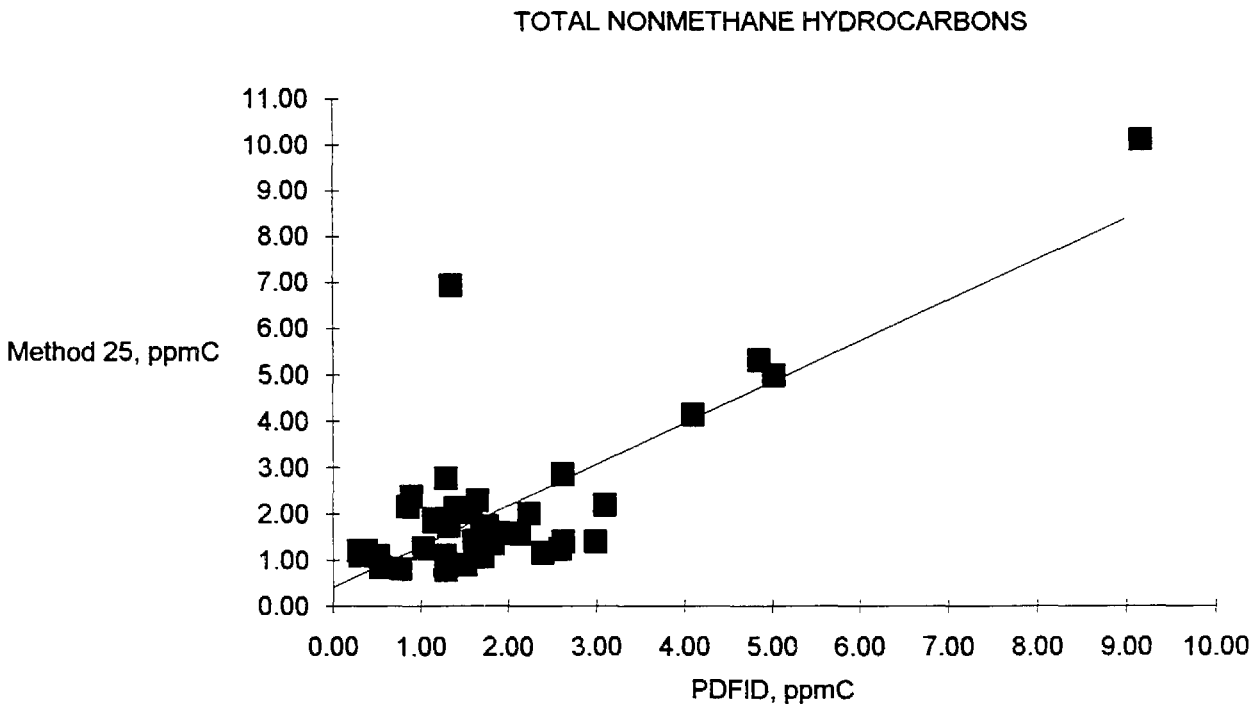

Figure 60. TNMHC comparison of PDFID versus Method 25 (canister samples).

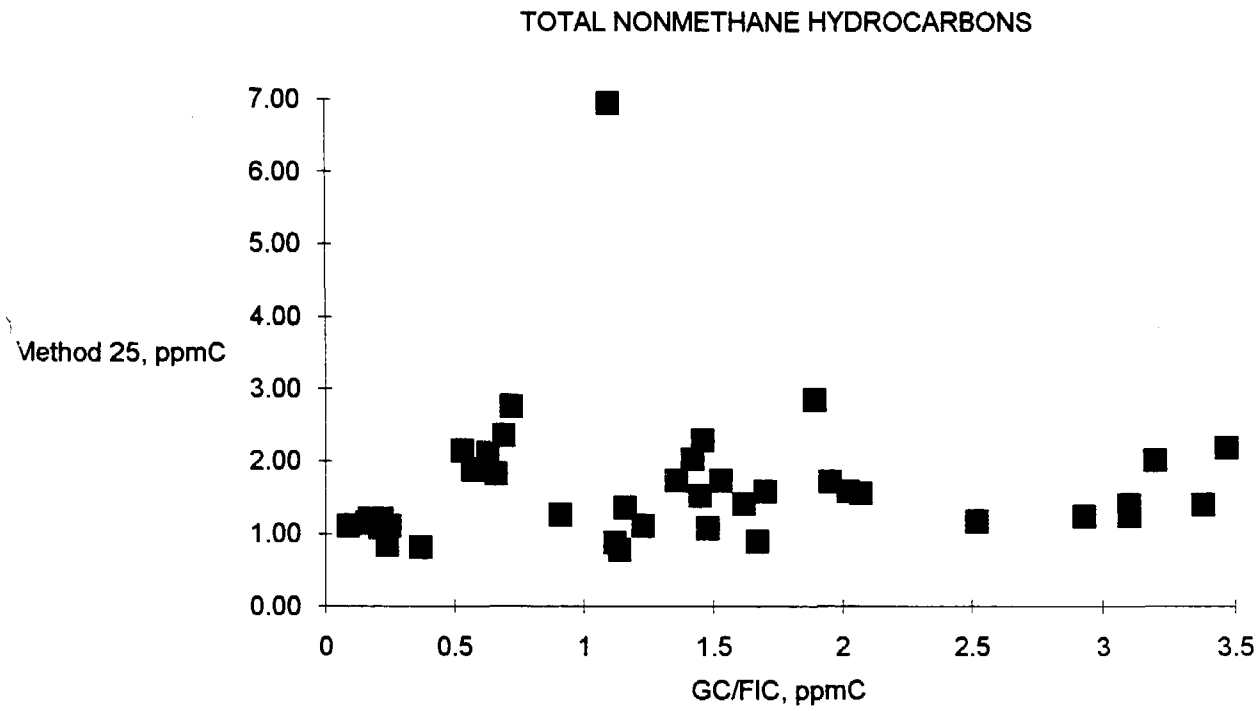

Figure 61. TNMHC comparison of GC/FID versus Method 25 (canister samples).

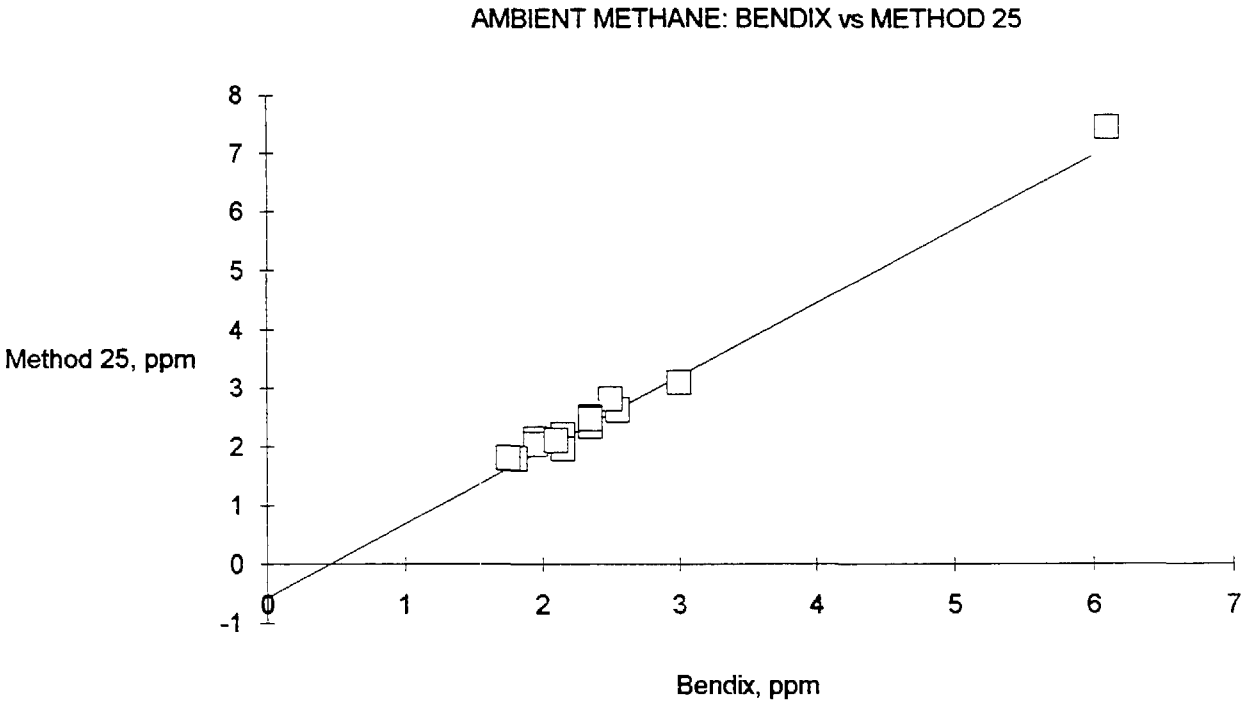

Figure 62. Ambient CH_4 comparison of continuous method (Bendix) versus Method 25 (canister samples).

TNMHC concentrations obtained by the GC/FID and PDFID methods (excluding LA/Best Western samples) is good (R^2=0.855).

Also, as can be seen from Table 26 and Figures 58 and 59, the agreement between GC/FID, PDFID, and continuous analyzers, for Los Angeles samples (Figure 58) and combined Los Angeles and Oildale samples (Figure 59), is satisfactory. However, as can be seen from these two figures as well as from Figures 60 and 61, EPA Method 25 often shows very different results from all other methods. As discussed in Section 5.5 above, one possible explanation of these observed differences between "total" and "speciated" methods may be due to different response factors observed for hydrocarbons and oxygenated, nitrated, or halogenated hydrocarbons in the FID detector. The GC/FID, PDFID, and continuous analyzer (Bendix) techniques are based on the FID with detector response assumed to be equal for all VOCs, and all compounds are treated as hydrocarbons by these methods. In contrast, EPA Method 25 employs oxidation of all VOCs to CO_2 with subsequent conversion of the CO_2 to CH_4 for detection as CH_4. This normalizes the differences in response factors of hydrocarbons with functional groups (i.e., containing any heteroatom, such as O, N, Cl, F, S, etc.) versus hydrocarbons. As shown in Figure 62, the correlation between ambient methane, measured *in situ* by continuous TNMHC (Bendix) analyzer and ambient methane measured from canister by EPA Method 25 is excellent. This suggests that the reasons for differences observed in TNMHC between these two methods are due to different detection principles rather than calibration problems.

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Appendix A
SITE/SAMPLE LIST

Site	Canister #	Date	Sampling Time	Table No.
CALDECOTT TUNNEL	00284	6/25/91	1000 - 1200	A1
	00282	6/25/91	1600 - 1800	A2
	00285	6/25/91	1600 - 1800	A3
	00270	6/26/91	0600 - 0800	A4
	00283	6/26/91	1000 - 1200	A5
	00272	6/26/91	1600 - 1800	A6
	00277	6/27/91	0600 - 0800	A7
	00275	6/27/91	1000 - 1200	A8
	00274	6/27/91	1000 - 1200	A9
	00271	6/27/91	1600 - 1800	A10
	00276	6/27/91	1600 - 1800	A11
	00281	6/28/91	0600 - 0800	A12
	00280	6/28/91	1000 - 1200	A13
	00278	6/28/91	0600 - 0800[a]	A14
	00279	6/28/91	1000 - 1200[a]	A15
OILDALE	00300	7/30/91	0600 - 0800	A16
	00299	7/30/91	1000 - 1200	A17
	00291	7/31/91	0600 - 0800	A18
	00292	7/31/91	0600 - 0800	A19
	00293	7/31/91	1000 - 1200	A20
	00294	8/1/91	0600 - 0800	A21
	00298	8/1/91	0600 - 0800	A22
LOS ANGELES	00296	8/21/91	0600 - 0800	A23
	00297	8/21/91	1000 - 1200	A24
	00295	8/22/91	0600 - 0800	A25
	00341	8/22/91	1000 - 1200	A26
	00342	8/23/91	0600 - 0800	A27
	00344	8/23/91	0600 - 0800	A28
	00343	8/23/91	1000 - 1200	A29
	00339	8/23/91	1000 - 1200	A30
	00340	8/24/91	0600 - 0800	A31
	00338	8/24/91	1000 - 1200	A32
	Bill Lonneman			A33

Appendix A (continued)
SITE/SAMPLE LIST

Site	Canister #	Date	Sampling Time	Table No.
LA/BEST WESTERN	00345			A34
	00346			A35
	00348			A36
LA/LINCOLN PARK	00347			A37
	00357			A38
	00359			A39
	00358			A40
	00356			A41
LA/SOUTHWEST MUSEUM	00352			A42
	00349			A43
	00350			A44
	00351			A45

[a] Background sample, collected in clean air intake room.

TABLE A1

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	14.28	28.56	3.93
2		ETHYLENE	58.00	116.00	3.98
3		ETHANE	4.45	8.90	4.09
4		PROPENE	15.10	45.30	5.23
5		PROPANE	1.80	5.40	5.36
6		ISOBUTANE	2.43	9.70	6.71
7		BUTENE–1	7.28	29.10	7.56
8		1,3–BUTADIENE	1.83	7.32	7.74
9	400.00	n–BUTANE	11.83	47.33	7.96
10	410.42	trans–2–BUTENE	1.43	5.72	8.46
11	423.54	cis–2–BUTENE	1.12	4.47	9.09
12		C4 OLEFIN	0.00		
13	459.79	C4 OLEFIN	1.13	4.52	10.83
14		3–METHYL–1–BUTENE	0.00		
15	472.71	ISOPENTANE	25.24	126.19	11.45
16	488.54	1–PENTENE	0.99	4.93	12.21
17	495.83	2–METHYL–1–BUTENE	1.52	7.58	12.56
18	500.00	n–PENTANE	8.89	44.43	12.76
19		ISOPRENE	0.00		
20	508.30	t–2–PENTENE	1.64	8.21	13.17
21	515.79	c–2–PENTENE	0.91	4.56	13.54
22	519.03	C5 OLEFIN	1.28	6.38	13.70
23	520.65	2–METHYL–2–BUTENE	2.24	11.20	13.78
24		C6 PARAFFIN	0.00		
25	535.63	2,2–DIMETHYLBUTANE	1.36	8.14	14.52
26	552.43	CYCLOPENTENE	0.32	1.60	15.35
27		4–METHYL–1–PENTENE	0.00		
28	563.36	CYCLOPENTANE	1.35	6.74	15.89
29	565.38	2,3–DIMETHYLBUTANE	2.43	14.58	15.99
30	569.64	2–METHYLPENTANE	8.85	53.09	16.20
31		C6 OLEFIN	0.00		
32		UNKNOWN	1.29	7.74	16.65
33	583.40	3–METHYLPENTANE	5.31	31.86	16.88
34	588.66	2–METHYL–1–PENTENE + 1–HEXENE	0.82	4.91	17.14
35		C6 OLEFIN			
36	600.00	n–HEXANE	4.45	26.71	17.70
37	604.84	t–3–HEXENE	0.48	2.90	17.92
38	607.25	t–2–HEXENE	0.94	5.62	18.03
39		C6 OLEFIN	0.00		
40		C6 OLEFIN	0.00		

Table A1 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN			
42	628.35	METHYLCYCLOPENTANE	5.36	32.16	18.99
43	631.21	2,4–DIMETHYLPENTANE	1.09	7.66	19.12
44	643.52	C7 HYDROCARBON	0.83	5.81	19.68
45	652.97	BENZENE	15.76	94.57	20.11
46		3,3–DIMETHYLPENTANE	0.00		
47	662.42	CYCLOHEXANE	0.85	5.12	20.54
48	668.57	2–METHYLHEXANE	2.87	20.08	20.82
49	671.21	2,3–DIMETHYLPENTANE	1.22	8.56	20.94
50	677.14	3–METHYLHEXANE	3.10	21.72	21.21
51		C7 OLEFIN	0.00		
52	685.27	1,3–DIMETHYLCYCLOPENTANE	0.98	6.83	21.58
53	688.13	3–ETHYLPENTANE	1.21	8.44	21.71
54	691.21	2,2,4–TRIMETHYLPENTANE	3.68	29.40	21.85
55	700.00	n–HEPTANE	1.72	12.07	22.25
56	713.11	C8 HYDROCARBON	0.63	4.43	22.79
57	724.03	C8 OLEFIN	0.76	6.07	23.24
58	726.21	METHYLCYCLOHEXANE	1.57	11.01	23.33
59		C8 PARAFFIN	0.00		
60	733.50	2,5–DIMETHYLHEXANE	0.67	5.33	23.63
61	736.41	2,4–DIMETHYLHEXANE	1.31	10.45	23.75
62		C8 PARAFFIN	0.00		
63		C8 PARAFFIN	0.00		
64	754.61	2,3,4–TRIMETHYLPENTANE	1.45	11.57	24.50
65	760.92	TOLUENE	21.76	152.31	24.76
66		2,3–DIMETHYLHEXANE	0.00		
67	767.72	2–METHYLHEPTANE	1.23	9.87	25.04
68		3–METHYLHEPTANE	0.00		
69	775.49	3–ETHYLHEXANE	0.95	7.63	25.36
70		C8 PARAFFIN	0.00		
71	786.65	2,2,5–TRIMETHYLHEXANE	0.55	4.93	25.82
72		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
73		C8 PARAFFIN	0.00		
74	800.00	n–OCTANE	0.58	4.68	26.37
75		PERCHLOROETHYLENE	0.00		
76		C9 PARAFFIN	0.00		
77		DIMETHYLHEPTANE	0.00		
78	816.84	C9 PARAFFIN	0.57	5.16	27.03
79		C9 PARAFFIN	0.00		
80		2,5–DIMETHYLHEPTANE	0.00		

Table A1 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81		C9 PARAFFIN	0.00		
82	855.87	ETHYLBENZENE	3.24	25.92	28.56
83		C9 OLEFFIN	0.00		
84	863.78	m&p-XYLENE	12.99	103.91	28.87
85		4-METHYLOCTANE	0.00		
86		3-METHYLOCTANE	0.00		
87		C9 PARAFFIN	0.00		
88	880.10	STYRENE	2.75	22.02	29.51
89	887.24	o-XYLENE	6.07	48.60	29.79
90	896.17	1-NONENE	1.66	14.91	30.14
91	900.00	n-NONANE	1.51	13.56	30.29
92		C9 PARAFFIN	0.00		
93	917.35	ISOPROPYLBENZENE	1.29	11.63	30.88
94		C10 PARAFFIN	0.00		
95		CYCLOOCTANE	0.00		
96		C10 PARAFFIN	0.00		
97	934.71	C10 PARAFFIN	1.22	12.19	31.47
98		a-PINENE	0.00		
99		C10 PARAFFIN	0.00		
100	950.59	n-PROPYLBENZENE	0.66	5.98	32.01
101	957.06	m-ETHYLTOLUENE	3.46	31.13	32.23
102	960.00	p-ETHYLTOLUENE	2.00	18.02	32.33
103	966.76	☼ 1,3,5-TRIMETHYLBENZENE	11.91	107.15	32.56
104	977.65	C10 PARAFFIN	1.94	19.36	32.93
105	981.18	o-ETHYLTOLUENE	2.03	18.30	33.05
106		C10 PARAFFIN	0.00		
107	992.35	1,2,4-TRIMETHYLBENZENE	4.43	39.84	33.43
108		C10 PARAFFIN	0.00		
109	1000.00	n-DECANE	1.26	12.61	33.69
110		SEC-BUTYLBENZENE	0.00		
111		C10 OLEFIN	0.00		
112	1024.36	1,2,3-TRIMETHYLBENZENE	1.40	12.61	34.45
113		1-METHYL-4-ISOPROPYLBENZENE	0.00		
114	1029.81	C10 PARAFFIN	0.92	9.16	34.62
115	1040.38	C10 AROMATIC	0.62	6.24	34.95
116		n-BUTYLCYCLOHEXANE	0.00		
117	1049.04	1,3-DIETHYLBENZENE	1.59	15.88	35.22
118		C10 AROMATIC	0.00		
119	1056.73	1,4-DIETHYLBENZENE	1.04	10.39	35.46
120		C10 AROMATIC	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		C11 PARAFFIN	0.00		
122		2,6–DIMETHYLSTYRENE	0.00		
123	1078.85	1,3–DIMETHYL–4–ETHYLBENZENE	0.38	3.84	36.15
124	1087.82	C10 AROMATIC	0.87	8.74	36.43
125		C10 AROMATIC	0.00		
126		C10 AROMATIC	0.00		
127	1100.00	n–UNDECANE	0.00		36.81
128		C10 AROMATIC	0.00		
129		1,2,4,5–TETRAMETHYLBENZENE	0.00		
130		1,2,3,5–TETRAMETHYLBENZENE	0.39	3.87	37.63
131		C11 PARAFFIN	0.00		
132		C10 AROMATIC	0.00		
133		C10 AROMATIC	0.37	3.72	38.31
134		C11 PARAFFIN	0.00		
135		m–DIISOPROPYLBENZENE	0.00		
136		C11 AROMATIC	0.49	5.37	38.66
137		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
138		C11 AROMATIC	0.00		
139		C11 AROMATIC	0.00		
140		NAPHTHALENE	1.25	12.48	39.76
141		C11 AROMATIC	0.00	0.00	
142		n–DODECANE	0.00	0.00	
		TOTAL	329.41	1772.96	
		TOTAL CORRECTED*	319.01	1678.96	
		TOTAL AROMATICS	96.76	762.52	
		TOTAL PARAFFINS	106.18	612.85	
		TOTAL OLEFIN	114.36	325.09	
		TOTAL FROM #113	7.92	79.69	

☼ Flagged data. Approximate concentration = 1.5 ppbv and 13.2 ppbC

* Corrected for 1,3,5–trimethylbenzene concentration

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	13.45	26.90	3.95
2		ETHYLENE	49.75	99.50	4.00
3		ETHANE	4.27	8.54	4.10
4		PROPENE	12.98	38.93	5.24
5		PROPANE	1.37	4.10	5.38
6		ISOBUTANE	2.53	10.10	6.55
7		BUTENE–1	7.14	28.56	7.54
8		1,3–BUTADIENE	2.45	9.80	7.72
9	400.00	n–BUTANE	10.35	41.40	7.94
10	409.98	trans–2–BUTENE	1.30	5.22	8.42
11	423.49	cis–2–BUTENE	1.11	4.46	9.07
12		C4 OLEFIN	0.00		
13	459.88	C4 OLEFIN	1.15	4.60	10.82
14		3–METHYL–1–BUTENE	0.00		
15	472.77	ISOPENTANE	20.77	103.84	11.44
16	488.36	1–PENTENE	0.77	3.87	12.19
17	495.63	2–METHYL–1–BUTENE	1.13	5.64	12.54
18	500.00	n–PENTANE	7.28	36.38	12.75
19		ISOPRENE	0.00		
20	508.30	t–2–PENTENE	1.34	6.71	13.16
21	515.79	c–2–PENTENE	0.73	3.66	13.53
22	519.03	C5 OLEFIN	1.03	5.16	13.69
23	520.65	2–METHYL–2–BUTENE	1.14	5.72	13.77
24		C6 PARAFFIN	0.00		
25	535.63	2,2–DIMETHYLBUTANE	0.92	5.49	14.51
26		CYCLOPENTENE	0.00		
27		4–METHYL–1–PENTENE	0.00		
28	563.36	CYCLOPENTANE	1.01	5.05	15.88
29	565.38	2,3–DIMETHYLBUTANE	1.79	10.71	15.98
30	569.64	2–METHYLPENTANE	6.58	39.47	16.19
31	573.89	C6 OLEFIN	0.55	3.32	16.40
32	578.74	UNKNOWN	1.12	6.72	16.64
33	583.60	3–METHYLPENTANE	3.96	23.79	16.88
34		2–METHYL–1–PENTENE +			
		1–HEXENE	0.00		
35		C6 OLEFIN			
36	600.00	n–HEXANE	3.61	21.67	17.69
37		t–3–HEXENE	0.00		
38	607.25	t–2–HEXENE	0.66	3.96	18.02
39		C6 OLEFIN	0.00		
40		C6 OLEFIN	0.00		

Table A2 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00		
42	628.35	METHYLCYCLOPENTANE	3.96	23.75	18.98
43	631.43	2,4–DIMETHYLPENTANE	0.81	5.69	19.12
44	643.52	C7 HYDROCARBON	0.72	5.07	19.67
45	652.97	BENZENE	15.06	90.36	20.10
46		3,3–DIMETHYLPENTANE	0.00		
47	662.64	CYCLOHEXANE	0.68	4.07	20.54
48	668.57	2–METHYLHEXANE	2.18	15.28	20.81
49	671.21	2,3–DIMETHYLPENTANE	0.91	6.34	20.93
50	677.36	3–METHYLHEXANE	2.32	16.22	21.21
51		C7 OLEFIN	0.00		
52	685.71	1,3–DIMETHYLCYCLOPENTANE	0.69	4.81	21.59
53	688.13	3–ETHYLPENTANE	0.86	6.00	21.70
54	691.21	2,2,4–TRIMETHYLPENTANE	2.60	20.76	21.84
55	700.00	n–HEPTANE	1.35	9.43	22.24
56	713.08	C8 HYDROCARBON	0.71	4.95	22.78
57	723.73	C8 OLEFIN	0.64	5.15	23.22
58	726.15	METHYLCYCLOHEXANE	1.13	7.88	23.32
59		C8 PARAFFIN	0.00		
60	733.41	2,5–DIMETHYLHEXANE	0.49	3.89	23.62
61	736.32	2,4–DIMETHYLHEXANE	0.96	7.67	23.74
62		C8 PARAFFIN	0.00		
63		C8 PARAFFIN	0.00		
64	754.48	2,3,4–TRIMETHYLPENTANE	0.95	7.58	24.49
65	760.77	TOLUENE	18.20	127.40	24.75
66		2,3–DIMETHYLHEXANE	0.00		
67	767.55	2–METHYLHEPTANE	0.46	3.66	25.03
68		3–METHYLHEPTANE	0.00		
69	775.54	3–ETHYLHEXANE	0.66	5.27	25.36
70		C8 PARAFFIN	0.00		
71	786.44	2,2,5–TRIMETHYLHEXANE	0.43	3.83	25.81
72		DIMETHYLCYCLOHEXANE +			
		1–OCTENE	0.00		
73		C8 PARAFFIN	0.00		
74	800.00	n–OCTANE	0.42	3.38	26.37
75		PERCHLOROETHYLENE	0.00		
76	816.58	C9 PARAFFIN	0.66	5.92	27.02
77		DIMETHYLHEPTANE	0.00		
78		C9 PARAFFIN	0.00		
79		C9 PARAFFIN	0.00		
80		2,5–DIMETHYLHEPTANE	0.00		

Table A2 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81		C9 PARAFFIN			
82	855.87	ETHYLBENZENE	2.37	21.31	28.56
83		C9 OLEFFIN	0.00		
84	863.78	m&p-XYLENE	9.71	87.35	28.87
85		4-METHYLOCTANE	0.00		
86		3-METHYLOCTANE	0.00		
87		C9 PARAFFIN	0.00		
88	879.85	STYRENE	2.07	18.67	29.50
89	886.99	o-XYLENE	4.97	39.75	29.78
90	895.92	1-NONENE	1.65	13.19	30.13
91	900.00	n-NONANE	1.10	9.89	30.29
92		C9 PARAFFIN	0.00		
93	917.11	ISOPROPYLBENZENE	0.97	8.72	30.87
94		C10 PARAFFIN	0.00		
95		CYCLOOCTANE	0.00		
96		C10 PARAFFIN	0.00		
97	934.51	C10 PARAFFIN	0.88	8.83	31.46
98		a-PINENE	0.00		
99		C10 PARAFFIN	0.00		
100	950.44	n-PROPYLBENZENE	0.38	3.84	32.00
101	956.93	m-ETHYLTOLUENE	2.63	23.66	32.22
102	959.88	p-ETHYLTOLUENE	1.45	13.03	32.32
103	966.67	☼ 1,3,5-TRIMETHYLBENZENE	8.70	78.28	32.55
104		C10 PARAFFIN	0.00		
105	977.58	o-ETHYLTOLUENE	1.47	14.72	32.92
106	981.12	C10 PARAFFIN	1.46	13.17	33.04
107	992.33	1,2,4-TRIMETHYLBENZENE	3.27	32.69	33.42
108		C10 PARAFFIN	0.00		
109	1000.00	n-DECANE	1.27	12.67	33.68
110		SEC-BUTYLBENZENE	0.00		
111		C10 OLEFIN	0.00		
112	1024.28	1,2,3-TRIMETHYLBENZENE	1.01	10.11	34.44
113		1-METHYL-4-ISOPROPYLBENZENE	0.00		
114	1029.71	C10 PARAFFIN	0.66	6.64	34.61
115	1040.26	C10 AROMATIC	0.47	4.68	34.94
116		n-BUTYLCYCLOHEXANE	0.00		
117	1048.88	1,3-DIETHYLBENZENE	1.24	12.38	35.21
118		C10 AROMATIC	0.00		
119	1056.55	1,4-DIETHYLBENZENE	0.75	7.51	35.45
120		C10 AROMATIC			

Table A2 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		C11 PARAFFIN			
122		2,6–DIMETHYLSTYRENE	0.00		
123		1,3–DIMETHYL–4–ETHYLBENZENE	0.00		
124		C10 AROMATIC	0.00		
125		C10 AROMATIC	0.00		
126	1087.54	C10 AROMATIC	0.65	6.53	36.42
127	1100.00	n–UNDECANE	0.00		36.81
128		C10 AROMATIC	0.00		
129		1,2,4,5–TETRAMETHYLBENZENE	0.16	1.59	37.52
130		1,2,3,5–TETRAMETHYLBENZENE	0.35	3.49	37.62
131		C11 PARAFFIN	0.00		
132		C10 AROMATIC	0.00		
133		C10 AROMATIC	0.00		
134		C11 PARAFFIN	0.00		
135		m–DIISOPROPYLBENZENE	0.00		
136		C11 AROMATIC	0.31	3.75	38.66
137		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
138		C11 AROMATIC	0.00		
139		C11 AROMATIC	0.00		
140		NAPHTHALENE	1.03	11.35	39.75
141		C11 AROMATIC	0.00	0.00	
142		n–DODECANE	0.00	0.00	

TOTAL	271.04	1435.41
TOTAL CORRECTED	268.86	1368.03
TOTAL AROMATICS	58.04	439.71
TOTAL PARAFFINS	93.11	557.06
TOTAL OLEFIN	109.84	373.30
TOTAL FROM #113	5.63	57.92

☼ Flagged data. Approximate concentration: 1.1 ppbv and 10.9 ppbC

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	14.15	28.30	3.94
2		ETHYLENE	47.15	94.30	4.00
3		ETHANE	4.43	8.85	4.10
4		PROPENE	10.53	31.60	5.25
5		PROPANE	1.23	3.70	5.38
6		ISOBUTANE	2.01	8.03	7.45
7		BUTENE–1	6.25	25.00	8.36
8		1,3–BUTADIENE	2.80	11.20	8.55
9	400.00	n–BUTANE	9.75	39.00	8.26
10	410.27	trans–2–BUTENE	1.22	4.89	8.76
11	423.61	cis–2–BUTENE	1.00	4.01	9.41
12		C4 OLEFIN	0.00		
13		C4 OLEFIN	0.00		
14		3–METHYL–1–BUTENE	0.00		
15	472.90	ISOPENTANE	17.47	87.37	11.81
16	488.50	1–PENTENE	0.63	3.17	12.57
17	495.69	2–METHYL–1–BUTENE	1.03	5.15	12.92
18	500.00	n–PENTANE	6.25	31.27	13.13
19	504.63	C5 HYDROCARBON	0.94	4.69	13.36
20	508.25	t–2–PENTENE	1.16	5.78	13.54
21	515.90	c–2–PENTENE	0.59	2.97	13.92
22	518.91	C5 OLEFIN	0.84	4.21	14.07
23	520.52	2–METHYL–2–BUTENE	1.92	9.62	14.15
24		C6 PARAFFIN	0.00		
25	533.20	2,2–DIMETHYLBUTANE	0.78	4.70	14.78
26		CYCLOPENTENE	0.00		
27		4–METHYL–1–PENTENE	0.00		
28	563.58	CYCLOPENTANE	0.84	4.21	16.29
29	565.59	2,3–DIMETHYLBUTANE	1.55	9.30	16.39
30	569.82	2–METHYLPENTANE	5.91	35.46	16.60
31		C6 OLEFIN	0.00		
32	578.67	UNKNOWN	0.89	5.32	17.04
33	583.50	3–METHYLPENTANE	3.25	19.47	17.28
34		2–METHYL–1–PENTENE +			
		1–HEXENE	0.00		
35		C6 OLEFIN			
36	600.00	n–HEXANE	3.45	20.73	18.10
37		t–3–HEXENE	0.00		
38	607.22	t–2–HEXENE	0.62	3.75	18.43
39		C6 OLEFIN	0.00		
40		C6 OLEFIN	0.00		

Table A3 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00		
42	628.67	METHYLCYCLOPENTANE	3.37	20.22	19.41
43	631.29	2,4-DIMETHYLPENTANE	0.91	6.34	19.53
44		2,3,3-TRIMETHYL-1-BUTENE +			
		1,1,1-TRICHLOROETHANE	0.00		
45	653.39	BENZENE	16.37	98.23	20.54
46		3,3-DIMETHYLPENTANE	0.00		
47	662.80	CYCLOHEXANE	0.51	3.07	20.97
48	668.49	2-METHYLHEXANE	1.85	12.95	21.23
49	671.33	2,3-DIMETHYLPENTANE	0.72	5.06	21.36
50	677.24	3-METHYLHEXANE	2.08	14.55	21.63
51		C7 OLEFIN	0.00		
52	685.56	1,3-DIMETHYLCYCLOPENTANE	0.71	4.98	22.01
53	688.40	3-ETHYLPENTANE	0.96	6.74	22.14
54	691.25	2,2,4-TRIMETHYLPENTANE	2.69	21.52	22.27
55	700.00	n-HEPTANE	5.07	35.50	22.67
56	723.91	C8 OLEFIN	0.88	7.00	23.66
57	726.57	METHYLCYCLOHEXANE	1.03	7.18	23.77
58		C8 PARAFFIN	0.00		
59	733.57	2,5-DIMETHYLHEXANE	0.42	3.36	24.06
60	736.47	2,4-DIMETHYLHEXANE	0.78	6.27	24.18
61		C8 PARAFFIN	0.00		
62		C8 PARAFFIN	0.00		
63	754.83	2,3,4-TRIMETHYLPENTANE	1.02	8.17	24.94
64	761.11	TOLUENE	16.56	115.92	25.20
65		2,3-DIMETHYLHEXANE	0.00		
66	767.63	2-METHYLHEPTANE	0.55	4.43	25.47
67	775.60	3-METHYLHEPTANE	0.62	4.97	25.80
68	780.43	3-ETHYLHEXANE	0.33	2.60	26.00
69	786.96	C8 PARAFFIN	0.56	4.50	26.27
70		2,2,5-TRIMETHYLHEXANE	0.00		
71		DIMETHYLCYCLOHEXANE +			
		1-OCTENE	0.00		
72		C8 PARAFFIN	0.00		
73	800.00	n-OCTANE	0.60	4.79	26.81
74		PERCHLOROETHYLENE	0.00		
75		C9 PARAFFIN	0.00		
76		DIMETHYLHEPTANE	0.00		
77	816.41	C9 PARAFFIN	0.36	3.20	27.46
78		C9 PARAFFIN	0.00		
79		2,5-DIMETHYLHEPTANE	0.00		
80		C9 PARAFFIN	0.00		

Table A3 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	855.81	ETHYLBENZENE	2.67	21.38	29.02
82		C9 OLEFFIN	0.00		
83	863.64	m&p-XYLENE	10.45	83.61	29.33
84		4-METHYLOCTANE	0.00		
85		3-METHYLOCTANE	0.00		
86	871.21	C9 PARAFFIN	0.50	4.50	29.63
87	881.57	STYRENE	1.28	10.27	30.04
88	887.12	o-XYLENE	3.83	30.67	30.26
89	895.96	1-NONENE	0.34	3.10	30.61
90		n-NONANE	0.00		30.77
91		C9 PARAFFIN	0.00		
92		ISOPROPYLBENZENE	0.00		
93		C10 PARAFFIN	0.00		
94		CYCLOOCTANE	0.00		
95		C10 PARAFFIN	0.00		
96		C10 PARAFFIN	0.00		
97		a-PINENE	0.00		
98		C10 PARAFFIN	0.00		
99	950.74	n-PROPYLBENZENE	0.67	6.02	32.49
100	957.23	m-ETHYLTOLUENE	2.53	22.81	32.71
101	959.88	p-ETHYLTOLUENE	1.15	10.39	32.80
102	964.90	1,3,5-TRIMETHYLBENZENE	1.30	11.70	32.97
103		C10 PARAFFIN	0.00		
104	977.88	o-ETHYLTOLUENE	0.81	7.29	33.41
105	989.38	C10 PARAFFIN	0.34	3.39	33.80
106	992.63	1,2,4-TRIMETHYLBENZENE	3.42	30.77	33.91
107		C10 PARAFFIN	0.00		
108		n-DECANE	0.00		34.16
109		SEC-BUTYLBENZENE	0.00		
110		C10 OLEFIN	0.00		
111	1024.92	1,2,3-TRIMETHYLBENZENE	0.75	6.73	34.94
112		1-METHYL-4-ISOPROPYLBENZENE	0.00		
113		C10 PARAFFIN	0.00		
114	1041.21	C10 AROMATIC	0.50	4.97	35.45
115		n-BUTYLCYCLOHEXANE	0.00		
116	1048.88	1,3-DIETHYLBENZENE	0.56	5.61	35.69
117		C10 AROMATIC	0.00		
118	1057.19	1,4-DIETHYLBENZENE	1.21	12.14	35.95
119		C10 AROMATIC	0.00		
120		C11 PARAFFIN	0.00		

Table A3 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		2,6–DIMETHYLSTYRENE	0.00		
122		1,3–DIMETHYL–4–ETHYLBENZENE	0.00		
123		C10 AROMATIC	0.00		
124	1079.87	C10 AROMATIC	0.27	2.70	36.66
125	1088.82	C10 AROMATIC	1.02	10.21	36.94
126	1100.00	n–UNDECANE	0.00		37.29
127		C10 AROMATIC	0.00		
128		1,2,4,5–TETRAMETHYLBENZENE	0.00		
129		1,2,3,5–TETRAMETHYLBENZENE	0.38	3.80	38.14
130		C11 PARAFFIN	0.00	0.00	
131		C10 AROMATIC	0.00	0.00	
132		C10 AROMATIC	0.00	0.00	
133		C11 PARAFFIN	0.00	0.00	
134		m–DIISOPROPYLBENZENE	0.00	0.00	
135		C11 AROMATIC	0.26	2.90	38.82
136		1,2,3,4,–TETRAMETHYLBENZENE	0.00	0.00	
137		C11 AROMATIC	0.26	2.90	39.18
138		C11 AROMATIC	0.87	9.54	40.02
139		NAPHTHALENE	0.78	7.80	40.26
140		C11 AROMATIC	0.00	0.00	
141		n–DODECANE	0.00	0.00	
		TOTAL	243.79	1232.76	
		TOTAL AROMATICS	51.55	420.12	
		TOTAL PARAFFINS	91.18	507.74	
		TOTAL OLEFIN	94.15	263.28	
		TOTAL FROM #112	6.12	62.56	

TABLE A4

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETHYLENE	18.40	36.80	3.94
2		ETHYLENE	69.50	139.00	4.00
3		ETHANE	6.70	13.40	4.09
4		PROPENE	21.87	65.60	5.23
5		PROPANE	3.13	9.40	5.36
6		ISOBUTANE	2.68	10.70	6.78
7		BUTENE–1	9.54	38.14	7.78
8		1,3–BUTADIENE	4.61	18.43	7.96
9	400.00	n–BUTANE	16.80	67.19	8.18
10	410.22	trans–2–BUTENE	2.62	10.50	8.68
11	423.52	cis–2–BUTENE	2.25	9.00	9.33
12	455.01	C4 OLEFIN	1.20	4.81	10.87
13		C4 OLEFIN	0.00		
14	466.26	3–METHYL–1–BUTENE	0.68	3.42	11.42
15	472.80	ISOPENTANE	50.58	252.90	11.74
16	488.34	1–PENTENE	1.99	9.97	12.50
17	495.71	2–METHYL–1–BUTENE	3.04	15.20	12.86
18	500.00	n–PENTANE	18.21	91.03	13.07
19		ISOPRENE	1.64	8.21	
20	508.20	t–2–PENTENE	3.42	17.10	13.48
21	515.80	c–2–PENTENE	1.81	9.03	13.86
22		C5 OLEFIN	0.00		
23	520.60	2–METHYL–2–BUTENE	5.40	26.99	14.10
24	533.00	C6 PARAFFIN	0.97	5.82	14.72
25	535.60	2,2–DIMETHYLBUTANE	1.84	11.03	14.85
26	552.80	CYCLOPENTENE	1.62	8.10	15.71
27		4–METHYL–1–PENTENE	0.00		
28	563.60	CYCLOPENTANE	2.68	13.42	16.25
29	565.60	2,3–DIMETHYLBUTANE	5.14	30.87	16.35
30	569.80	2–METHYLPENTANE	18.69	112.11	16.56
31		C6 OLEFIN	0.00		
32	578.80	UNKNOWN	2.90	17.41	17.01
33	583.60	3–METHYLPENTANE	10.44	62.63	17.25
34	589.20	2–METHYL–1–PENTENE + 1–HEXENE	1.55	9.32	17.53
35		C6 OLEFIN			
36	600.00	n–HEXANE	8.82	52.94	18.07
37	604.79	t–3–HEXENE	1.52	9.13	18.29
38	607.19	t–2–HEXENE	3.35	20.12	18.40
39	610.46	C6 OLEFIN	1.46	8.79	18.55
40	614.60	C6 OLEFIN	0.92	5.54	18.74

Table A4 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	620.70	C6 OLEFIN	1.10	6.58	19.02
42	628.54	METHYLCYCLOPENTANE	10.58	63.49	19.38
43	631.37	2,4-DIMETHYLPENTANE	2.59	18.11	19.51
44		2,3,3-TRIMETHYL-1-BUTENE + 1,1,1-TRICHLOROETHANE	0.00		
45	653.38	BENZENE	33.97	203.79	20.52
46		3,3-DIMETHYLPENTANE	0.00		
47	662.96	CYCLOHEXANE	1.74	10.44	20.96
48	668.63	2-METHYLHEXANE	6.38	44.63	21.22
49	671.46	2,3-DIMETHYLPENTANE	2.56	17.93	21.35
50	677.34	3-METHYLHEXANE	6.38	44.63	21.62
51		C7 OLEFIN	0.00		
52	685.62	1,3-DIMETHYLCYCLOPENTANE	2.18	15.24	22.00
53	688.45	3-ETHYLPENTANE	2.65	18.58	22.13
54	691.29	2,2,4-TRIMETHYLPENTANE	7.94	63.51	22.26
55	700.00	n-HEPTANE	4.15	29.08	22.66
56	723.86	C8 OLEFIN	1.56	12.51	23.65
57	726.51	METHYLCYCLOHEXANE	3.17	22.18	23.76
58		C8 PARAFFIN	0.00		
59	733.49	2,5-DIMETHYLHEXANE	1.36	10.87	24.05
60	736.39	2,4-DIMETHYLHEXANE	2.65	21.24	24.17
61	745.30	C8 PARAFFIN	0.71	5.72	24.54
62		C8 PARAFFIN	0.00		
63	754.70	2,3,4-TRIMETHYLPENTANE	3.29	26.32	24.93
64	761.20	TOLUENE	46.09	322.60	25.20
65		2,3-DIMETHYLHEXANE	0.00		
66	767.71	2-METHYLHEPTANE	1.75	13.97	25.47
67		3-METHYLHEPTANE	0.00		
68	775.66	3-ETHYLHEXANE	2.27	18.16	25.80
69	784.10	C8 PARAFFIN	0.59	4.68	26.15
70	786.51	2,2,5-TRIMETHYLHEXANE	1.56	14.07	26.25
71	793.01	DIMETHYLCYCLOHEXANE + 1-OCTENE	0.52	4.16	26.52
72		C8 PARAFFIN	0.00		
73	800.00	n-OCTANE	1.67	13.32	26.81
74		PERCHLOROETHYLENE	0.00		
75		C9 PARAFFIN	0.00		
76		DIMETHYLHEPTANE	0.00		
77	817.15	C9 PARAFFIN	0.63	5.69	27.46
78		C9 PARAFFIN	0.00		
79		2,5-DIMETHYLHEPTANE	0.00		
80	839.31	C9 PARAFFIN	0.72	6.51	28.30

Table A4 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	858.58	ETHYLBENZENE	7.66	61.25	29.03
82		C9 OLEFFIN	0.00		
83	866.75	m&p-XYLENE	29.69	237.48	29.34
84		4-METHYLOCTANE	0.00		
85		3-METHYLOCTANE	0.00		
86	874.41	C9 PARAFFIN	0.81	7.29	29.63
87	885.49	STYRENE	2.82	22.57	30.05
88	891.03	o-XYLENE	10.84	86.68	30.26
89		1-NONENE	0.00		
90	900.00	n-NONANE	1.05	9.43	30.60
91		C9 PARAFFIN	0.00		
92		ISOPROPYLBENZENE	0.00		
93		C10 PARAFFIN	0.00		
94		CYCLOOCTANE	0.00		
95		C10 PARAFFIN	0.00		
96		C10 PARAFFIN	0.00		
97		a-PINENE	0.00		
98		C10 PARAFFIN	0.00		
99	954.44	n-PROPYLBENZENE	2.43	21.89	32.50
100	960.46	m-ETHYLTOLUENE	7.25	65.26	32.71
101	963.32	p-ETHYLTOLUENE	2.92	29.16	32.81
102	967.91	☼ 1,3,5-TRIMETHYLBENZENE	3.72	33.50	32.97
103	980.52	C10 PARAFFIN	2.10	20.95	33.41
104		o-ETHYLTOLUENE	0.00		
105	986.53	C10 PARAFFIN	1.01	10.13	33.62
106	995.13	1,2,4-TRIMETHYLBENZENE	10.33	92.96	33.92
107		C10 PARAFFIN	0.00		
108	1000.00	n-DECANE	0.46	4.61	34.09
109		SEC-BUTYLBENZENE	0.00		
110		C10 OLEFIN	0.00		
111	1027.48	1,2,3-TRIMETHYLBENZENE	2.24	20.14	34.95
112	1038.34	C10 AROMATIC	0.49	4.92	35.29
113		C10 PARAFFIN	0.00		
114	1043.77	C10 AROMATIC	1.66	16.61	35.46
115		n-BUTYLCYCLOHEXANE	0.00		
116	1051.44	1,3-DIETHYLBENZENE	1.65	16.47	35.70
117	1053.99	C10 AROMATIC	1.40	13.97	35.78
118	1059.74	1,4-DIETHYLBENZENE	3.20	31.98	35.96
119		C10 AROMATIC	0.00		
120		C11 PARAFFIN	0.00		

Table A4 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		2,6-DIMETHYLSTYRENE	0.76	7.56	36.40
122	1081.79	1,3-DIMETHYL-4-ETHYLBENZENE	0.98	9.80	36.65
123		C10 AROMATIC	0.00		
124	1091.05	C10 AROMATIC	2.51	25.11	36.94
125	1097.44	C10 AROMATIC	0.78	7.80	37.14
126	1100.00	n-UNDECANE	0.00		37.22
127		C10 AROMATIC	0.44	4.44	37.68
128		1,2,4,5-TETRAMETHYLBENZENE	0.65	6.51	38.02
129		1,2,3,5-TETRAMETHYLBENZENE	1.16	11.55	38.14
130		C11 PARAFFIN	0.00		
131		C10 AROMATIC	0.00		
132		C10 AROMATIC	1.08	10.82	38.82
133		C11 PARAFFIN	0.00		
134		m-DIISOPROPYLBENZENE	0.00		
135		C11 AROMATIC	0.76	8.31	39.18
136		1,2,3,4,-TETRAMETHYLBENZENE	0.00		
137		C11 AROMATIC	0.00		
138		C11 AROMATIC	0.76	8.39	40.02
139		NAPHTHALENE	2.75	27.49	40.26
140		C11 AROMATIC	0.00	0.00	
141		n-DODECANE	0.00	0.00	
		TOTAL	565.07	3197.10	
		TOTAL AROMATICS	147.00	1205.26	
		TOTAL PARAFFINS	227.96	1317.42	
		TOTAL OLEFIN	166.34	532.97	
		TOTAL FROM #112	21.02	211.75	

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	14.00	28.00	3.94
2		ETHYLENE	61.10	122.20	3.99
3		ETHANE	4.95	9.90	4.09
4		PROPENE	16.90	50.70	5.23
5		PROPANE	1.93	5.80	5.37
6		ISOBUTANE	3.33	13.30	6.93
7		BUTENE-1	8.23	32.94	7.83
8		1,3-BUTADIENE	3.35	13.38	8.02
9	400.00	n-BUTANE	13.92	55.66	8.24
10	410.25	trans-2-BUTENE	2.41	9.66	8.74
11	423.57	cis-2-BUTENE	2.12	8.48	9.39
12	455.12	C4 OLEFIN	1.00	4.01	10.93
13		C4 OLEFIN	0.00		
14	466.39	3-METHYL-1-BUTENE	0.71	3.56	11.48
15	472.95	ISOPENTANE	46.75	233.73	11.80
16	488.52	1-PENTENE	3.12	15.62	12.56
17	495.70	2-METHYL-1-BUTENE	3.20	15.98	12.91
18	500.00	n-PENTANE	16.87	84.37	13.12
19		ISOPRENE	0.87	4.33	
20	508.25	t-2-PENTENE	3.69	18.46	13.53
21	515.90	c-2-PENTENE	2.29	11.43	13.91
22		C5 OLEFIN	2.65	13.26	
23	520.72	2-METHYL-2-BUTENE	4.71	23.55	14.15
24		C6 PARAFFIN	0.00		
25	535.61	2,2-DIMETHYLBUTANE	2.29	13.73	14.89
26	552.72	CYCLOPENTENE	1.65	8.25	15.74
27		4-METHYL-1-PENTENE	0.00		
28	563.58	CYCLOPENTANE	2.19	10.96	16.28
29	565.59	2,3-DIMETHYLBUTANE	4.96	29.79	16.38
30	569.82	2-METHYLPENTANE	17.20	103.18	16.59
31	573.84	C6 OLEFIN	0.82	4.95	16.79
32	578.67	UNKNOWN	3.18	19.07	17.03
33	583.70	3-METHYLPENTANE	9.16	54.98	17.28
34	589.13	2-METHYL-1-PENTENE + 1-HEXENE	1.62	9.73	17.55
35		C6 OLEFIN			
36	600.00	n-HEXANE	8.32	49.92	18.09
37	604.81	t-3-HEXENE	1.32	7.92	18.31
38	607.22	t-2-HEXENE	2.32	13.91	18.42
39	610.50	C6 OLEFIN	1.51	9.09	18.57
40	614.44	C6 OLEFIN	1.02	6.14	18.75

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	620.79	C6 OLEFIN	1.90	11.43	19.04
42	628.67	METHYLCYCLOPENTANE	9.61	57.67	19.40
43	631.29	2,4-DIMETHYLPENTANE	2.18	15.26	19.52
44	637.64	2,3,3-TRIMETHYL-1-BUTENE + 1,1,1-TRICHLOROETHANE	1.22	8.52	19.81
45	653.39	BENZENE	31.85	191.09	20.53
46		3,3-DIMETHYLPENTANE	0.00		
47	662.80	CYCLOHEXANE	1.70	10.20	20.96
48	668.71	2-METHYLHEXANE	6.12	42.82	21.23
49	671.33	2,3-DIMETHYLPENTANE	2.38	16.66	21.35
50	677.46	3-METHYLHEXANE	6.65	46.57	21.63
51		C7 OLEFIN	0.00		
52	685.78	1,3-DIMETHYLCYCLOPENTANE	2.08	14.58	22.01
53	688.40	3-ETHYLPENTANE	2.42	16.91	22.13
54	691.47	2,2,4-TRIMETHYLPENTANE	6.72	53.77	22.27
55	700.00	n-HEPTANE	3.38	23.63	22.66
56	723.86	C8 OLEFIN	1.62	12.95	23.65
57	726.51	METHYLCYCLOHEXANE	2.99	20.94	23.76
58		C8 PARAFFIN	0.00		
59	733.49	2,5-DIMETHYLHEXANE	1.11	8.89	24.05
60	736.39	2,4-DIMETHYLHEXANE	2.55	20.42	24.17
61	745.30	C8 PARAFFIN	0.68	5.47	24.54
62		C8 PARAFFIN	0.00		
63	754.70	2,3,4-TRIMETHYLPENTANE	2.85	22.83	24.93
64	761.20	TOLUENE	41.65	291.58	25.20
65		2,3-DIMETHYLHEXANE	0.00		
66	767.47	2-METHYLHEPTANE	1.64	13.13	25.46
67		3-METHYLHEPTANE	0.00		
68	775.42	3-ETHYLHEXANE	2.67	21.37	25.79
69	783.86	C8 PARAFFIN	0.48	3.81	26.14
70	786.51	2,2,5-TRIMETHYLHEXANE	1.22	11.00	26.25
71	792.77	DIMETHYLCYCLOHEXANE + 1-OCTENE	0.59	4.75	26.51
72		C8 PARAFFIN	0.00		
73	800.00	n-OCTANE	1.61	12.90	26.81
74		PERCHLOROETHYLENE	0.00		
75		C9 PARAFFIN	0.00		
76		DIMETHYLHEPTANE	0.00		
77	816.89	C9 PARAFFIN	0.61	5.45	27.45
78		C9 PARAFFIN	0.00		
79		2,5-DIMETHYLHEPTANE	0.00		
80	839.31	C9 PARAFFIN	1.32	11.86	28.30

Table A5 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		2,6-DIMETHYLSTYRENE	2.25	22.53	35.94
122	1084.26	1,3-DIMETHYL-4-ETHYLBENZENE	0.87	8.67	36.65
123	1093.44	C10 AROMATIC	2.37	23.71	36.93
124		C10 AROMATIC	0.00		
125		C10 AROMATIC	0.00		
126	1100.00	n-UNDECANE	0.76	8.36	37.13
127		C10 AROMATIC	0.00		
128		1,2,4,5-TETRAMETHYLBENZENE	0.83	8.33	38.01
129		1,2,3,5-TETRAMETHYLBENZENE	1.16	11.62	38.13
130		C11 PARAFFIN	0.00		
131		C10 AROMATIC	0.00		
132		C10 AROMATIC	0.71	7.07	38.81
133		C11 PARAFFIN	0.00		
134		m-DIISOPROPYLBENZENE	0.00		
135		C11 AROMATIC	1.42	15.59	39.17
136		1,2,3,4,-TETRAMETHYLBENZENE	0.00		
137		C11 AROMATIC	0.00		
138		C11 AROMATIC	0.97	10.72	40.02
139		NAPHTHALENE	3.16	31.63	40.26
140		C11 AROMATIC	0.00	0.00	
141		n-DODECANE	0.00	0.00	
		TOTAL	515.22	2953.77	
		TOTAL AROMATICS	134.94	1101.87	
		TOTAL PARAFFINS	208.62	1218.28	
		TOTAL OLEFIN	149.75	503.00	
		TOTAL FROM #112	19.25	195.61	

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	25.50	51.00	3.94
2		ETHYLENE	98.00	196.00	4.00
3		ETHANE	7.90	15.80	4.09
4		PROPENE	24.83	74.50	5.24
5		PROPANE	4.57	13.70	5.37
6		ISOBUTANE	4.50	18.00	9.10
7		BUTENE–1	11.50	46.00	9.27
8		1,3–BUTADIENE	4.80	19.21	9.41
9	400.00	n–BUTANE	18.93	75.72	9.57
10	409.59	trans–2–BUTENE	2.33	9.33	9.94
11	422.02	cis–2–BUTENE	1.91	7.64	10.42
12	453.11	C4 OLEFIN	2.52	10.08	11.62
13	456.99	C4 OLEFIN	0.00		11.77
14	464.25	3–METHYL–1–BUTENE	0.00		12.05
15	471.50	ISOPENTANE	39.81	199.03	12.33
16	487.56	1–PENTENE	1.45	7.24	12.95
17	495.08	2–METHYL–1–BUTENE	2.31	11.55	13.24
18	500.00	n–PENTANE	14.30	71.51	13.43
19	504.48	ISOPRENE	1.50	7.49	13.63
20	507.62	t–2–PENTENE	2.65	13.27	13.77
21	515.02	c–2–PENTENE	1.48	7.38	14.10
22		C5 OLEFIN	0.87	4.33	
23	519.51	2–METHYL–2–BUTENE	4.26	21.30	14.30
24	532.29	C6 PARAFFIN	1.01	6.05	14.87
25	534.30	2,2–DIMETHYLBUTANE	1.26	7.56	14.96
26	552.02	CYCLOPENTENE	0.70	3.50	15.75
27		4–METHYL–1–PENTENE	0.00		
28	562.78	CYCLOPENTANE	2.05	10.27	16.23
29	564.57	2,3–DIMETHYLBUTANE	3.51	21.07	16.31
30	568.61	2–METHYLPENTANE	13.43	80.58	16.49
31		C6 OLEFIN	0.89	5.32	
32	578.25	UNKNOWN	0.00		16.92
33	582.96	3–METHYLPENTANE	7.68	46.10	17.13
34	588.34	2–METHYL–1–PENTENE + 1–HEXENE	1.16	6.95	17.37
35		C6 OLEFIN			
36	600.00	n–HEXANE	6.25	37.47	17.89
37	604.77	t–3–HEXENE	1.02	6.12	18.10
38	607.05	t–2–HEXENE	1.58	9.45	18.20
39	610.45	C6 OLEFIN	0.87	5.20	18.35
40	614.09	C6 OLEFIN	0.63	3.80	18.51

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	620.45	C6 OLEFIN	0.72	4.33	18.79
42	628.41	METHYLCYCLOPENTANE	7.48	44.90	19.14
43	631.14	2,4–DIMETHYLPENTANE	1.71	11.96	19.26
44	643.41	2,3,3–TRIMETHYL–1–BUTENE + 1,1,1–TRICHLOROETHANE	0.77	5.39	19.80
45	653.18	BENZENE	27.42	164.49	20.23
46	656.82	3,3–DIMETHYLPENTANE	1.00	6.98	20.39
47	662.73	CYCLOHEXANE	1.44	8.65	20.65
48	668.18	2–METHYLHEXANE	4.15	29.04	20.89
49	671.14	2,3–DIMETHYLPENTANE	1.72	12.02	21.02
50	677.05	3–METHYLHEXANE	4.84	33.89	21.28
51		C7 OLEFIN	0.00		
52	685.45	1,3–DIMETHYLCYCLOPENTANE	1.48	10.38	21.65
53	688.41	3–ETHYLPENTANE	1.86	13.02	21.78
54	691.36	2,2,4–TRIMETHYLPENTANE	4.74	37.90	21.91
55	700.00	n–HEPTANE	2.62	18.33	22.29
56	723.83	C8 OLEFIN	0.98	7.80	23.26
57	726.54	METHYLCYCLOHEXANE	2.36	16.51	23.37
58		C8 PARAFFIN	0.00		
59	733.42	2,5–DIMETHYLHEXANE	1.00	7.99	23.65
60	736.36	2,4–DIMETHYLHEXANE	1.81	14.46	23.77
61	744.96	C8 PARAFFIN	0.00		24.12
62		C8 PARAFFIN	0.00		
63	754.55	2,3,4–TRIMETHYLPENTANE	1.89	15.13	24.51
64	760.93	TOLUENE	34.84	243.89	24.77
65		2,3–DIMETHYLHEXANE	0.00		
66	767.57	2–METHYLHEPTANE	1.49	11.91	25.04
67		3–METHYLHEPTANE	0.00		
68	775.43	3–ETHYLHEXANE	1.62	12.99	25.36
69	783.78	C8 PARAFFIN	0.00		25.70
70	786.49	2,2,5–TRIMETHYLHEXANE	0.83	7.51	25.81
71		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
72		C8 PARAFFIN	0.00		
73	800.00	n–OCTANE	0.95	7.64	26.36
74		PERCHLOROETHYLENE	0.00		
75		C9 PARAFFIN	0.00		
76		DIMETHYLHEPTANE	0.00		
77	817.29	C9 PARAFFIN	1.05	9.43	27.01
78		C9 PARAFFIN	0.00		
79		2,5–DIMETHYLHEPTANE	0.00		
80	839.10	C9 PARAFFIN	1.01	9.10	27.83

Table A6 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	858.24	ETHYLBENZENE	5.26	42.06	28.55
82		C9 OLEFFIN	0.00		
83	866.49	m&p–XYLENE	21.33	170.64	28.86
84		4–METHYLOCTANE	0.00		
85		3–METHYLOCTANE	0.00		
86	874.20	C9 PARAFFIN	0.62	5.61	29.15
87	883.24	STYRENE	1.90	15.23	29.49
88	890.43	o–XYLENE	7.46	59.72	29.76
89		1–NONENE	0.00		
90	900.00	n–NONANE	0.49	4.39	30.12
91		C9 PARAFFIN	0.00		
92		ISOPROPYLBENZENE	0.00		
93		C10 PARAFFIN	0.00		
94		CYCLOOCTANE	0.00		
95		C10 PARAFFIN	0.00		
96		C10 PARAFFIN	0.00		
97		a–PINENE	0.00		
98		C10 PARAFFIN	0.00		
99	952.97	n–PROPYLBENZENE	1.25	11.22	31.99
100	958.92	m–ETHYLTOLUENE	5.01	45.07	32.20
101	961.76	p–ETHYLTOLUENE	2.29	20.65	32.30
102	966.57	1,3,5–TRIMETHYLBENZENE	2.56	23.05	32.47
103		C10 PARAFFIN	0.00		
104	978.75	o–ETHYLTOLUENE	1.57	14.12	32.90
105	989.80	C10 PARAFFIN	0.53	5.25	33.29
106	992.92	1,2,4–TRIMETHYLBENZENE	7.16	64.46	33.40
107		C10 PARAFFIN	0.00		
108		n–DECANE	0.00		
109	1013.97	SEC–BUTYLBENZENE	2.63	26.30	34.09
110		C10 OLEFIN	0.00		
111	1024.13	1,2,3–TRIMETHYLBENZENE	1.55	13.94	34.41
112		C10 AROMATIC	0.00		
113		C10 PARAFFIN	0.00		
114	1040.00	C10 AROMATIC	0.96	9.65	34.91
115		n–BUTYLCYCLOHEXANE	0.00		
116	1048.89	1,3–DIETHYLBENZENE	1.05	10.47	35.19
117		C10 AROMATIC	.		
118	1056.51	1,4–DIETHYLBENZENE	1.64	16.43	35.43
119		C10 AROMATIC	0.00		
120	1069.21	C11 PARAFFIN	0.96	10.60	35.83

Table A6 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		2,6–DIMETHYLSTYRENE	0.00		
122	1078.41	1,3–DIMETHYL–4–ETHYLBENZENE	0.60	6.04	36.12
123	1087.30	C10 AROMATIC	1.17	11.66	36.40
124	1093.33	C10 AROMATIC	0.23	2.30	36.59
125		C10 AROMATIC	0.00		
126	1100.00	n–UNDECANE	0.00		36.80
127		C10 AROMATIC	0.00		
128		1,2,4,5–TETRAMETHYLBENZENE	0.49	4.90	37.47
129		1,2,3,5–TETRAMETHYLBENZENE	0.58	5.78	37.59
130		C11 PARAFFIN	0.00		
131		C10 AROMATIC	0.00		
132		C10 AROMATIC	0.53	5.28	38.27
133		C11 PARAFFIN	0.00		
134		m–DIISOPROPYLBENZENE	0.00		
135		C11 AROMATIC	0.58	6.41	38.63
136		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
137		C11 AROMATIC	0.00		
138		C11 AROMATIC	0.00		
139		NAPHTHALENE	1.15	13.78	39.73
140		C11 AROMATIC	0.00	0.00	
141		n–DODECANE	0.00	0.00	
		TOTAL	501.28	2520.17	
		TOTAL AROMATICS	104.57	848.44	
		TOTAL PARAFFINS	181.30	996.18	
		TOTAL OLEFIN	198.59	569.19	
		TOTAL FROM #112	9.95	103.30	

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	30.20	60.39	2.99
2		ETHYLENE	51.40	102.80	3.06
3		ETHANE	10.43	20.86	3.13
4		PROPENE	17.53	52.60	4.25
5		PROPANE	3.57	10.70	4.38
6		ISOBUTANE	3.13	12.50	6.52
7		BUTENE–1	8.06	32.25	7.52
8		1,3–BUTADIENE	2.54	10.15	7.70
9	400.00	n–BUTANE	11.37	45.48	7.92
10	410.17	trans–2–BUTENE	1.36	5.42	8.41
11	423.44	cis–2–BUTENE	1.09	4.37	9.05
12		C4 OLEFIN	0.00		
13	459.75	C4 OLEFIN	1.80	7.21	10.80
14		3–METHYL–1–BUTENE	0.00		
15	472.82	ISOPENTANE	24.70	123.50	11.43
16	488.38	1–PENTENE	0.99	4.94	12.18
17	495.64	2–METHYL–1–BUTENE	1.55	7.77	12.53
18	500.00	n–PENTANE	9.10	45.51	12.74
19	504.46	C5 HYDROCARBON	1.11	5.55	12.96
20	508.11	t–2–PENTENE	1.68	8.41	13.14
21	515.82	c–2–PENTENE	0.87	4.35	13.52
22	518.86	C5 OLEFIN	1.32	6.60	13.67
23	520.49	2–METHYL–2–BUTENE	3.15	15.75	13.75
24	530.63	C6 PARAFFIN	2.77	16.65	14.25
25	535.50	2,2–DIMETHYLBUTANE	1.02	6.10	14.49
26	552.54	CYCLOPENTENE	0.79	3.97	15.33
27		4–METHYL–1–PENTENE	0.00		
28	563.29	CYCLOPENTANE	1.34	6.71	15.86
29	565.31	2,3–DIMETHYLBUTANE	2.62	15.70	15.96
30	569.78	2–METHYLPENTANE	9.44	56.67	16.18
31	573.83	C6 OLEFIN	0.64	3.87	16.38
32	578.70	UNKNOWN	1.66	9.99	16.62
33	583.57	3–METHYLPENTANE	6.29	37.74	16.86
34		2–METHYL–1–PENTENE +			
35	589.05	1–HEXENE	0.83	5.00	17.13
36		C6 OLEFIN			
37	600.00	n–HEXANE	8.78	52.69	17.67
38	604.84	t–3–HEXENE	0.47	2.81	17.89
39	607.25	t–2–HEXENE	0.89	5.37	18.00
40		C6 OLEFIN	0.00		

Table A7 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00		
42	620.66	C6 OLEFIN	0.61	3.65	18.61
43	628.35	METHYLCYCLOPENTANE	7.26	43.58	18.96
44	631.43	2,4–DIMETHYLPENTANE	1.31	9.18	19.10
45	643.52	C7 PARAFFIN	1.32	9.27	19.65
46	652.97	BENZENE	15.72	94.31	20.08
47		3,3–DIMETHYLPENTANE	0.00		
48	662.42	CYCLOHEXANE	1.24	7.42	20.51
49	668.57	2–METHYLHEXANE	3.36	23.49	20.79
50	671.21	2,3–DIMETHYLPENTANE	1.31	9.15	20.91
51	677.36	3–METHYLHEXANE	3.52	24.63	21.19
52		C7 OLEFIN	0.00		
53	685.49	1,3–DIMETHYLCYCLOPENTANE	1.00	6.97	21.56
54	688.13	3–ETHYLPENTANE	1.19	8.36	21.68
55	691.21	2,2,4–TRIMETHYLPENTANE	3.68	29.42	21.82
56	700.00	n–HEPTANE	1.73	12.14	22.22
57		C8–HYDROCARBON			
58	723.54	C8 OLEFIN	1.16	9.30	23.19
59	726.21	METHYLCYCLOHEXANE	1.48	10.33	23.30
60		C8 PARAFFIN	0.00		
61	733.50	2,5–DIMETHYLHEXANE	0.69	5.52	23.60
62	736.41	2,4–DIMETHYLHEXANE	1.29	10.32	23.72
63		C8 PARAFFIN	0.00		
64		C8 PARAFFIN	0.00		
65	754.61	2,3,4–TRIMETHYLPENTANE	1.38	11.03	24.47
66	760.68	TOLUENE	22.40	156.83	24.72
67		2,3–DIMETHYLHEXANE	0.00		
68	767.72	2–METHYLHEPTANE	1.73	13.83	25.01
69		3–METHYLHEPTANE	0.00		
70	775.49	3–ETHYLHEXANE	1.12	8.97	25.33
71	780.10	C8 PARAFFIN	0.54	4.29	25.52
72	786.41	2,2,5–TRIMETHYLHEXANE	0.59	5.30	25.78
73		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
74		C8 PARAFFIN	0.00		
75	800.00	n–OCTANE	0.63	5.05	26.34
76		PERCHLOROETHYLENE	0.00		
77		C9 PARAFFIN	0.00		
78		DIMETHYLHEPTANE	0.00		
79	816.84	C9 PARAFFIN	1.00	9.00	27.00
80		C9 PARAFFIN	0.00		
81		2,5–DIMETHYLHEPTANE	0.00		

Table A7 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
82		C9 PARAFFIN	0.00		
83	855.87	ETHYLBENZENE	3.41	27.31	28.53
84		C9 OLEFFIN	0.00		
85	863.78	m&p-XYLENE	13.40	107.20	28.84
86		4-METHYLOCTANE	0.00		
87		3-METHYLOCTANE	0.00		
88		C9 PARAFFIN	0.00		
89	879.85	STYRENE	4.13	33.07	29.47
90	886.99	o-XYLENE	6.89	55.09	29.75
91	896.17	1-NONENE	2.39	21.53	30.11
92	900.00	n-NONANE	2.10	18.88	30.26
93	913.84	C9 PARAFFIN	0.54	4.86	30.73
94	917.37	ISOPROPYLBENZENE	1.78	16.04	30.85
95		C10 PARAFFIN	0.00		
96		CYCLOOCTANE	0.00		
97		C10 PARAFFIN	0.00		
98	934.75	C10 PARAFFIN	1.61	16.07	31.44
99		a-PINENE	0.00		
100		C10 PARAFFIN	0.00		
101	950.65	n-PROPYLBENZENE	0.72	6.51	31.98
102	956.83	m-ETHYLTOLUENE	3.59	32.28	32.19
103	959.78	p-ETHYLTOLUENE	2.38	21.43	32.29
104	966.55	☼ 1,3,5-TRIMETHYLBENZENE	15.21	136.87	32.52
105	977.74	C10 PARAFFIN	2.20	22.02	32.90
106	980.98	o-ETHYLTOLUENE	2.61	23.49	33.01
107	983.33	C10 PARAFFIN	1.67	16.75	33.09
108	992.17	1,2,4-TRIMETHYLBENZENE	4.59	41.34	33.39
109		C10 PARAFFIN	0.00		
110	1000.00	n-DECANE	1.63	16.33	33.66
111	1013.38	SEC-BUTYLBENZENE	0.69	6.85	34.08
112		C10 OLEFIN	0.00		
113	1023.89	1,2,3-TRIMETHYLBENZENE	1.71	15.37	34.41
114		1-METHYL-4-ISOPROPYLBENZENE	0.00		
115	1029.30	C10 PARAFFIN	1.26	12.58	34.58
116	1039.81	C10 AROMATIC	0.79	7.95	34.91
117		n-BUTYLCYCLOHEXANE	0.00		
118	1048.41	1,3-DIETHYLBENZENE	2.24	22.36	35.18
119		C10 AROMATIC	0.00		
120	1056.05	1,4-DIETHYLBENZENE	0.96	9.61	35.42
121		C10 AROMATIC	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
122		C11 PARAFFIN	0.00		
123		2,6–DIMETHYLSTYRENE	0.00		
124	1078.03	1,3–DIMETHYL–4–ETHYLBENZENE	0.39	3.89	36.11
125	1087.26	C10 AROMATIC	1.06	10.61	36.40
126		C10 AROMATIC	0.00		
127		C10 AROMATIC	0.00☼		
128	1100.00	n–UNDECANE	0.00		36.80
129		C10 AROMATIC	0.00		
130		1,2,4,5–TETRAMETHYLBENZENE	0.00		
131		1,2,3,5–TETRAMETHYLBENZENE	0.48	4.84	37.59
132		C11 PARAFFIN	0.00		
133		C10 AROMATIC	0.00		
134		C10 AROMATIC	0.33	3.27	38.27
135		C11 PARAFFIN	0.00		
136		m–DIISOPROPYLBENZENE	0.00		
137		C11 AROMATIC	0.68	7.44	38.62
138		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
139		C11 AROMATIC	0.00		
140		C11 AROMATIC	0.00		
141		NAPHTHALENE	1.33	13.32	39.72
142		C11 AROMATIC	0.00	0.00	
143		n–DODECANE	0.00	0.00	

TOTAL	384.54	2076.86
TOTAL CORRECTED*	370.86	1953.76
TOTAL AROMATICS	107.50	857.30
TOTAL PARAFFINS	111.27	634.42
TOTAL OLEFIN	142.33	442.79
TOTAL FROM #114	9.52	95.88

☼ Flagged data. Approximate concentration: 1.5 ppbv and 13.8 ppbC.

* Corrected for 1,3,5–trimethylbenzene concentration

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETHYLENE	37.25	74.50	2.99
2		ETHYLENE	106.45	212.90	3.06
3		ETHANE	11.87	23.73	3.13
4		PROPENE	28.90	86.70	5.25
5		PROPANE	6.23	18.70	4.38
6		ISOBUTANE	5.77	23.09	6.52
7		BUTENE–1	12.37	49.49	7.56
8		1,3–BUTADIENE	5.03	20.13	7.74
9	400.00	n–BUTANE	23.10	92.41	7.96
10	410.19	trans–2–BUTENE	2.56	10.24	8.45
11	423.49	cis–2–BUTENE	2.20	8.81	9.09
12	454.89	C4 OLEFIN	1.08	4.31	10.60
13	459.88	C4 OLEFIN	1.21	4.84	10.84
14	466.53	3–METHYL–1–BUTENE	0.63	3.13	11.16
15	472.77	ISOPENTANE	49.18	245.92	11.46
16	488.36	1–PENTENE	1.60	8.00	12.21
17	495.63	2–METHYL–1–BUTENE	2.77	13.87	12.56
18	500.00	n–PENTANE	17.45	87.27	12.77
19	504.46	C5 HYDROCARBON	1.84	9.20	12.99
20	508.11	t–2–PENTENE	3.07	15.36	13.17
21	515.82	c–2–PENTENE	1.72	8.58	13.55
22		C5 OLEFIN	0.80	4.00	13.71
23	520.49	2–METHYL–2–BUTENE	5.21	26.04	13.78
24	532.86	C6 PARAFFIN	1.30	7.79	14.39
25	535.50	2,2–DIMETHYLBUTANE	1.39	8.32	14.52
26	543.00	C6 HYDROCARBON	1.00	5.99	14.89
27	552.54	CYCLOPENTENE	1.12	5.62	15.36
28		4–METHYL–1–PENTENE	0.00		
29	563.29	CYCLOPENTANE	2.41	12.06	15.89
30	565.52	2,3–DIMETHYLBUTANE	4.16	24.99	16.00
31	569.78	2–METHYLPENTANE	16.00	96.00	16.21
32		C6 OLEFIN	0.00		
33	578.90	UNKNOWN	1.20	7.22	16.66
34	583.57	3–METHYLPENTANE	9.81	58.88	16.89
35	588.64	2–METHYL–1–PENTENE + 1–HEXENE	1.35	8.13	17.14
36		C6 OLEFIN	0.00		
37	600.00	n–HEXANE	9.21	55.25	17.70
38	604.84	t–3–HEXENE	1.24	7.45	17.92
39	607.25	t–2–HEXENE	1.89	11.34	18.03
40	610.55	C6 OLEFIN	1.01	6.06	18.18

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	614.51	C6 OLEFIN	0.77	4.65	18.36
42	620.88	C6 OLEFIN	0.86	5.15	18.65
43	628.57	METHYLCYCLOPENTANE	10.22	61.32	19.00
44	631.43	2,4–DIMETHYLPENTANE	1.98	13.84	19.13
45	637.36	2,3,3–TRIMETHYL–1–BUTENE + 1,1,1–TRICHLOROETHANE	0.81	5.69	19.40
46	643.52	C7 PARAFFIN	1.16	8.13	19.68
47	653.19	BENZENE	25.39	152.35	20.12
48		3,3–DIMETHYLPENTANE	0.00		
49	662.64	CYCLOHEXANE	1.78	10.71	20.55
50	668.57	2–METHYLHEXANE	5.25	36.77	20.82
51	671.21	2,3–DIMETHYLPENTANE	1.99	13.96	20.94
52	677.36	3–METHYLHEXANE	5.48	38.35	21.22
53		C7 OLEFIN	0.00		
54	685.49	1,3–DIMETHYLCYCLOPENTANE	1.83	12.82	21.59
55	688.13	3–ETHYLPENTANE	2.23	15.63	21.71
56	691.21	2,2,4–TRIMETHYLPENTANE	5.37	42.96	21.85
57	694.73	C8 HYDROCARBON	0.52	4.16	22.01
58	700.00	n–HEPTANE	3.24	22.71	22.25
59	713.32	C8 HYDROCARBON	0.60	4.81	22.80
60	724.21	C8 OLEFIN	1.04	8.31	23.25
61	726.15	METHYLCYCLOHEXANE	2.68	18.74	23.33
62		C8 PARAFFIN	0.00		
63	733.41	2,5–DIMETHYLHEXANE	1.02	8.16	23.63
64	736.56	2,4–DIMETHYLHEXANE	2.03	16.27	23.76
65	745.04	C8 PARAFFIN	0.48	3.81	24.11
66		C8 PARAFFIN	0.00		
67	754.48	2,3,4–TRIMETHYLPENTANE	2.06	16.52	24.50
68	760.77	TOLUENE	37.76	264.33	24.76
69		2,3–DIMETHYLHEXANE	0.00		
70	767.55	2–METHYLHEPTANE	1.75	14.02	25.04
71		3–METHYLHEPTANE	0.00		
72	775.54	3–ETHYLHEXANE	2.06	16.47	25.37
73	783.54	C8 PARAFFIN	0.50	3.96	25.70
74	786.44	2,2,5–TRIMETHYLHEXANE	0.90	8.12	25.82
75		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
76		C8 PARAFFIN	0.00		
77	800.00	n–OCTANE	1.13	9.04	26.38
78		PERCHLOROETHYLENE	0.00		
79		C9 PARAFFIN	0.00		
80		DIMETHYLHEPTANE	0.00		

Table A8 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	810.46	C9 PARAFFIN	0.52	4.67	26.79
82	816.84	C9 PARAFFIN	0.58	5.25	27.04
83		2,5-DIMETHYLHEPTANE	0.00		
84	837.76	C9 PARAFFIN	1.03	9.28	27.86
85	855.87	ETHYLBENZENE	5.57	44.59	28.57
86		C9 OLEFFIN	0.00		
87	863.78	m&p-XYLENE	22.55	180.38	28.88
88		4-METHYLOCTANE	0.00		
89		3-METHYLOCTANE	0.00		
90	871.43	C9 PARAFFIN	0.72	6.51	29.18
91	879.85	STYRENE	4.59	36.73	29.51
92	886.99	o-XYLENE	10.04	80.29	29.79
93	896.17	1-NONENE	2.01	18.12	30.15
94	900.00	n-NONANE	2.22	19.97	30.30
95	913.86	C9 PARAFFIN	0.64	5.80	30.77
96	917.11	ISOPROPYLBENZENE	1.94	17.48	30.88
97	924.19	C10 PARAFFIN	0.38	3.80	31.12
98		CYCLOOCTANE	0.00		
99		C10 PARAFFIN	0.00		
100	934.81	C10 PARAFFIN	1.83	18.28	31.48
101		a-PINENE	0.00		
102		C10 PARAFFIN	0.00		
103	950.74	n-PROPYLBENZENE	0.97	8.69	32.02
104	956.93	m-ETHYLTOLUENE	5.41	48.68	32.23
105	959.88	p-ETHYLTOLUENE	3.07	27.63	32.33
106	966.67	☼ 1,3,5-TRIMETHYLBENZENE	17.00	153.02	32.56
107	977.58	C10 PARAFFIN	2.83	28.28	32.93
108	981.12	o-ETHYLTOLUENE	2.87	25.81	33.05
109	989.09	C10 PARAFFIN	0.65	6.51	33.32
110	992.33	1,2,4-TRIMETHYLBENZENE	7.65	68.83	33.43
111		C10 PARAFFIN	0.00		
112	1000.00	n-DECANE	1.87	18.67	33.69
113	1013.78	SEC-BUTYLBENZENE	0.74	7.43	34.12
114	1021.79	C10 OLEFIN	0.00		34.37
115	1024.36	1,2,3-TRIMETHYLBENZENE	2.28	20.55	34.45
116	1029.81	1-METHYL-4-ISOPROPYLBENZENE	1.26	12.59	34.62
117		C10 PARAFFIN	0.00		
118	1040.38	C10 AROMATIC	1.05	10.48	34.95
119		n-BUTYLCYCLOHEXANE	0.00		
120	1048.72	1,3-DIETHYLBENZENE	3.05	30.48	35.21

Table A8 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		C10 AROMATIC	0.00		
122	1056.73	1,4–DIETHYLBENZENE	1.79	17.88	35.46
123	1070.19	C10 AROMATIC	0.60	6.04	35.88
124		C11 PARAFFIN	0.00		
125		2,6–DIMETHYLSTYRENE	0.00		
126	1079.17	1,3–DIMETHYL–4–ETHYLBENZENE	0.65	6.54	36.16
127	1087.82	C10 AROMATIC	1.34	13.42	36.43
128	1094.23	C10 AROMATIC	0.47	4.67	36.63
129		C10 AROMATIC	0.00		
130	1100.00	n–UNDECANE	0.00		36.81
131		C10 AROMATIC	0.00		
132		1,2,4,5–TETRAMETHYLBENZENE	0.54	5.42	37.51
133		1,2,3,5–TETRAMETHYLBENZENE	0.84	8.41	37.63
134		C11 PARAFFIN	0.00		
135		C10 AROMATIC	0.00		
136		C10 AROMATIC	0.65	6.47	38.31
137		C11 PARAFFIN	0.00		
138		m–DIISOPROPYLBENZENE	0.00		
139		C11 AROMATIC	0.75	8.24	38.67
140		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
141		C11 AROMATIC	0.00		
142		C11 AROMATIC	0.00		
143		NAPHTHALENE	1.67	16.68	39.76
144		C11 AROMATIC	0.00	0.00	
145		n–DODECANE	0.00	0.00	
		TOTAL	618.94	3220.60	
		TOTAL CORRECTED*	604.49	3090.54	
		TOTAL AROMATICS	162.49	1284.09	
		TOTAL PARAFFINS	207.36	1158.94	
		TOTAL OLEFIN	223.03	620.09	
		TOTAL FROM #116	14.66	147.31	

☼ Flagged data. Approximate concentration: 2.5 ppbv and 22.9 ppbC

* Corrected for 1,3,5–trimethylbenzene concentration

TABLE A9

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	44.95	89.90	3.01
2		ETHYLENE	103.05	206.10	3.06
3		ETHANE	11.79	23.57	3.14
4		PROPENE	29.20	87.59	4.25
5		PROPANE	6.27	18.80	4.38
6		ISOBUTANE	6.10	24.38	6.52
7		BUTENE–1	21.76	87.04	7.51
8		1,3–BUTADIENE	3.53	14.10	7.70
9	400.00	n–BUTANE	21.76	87.04	7.92
10	410.17	trans–2–BUTENE	2.41	9.65	8.41
11	423.44	cis–2–BUTENE	2.03	8.11	9.05
12	454.77	C4 OLEFIN	1.05	4.20	10.56
13	459.75	C4 OLEFIN	1.36	5.43	10.80
14	466.39	3–METHYL–1–BUTENE	0.66	3.30	11.12
15	472.61	ISOPENTANE	46.81	234.05	11.42
16	488.38	1–PENTENE	1.66	8.29	12.18
17	495.64	2–METHYL–1–BUTENE	2.64	13.19	12.53
18	500.00	n–PENTANE	17.02	85.09	12.74
19	504.46	C5 HYDROCARBON	0.69	3.43	12.96
20	508.11	t–2–PENTENE	2.96	14.81	13.14
21	515.82	c–2–PENTENE	1.74	8.72	13.52
22	518.86	C5 OLEFIN	0.95	4.73	13.67
23	520.49	2–METHYL–2–BUTENE	4.99	24.94	13.75
24		C6 PARAFFIN	0.00		
25	535.50	2,2–DIMETHYLBUTANE	1.57	9.43	14.49
26	542.80	C6 HYDROCARBON	0.72	4.34	14.85
27	552.54	CYCLOPENTENE	0.42	2.10	15.33
28		4–METHYL–1–PENTENE	0.00		
29	563.29	CYCLOPENTANE	2.34	11.72	15.86
30	565.31	2,3–DIMETHYLBUTANE	4.06	24.36	15.96
31	569.78	2–METHYLPENTANE	15.55	93.30	16.18
32		C6 OLEFIN	0.00		
33	578.70	UNKNOWN	1.65	9.89	16.62
34	583.57	3–METHYLPENTANE	9.85	59.07	16.86
35	589.05	2–METHYL–1–PENTENE + 1–HEXENE	1.33	7.96	17.13
36		C6 OLEFIN			
37	600.00	n–HEXANE	10.47	62.81	17.67
38	604.84	t–3–HEXENE	1.12	6.72	17.89
39	607.25	t–2–HEXENE	1.70	10.17	18.00
40	610.33	C6 OLEFIN	1.00	6.00	18.14

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	614.51	C6 OLEFIN	0.78	4.68	18.33
42	620.66	C6 OLEFIN	0.85	5.11	18.61
43	628.35	METHYLCYCLOPENTANE	10.30	61.80	18.96
44	631.43	2,4–DIMETHYLPENTANE	1.77	12.38	19.10
45	637.36	2,3,3–TRIMETHYL–1–BUTENE + 1,1,1–TRICHLOROETHANE	0.72	5.07	19.37
46	643.52	C7 PARAFFIN	1.07	7.50	19.65
47	652.97	BENZENE	25.32	151.94	20.08
48		3,3–DIMETHYLPENTANE	0.00		
49	662.42	CYCLOHEXANE	1.52	9.15	20.51
50	668.57	2–METHYLHEXANE	4.94	34.57	20.79
51	671.21	2,3–DIMETHYLPENTANE	1.86	13.01	20.91
52	677.36	3–METHYLHEXANE	5.44	38.06	21.19
53		C7 OLEFIN	0.00		
54	685.49	1,3–DIMETHYLCYCLOPENTANE	1.69	11.85	21.56
55	688.13	3–ETHYLPENTANE	2.10	14.72	21.68
56	691.21	2,2,4–TRIMETHYLPENTANE	5.31	42.51	21.82
57	694.51	C8 HYDROCARBON	0.46	3.64	21.97
58	734.19	n–HEPTANE	3.12	21.85	22.22
59	742.81	C8 HYDROCARBON	0.83	6.60	22.76
60	750.00	C8 OLEFIN	1.34	10.71	23.21
61	751.44	METHYLCYCLOHEXANE	2.72	19.05	23.30
62		C8 PARAFFIN	0.00		
63	756.23	2,5–DIMETHYLHEXANE	1.00	7.97	23.60
64	758.15	2,4–DIMETHYLHEXANE	1.99	15.89	23.72
65	763.74	C8 PARAFFIN	0.47	3.75	24.07
66		C8 PARAFFIN	0.00		
67	770.13	2,3,4–TRIMETHYLPENTANE	2.07	16.59	24.47
68	774.28	TOLUENE	36.43	254.98	24.73
69		2,3–DIMETHYLHEXANE	0.00		
70	778.75	2–METHYLHEPTANE	1.78	14.27	25.01
71		3–METHYLHEPTANE	0.00		
72	783.87	3–ETHYLHEXANE	1.80	14.38	25.33
73	789.30	C8 PARAFFIN	0.47	3.76	25.67
74	791.05	2,2,5–TRIMETHYLHEXANE	0.84	7.59	25.78
75		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
76		C8 PARAFFIN	0.00		
77	800.00	n–OCTANE	1.04	8.31	26.34
78		PERCHLOROETHYLENE	0.00		
79		C9 PARAFFIN	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
80		DIMETHYLHEPTANE	0.00		
81		C9 PARAFFIN	0.53	4.74	26.75
82	816.84	C9 PARAFFIN	1.04	9.40	27.00
83		2,5–DIMETHYLHEPTANE	0.00		
84	837.76	C9 PARAFFIN	1.06	9.56	27.82
85	855.87	ETHYLBENZENE	5.75	46.00	28.53
86		C9 OLEFFIN	0.00		
87	863.78	m&p–XYLENE	22.65	181.21	28.84
88		4–METHYLOCTANE	0.00		
89		3–METHYLOCTANE	0.00		
90	871.43	C9 PARAFFIN	0.70	6.27	29.14
91	880.10	STYRENE	4.59	36.76	29.48
92	886.99	o–XYLENE	10.12	80.95	29.75
93	896.17	1–NONENE	2.61	23.45	30.11
94	900.00	n–NONANE	2.32	20.88	30.26
95	913.86	C9 PARAFFIN	0.67	6.00	30.73
96	917.40	ISOPROPYLBENZENE	2.05	18.47	30.85
97	924.48	C10 PARAFFIN	0.40	3.95	31.09
98		CYCLOOCTANE	0.00		
99		C10 PARAFFIN	0.00		
100	934.81	C10 PARAFFIN	1.96	19.64	31.44
101		a–PINENE	0.00		
102		C10 PARAFFIN	0.00		
103	950.74	n–PROPYLBENZENE	1.00	9.00	31.98
104	957.23	m–ETHYLTOLUENE	5.41	48.69	32.20
105	959.88	p–ETHYLTOLUENE	3.18	28.61	32.29
106	966.67	☼ 1,3,5–TRIMETHYLBENZENE	18.10	162.90	32.52
107	977.58	C10 PARAFFIN	2.99	29.94	32.89
108	981.12	o–ETHYLTOLUENE	3.04	27.39	33.01
109	989.09	C10 PARAFFIN	0.58	5.85	33.28
110	992.33	1,2,4–TRIMETHYLBENZENE	7.61	68.51	33.39
111		C10 PARAFFIN	0.00		
112	1000.00	n–DECANE	2.81	28.13	33.65
113	1013.74	SEC–BUTYLBENZENE	0.85	8.54	34.08
114		C10 OLEFIN	0.00		
115	1024.28	1,2,3–TRIMETHYLBENZENE	2.41	21.70	34.41
116		1–METHYL–4–ISOPROPYLBENZENE	0.00		
117	1029.71	C10 PARAFFIN	1.43	14.26	34.58
118	1040.26	C10 AROMATIC	1.07	10.69	34.91
119		n–BUTYLCYCLOHEXANE	0.00		
120	1048.88	1,3–DIETHYLBENZENE	2.99	29.89	35.18

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		C10 AROMATIC	0.00		
122	1056.55	1,4–DIETHYLBENZENE	1.79	17.86	35.42
123	1069.97	C10 AROMATIC	0.44	4.39	35.84
124		C11 PARAFFIN	0.00		
125		2,6–DIMETHYLSTYRENE	0.00		
126	1078.59	1,3–DIMETHYL–4–ETHYLBENZENE	0.65	6.49	36.11
127	1087.54	C10 AROMATIC	1.39	13.85	36.39
128	1093.93	C10 AROMATIC	0.52	5.21	36.59
129		C10 AROMATIC	0.00		
130	1100.00	n–UNDECANE	0.00		36.78
131		C10 AROMATIC	0.00		
132		1,2,4,5–TETRAMETHYLBENZENE	0.49	4.87	37.47
133		1,2,3,5–TETRAMETHYLBENZENE	0.70	7.05	37.59
134		C11 PARAFFIN	0.00		
135		C10 AROMATIC	0.00		
136		C10 AROMATIC	0.55	5.55	38.27
137		C11 PARAFFIN	0.00		
138		m–DIISOPROPYLBENZENE	0.00		
139		C11 AROMATIC	0.83	9.09	38.62
140		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
141		C11 AROMATIC	0.00		
142		C11 AROMATIC	0.00		
143		NAPHTHALENE	1.73	17.27	39.72
144		C11 AROMATIC		0.00	
145		n–DODECANE		0.00	
		TOTAL	626.17	3249.04	
		TOTAL CORRECTED*	610.61	3108.94	
		TOTAL AROMATICS	161.66	1277.86	
		TOTAL PARAFFINS	205.00	1160.38	
		TOTAL OLEFIN	235.64	664.91	
		TOTAL FROM #116	14.56	146.47	

☼ Flagged data. Approximate concentration: 2.5 ppbv and 22.8 ppbc

* Corrected for 1,3,5–trimethylbenzene concentration

TABLE A10

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	43.32	86.64	3.95
2		ETHYLENE	120.25	240.50	4.00
3		ETHANE	13.95	27.90	4.10
4		PROPENE	31.80	95.40	5.25
5		PROPANE	5.10	15.30	5.38
6		ISOBUTANE	7.25	29.00	29.00
7		BUTENE-1	13.86	55.43	55.43
8		1,3-BUTADIENE	3.22	12.88	12.88
9	2771.92	n-BUTANE	30.56	122.25	122.25
10	493.15	trans-2-BUTENE	3.10	12.41	12.41
11	449.33	cis-2-BUTENE	2.57	10.30	10.30
12	333.88	C4 OLEFIN	1.18	4.73	4.73
13	374.44	C4 OLEFIN	1.67	6.69	6.69
14	308.32	3-METHYL-1-BUTENE	0.70	3.50	3.50
15	6237.15	ISOPENTANE	57.85	289.27	289.27
16	434.52	1-PENTENE	1.92	9.58	9.58
17	543.40	2-METHYL-1-BUTENE	2.97	14.83	14.83
18	2216.62	n-PENTANE	19.47	97.37	97.37
19		ISOPRENE	0.00		17.48
20	437.28	t-2-PENTENE	3.50	17.48	9.65
21	876.06	c-2-PENTENE	1.93	9.65	31.28
22		C5 OLEFIN	0.00		4.28
23	515.37	2-METHYL-2-BUTENE	6.26	31.28	13.50
24	372.50	C6 PARAFFIN	0.71	4.28	6.45
25	506.15	2,2-DIMETHYLBUTANE	2.25	13.50	13.04
		C6-HYDROCARBON			28.66
26	2375.26	CYCLOPENTENE	1.29	6.45	105.19
27		4-METHYL-1-PENTENE	0.00		3.90
28	491.61	CYCLOPENTANE	2.61	13.04	12.33
29	1456.15	2,3-DIMETHYLBUTANE	4.78	28.66	59.88
30	426.70	2-METHYLPENTANE	17.53	105.19	9.13
31	1185.87	C6 OLEFIN	0.65	3.90	46.55
32	396.00	UNKNOWN	2.05	12.33	7.61
33	474.02	3-METHYLPENTANE	9.98	59.88	11.46
34		2-METHYL-1-PENTENE +			6.24
	336.74	1-HEXENE	1.52	9.13	4.69
35		C6 OLEFIN			
36	600.00	n-HEXANE	7.76	46.55	17.67
37	604.84	t-3-HEXENE	1.27	7.61	17.89
38	607.25	t-2-HEXENE	1.91	11.46	18.00
39	610.33	C6 OLEFIN	1.04	6.24	18.14
40	614.51	C6 OLEFIN	0.78	4.69	18.33

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	620.66	C6 OLEFIN	0.90	5.40	18.61
42	628.35	METHYLCYCLOPENTANE	9.42	56.50	18.96
43		2,4–DIMETHYLPENTANE	1.97	13.77	19.13
44		TRIMETHYLBUTANE			
45		+TRICHLOROETHANE			
46	643.74	C7 PARAFFIN	0.93	6.48	19.66
47	653.19	BENZENE	29.19	175.16	20.09
48		3,3–DIMETHYLPENTANE	0.00		
49	662.64	CYCLOHEXANE	1.59	9.54	20.52
50	668.57	2–METHYLHEXANE	5.30	37.07	20.79
51	671.21	2,3–DIMETHYLPENTANE	2.05	14.37	20.91
52	677.36	3–METHYLHEXANE	5.74	40.18	21.19
53		C7 OLEFIN	0.00		
54	685.49	1,3–DIMETHYLCYCLOPENTANE	1.80	12.58	21.56
55	688.13	3–ETHYLPENTANE	2.23	15.60	21.68
56	691.21	2,2,4–TRIMETHYLPENTANE	6.32	50.59	21.82
		C8–HYDROCARBON			
57	700.00	n–HEPTANE	2.99	20.92	22.22
		C8 HYDROCARBON			
58	723.79	C8 OLEFIN			23.20
59	726.21	METHYLCYCLOHEXANE	2.66	13.80	23.30
60		C8 PARAFFIN	1.15	18.65	
61	733.50	2,5–DIMETHYLHEXANE	1.15	9.20	23.60
62	736.41	2,4–DIMETHYLHEXANE	2.25	17.97	23.72
63	744.90	C8 PARAFFIN	0.52	4.19	24.07
64		C8 PARAFFIN	0.00		
65	754.61	2,3,4–TRIMETHYLPENTANE	2.58	20.68	24.47
66	760.92	TOLUENE	42.01	294.10	24.73
67		2,3–DIMETHYLHEXANE	0.00		
68	767.48	2–METHYLHEPTANE	1.76	14.05	25.00
69		3–METHYLHEPTANE	0.00		
70	775.49	3–ETHYLHEXANE	1.85	14.80	25.33
71	783.74	C8 PARAFFIN	0.49	3.94	25.67
72	786.65	2,2,5–TRIMETHYLHEXANE	1.14	10.24	25.79
73		DIMETHYLCYCLOHEXANE +			
		1–OCTENE	0.00		
74		C8 PARAFFIN	0.00		
75	800.00	n–OCTANE	1.20	9.61	26.34
76		PERCHLOROETHYLENE	0.00		
77		C9 PARAFFIN	0.00		
78		DIMETHYLHEPTANE	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
79	810.71	C9 PARAFFIN	0.57	5.17	26.76
80	816.84	C9 PARAFFIN	0.73	6.54	27.00
81		2,5-DIMETHYLHEPTANE	0.00		
82	837.76	C9 PARAFFIN	0.96	8.68	27.82
83	861.48	ETHYLBENZENE	6.42	51.39	28.75
84		C9 OLEFFIN	0.00		
85	864.80	m&p-XYLENE	25.85	206.82	28.88
86		4-METHYLOCTANE	0.00		
83		3-METHYLOCTANE	0.00		
84	871.43	C9 PARAFFIN	0.71	6.35	29.14
85	880.10	STYRENE	4.21	33.64	29.48
86	886.99	o-XYLENE	10.91	87.25	29.75
87	896.17	1-NONENE	1.97	17.72	30.11
88	900.00	n-NONANE	2.01	18.06	30.26
89	913.86	C9 PARAFFIN	0.56	5.04	30.73
90	917.40	ISOPROPYLBENZENE	1.73	15.53	30.85
91	924.48	C10 PARAFFIN	0.41	4.10	31.09
92		CYCLOOCTANE	0.00		
93		C10 PARAFFIN	0.00		
94	934.81	C10 PARAFFIN	1.62	16.15	31.44
95		a-PINENE	0.00		
96		C10 PARAFFIN	0.00		
97	950.74	n-PROPYLBENZENE	1.23	11.04	31.98
98	957.23	m-ETHYLTOLUENE	6.17	55.55	32.20
99	959.88	p-ETHYLTOLUENE	3.41	30.69	32.29
100	966.67	☼ 1,3,5-TRIMETHYLBENZENE	15.49	139.41	32.52
101	977.58	C10 PARAFFIN	2.94	29.44	32.89
102	981.12	o-ETHYLTOLUENE	2.45	22.08	33.01
103	989.09	C10 PARAFFIN	0.54	5.40	33.28
104	992.33	1,2,4-TRIMETHYLBENZENE	8.74	78.66	33.39
105		C10 PARAFFIN	0.00		
106	1000.00	n-DECANE	1.72	17.16	33.65
107	1013.74	SEC-BUTYLBENZENE	0.73	7.31	34.08
108		C10 OLEFIN	0.00		
109	1024.28	1,2,3-TRIMETHYLBENZENE	2.59	23.32	34.41
110	1029.71	C10 AROMATIC	1.34	13.45	34.58
111		C10 PARAFFIN	0.00		
112	1040.26	C10 AROMATIC	1.47	14.66	34.91
113		n-BUTYLCYCLOHEXANE	0.00		
114	1048.88	1,3-DIETHYLBENZENE	2.28	22.76	35.18
115		C10 AROMATIC	0.00		
116	1056.55	1,4-DIETHYLBENZENE	2.19	21.90	35.42
117	1069.65	C10 AROMATIC	0.58	5.77	35.83
118		C11 PARAFFIN	0.00	0.00	

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
119		2,6–DIMETHYLSTYRENE			
120	1078.59	1,3–DIMETHYL–4–ETHYLBENZENE	0.78	7.82	36.11
121	1087.54	C10 AROMATIC	1.82	18.16	36.39
122	1093.93	C10 AROMATIC	0.60	6.01	36.59
123		C10 AROMATIC	0.00		
124	1100.00	n–UNDECANE	0.44	4.79	36.78
125		C10 AROMATIC	0.00		
126		1,2,4,5–TETRAMETHYLBENZENE	0.62	6.18	37.47
127		1,2,3,5–TETRAMETHYLBENZENE	0.85	8.53	37.59
128		C11 PARAFFIN	0.00		
129		C10 AROMATIC	0.00		
130		C10 AROMATIC	0.70	6.98	38.27
131		C11 PARAFFIN	0.00		
132		m–DIISOPROPYLBENZENE	0.00		
133		C11 AROMATIC	0.99	10.85	39.63
134		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
135		C11 AROMATIC	0.00		
136		C11 AROMATIC	0.00		
137		NAPHTHALENE	2.68	26.84	39.72
138		C11 AROMATIC	0.00		
139		n–DODECANE	0.00		
		TOTAL	679.75	3491.88	
		TOTAL CORRECTED*	673.95	3378.98	
		TOTAL AROMATICS	178.02	1401.84	
		TOTAL PARAFFINS	231.09	1281.86	
		TOTAL OLEFIN	251.28	698.39	
		TOTAL FROM #110	17.33	174.68	

☼ Flagged data. Approximate concentration: 2.95 ppbv and 26.5 ppbC

* Corrected for 1,3,5–trimethylbenzene concentration

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	46.80	93.60	2.84
2		ETHYLENE	120.65	241.30	2.91
3		ETHANE	14.24	28.47	2.95
4		PROPENE	36.97	110.90	4.13
5		PROPANE	6.43	19.30	4.27
6		ISOBUTANE	9.36	37.42	6.45
7		BUTENE–1	11.50	46.00	7.55
8		1,3–BUTADIENE	4.08	16.30	7.73
9	400.00	n–BUTANE	29.54	118.15	7.95
10	410.17	trans–2–BUTENE	2.85	11.39	8.44
11	423.44	cis–2–BUTENE	2.51	10.03	9.08
12	454.98	C4 OLEFIN	1.14	4.55	10.60
13	459.75	C4 OLEFIN	1.32	5.29	10.83
14	466.39	3–METHYL–1–BUTENE	0.73	3.65	11.15
15	472.82	ISOPENTANE	58.64	293.21	11.46
16	488.38	1–PENTENE	2.11	10.57	12.21
17	495.64	2–METHYL–1–BUTENE	3.14	15.71	12.56
18	500.00	n–PENTANE	20.10	100.50	12.77
19	504.46	C5 HYDROCARBON	0.70	3.51	12.99
20	508.11	t–2–PENTENE	3.58	17.91	13.17
21	515.82	c–2–PENTENE	2.05	10.25	13.55
22		C5 OLEFIN	0.00		
23	520.49	2–METHYL–2–BUTENE	5.83	29.15	13.78
24		C6 PARAFFIN	0.00		
25	535.50	2,2–DIMETHYLBUTANE	1.82	10.94	14.52
26	543.00	C6 HYDROCARBON	1.03	6.17	14.89
27	552.54	CYCLOPENTENE	1.30	6.50	15.36
28		4–METHYL–1–PENTENE	0.00		
29	563.29	CYCLOPENTANE	2.67	13.35	15.89
30	565.52	2,3–DIMETHYLBUTANE	4.80	28.77	16.00
31	569.78	2–METHYLPENTANE	17.78	106.71	16.21
32		C6 OLEFIN	0.00		
33	578.90	UNKNOWN	1.56	9.39	16.66
34	583.57	3–METHYLPENTANE	10.42	62.50	16.89
35	588.64	2–METHYL–1–PENTENE + 1–HEXENE	1.51	9.06	17.14
36		C6 OLEFIN			
37	600.00	n–HEXANE	8.41	50.43	17.70
38	604.84	t–3–HEXENE	0.91	5.46	17.92
39	607.25	t–2–HEXENE	1.77	10.62	18.03
40	610.55	C6 OLEFIN	0.95	5.70	18.18

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	614.51	C6 OLEFIN	0.79	4.74	18.36
42	620.88	C6 OLEFIN	0.92	5.53	18.65
43	628.57	METHYLCYCLOPENTANE	10.06	60.34	19.00
44	631.43	2,4–DIMETHYLPENTANE	2.11	14.75	19.13
		2,3,3–TRIMETHYLBUTANE			
		+TRICHLOROETHANE			
45	643.52	C7 PARAFFIN	2.16	15.11	19.68
46	653.19	BENZENE	29.50	177.01	20.12
47	657.14	3,3–DIMETHYLPENTANE	0.78	5.46	20.30
48	662.64	CYCLOHEXANE	1.70	10.21	20.55
49	668.57	2–METHYLHEXANE	5.31	37.15	20.82
50	671.21	2,3–DIMETHYLPENTANE	2.11	14.77	20.94
51	677.36	3–METHYLHEXANE	5.85	40.97	21.22
52		C7 OLEFIN	0.00		
53	685.49	1,3–DIMETHYLCYCLOPENTANE	1.85	12.95	21.59
54	688.13	3–ETHYLPENTANE	2.30	16.10	21.71
55	691.21	2,2,4–TRIMETHYLPENTANE	6.65	53.17	21.85
56	694.73	C8 HYDROCARBON	0.71	5.71	22.01
57	700.00	n–HEPTANE	3.36	23.51	22.25
58	713.32	C8 HYDROCARBON	0.63	5.03	22.80
59	724.21	C8 OLEFIN	1.37	10.95	23.25
60	726.39	METHYLCYCLOHEXANE	2.84	19.91	23.34
61		C8 PARAFFIN	0.00		
62	733.66	2,5–DIMETHYLHEXANE	1.23	9.86	23.64
63	736.56	2,4–DIMETHYLHEXANE	2.39	19.13	23.76
64	745.04	C8 PARAFFIN	0.52	4.17	24.11
65		C8 PARAFFIN	0.00		
66	754.72	2,3,4–TRIMETHYLPENTANE	2.63	21.05	24.51
67	760.77	TOLUENE	41.95	293.66	24.76
68		2,3–DIMETHYLHEXANE	0.00		
69	767.55	2–METHYLHEPTANE	1.94	15.50	25.04
70		3–METHYLHEPTANE	0.00		
71	775.54	3–ETHYLHEXANE	1.98	15.83	25.37
72	783.54	C8 PARAFFIN	0.55	4.40	25.70
73	786.44	2,2,5–TRIMETHYLHEXANE	1.23	11.11	25.82
74		DIMETHYLCYCLOHEXANE +			
	792.49	1–OCTENE	0.38	3.01	26.07
75		C8 PARAFFIN	0.00		
76	800.00	n–OCTANE	1.21	9.67	26.38
77		PERCHLOROETHYLENE	0.00		
78		C9 PARAFFIN	0.00		
79		DIMETHYLHEPTANE	0.00		
80	810.46	C9 PARAFFIN	0.23	2.06	26.79

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	816.84	C9 PARAFFIN	0.67	6.06	27.04
82		2,5–DIMETHYLHEPTANE	0.00		
83	837.76	C9 PARAFFIN	1.06	9.53	27.86
84	855.87	ETHYLBENZENE	6.29	50.33	28.57
85		C9 OLEFFIN	0.00		
86	863.78	m&p–XYLENE	25.57	204.52	28.88
87		4–METHYLOCTANE	0.00		
88		3–METHYLOCTANE	0.00		
89	871.43	C9 PARAFFIN	0.77	6.93	29.18
90	879.85	STYRENE	5.00	40.00	29.51
91	886.99	o–XYLENE	11.29	90.35	29.79
92	896.17	1–NONENE	2.22	19.98	30.15
93	900.00	n–NONANE	2.52	22.69	30.30
94	913.86	C9 PARAFFIN	0.67	6.01	30.77
95	917.40	ISOPROPYLBENZENE	2.21	19.85	30.89
96	924.66	C10 PARAFFIN	0.42	4.20	31.14
97		CYCLOOCTANE	0.00		
98		C10 PARAFFIN	0.00		
99	934.81	C10 PARAFFIN	2.03	20.28	31.48
100		a–PINENE	0.00		
101	941.59	C10 PARAFFIN	0.62	6.23	31.71
102	950.74	n–PROPYLBENZENE	1.09	9.80	32.02
103	957.23	m–ETHYLTOLUENE	6.08	54.70	32.24
104	959.88	p–ETHYLTOLUENE	3.50	31.52	32.33
105	966.67	☼ 1,3,5–TRIMETHYLBENZENE	19.23	173.09	32.56
106	977.88	C10 PARAFFIN	3.18	31.78	32.94
107	981.12	o–ETHYLTOLUENE	3.19	28.68	33.05
108	989.09	C10 PARAFFIN	0.63	6.29	33.32
109	992.33	1,2,4–TRIMETHYLBENZENE	8.41	75.65	33.43
110		C10 PARAFFIN	0.00		
111	1000.00	n–DECANE	2.74	27.42	33.69
112	1013.78	SEC–BUTYLBENZENE	0.83	8.29	34.12
113		C10 OLEFIN	0.00		
114	1024.68	1,2,3–TRIMETHYLBENZENE	2.47	22.19	34.46
115		1–METHYL–4–ISOPROPYLBENZENE	0.00		
116	1029.81	C10 AROMATIC	1.39	13.92	34.62
117	1040.38	C10 AROMATIC	1.15	11.46	34.95
118		n–BUTYLCYCLOHEXANE	0.00		
119	1049.04	1,3–DIETHYLBENZENE	3.04	30.37	35.22
120		C10 AROMATIC	0.00		
121	1056.73	1,4–DIETHYLBENZENE	1.86	18.64	35.46
122	1070.19	C10 AROMATIC	0.65	6.49	35.88
123		C11 PARAFFIN	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
124		2,6–DIMETHYLSTYRENE			
125	1079.17	1,3–DIMETHYL–4–ETHYLBENZENE	0.70	6.97	36.16
126	1087.82	C10 AROMATIC	1.51	15.06	36.43
127	1094.23	C10 AROMATIC	0.31	3.09	36.63
128		C10 AROMATIC	0.00		
129	1100.00	n–UNDECANE	0.00		36.81
130		C10 AROMATIC	0.00		
131		1,2,4,5–TETRAMETHYLBENZENE	0.50	5.03	37.51
132		1,2,3,5–TETRAMETHYLBENZENE	0.77	7.70	37.63
133		C11 PARAFFIN	0.00		
134		C10 AROMATIC	0.00		
135		C10 AROMATIC	0.59	5.85	38.31
136		C11 PARAFFIN	0.00		
137		m–DIISOPROPYLBENZENE	0.00		
138		C11 AROMATIC	0.88	9.66	38.67
139		1,2,3,4,–TETRAMETHYLBENZENE	0.00		
140		C11 AROMATIC	0.00		
141		C11 AROMATIC	0.00		
142		NAPHTHALENE	1.87	18.75	39.76
143		C11 AROMATIC	0.00	0.00	
144		n–DODECANE	0.00	0.00	

TOTAL	704.31	3624.91
TOTAL CORRECTED	687.90	3477.00
TOTAL AROMATICS	180.42	1418.70
TOTAL PARAFFINS	241.95	759.84
TOTAL OLEFIN	258.06	714.22
TOTAL FROM #115	15.21	152.96

☼ Flagged data. Approximate concentration 2.9 ppbv and 26.5 ppbC

TABLE A12

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETHYLENE	27.80	55.60	2.99
2		ETHYLENE	53.70	107.40	3.06
3		ETHANE	8.40	16.80	3.13
4		PROPENE	17.73	53.20	4.24
5		PROPANE	3.53	10.60	4.38
6		ISOBUTANE	2.70	10.80	6.52
7		BUTENE–1	7.28	29.12	7.52
8		1,3–BUTADIENE	2.11	8.43	7.71
9	400.00	n–BUTANE	11.19	44.77	7.93
10	409.96	trans–2–BUTENE	1.35	5.40	8.41
11	423.44	cis–2–BUTENE	1.09	4.36	9.06
12		C4 OLEFIN	0.00		
13	459.75	C4 OLEFIN	1.19	4.76	10.81
14		3–METHYL–1–BUTENE	0.00		
15	472.82	ISOPENTANE	23.82	119.08	11.44
16	488.38	1–PENTENE	0.91	4.57	12.19
17	495.64	2–METHYL–1–BUTENE	1.49	7.44	12.54
18	500.00	n–PENTANE	8.87	44.36	12.75
19		ISOPRENE	0.00		
20	508.10	t–2–PENTENE	1.60	7.99	13.15
21	515.79	c–2–PENTENE	0.97	4.84	13.53
22	519.03	C5 OLEFIN	0.95	4.74	13.69
23	520.45	2–METHYL–2–BUTENE	2.66	13.28	13.76
24		C6 PARAFFIN	0.00		
25	535.63	2,2–DIMETHYLBUTANE	1.45	8.72	14.51
26	542.91	C6 HYDROCARBON	0.57	3.39	14.87
27	552.43	CYCLOPENTENE	0.31	1.55	15.34
28		4–METHYL–1–PENTENE	0.00		
29	563.36	CYCLOPENTANE	1.25	6.24	15.88
30	565.38	2,3–DIMETHYLBUTANE	2.27	13.63	15.98
31	569.64	2–METHYLPENTANE	8.58	51.48	16.19
32	573.89	C6 OLEFIN	0.50	3.01	16.40
33	578.74	UNKNOWN	1.11	6.68	16.64
34	583.40	3–METHYLPENTANE	5.05	30.27	16.87
35		2–METHYL–1–PENTENE + 1–HEXENE	0.00		
36		C6 OLEFIN			
37	600.00	n–HEXANE	4.58	27.50	17.69
38	604.84	t–3–HEXENE	0.67	4.02	17.91
39	607.25	t–2–HEXENE	0.95	5.68	18.02
40		C6 OLEFIN	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00		
42	628.35	METHYLCYCLOPENTANE	5.07	30.40	18.98
43	631.21	2,4–DIMETHYLPENTANE	1.02	7.17	19.11
44	643.30	C7 HYDROCARBON	0.81	5.66	19.66
45	652.97	BENZENE	14.71	88.28	20.10
46		3,3–DIMETHYLPENTANE	0.00		
47	662.42	CYCLOHEXANE	0.86	5.17	20.53
48	668.57	2–METHYLHEXANE	2.78	19.43	20.81
49	671.21	2,3–DIMETHYLPENTANE	1.12	7.85	20.93
50	677.36	3–METHYLHEXANE	2.91	20.34	21.21
51		C7 OLEFIN	0.00		
52	685.27	1,3–DIMETHYLCYCLOPENTANE	0.93	6.53	21.57
53	688.13	3–ETHYLPENTANE	1.15	8.06	21.70
54	691.21	2,2,4–TRIMETHYLPENTANE	3.26	26.08	21.84
55	700.00	n–HEPTANE	1.74	12.19	22.24
56	713.08	C8 HYDROCARBON	0.64	5.09	22.78
57	723.73	C8 OLEFIN	0.75	5.99	23.22
58	726.15	METHYLCYCLOHEXANE	1.41	9.85	23.32
59		C8 PARAFFIN	0.00		
60	733.41	2,5–DIMETHYLHEXANE	0.60	4.78	23.62
61	736.32	2,4–DIMETHYLHEXANE	1.24	9.89	23.74
62		C8 PARAFFIN	0.00		
63		C8 PARAFFIN	0.00		
64	754.48	2,3,4–TRIMETHYLPENTANE	1.27	10.19	24.49
65	760.77	TOLUENE	20.91	146.40	24.75
66		2,3–DIMETHYLHEXANE	0.00		
67	767.55	2–METHYLHEPTANE	1.00	7.98	25.03
68		3–METHYLHEPTANE	0.00		
69	775.30	3–ETHYLHEXANE	1.10	8.81	25.35
70		C8 PARAFFIN	0.00		
71	786.44	2,2,5–TRIMETHYLHEXANE	0.58	5.22	25.81
72		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00		
73		C8 PARAFFIN	0.00		
74	800.00	n–OCTANE	0.61	4.90	26.37
75		PERCHLOROETHYLENE	0.00		
76		C9 PARAFFIN	0.00		
77		DIMETHYLHEPTANE	0.00		
78		C9 PARAFFIN	0.00		
79	816.58	C9 PARAFFIN	0.76	6.86	27.02

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
80		2,5–DIMETHYLHEPTANE	0.00		
81		C9 PARAFFIN	0.00		
82	855.61	ETHYLBENZENE	3.10	24.76	28.55
83		C9 OLEFFIN	0.00		
84	863.78	m&p–XYLENE	12.47	99.72	28.87
85		4–METHYLOCTANE	0.00		
86		3–METHYLOCTANE	0.00		
87		C9 PARAFFIN	0.00		
88	879.85	STYRENE	2.39	19.13	29.50
89	886.99	o–XYLENE	5.54	44.32	29.78
90	895.92	1–NONENE	1.37	12.32	30.13
91	900.00	n–NONANE	1.08	9.71	30.29
92		C9 PARAFFIN	0.00		
93	917.11	ISOPROPYLBENZENE	0.98	8.82	30.87
94		C10 PARAFFIN	0.00		
95		CYCLOOCTANE	0.00		
96		C10 PARAFFIN	0.00		
97	934.51	C10 PARAFFIN	0.94	9.38	31.46
98		a–PINENE	0.00		
99		C10 PARAFFIN	0.00		
100	950.44	n–PROPYLBENZENE	0.56	5.02	32.00
101	956.93	m–ETHYLTOLUENE	3.11	27.95	32.22
102	959.88	p–ETHYLTOLUENE	1.83	16.45	32.32
103	966.67	☼ 1,3,5–TRIMETHYLBENZENE	8.72	78.44	32.55
104	977.58	C10 PARAFFIN	0.96	9.63	32.92
105	981.12	o–ETHYLTOLUENE	0.65	5.86	33.04
106	985.55	C10 PARAFFIN	0.56	5.62	33.19
107	992.33	1,2,4–TRIMETHYLBENZENE	3.94	35.45	33.42
108		C10 PARAFFIN	0.00		
109	1000.00	n–DECANE	1.15	11.52	33.68
110		SEC–BUTYLBENZENE	0.00		
111		C10 OLEFIN	0.00		
112	1024.28	1,2,3–TRIMETHYLBENZENE	1.19	10.73	34.44
113		1–METHYL–4–ISOPROPYLBENZENE	0.00		
114	1029.71	C10 PARAFFIN	0.57	5.74	34.61
115	1040.26	C10 AROMATIC	0.59	5.94	34.94
116		n–BUTYLCYCLOHEXANE	0.00		
117	1048.56	1,3–DIETHYLBENZENE	1.58	15.82	35.20
118		C10 AROMATIC	0.00		
119	1056.55	1,4–DIETHYLBENZENE	1.01	10.08	35.45

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
120		C10 AROMATIC	0.00		
121		C11 PARAFFIN	0.00		
122		2,6-DIMETHYLSTYRENE	0.00		
123		1,3-DIMETHYL-4-ETHYLBENZENE	0.00		
124		C10 AROMATIC	0.00		
125	1078.59	C10 AROMATIC	0.34	3.37	36.14
126	1087.54	C10 AROMATIC	0.74	7.36	36.42
127	1100.00	n-UNDECANE	0.00		36.81
128		C10 AROMATIC	0.00		
129		1,2,4,5-TETRAMETHYLBENZENE	0.21	2.10	37.50
130		1,2,3,5-TETRAMETHYLBENZENE	0.30	3.00	37.65
131		C11 PARAFFIN	0.00	0.00	
132		C10 AROMATIC	0.00	0.00	
133		C10 AROMATIC	0.36	3.60	38.30
134		C11 PARAFFIN	0.00	0.00	
135		m-DIISOPROPYLBENZENE	0.00	0.00	
136		C11 AROMATIC	0.40	4.40	38.66
137		1,2,3,4,-TETRAMETHYLBENZENE	0.00	0.00	
138		C11 AROMATIC	0.00	0.00	
139		C11 AROMATIC	0.00	0.00	
140		NAPHTALENE	0.92	9.20	39.75
141		C11 AROMATIC	0.00	0.00	
142		n-DODECANE	0.00	0.00	
		TOTAL	331.40	1688.30	
		TOTAL CORRECTED	324.00	1621.70	
		TOTAL AROMATICS	86.54	676.22	
		TOTAL PARAFFINS	91.00	495.07	
		TOTAL OLEFIN	144.01	456.47	
		TOTAL FROM #113	29.71	277.47	

☼ Flagged data. Approximate concentration = 1.2 ppbv and 10.9 ppbC

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	31.40	62.80	3.00
2		ETHYLENE	64.90	129.80	3.06
3		ETHANE	31.40	62.80	3.13
4		PROPENE	22.17	66.50	4.25
5		PROPANE	6.22	18.65	4.38
6		ISOBUTANE	3.86	15.44	6.70
7		BUTENE–1	8.36	33.44	7.60
8		1,3–BUTADIENE	2.32	9.27	7.70
9	400.00	n–BUTANE	14.26	57.04	7.96
10	410.42	trans–2–BUTENE	1.69	6.75	8.46
11	423.54	cis–2–BUTENE	1.87	7.50	9.09
12	455.00	C4 OLEFIN	0.82	3.30	10.60
13	459.79	C4 OLEFIN	0.96	3.82	10.83
14		3–METHYL–1–BUTENE	0.00		
15	472.71	ISOPENTANE	32.94	164.70	11.45
16	488.54	1–PENTENE	1.08	5.38	12.21
17	495.83	2–METHYL–1–BUTENE	1.87	9.33	12.56
18	500.00	n–PENTANE	10.79	53.93	12.76
19		ISOPRENE	0.00		
20	508.30	t–2–PENTENE	2.04	10.20	13.17
21	515.79	c–2–PENTENE	0.93	4.65	13.54
22		C5 OLEFIN	0.00		
23	520.65	2–METHYL–2–BUTENE	3.91	19.56	13.78
24	535.02	C6 PARAFFIN	1.49	8.97	14.49
25	535.63	2,2–DIMETHYLBUTANE	0.67	4.01	14.52
26	552.43	CYCLOPENTENE	1.24	6.20	15.35
27		4–METHYL–1–PENTENE	0.00		
28	563.36	CYCLOPENTANE	5.22	26.10	15.89
29	565.38	2,3–DIMETHYLBUTANE	5.22	31.32	15.99
30	569.64	2–METHYLPENTANE	10.52	63.13	16.20
31	573.68	C6 OLEFIN	0.00		16.40
32	578.54	UNKNOWN	1.27	7.62	16.64
33	583.40	3–METHYLPENTANE	6.34	38.06	16.88
34	588.66	2–METHYL–1–PENTENE + 1–HEXENE	1.06	6.36	17.14
35		C6 OLEFIN			
36	600.00	n–HEXANE	5.79	34.72	17.70
37	604.84	t–3–HEXENE	0.83	4.98	17.92
38	607.25	t–2–HEXENE	1.07	6.41	18.03
39	610.55	C6 OLEFIN	0.57	3.42	18.18
40	614.51	C6 OLEFIN	0.39	2.33	18.36

TABLE A13 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	620.88	C6 OLEFIN	0.53	3.16	18.65
42	628.35	METHYLCYCLOPENTANE	7.52	45.15	18.99
43	631.21	2,4–DIMETHYLPENTANE	0.00		19.12
44	643.52	C7–HYDROCARBON	0.77	5.37	19.68
45	652.97	BENZENE	18.23	109.35	20.11
46		3,3–DIMETHYLPENTANE	0.00		
47	662.42	CYCLOHEXANE	1.08	6.49	20.54
48	668.57	2–METHYLHEXANE	3.42	23.91	20.82
49	671.21	2,3–DIMETHYLPENTANE	1.41	9.89	20.94
50	677.14	3–METHYLHEXANE	3.53	24.70	21.21
51		C7 OLEFIN	0.00		
52	685.49	1,3–DIMETHYLCYCLOPENTANE	1.41	9.88	21.59
53	688.13	3–ETHYLPENTANE	0.94	6.61	21.71
54	691.21	2,2,4–TRIMETHYLPENTANE	3.62	28.94	21.85
55	700.00	n–HEPTANE	2.38	16.65	22.25
56	724.03	C8 OLEFIN	0.61	4.85	23.24
57	726.21	METHYLCYCLOHEXANE	0.61	4.24	23.33
58		C8 PARAFFIN	2.07	16.52	
59	733.50	2,5–DIMETHYLHEXANE	0.75	6.03	23.63
60	736.41	2,4–DIMETHYLHEXANE	0.81	6.49	23.75
61	744.17	C8 PARAFFIN	0.67	5.34	24.07
62		C8 PARAFFIN	0.61	4.90	
63	754.61	2,3,4–TRIMETHYLPENTANE	1.76	14.11	24.50
64	760.92	TOLUENE	25.88	181.19	24.76
65		2,3–DIMETHYLHEXANE	1.89	15.11	
66	767.72	2–METHYLHEPTANE	1.66	13.31	25.04
67		3–METHYLHEPTANE	0.00		
68	775.49	3–ETHYLHEXANE	1.25	9.97	25.36
69	783.74	C8 PARAFFIN	0.46	3.67	25.70
70	786.65	2,2,5–TRIMETHYLHEXANE	0.00		25.82
71		DIMETHYLCYCLOHEXANE +			
72		1–OCTENE	0.00		
73		C8 PARAFFIN	0.00		
74	800.00	n–OCTANE	1.44	11.49	26.37
75		PERCHLOROETHYLENE	0.00		
76	816.84	C9 PARAFFIN	0.48	4.29	27.03
77		DIMETHYLHEPTANE	0.00		
78		C9 PARAFFIN	0.00		
79		C9 PARAFFIN	0.00		
80		2,5–DIMETHYLHEPTANE	0.00		
81		C9 PARAFFIN	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
82	855.87	ETHYLBENZENE	4.06	32.48	28.56
83		C9 OLEFFIN	0.00		
84	863.78	m&p–XYLENE	15.44	123.49	28.87
85		4–METHYLOCTANE	0.00		
86		3–METHYLOCTANE	0.00		
87	871.68	C9 PARAFFIN	1.08	9.70	29.18
88	880.10	STYRENE	1.23	9.83	29.51
89	887.24	o–XYLENE	5.51	44.06	29.79
90	896.17	1–NONENE	1.60	14.38	30.14
91	900.00	n–NONANE	0.84	7.56	30.29
92		C9 PARAFFIN	0.00		
93	917.35	ISOPROPYLBENZENE	0.92	8.29	30.88
94	934.71	C10 PARAFFIN	0.59	5.92	31.47
95		CYCLOOCTANE			
96		C10 PARAFFIN			
97	934.71	C10 PARAFFIN	0.40	4.01	31.47
98		a–PINENE	0.00		
99		C10 PARAFFIN	0.00		
100	950.59	n–PROPYLBENZENE	1.01	9.12	32.01
101	957.06	m–ETHYLTOLUENE	3.69	33.17	32.23
102	959.71	p–ETHYLTOLUENE	2.17	19.50	32.32
103	966.76	* 1,3,5–TRIMETHYLBENZENE	7.20	64.82	32.56
104		C10 PARAFFIN	0.00		32.93
105	981.18	o–ETHYLTOLUENE	4.21	37.90	33.05
106		C10 PARAFFIN	0.00		
107	992.35	1,2,4–TRIMETHYLBENZENE	5.58	50.22	33.43
108		C10 PARAFFIN	0.00		
109	1000.00	n–DECANE	0.81	8.12	33.69
110		SEC–BUTYLBENZENE	0.00		34.12
111		C10 OLEFIN	0.00		34.37
112	1024.36	1,2,3–TRIMETHYLBENZENE	2.21	19.89	34.45
113	1029.81	1–METHYL–4–ISOPROPYLBENZENE	0.60	6.00	34.62
114		C10 PARAFFIN	0.00		
115	1040.38	C10 AROMATIC	0.80	8.00	34.95
116		n–BUTYLCYCLOHEXANE	0.00		
117	1048.72	1,3–DIETHYLBENZENE	1.30	13.03	35.21
118		C10 AROMATIC	0.00		
119	1056.73	1,4–DIETHYLBENZENE	0.41	4.13	35.46

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
120		C10 AROMATIC			
121	1070.19	C11 PARAFFIN	0.80	8.80	35.88
122		2,6–DIMETHYLSTYRENE	0.28	2.84	
123		1,3–DIMETHYL–4–ETHYLBENZENE	0.53	5.27	36.15
124	1087.82	C10 AROMATIC	0.40	3.97	36.43
125		C10 AROMATIC	0.00	0.00	
126		C10 AROMATIC	0.00	0.00	
127	1100.00	n–UNDECANE	0.18	2.00	36.81
128		C10 AROMATIC	0.00	0.00	
129		1,2,4,5–TETRAMETHYLBENZENE	0.40	4.00	37.51
130		1,2,3,5–TETRAMETHYLBENZENE	0.40	4.00	37.63
131		C11 PARAFFIN	0.00	0.00	
132		C10 AROMATIC	0.00	0.00	
133		C10 AROMATIC	0.68	6.80	38.31
134		C11 PARAFFIN	0.00	0.00	
135		m–DIISOPROPYLBENZENE	0.00	0.00	
136		C11 AROMATIC	0.73	8.00	38.66
137		1,2,3,4,–TETRAMETHYLBENZENE	0.00	0.00	
138		C11 AROMATIC	0.00	0.00	
139		C11 AROMATIC	0.00	0.00	
140		NAPHTHALENE	1.01	10.10	39.76
141		C11 AROMATIC	0.00	0.00	
142		n–DODECANE	0.00	0.00	
		TOTAL	438.30	2169.51	
		TOTAL CORRECTED**	432.70	2119.51	
		TOTAL AROMATICS	104.88	819.48	
		TOTAL PARAFFINS	146.39	715.84	
		TOTAL OLEFIN	175.66	565.33	
		TOTAL FROM #113	8.52	86.95	

* Flagged data. Approximate concentration: 1.6 ppbv and 50 ppbC

** Corrected for 1,3,5–trimethylbenzene concentration

CALDECOT TUNNEL CAN #00278 6/28/91 0600–0800 (Background Sample) -- Page 1

TABLE A14

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	1.15	2.30	3.01
2		ETHYLENE	2.10	4.20	3.08
3		ETHANE	1.15	2.30	3.14
4		PROPENE	0.53	1.60	4.27
5		PROPANE	1.07	3.20	4.40
6		ISOBUTANE	0.08	0.30	6.73
7		BUTENE–1	0.33	1.30	7.67
8		1,3–BUTADIENE	0.00	0.00	
9	400.00	n–BUTANE	0.48	1.90	7.08
10	410.04	trans–2–BUTENE	0.13	0.50	7.55
11	418.80	UNKNOWN	0.35	1.40	7.96
12		C4 OLEFIN	0.00	0.00	
13	460.68	C4 OLEFIN	0.83	3.30	9.92
14	467.31	3–METHYL–1–BUTENE	0.08	0.42	10.23
15	472.44	ISOPENTANE	0.64	3.20	10.47
16		1–PENTENE	0.00	0.00	
17		2–METHYL–1–BUTENE	0.00	0.00	
18	500.00	n–PENTANE	0.32	1.60	11.76
19		ISOPRENE	0.00	0.00	
20		t–2–PENTENE	0.00	0.00	
21		c–2–PENTENE	0.00	0.00	
22	519.14	C5 OLEFIN	0.32	1.61	12.69
23	522.22	2–METHYL–2–BUTENE	0.16	0.80	12.84
24	530.86	C6 PARAFFIN	0.30	1.80	13.26
25	543.62	2,2–DIMETHYLBUTANE	0.12	0.70	13.88
26		CYCLOPENTENE	0.00	0.00	
27		4–METHYL–1–PENTENE	0.00	0.00	
28		CYCLOPENTANE	0.00	0.00	
29		2,3–DIMETHYLBUTANE	0.00	0.00	
30	569.55	2–METHYLPENTANE	0.19	1.15	15.14
31	574.49	C6 OLEFIN	0.70	4.20	15.38
32	580.25	UNKNOWN	0.22	1.30	15.66
33	583.33	3–METHYLPENTANE	0.17	1.03	15.81
34		2–METHYL–1–PENTENE + 1–HEXENE	0.00	0.00	
35		C6 OLEFIN		0.00	
36	600.00	n–HEXANE	0.20	1.20	16.62
37		t–3–HEXENE	0.00	0.00	
38		t–2–HEXENE	0.00	0.00	
39		C6 OLEFIN	0.00	0.00	
40		C6 OLEFIN	0.00	0.00	

TABLE A14 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00	0.00	
42	627.84	METHYLCYCLOPENTANE	0.13	0.80	17.87
43		2,4–DIMETHYLPENTANE	0.00	0.00	
44	636.75	C7 HYDROCARBON	0.13	0.92	18.27
45	652.56	BENZENE	0.34	2.01	18.98
46		3,3–DIMETHYLPENTANE	0.00	0.00	
47		CYCLOHEXANE	0.00	0.00	
48	668.60	2–METHYLHEXANE	0.07	0.47	19.70
49		2,3–DIMETHYLPENTANE	0.00	0.00	
50	677.73	3–METHYLHEXANE	0.21	1.47	20.11
51		C7 OLEFIN	0.00	0.00	
52		1,3–DIMETHYLCYCLOPENTANE	0.00	0.00	
53		3–ETHYLPENTANE	0.00	0.00	
54	690.87	2,2,4–TRIMETHYLPENTANE	0.13	1.04	20.70
55	700.00	n–HEPTANE	0.06	0.42	21.11
56					
57	712.47	UNKNOWN	0.30	1.82	21.62
58		METHYLCYCLOHEXANE	0.00	0.00	
59		C8 PARAFFIN	0.00	0.00	
60		2,5–DIMETHYLHEXANE	0.00	0.00	
61		2,4–DIMETHYLHEXANE	0.00	0.00	
62		C8 PARAFFIN	0.00	0.00	
63		C8 PARAFFIN	0.00	0.00	
64		2,3,4–TRIMETHYLPENTANE	0.00	0.00	
65	760.15	TOLUENE	1.42	9.97	23.57
66		2,3–DIMETHYLHEXANE	0.00	0.00	
67		2–METHYLHEPTANE	0.00	0.00	
68		3–METHYLHEPTANE	0.00	0.00	
69		3–ETHYLHEXANE	0.00	0.00	
70	780.44	C8 PARAFFIN	0.14	1.09	24.40
71		2,2,5–TRIMETHYLHEXANE	0.00	0.00	
72		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00	0.00	
73		C8 PARAFFIN	0.00	0.00	
74		n–OCTANE	0.00	0.00	25.20
75		PERCHLOROETHYLENE	0.00	0.00	
76		C9 PARAFFIN	0.00	0.00	
77		DIMETHYLHEPTANE	0.00	0.00	
78		C9 PARAFFIN	0.00	0.00	
79		C9 PARAFFIN	0.00	0.00	
80		2,5–DIMETHYLHEPTANE	0.00	0.00	
81		C9 PARAFFIN	0.00	0.00	

TABLE A14 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
82	857.10	ETHYLBENZENE	0.13	1.04	27.33
83		C9 OLEFFIN	0.00	0.00	
84	865.42	m&p–XYLENE	0.47	3.74	27.64
85		4–METHYLOCTANE	0.00	0.00	
86		3–METHYLOCTANE	0.00	0.00	
87		C9 PARAFFIN	0.00	0.00	
88	883.38	STYRENE	0.10	0.77	28.31
89	889.28	o–XYLENE	0.23	1.84	28.53
90		1–NONENE	0.00	0.00	
91	900.00	n–NONANE	0.05	0.45	28.93
92		C9 PARAFFIN	0.00	0.00	
93		ISOPROPYLBENZENE	0.00	0.00	
94		C10 PARAFFIN	0.00	0.00	
95		CYCLOOCTANE	0.00	0.00	
96		C10 PARAFFIN	0.00	0.00	
97		C10 PARAFFIN	0.00	0.00	
98		a–PINENE	0.00	0.00	
99		C10 PARAFFIN	0.00	0.00	
100		n–PROPYLBENZENE	0.00	0.00	
101	959.18	m–ETHYLTOLUENE	0.11	0.99	30.96
102	961.52	p–ETHYLTOLUENE	0.17	1.52	31.04
103	966.47	1,3,5–TRIMETHYLBENZENE	0.06	0.55	31.21
104		C10 PARAFFIN	0.00	0.00	
105		o–ETHYLTOLUENE	0.00	0.00	
106	989.50	C10 PARAFFIN	0.06	0.62	32.00
107	993.59	1,2,4–TRIMETHYLBENZENE	0.13	1.18	32.14
108		C10 PARAFFIN	0.00	0.00	
109	1000.00	n–DECANE	0.08	0.80	32.36
110		SEC–BUTYLBENZENE	0.00	0.00	
111	1022.08	C10 OLEFIN	0.20	1.96	33.06
112	1024.61	1,2,3–TRIMETHYLBENZENE	0.18	1.58	33.14
113		1–METHYL–4–ISOPROPYLBENZENE	0.00	0.00	
114		C10 PARAFFIN	0.00	0.00	
115	1048.90	C10 AROMATIC	0.08	0.77	33.91
116		n–BUTYLCYCLOHEXANE	0.00	0.00	
117		1,3–DIETHYLBENZENE	0.00	0.00	
118		C10 AROMATIC	0.00	0.00	
119		1,4–DIETHYLBENZENE	0.00	0.00	
120		C10 AROMATIC	0.00	0.00	
121		C11 PARAFFIN	0.00	0.00	

TABLE A14 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
122		2,6–DIMETHYLSTYRENE	0.00	0.00	
123	1078.23	1,3–DIMETHYL–4–ETHYLBENZENE	0.11	1.05	34.84
124	1086.44	C10 AROMATIC	0.10	1.00	35.10
125	1092.74	C10 AROMATIC	0.06	0.62	35.30
126		C10 AROMATIC	0.00	0.00	
127	1100.00	n–UNDECANE	0.14	1.51	35.53
128		C10 AROMATIC	0.00	0.00	
129		1,2,4,5–TETRAMETHYLBENZENE	0.05	0.45	36.18
130		1,2,3,5–TETRAMETHYLBENZENE	0.02	0.15	36.33
131		C11 PARAFFIN	0.00	0.00	
132		C10 AROMATIC	0.00	0.00	
133		C10 AROMATIC	0.00	0.00	
134		C11 PARAFFIN	0.00	0.00	
135		m–DIISOPROPYLBENZENE	0.00	0.00	
136		C11 AROMATIC	0.00	0.00	
137		1,2,3,4,–TETRAMETHYLBENZENE	0.00	0.00	
138		C11 AROMATIC	0.00	0.00	
139	99.71	C11 AROMATIC	0.09	0.99	38.37
140		NAPHTHALENE	0.11	1.10	38.48
141		C11 AROMATIC	0.00	0.00	
142		n–DODECANE	0.00	0.00	
		TOTAL	17.23	86.00	
		TOTAL AROMATICS	3.93	31.32	
		TOTAL PARAFFINS	5.80	27.34	
		TOTAL OLEFIN	6.89	23.71	
		TOTAL FROM ETHYLBENZENE	2.70	24.68	

TABLE A15

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETHYLENE	1.53	3.05	3.01
2		ETHYLENE	4.06	8.12	3.07
3		ETHANE	1.20	2.40	3.14
4		PROPENE	0.87	2.60	4.25
5		PROPANE	1.02	3.05	4.38
6		ISOBUTANE	0.31	1.25	6.52
7		BUTENE–1	0.54	2.15	7.66
8		1,3–BUTADIENE	0.00	0.00	
9	400.00	n–BUTANE	1.58	6.30	7.13
10	410.06	trans–2–BUTENE	0.22	0.87	7.60
11	423.34	cis–2–BUTENE	0.14	0.57	8.22
12	461.03	C4 OLEFIN	0.44	1.74	9.98
13		C4 OLEFIN	0.00	0.00	
14		3–METHYL–1–BUTENE	0.00	0.00	
15	472.59	ISOPENTANE	3.00	15.00	10.52
16	488.65	1–PENTENE	0.10	0.50	11.27
17	495.93	2–METHYL–1–BUTENE	0.10	0.50	11.61
18	500.00	n–PENTANE	1.16	5.80	11.80
19	504.72	ISOPRENE	0.12	0.60	12.03
20	508.42	t–2–PENTENE	0.17	0.87	12.21
21	516.02	c–2–PENTENE	0.09	0.43	12.58
22	519.30	C5 OLEFIN	0.16	0.80	12.74
23	520.74	2–METHYL–2–BUTENE	0.28	1.39	12.81
24	531.01	C6 PARAFFIN	0.15	0.90	13.31
25		2,2–DIMETHYLBUTANE	0.00	0.00	
26		CYCLOPENTENE	0.00	0.00	
27		4–METHYL–1–PENTENE	0.00	0.00	
28	562.83	CYCLOPENTANE	0.13	0.64	14.86
29	565.09	2,3–DIMETHYLBUTANE	0.22	1.29	14.97
30	569.61	2–METHYLPENTANE	0.87	5.22	15.19
31	574.54	C6 OLEFIN	0.46	2.78	15.43
32	580.29	UNKNOWN	0.24	1.41	15.71
33	583.37	3–METHYLPENTANE	0.55	3.32	15.86
34		2–METHYL–1–PENTENE + 1–HEXENE	0.00	0.00	
35		C6 OLEFIN		0.00	
36	600.00	n–HEXANE	0.61	3.63	16.67
37		t–3–HEXENE	0.00	0.00	
38	607.35	t–2–HEXENE	0.08	0.48	17.00
39		C6 OLEFIN	0.00	0.00	
40		C6 OLEFIN	0.00	0.00	

TABLE A15 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41		C6 OLEFIN	0.00	0.00	
42	627.84	METHYLCYCLOPENTANE	0.51	3.08	17.92
43	631.18	2,4–DIMETHYLPENTANE	0.11	0.77	18.07
44	636.75	C7 HYDROCARBON	0.16	1.10	18.32
45	652.56	BENZENE	1.21	7.23	19.03
46		3,3–DIMETHYLPENTANE	0.00	0.00	
47	661.69	CYCLOHEXANE	0.12	0.73	19.44
48	668.60	2–METHYLHEXANE	0.28	1.96	19.75
49	671.05	2,3–DIMETHYLPENTANE	0.13	0.90	19.86
50	677.28	3–METHYLHEXANE	0.38	2.69	20.14
51		C7 OLEFIN	0.00	0.00	
52	684.86	1,3–DIMETHYLCYCLOPENTANE	0.09	0.61	20.48
53	687.53	3–ETHYLPENTANE	0.11	0.74	20.60
54	690.87	2,2,4–TRIMETHYLPENTANE	0.36	2.86	20.75
55	700.00	n–HEPTANE	0.18	1.27	21.16
56		C8 HYDROCARBON			
57	712.75	C8 OLEFIN	0.12	0.92	21.68
58	725.17	METHYLCYCLOHEXANE	0.25	1.75	22.19
59		C8 PARAFFIN	0.00	0.00	
60	733.33	2,5–DIMETHYLHEXANE	0.06	0.46	22.52
61	736.03	2,4–DIMETHYLHEXANE	0.11	0.85	22.63
62		C8 PARAFFIN	0.00	0.00	
63		C8 PARAFFIN	0.00	0.00	
64	753.92	2,3,4–TRIMETHYLPENTANE	0.11	0.88	23.36
65	760.05	TOLUENE	2.04	14.28	23.61
66		2,3–DIMETHYLHEXANE	0.00	0.00	
67	767.40	2–METHYLHEPTANE	0.09	0.74	23.91
68	775.25	3–METHYLHEPTANE	0.09	0.72	24.23
69		3–ETHYLHEXANE	0.00	0.00	
70	780.64	C8 PARAFFIN	0.08	0.64	24.45
71		2,2,5–TRIMETHYLHEXANE	0.00	0.00	
72		DIMETHYLCYCLOHEXANE + 1–OCTENE	0.00	0.00	
73		C8 PARAFFIN	0.00	0.00	
74	800.00	n–OCTANE	0.07	0.57	25.24
75		PERCHLOROETHYLENE	0.00	0.00	
76		C9 PARAFFIN	0.00	0.00	
77		DIMETHYLHEPTANE	0.00	0.00	
78		C9 PARAFFIN	0.00	0.00	
79		C9 PARAFFIN	0.00	0.00	
80		2,5–DIMETHYLHEPTANE	0.00	0.00	
81		C9 PARAFFIN	0.00	0.00	

TABLE A15 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
82	857.10	ETHYLBENZENE	0.32	2.57	27.37
83		C9 OLEFFIN	0.00	0.00	
84	865.42	m&p–XYLENE	1.24	9.89	27.68
85		4–METHYLOCTANE	0.00	0.00	
86		3–METHYLOCTANE	0.00	0.00	
87		C9 PARAFFIN	0.00	0.00	
88	884.18	STYRENE	0.10	0.76	28.38
89	889.54	o–XYLENE	0.46	3.69	28.58
90		1–NONENE	0.00	0.00	
91	900.00	n–NONANE	0.07	0.65	28.97
92		C9 PARAFFIN	0.00	0.00	
93		ISOPROPYLBENZENE	0.00	0.00	
94		C10 PARAFFIN	0.00	0.00	
95		CYCLOOCTANE	0.00	0.00	
96		C10 PARAFFIN	0.00	0.00	
97		C10 PARAFFIN	0.00	0.00	
98		a–PINENE	0.00	0.00	
99		C10 PARAFFIN	0.00	0.00	
100	952.62	n–PROPYLBENZENE	0.06	0.52	30.78
101	959.30	m–ETHYLTOLUENE	0.29	2.64	31.01
102	961.92	p–ETHYLBENZENE	0.21	1.87	31.10
103	966.57	1,3,5–TRIMETHYLBENZENE	0.17	1.53	31.26
104		C10 PARAFFIN	0.00	0.00	
105	978.78	o–ETHYLTOLUENE	0.13	1.17	31.68
106	989.83	C10 PARAFFIN	0.09	0.91	32.06
107	993.60	1,2,4–TRIMETHYLBENZENE	0.43	3.90	32.19
108		C10 PARAFFIN	0.00	0.00	
109	1000.00	n–DECANE	0.12	1.16	32.41
110		SEC–BUTYLBENZENE	0.00	0.00	
111	1022.40	C10 OLEFIN	0.11	1.06	33.12
112	1024.61	1,2,3–TRIMETHYLBENZENE	0.16	1.47	33.19
113		1–METHYL–4–ISOPROPYLBENZENE	0.00	0.00	
114		C10 PARAFFIN	0.00	0.00	
115	1039.75	C10 AROMATIC	0.07	0.68	33.67
116		n–BUTYLCYCLOHEXANE	0.00	0.00	
117		1,3–DIETHYLBENZENE	0.00	0.00	
118		C10 AROMATIC	0.00	0.00	
119	1056.47	1,4–DIETHYLBENZENE	0.12	1.19	34.20
120		C10 AROMATIC	0.00	0.00	
121		C11 PARAFFIN	0.00	0.00	

TABLE A15 cont

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
122		2,6-DIMETHYLSTYRENE	0.00	0.00	
123	1078.23	1,3-DIMETHYL-4-ETHYLBENZENE	0.09	0.93	34.89
124	1086.44	C10 AROMATIC	0.17	1.73	35.15
125		C10 AROMATIC	0.00	0.00	
126		C10 AROMATIC	0.00	0.00	
127	1100.00	n-UNDECANE	0.16	1.72	35.58
128		C10 AROMATIC	0.00	0.00	
129		1,2,4,5-TETRAMETHYLBENZENE	0.00	0.00	
130		1,2,3,5-TETRAMETHYLBENZENE	0.09	0.91	36.22
131		C11 PARAFFIN	0.00	0.00	
132		C10 AROMATIC	0.00	0.00	
133		C10 AROMATIC	0.00	0.00	
134		C11 PARAFFIN	0.00	0.00	
135		m-DIISOPROPYLBENZENE	0.00	0.00	
136		C11 AROMATIC	0.07	0.74	37.34
137		1,2,3,4,-TETRAMETHYLBENZENE	0.00	0.00	
138		C11 AROMATIC	0.00	0.00	
139		C11 AROMATIC	0.00	0.00	
140		NAPHTHALENE	0.10	1.03	38.53
141		C11 AROMATIC		0.00	
142		n-DODECANE		0.00	
		TOTAL	31.84	166.13	
		TOTAL AROMATICS	7.53	58.73	
		TOTAL PARAFFINS	12.35	63.39	
		TOTAL OLEFIN	10.07	32.33	
		TOTAL FROM ETHYLBENZENE	4.83	42.72	

OILDALE CAN #00300 7/30/91 0600-0800 Sampler #1 TABLE A16

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
1		ACETYLENE	7.15	14.30	3.06
2		ETHYLENE	31.79	63.58	3.12
3		ETHANE	25.10	50.20	3.20
4		PROPENE	2.09	6.27	4.30
5		PROPANE	19.67	59.02	4.43
6		ISOBUTANE	5.03	20.10	6.58
7		BUTENE-1	0.54	2.17	7.76
8		1,3-BUTADIENE	0.28	1.10	
9	400.00	n-BUTANE	11.00	44.01	7.08
10	410.28	trans-2-BUTENE	0.19	0.76	7.56
11	423.34	cis-2-BUTENE	0.17	0.68	8.17
12		C4 OLEFIN	0.00		
13	461.24	C4 OLEFIN	0.36	1.42	9.94
14	467.45	3-METHYL-1-BUTENE	0.10	0.49	10.23
15	472.59	ISOPENTANE	9.18	45.90	10.47
16	488.44	1-PENTENE	0.15	0.73	11.21
17	495.72	2-METHYL-1-BUTENE	0.11	0.53	11.55
18	500.00	n-PENTANE	4.76	23.80	11.75
19	504.73	ISOPRENE	0.20	0.98	11.98
20	508.44	t-2-PENTENE	0.17	0.85	12.16
21	515.84	c-2-PENTENE	0.08	0.40	12.52
22	519.34	C5 OLEFIN	0.26	1.28	12.69
23	520.58	2-METHYL-2-BUTENE	0.26	1.28	12.75
24	522.43	C6 PARAFFIN	0.16	0.93	12.84
25	535.19	C6 PARAFFIN	1.03	6.17	13.46
26	543.83	C6 HYDROCARBON	0.13	0.75	13.88
27		4-METHYL-1-PENTENE	0.00		
28	562.76	CYCLOPENTANE	0.64	3.22	14.80
29	565.02	2,3-DIMETHYLBUTANE	2.63	15.78	14.91
30	569.55	2-METHYLPENTANE	2.54	15.24	15.13
31	574.69	C6 OLEFIN	0.72	4.29	15.38
32	580.45	UNKNOWN	0.35	2.07	15.66
33	583.33	3-METHYLPENTANE	1.92	11.51	15.80
34		2-METHYL-1-PENTENE +			
	589.51	1-HEXENE	0.11	0.67	16.10
35		C6 OLEFIN			
36	600.00	n-HEXANE	1.77	10.60	16.61
37		t-3-HEXENE	0.00		
38		t-2-HEXENE	0.00		
39		C6 OLEFIN	0.00		
40		C6 OLEFIN	0.00		

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
41	625.11	C6 OLEFIN	0.34	2.04	17.74
42	627.78	METHYLCYCLOPENTANE	2.02	12.10	17.86
43	631.33	2,4-DIMETHYLPENTANE	0.61	4.30	18.02
44	637.11	C8 PARAFFIN+TRICHLOROETHANE	0.85	5.97	18.28
45	652.44	BENZENE	2.70	16.20	18.97
46	657.11	3,3-DIMETHYLPENTANE	0.41	2.90	19.18
47	661.56	CYCLOHEXANE	0.61	3.64	19.38
48	668.44	2-METHYLHEXANE	0.75	5.28	19.69
49	670.89	2,3-DIMETHYLPENTANE	1.34	9.38	19.80
50	677.11	3-METHYLHEXANE	1.06	7.39	20.08
51		C7 OLEFIN	0.00		
52	684.89	1,3-DIMETHYLCYCLOPENTANE	0.47	3.31	20.43
53	687.56	3-ETHYLPENTANE	0.72	5.02	20.55
54	690.44	2,2,4-TRIMETHYLPENTANE	0.70	5.57	20.68
55	700.00	n-HEPTANE	0.76	5.34	21.11
56	712.50	C8 HYDROCARBON	0.49	3.93	21.62
57	725.00	METHYLCYCLOHEXANE	0.78	5.43	22.13
58	726.96	C8 PARAFFIN	1.41	11.24	22.21
59	733.33	2,5-DIMETHYLHEXANE	0.16	1.31	22.47
60	736.03	2,4-DIMETHYLHEXANE	0.47	3.79	22.58
61	744.36	C8 PARAFFIN	2.01	16.06	22.92
62	751.72	C8 PARAFFIN	0.52	4.13	23.22
63	753.92	2,3,4-TRIMETHYLPENTANE	0.69	5.49	23.31
64	760.05	TOLUENE	5.85	40.96	23.56
65	763.24	2,3-DIMETHYLHEXANE	0.21	1.68	23.69
66	767.65	2-METHYLHEPTANE	0.41	3.24	23.87
67	775.25	3-METHYLHEPTANE	0.35	2.80	24.18
68	780.64	3-ETHYLHEXANE	2.61	20.85	24.40
69	782.60	C8 PARAFFIN	0.31	2.45	24.48
70	784.56	2,2,5-TRIMETHYLHEXANE	0.52	4.65	24.56
71		DIMETHYLCYCLOHEXANE +			
	791.42	1-OCTENE	0.34	2.74	24.84
72	794.12	C8 PARAFFIN	0.20	1.63	24.95
73	800.00	n-OCTANE	0.32	2.59	25.19
74	805.80	C9 PARAFFIN	2.68	24.13	25.41
75	809.76	C9 PARAFFIN	0.31	2.83	25.56
76	816.62	DIMETHYLHEPTANE	1.33	11.96	25.82
77	822.43	C9 PARAFFIN	1.24	11.14	26.04
78	831.93	C9 PARAFFIN	0.35	3.12	26.40
79	835.09	C9 HYDROCARBON	0.31	2.76	26.52
80	837.73	2,5-DIMETHYLHEPTANE	0.40	3.58	26.62

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
81	840.37	C9 HYDROCARBON	0.60	5.42	26.72
82	844.59	C9 PARAFFIN	0.70	6.26	26.88
83	847.49	C9 HYDROCARBON	0.93	8.39	26.99
84	849.87	C9 HYDROCARBON	0.55	4.94	27.08
85	856.20	ETHYLBENZENE	1.45	11.59	27.32
86	859.63	C9 OLEFFIN	1.62	14.56	27.45
87	864.38	m&p-XYLENE	3.93	31.44	27.63
88		4-METHYLOCTANE	0.00		
89	871.50	C9 PARAFFIN	0.35	3.19	27.90
90	877.31	C9 PARAFFIN	1.22	10.98	28.12
91	882.32	STYRENE	1.12	8.96	28.31
92	887.86	o-XYLENE	1.79	14.33	28.52
93	891.82	1-NONENE	0.11	0.98	28.67
94	895.25	C9 HYDROCARBON	1.03	9.24	28.80
95	900.00	n-NONANE	0.44	4.00	28.98
96	907.44	C9 HYDROCARBON	1.27	11.43	29.23
97	915.48	C9 PARAFFIN	1.49	13.38	29.50
98	920.54	ISOPROPYLBENZENE	0.28	2.50	29.67
99	926.19	C10 PARAFFIN	0.79	7.87	29.86
100	929.17	CYCLOOCTANE	0.60	4.83	29.96
101	937.20	C10 PARAFFIN	1.94	19.42	30.23
102	943.15	C10 PARAFFIN	1.12	11.16	30.43
103		a-PINENE	0.00		
104	947.02	C10 PARAFFIN	0.40	3.96	30.56
105	952.68	n-PROPYLBENZENE	0.62	5.58	30.75
106	958.93	m-ETHYLTOLUENE	1.18	10.63	30.96
107	961.31	p-ETHYLTOLUENE	0.59	5.29	31.04
108	965.48	1,3,5-TRIMETHYLBENZENE	1.57	14.13	31.18
109	972.92	C10 PARAFFIN	0.68	6.83	31.43
110	978.87	o-ETHYLTOLUENE	0.37	3.36	31.63
111	984.52	C10 HYDROCARBON	0.80	7.19	31.82
112	987.20	C10 HYDROCARBON	0.68	6.16	31.91
113	989.88	C10 PARAFFIN	1.29	12.94	32.00
114	993.75	1,2,4-TRIMETHYLBENZENE	1.66	14.91	32.13
115		C10 PARAFFIN	0.00		
116	1000.00	n-DECANE	1.46	14.59	32.34
117	1009.40	SEC-BUTYLBENZENE	0.55	5.45	32.64
118	1013.17	C10 HYDROCARBON	0.27	2.72	32.76
119	1019.75	C10 OLEFIN	0.66	6.59	32.97
120	1025.08	1,2,3-TRIMETHYLBENZENE	1.50	13.51	33.14

PK #	RI	NAME	C(ppbv)	C(ppbC)	R.T.
121		1-METHYL-4-ISOPROPYLBENZENE		0.00	
122	1035.11	C10 PARAFFIN	0.60	6.00	33.46
123	1040.44	C10 AROMATIC	0.95	9.51	33.63
124	1043.57	n-BUTYLCYCLOHEXANE	0.54	5.43	33.73
125	1048.28	1,3-DIETHYLBENZENE	0.58	5.78	33.88
126	1051.41	C10 AROMATIC	0.66	6.64	33.98
127	1056.74	1,4-DIETHYLBENZENE	0.73	7.29	34.15
128	1065.83	C10 AROMATIC	0.42	4.21	34.44
129	1070.22	C11 PARAFFIN	0.32	3.48	34.58
130		2,6-DIMETHYLSTYRENE	0.00		
131	1078.37	1,3-DIMETHYL-4-ETHYLBENZENE	0.41	4.06	34.84
132	1080.56	C10 HYDROCARBON	0.49	4.85	34.91
133	1083.70	C10 HYDROCARBON	0.41	4.05	35.01
134	1086.52	C10 AROMATIC	0.77	7.70	35.10
135	1092.16	C10 AROMATIC	0.82	8.15	35.28
136		C10 AROMATIC	0.00		
137	1100.00	n-UNDECANE	0.98	10.82	35.53
138		C10 AROMATIC	0.72	7.17	35.86
139		1,2,4,5-TETRAMETHYLBENZENE	0.23	2.27	36.16
140		1,2,3,5-TETRAMETHYLBENZENE	0.48	4.79	36.28
141		C11 HYDROCARBON	0.23	2.53	36.45
142		C10 HYDROCARBON	0.25	2.47	36.61
143		C10 AROMATIC	0.44	4.38	36.94
144		C11 PARAFFIN	0.19	2.08	37.07
145		m-DIISOPROPYLBENZENE	0.00		
146		C11 AROMATIC	0.26	2.85	37.28
147		1,2,3,4,-TETRAMETHYLBENZENE	0.00		
148		C11 AROMATIC	0.11	1.19	37.47
149		C11 AROMATIC	0.00		
150		NAPHTHALENE	0.34	4.02	38.47
151		C11 AROMATIC	0.09	1.03	38.69
152		n-DODECANE	0.18	2.21	38.94
153		C12 HYDROCARBON	0.16	1.97	39.62
		TOTAL	217.96	1157.68	
		TOTAL AROMATICS	33.24	280.93	
		TOTAL PARAFFINS	125.71	679.66	
		TOTAL OLEFIN	53.87	165.81	
		TOTAL FROM #121	13.84	140.44	