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EPA-600/7-78-062
April 1978

MEASUREMENT OF CARCINOGENIC VAPORS IN AMBIENT ATMOSPHERES
Final Report

Interagency
Energy-Environment
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Final Report

by

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Contract No. 68-02-1228

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ABSTRACT

Analytical methods and instrumentation were evaluated for collecting and analyzing carcinogenic and mutagenic vapors occurring in ambient air. The areas of investigation included (a) the evaluation of Tenax GC sorbent for in situ reactions that may occur during the collection of organic vapors from ambient air; (b) the development and evaluation of a permeation system for delivering precise quantities of organic vapors for calibrating instruments; and (c) the characterization and quantification of hazardous organic vapors in ambient air collected at several different geographical areas within the Continental U.S.

This report was submitted in fulfillment of 68-02-1228 by the Research Triangle Institute under the sponsorship of the U. S. Enviromental Protection Agency. This report covers a period from June 22, 1976 to June 21, 1977, and work was completed as of June 21, 1977.

CONTENTS

FIGURES

FIGURES (cont'd)

TABLES

ACKNOWLEDGEMENTS

The valuable assistance of Dr. R. E. Berkley and J. E. Bunch in executing laboratory and field experimentation is gratefully appreciated. Ms. N. Castillo, D. Smith and Dr. J. T. Bursey provided the expertise necessary for interpretation of mass spectra and the analysis of samples by high resolution gas-liquid chromatography/mass spectrometry/computer in this research program a sincere thanks for their support.

The author is especially grateful to Drs. Dick Flannery, Lloyd Stewart Mr. Jim Tar and Mr. Rick Anderson for their assistance in selecting sites in the Greater Houston area. The success of the studies in the New Jersey area were primarily due to the helpful assistance of Dr. Paul Brown, Mr. Joe Spatola, Ms. Ann Krypel and Mr. Steve Rivar of the Region II, EPA, Edison, NJ. Arrangements for the sampling conducted along the Mississippi River were made by Mr. Gus VonBodungen of the Lousiana Air Board. A special thanks to Mr. VonBondungen for providing plant maps and emission data, and obtaining permission to sample on plant site properties.

The personnel at Tenneco (R. W. Schima), Shell (Dick Slyker), and Diamond Shamrock (Bill Hutton) in Houston, TX are acknowledged for their help during sampling on or near their facilities.

The constant encouragement and constructive criticisms of Drs. E. Sawicki, P. Altschuller, A. Ellison and Mr. K. Krost of NERC, RTP, NC are deeply appreciated. The guidance and assistance provided by Mr. J. Bachman, J. O'Conner and J. Padgett of EPA, RTP, NC are acknowledged for their valuable help in providing information on the various geographical sites.

SECTION 1
INTRODUCTION

This research program on the development of analytical techniques for measuring carcinogenic ambient atmospheric vapors has attempted to furnish a comprehensive and systematic approach to this problem. It has attempted to develop and evaluate the sampling device, field collection methodology, and the entire procedure of the data analysis of carcinogenic vapors in the atmosphere. Until this research program was initiated, the ability to collect from the atmosphere and analyze a wide variety of chemical classes which contained toxic and/or carcinogenic organic compounds did not exist. For this reason, research programs to determine and evaluate the health-impact of carcinogenic compounds in the environment had not been conducted. Comprehensive studies on the levels of carcinogenic agents in all media in addition to air and the correlation of this exposure to body burden and health effects on man could also not be executed. Thus, a well-defined epidemiological approach which is required in this type of study to establish whether an associational relationship existed has in the past suffered from the lack of appropriate technology in order to achieve these goals.

The main reasons for identifying and determining environmental carcinogenic organics even at low concentrations are as follows:

(1) A knowledge of the presence and concentrations of mutagens and carcinogens in the air is mandatory for a better understanding of genetic diseases and future carcinogenic and mutagenic problems which may arise after a long induction period.

(2) If the incidence of cancer in the US is to be understood and controlled, it will be necessary to determine the concentrations of environmental carcinogens. It is necessary also to understand the complete organic composition of the atmosphere since there are antagonistic and synergistic relationships, i.e., anti- and co-carcinogenic factors which may occur and contribute to the observed incidence of cancer.

(3) It is known that higher cancer mortality rates have been shown to occur near various sources of air pollution and in statistical studies, and it has been demonstrated that cancer associated with the respiratory system is higher where high air pollution occurs.

(4) Recent estimates indicate that chemical synthesis adds some quarter of a million new chemical compounds each year to the several million already in existence. These new compounds can be a serious source of air pollution and may have a significant effect on the health of the human populace.

and (5) The development of an analytical technique for measuring carcinogenic ambient vapors must provide a thorough analytical approach which will measure a wide number of potential environmental carcinogens and mutagens as well as their precursors and various co-factors and anti-factors.

The development of analytical techniques for measuring carcinogenic ambient atmospheric vapors has attempted to provide a conceptual approach which will allow the answering of questions cited above in subsequent research programs.

SECTION 2

CONCLUSIONS

A series of laboratory experiments was conducted to determine whether air containing both NO_x and ozone might be more effective in converting dimethylamine (DMA) to N-nitrosodimethylamine (DMN) than air containing only NO_x. Experiments were designed to delineate the conversion of DMA whether adsorbed on Tenax or at a low concentrations in air by atmospheric reactions or heterogeneous reactions which may take place on the walls of the sampler inlet tube. The extent of *in situ* reactions on the Tenax GC sorbent was specifically studied. The results of the study show that it is important to obtain simultaneous data on atmospheric concentrations of NO_x, ozone, and amines when sampling for nitrosoamines. A control such as the addition of $^2H_6$-DMA to the sampling stream should be used to determine those environmental factors which may contribute to *in situ* DMN formation. This would be especially necessary in an attempt to show that nitrosoamines had been formed in the atmosphere from reactants. Under typical concentrations of NO_x, ozone and humidity observed in the ambient air, the *in situ* formation of DMN was generally <0.3% on the Tenax GC sorbent.

The previously reported permeation flow system was modified to incorporate improvements which provide a higher accuracy and reproducibility during the delivery of known concentrations of air/vapor mixtures to cartridges for the purpose of calibrating instruments. The best method of delivery of carrier gas to the permeation tube flow system was to control the pressure in the chamber with a low pressure regulator and to control the flow rates only with a valve which was used to split the flow. Increasing the pressure from 2-6" of water minimized signal fluctuation due to differences in flow resistance of individual cartridges in-line with the permeation system.

An examination of long-term performance of permeation tubes was also conducted. The effect of cold storage (0°C) indicated that upon return of the permeation tube to a constant temperature (20.1°C) permeation rates were re-established in a relatively short period of time (48 hrs). It was generally concluded that for vapors of halogenated hydrocarbons, the plastics FEP and PFE were inadequate for obtaining a stabilized permeation rate after several weeks. Increasing the temperature to 30.4°C did not significantly increase the stabilization rate of permeation from these tubes. Preliminary studies indicate that polyethylene may be suitable for halogenated compounds.

A number of ambient air samples were collected from several geographical areas (Houston, TX and vicinity; Baton Rouge, LA and vicinity; and Edison, NJ) and characterized for hazardous organic vapors and gases. Many halogen-, sulfur-, oxgyen- and nitrogen-containing compounds were identified. Alkanes, alkenes and alkyl aromatics were ubiquitous in these samples and were probably derived primarily from fossil fuel burning. Several hundred aliphatics and aromatics (including benzene) were identified. Over fifty halogenated organics were detected and quantified. Among these were vinyl chloride, vinylidene chloride, ethylene dibromide, several chloro ethers, and perchloroalkanes and chlorinated aromatics. Other heteroatom-containing organics (7 sulfur, 14 nitrogen and 90 oxygen) were identified, some of which were associated with specific geographical areas.

SECTION 3

RECOMMENDATIONS

Six major phases of research should be expanded and pursued:

(1) the sampling cartridge should be further examined for potential *in situ* reactions which might occur during field sampling. This activity should delineate any problems associated with the sampling of atmospheres containing molecular chlorine, bromine or iodine in combination with olefins and NO_x, SO_2 and ozone. Other potential *in situ* reactions on the sorbent bed should also be examined, such as the ozonization of olefins by moderate to high atmospheric concentrations of ozone.

(2) The examination of alternate new sorbent materials as a backup or substitute for Tenax GC should be pursued. This may involve the synthesis of analogs or a modified polymer base of Tenax in order to incorporate the desired retention volume properties for organics without increasing the overall background contribution and retention of inorganic gases and water.

(3) Further development of capillary technology is recommended. New techniques for the modification of the glass capillary wall to minimize adsorption properties of the semi-polar and polar constituents should be developed. Techniques which circumvent the use of silanization should be pursued. An overall improvement in resolution and column capacity is recommended in order to improve the quantification of complex air mixtures.

(4) Extensive sampling of numerous sites for hazardous atmospheric pollutants should be conducted. The methodology for collection, resolution, and identification of hazardous vapors in ambient air which was developed during the past four years under Contract No. 68-02-1228 should be applied to field sampling of numerous sites within the Continental U.S. with a major thrust toward the

characterization and identification of carcinogenic and mutagenic vapors. The selection of sites should be based on the high incidence of cancer in these areas, the types of industrial activity or the unique photochemical atmospheric reactions which take place. The selection of sites should include a wide variety of meteorological conditions in order to evaluate the overall techniques.

(5) Identification and quantification of hazardous vapors in atmospheric samples should be performed. The hazardous vapors identified should be quantified in ambient air samples and the technique should be evaluated as to its accuracy and reproducibility for monitoring organic vapors in ambient air.

And (6) Pollution profiles indicative of individual sites should be developed. Pollution profiles should be assembled for the various geographical areas postulated to contain hazardous vapors. These profiles should indicate site-specific pollutants and those vapors which are ubiquitous.

SECTION 4

PROGRAM OBJECTIVES

The general aim of this research program has been to develop, perfect and validate methodology for the reliable and accurate collection and analysis of mutagenic and carcinogenic vapors (hazardous compounds) present in trace quantities in the atmosphere (ng/m^3). This information is necessary in order to determine the physiologically active vapors which may be present in polluted atmospheres so that researchers can ascertain their biological impact on populated areas and their overall relationship to the incidence of cancer. The major program objectives were: (1) to evaluate the Tenax GC sorbent for *in situ* reactions occurring between secondary amines, NO_x, ozone and humidity; (2) to develop and perfect the performance of a permeation system for synthesizing air/organic vapor mixtures for calibrating instruments used for the quantification of hazardous vapors in ambient air; and (3) the identification and quantification of hazardous organic vapors in ambient air from several geographical areas within the Continental U.S. The latter objective was coupled with the information obtained for hazardous vapors, the validation of the polypollutant method which had previously been developed, and the gathering of information on the quantity of hazardous vapors for evaluating the incidence of cancer in the future.

SECTION 5

EVALUATION OF TENAX GC SORBENT FOR *IN SITU* REACTIONS

The detection and unequivocal identification of N-nitrosodimethylamine (DMN) and its quantification in the ambient air of Baltimore, MD, has recently been reported.[1-3] Ambient air was sampled using Tenax GC cartridge technique[4-9] and sample analysis employed glass capillary gas chromatography/mass spectrometry/computer (glc/ms/comp) methods. N-Nitrosodimethylamine was also identified and quantified in ambient air in Belle, WV.[4] However, it and N-nitrosodiethylamine (DEN) were not present in significant amounts in the atmosphere containing NO_x, ozone, dimethylamine (DMA) and diethylamine (DEA) of South Charleston, WV.[4]

In view of the potency and the broad spectrum of carcinogenic activity of DMN in experimental animals,[10] the detection of DMN in the atmosphere had generated considerable interest in its origin. Studies were initiated to determine its emission from stationary and fugitive sources as well as its photochemical production[11] from precursors (NO_x, DMA).

In order to determine whether DMN may form in an atmospheric chemical reaction it is first necessary to know the extent to which it may form at trace levels as an "artifact" of the technique employed or the sample collection process. Furthermore, the experimental methods should differentiate between homogeneous and heterogeneous reaction mechanisms.

Our primary concern has been with the use of the Tenax GC sampling cartridge which has been extensively employed for collecting organic vapors from ambient air for characterization and quantification purposes. Since the Tenax GC cartridge would concentrate DMA if present in ambient air, it was conceivable that, in the presence of NO_x, DMA might be nitrosated to form DMN, even though inorganic gases do not appreciably accumulate on the sorbent.[3] It was the purpose of the present study to further supplement the previously reported observations[3,4] as to whether an *in situ* reaction could occur on the Tenax GC sampling cartridge.

Since urban air often contains substantial concentrations of ozone, we also conducted a series of laboratory experiments to determine whether air containing both NO_x and ozone might be more effective in converting DMA to DMN than air containing only NO_x. Experiments were designed to delineate the conversion of DMA whether adsorbed on Tenax GC or at low concentrations in air by atmospheric reaction(s) or heterogeneous reactions which might take place on the walls of the sample inlet tube.

EXPERIMENTAL

The apparatus used to determine whether air containing O_3, NO (Matheson, Coleman, Bell), NO_2 (Matheson, Coleman, Bell), $^1H_6$-DMA (Linde Division, Union Carbide Corp.), $^2H_6$-DMA (Merck, Sharpe, Dohme) and water might convert DMA to DMN on Tenax GC (35/60 mesh, Applied Science, State College, PA) is depicted in Figure 1. Nitric oxide was measured into the stream with a rotometer and a metering valve from a supply tank which contained 54.2 ppm of NO in nitrogen (Scott Environmental). Ozone was generated by an ultraviolet lamp equipped with a sliding cover for obtaining different concentrations and with the aid of a Welsbach ozone generator for concentrations >1 ppm. Concentrations of NO, NO_2, and O_3 were monitored with a Bendix NO_x analyzer (Model 5513802) and a Bendix Ozone analyzer. Intakes for these instruments were at the same point as the intake for the Tenax GC glass cartridge sampler (1.5 cm i.d. x 6.0 cm bed length) through which air was drawn by a Nutech Modèl 221-A (Nutech Corp., Durham, N.C.) sampler. The sampling cartridge and analyzer inlet tubes were centered in the air flow pattern of the reaction tube. Various relative humidities in the air stream were produced by changing the temperature of the humidifier bath.

The $^1H_6$-DMA and $^2H_6$-DMA were purified prior to use by low temperature vacuum distillation using a double bulb technique since $^1H_6$-DMA had been found to contain 10 ppm of DMN by gc/ms/comp analysis. Polyethylene permeation tubes of $^1H_6$-DMA and $^2H_6$-DMA were prepared and gravimetrically calibrated with a MS-5A Mettler balance after their equilibration to constant rates.

Prior to its use Tenax GC was purified by Soxhlet extraction for 18 hours each with acetone and _n_-hexane, respectively. After drying under a nitrogen atmosphere, Tenax GC was heated to 100°C for 2 hr in a vacuum oven (12 in H_2O), meshed into a 35/60 range and packed into glass tubes. All

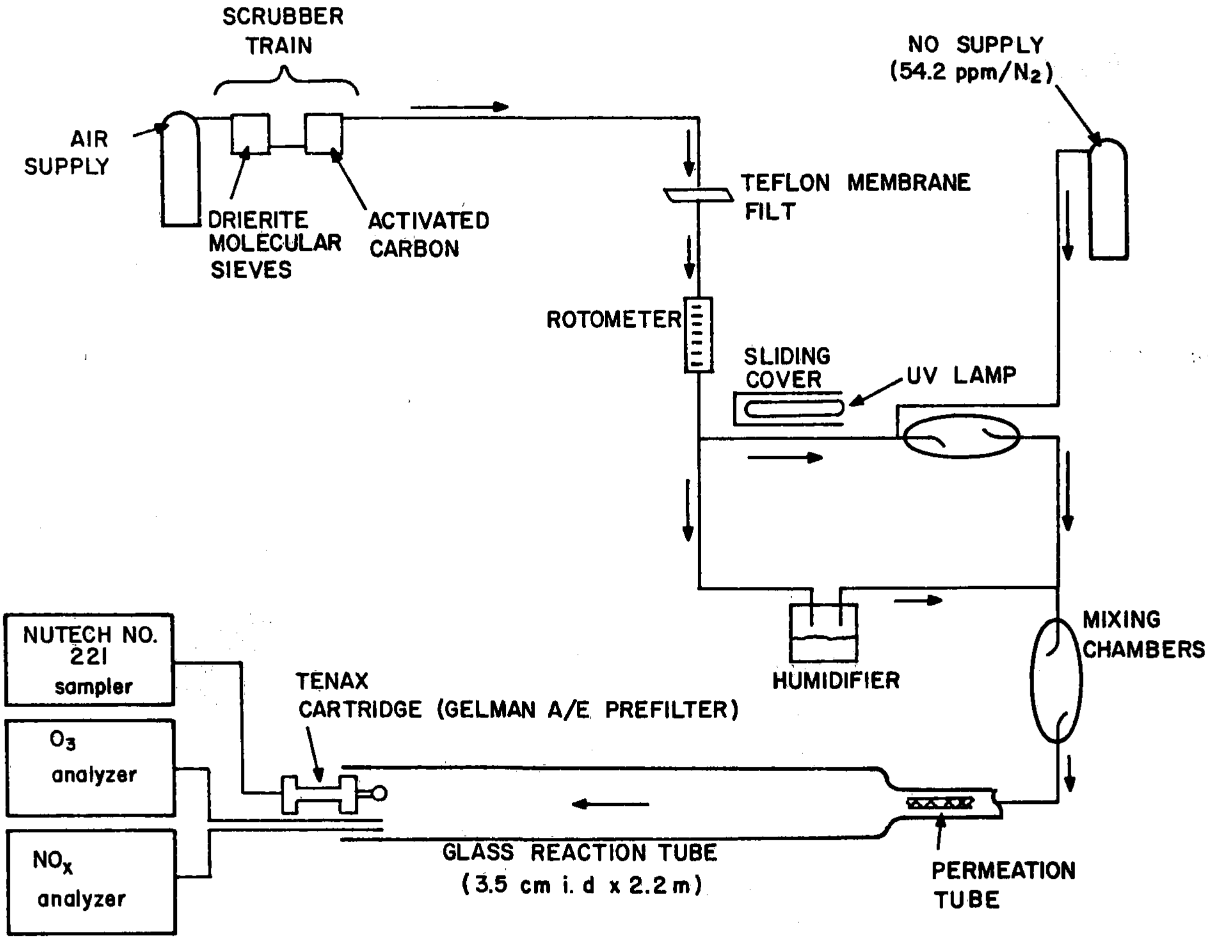

Figure 1. Schematic of instrumentation and devices for examining in situ formation of N-nitrosodimethylamine on Tenax GC cartridges.

sampling cartridges were preconditioned by heating to 275°C for 20 min under a He purge of 20-30 ml/min. After cooling in precleaned Kimax® culture tubes, the containers were sealed to prevent contamination of the cartridge.

Replicate samples and blanks were analyzed by glass capillary gc/ms/comp. Thermal desorption was used to transfer vapors from the cartridge sampler to the analytical system using a specially designed manifold.[5-7] In a typical thermal desorption cycle, a sampling cartridge was placed in the desorption chamber (250°C) and He gas was passed through the cartridge (ca. 20 ml/min) to purge the vapors into the liquid nitrogen cooled nickel capillary trap. After desorption (4 min), the six-port valve was rotated and the temperature on the capillary loop was rapidly raised (>10°C/min); the carrier gas introduced the vapors onto the capillary glc column.

A Varian MAT CH-7 glc/ms 620L computer system equipped with the inlet manifold was used for analyzing Tenax GC cartridges. The software provided reconstructed gas chromatograms and mass fragmentograms for a correlation between mass spectrum number and retention time. Operating parameters for the glc/ms/comp system are given in Table 1. A single stage glass jet separator interfaced the SCOT capillaries to the mass spectrometer.

The parent ions for $^{1}H_6$-DMN (m/e 74, I=100%) and $^{2}H_6$-DMN (m/e 80, I=100%) were selected for quantification (Fig. 2). Standard response curves for DMN were prepared by loading Tenax GC cartridges with concentrations of DMN from 100 pg to 2,000 ng followed by thermal desorption and analysis by glc/ms/comp.

RESULTS AND DISCUSSION

Laboratory experiments were conducted whereby Tenax GC cartridges (1.5 cm x 6.0 cm) were preloaded with dimethylamine (DMA) by passing through them nitrogen gas which contained a known quantity of DMA from a calibrated permeation tube ($^{1}H_6$-DMA or $^{2}H_6$-DMA). Each of these cartridges was used to sample a 10 liter volume of air containing known levels of NO, NO_2, O_3, and water. Then the cartridges were thermally desorbed and analyzed for $^{1}H_6$-DMN or $^{2}H_6$-DMN. The results are summarized in Table 2. One cartridge, preloaded (in absence of reactive gases) with $^{2}H_6$-DMA was submitted for gc/ms analysis (m/e 80) without further processing to determine the level of $^{2}H_6$-DMN present in the amine as a contaminant (Expt. No. 1). No $^{2}H_6$-DMN was found. Four experiments (Nos. 5-8) were run in which air with ~300 ppb NO

Table 1. OPERATING PARAMETERS FOR GLC/MS COMPUTER SYSTEM

Parameter	Setting
Inlet-manifold	
Desorption chamber	265-270°C
Valve	175°C
Capillary trap - minimum	-196°C
maximum	+175°C
Thermal desorption time	~4 min
Gas-liquid Chromatography	
DEGS glass SCOT (55 m)	70-205°C, 4°C/min
Carrier (He)	2.25 ml/min
Mass Spectrometry	
Single stage glass jet separator	220°C
Ion source vacuum	~2 x 10^{-6} Torr
Filament current	300 μA
Multiplier	5.5
Scan rate, automatic-cyclic	1 s/decade
Scan range	m/e 20 → 300

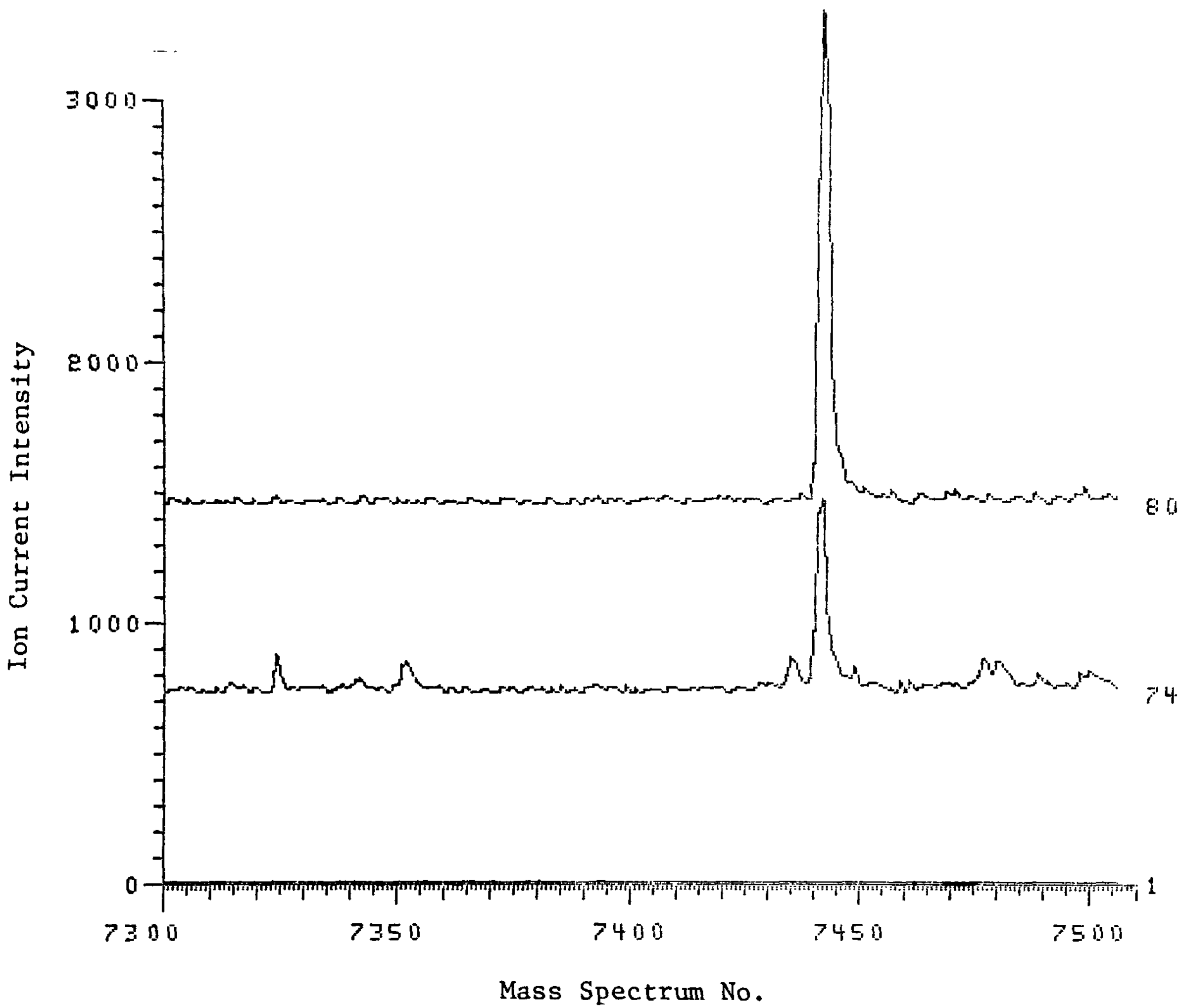

Figure 2. Mass fragmentograms for $^{1}H_6$-DMN (m/e 74) and $^{2}H_6$-DMN (m/e 80) obtained by glc/ms/comp (see Expt. No. 36, Table 3).

Table 2. EFFECT OF OZONE, NO, NO_2 AND DMA ON *IN SITU* FORMATION OF DMN

Experiment No.[a]	O_3 added (ppb)	O_3 excess (ppb)	NO_x (ppb)	NO (ppb)	NO_2 (ppb)	T°C	%RH	DMA (nM)/(liters)	DMN (nM)	% yield
1	0	0	0	0	0	25	–	202/10	0	0
2	0	0	500	500	0	25	50	202/10	0	0
3	0	0	500	500	0	25	90	202/0.151	0	0
4	80	0	500	420	80	25	50	202/10	0.18	0.089
5	200	0	500	300	200	25	50	202/10	0.32	0.158
6	200	0	510	310	200	24	67	202/0.151	0.14	0.069
7	210	0	490	280	210	27	10	202/10	0.12	0.059
8	210	0	530	320	210	27	10	202/0.151	0.65	0.322
9	510	10	530	30	500	25	50	202/10	0.54	0.267
10	479	9	515	45	470	26	90	202/0.151	0.92	0.455
11	550	50	540	40	500	26	10	202/10	0.12	0.059
12	489	9	520	40	480	27	10	202/0.151	1.46	0.723
13	650	150	500	0	500	26	50	202/10	0.86	0.426
14	640	140	500	0	500	27	90	202/0.151	1.24	0.614
15	650	150	500	0	500	26	10	202/10	0.93	0.460
16	640	140	500	0	500	27	10	202/0.151	1.46	0.723
17	482	2	540	60	480	24	50	404/0.42	0.58	0.144
18	680	180	500	0	500	24	50	404/0.42	0.25	0.062

(continued)

Table 2 (cont'd)

Experiment No.	O_3 added (ppb)	O_3 excess (ppb)	NO_x (ppb)	NO (ppb)	NO_2 (ppb)	T°C	%RH	DMA (nM)/liters	DMN (nM)	% yield
19	~1500	~1000	500	0	500	26	50	202/0.215	2.78	1.376
20	~2500	~500	~2000	0	~2000	26	50	202/0.215	1.16	0.574
21	~3000	~1000	~2000	0	~2000	26	50	202/0.215	1.04	0.515

[a] In all experiments a 1 ℓ/min sampling rate for 30 min was used.

and ~200 ppb NO_2 was sampled. Two of these (Nos. 7 & 8) were run with low humidity air. In two cases (Nos. 6 & 8) a very small volume of nitrogen was used to preload the $^2H_6$-DMA so that it would be confined to a relatively narrow zone in the cartridge bed. In the other two cases (Nos. 5 & 7) a 10 liter volume of nitrogen was used to preload the $^2H_6$-DMA so that it was distributed in a much broader zone in the sorbent bed. The amounts of $^2H_6$-DMN formed did not fall into any definite pattern. Except for Experiment No. 8 they are about the same as the amount formed in Experiment No. 4. The amount of ozone added to the air stream was increased so that most of the NO was converted to NO_2 leaving small residual amounts of NO and ozone (Nos. 9-12). This resulted in formation of increased quantities of $^2H_6$-DMN in three of the experiments. More $^2H_6$-DMN was formed on the cartridges which had been loaded with $^2H_6$-DMN confined as a small narrow zone (Nos. 10 & 12) than was formed on cartridges loaded with the same amount of $^2H_6$-DMA in a larger zone (Nos. 9 & 11). The ozone was further increased so that there was a substantial excess of it at the end of the flow tube and all of the NO was converted to NO_2 (Nos. 13-16). Again, the amount of $^2H_6$-DMN produced was generally larger and more was produced on the cartridges which were loaded with concentrated zones of $^2H_6$-DMA (Nos. 14 & 16). Doubling the amount of $^2H_6$-DMA on the cartridge did not result in any increase in the amount of $^2H_6$-DMN formed (Nos. 17 & 18). It was expected that a high concentration of DMA in a small volume of sorbent bed would produce more DMN than the same amount of DMA distributed evenly through the entire bed.

There was no clear indication that the level of relative humidity had any significant effect on the results. This was not surprising in view of the very large excess of water over the concentrations of other potential reactants at even the lowest levels of relative humidity. A constant, convenient level of 50% relative humidity was adopted for further experiments.

The concentrations of NO_x and ozone in these experiments were at levels approximating the highest found in polluted air. In order to test the possible effects of conditions that might prevail at extremely elevated levels of NO_x in plumes coming from a point source, three experiments (Nos. 19-21) were conducted at much higher NO_x and ozone concentrations. There was a substantial increase in the amount of DMN formed when the ozone level was increased (No. 19), but no indication of any increase from higher levels of NO_2 (Nos. 21 & 21).

The principal result of this series of experiments is that under extreme conditions of NO_2 and ozone pollution the conversion of 202 nM of DMA on a Tenax cartridge was small (less than 1%). However it must be remembered that the breakthrough volumes of DMA were not exceeded in these experiments. Furthermore, the breakthrough volume of DMN is much larger than that of DMA. If a volume of polluted air larger than the breakthrough volume of DMA had passed through the cartridge, presumably even more of the DMA would have been converted, and the resulting DMN would have been retained on the cartridge. Thus it would be misleading to attempt to extrapolate these results to higher sample volumes. On the otherhand, the concentrations of DMA used to load the cartridges (0.5-33 ppm) were quite large, approximating the levels that could be found in ambient air in the immediate vicinity of a primary source. The results of this study suggest that the efficiency of conversion of DMA to DMN would be greatly dependent on the concentration of DMA <u>in the sorbent bed</u>. This means that more DMN might be formed on the cartridge if the DMA concentration fluctuated during the sampling period than if the same amount of DMA were drawn into the cartridge at a constant, low concentration.

The presence of NO_2 was clearly necessary for formation of DMN. This suggests that the mechanism was formation of nitrous acid from NO, NO_2 and water with subsequent reaction between nitrous acid and DMA to form DMN. The smaller yields of DMN in Experiment Nos. 17, 18, 20 and 21 in which extremely high reactants levels were used were surprising.

A permeation tube containing $^2H_6$-DMA was placed in the upstream end of the reaction tube (Fig. 1) so that the air passing down the tube would carry with it a very low level of $^2H_6$-DMA. Various concentrations of NO, NO_2 and ozone were introduced into the air stream and samples of NO_2, ozone and organic vapors were taken at the downstream end of the reaction tube. The results are summarized in Table 3. In one experiment (No. 22) neither NO or ozone was added to the air, and no $^2H_6$-DMN was produced. Air containing 500 ppb NO without ozone was passed through the tube, and again no $^2H_6$-DMN was found (No. 23). However, substantial quantities of $^2H_6$-DMN, somewhat larger than those formed in the comparable <u>in situ</u> experiments, were found when

Table 3. FORMATION OF DMN FROM OZONE, NO, NO_2 AND DMN IN A FLOW TUBE

Experiment No.	O_3 added (ppb)	O_3 excess (ppb)	NO_x (ppb)	NO (ppb)	NO_2 (ppb)	T°C	%RH	[1] H_6-DMA (nM)/(liters)	[2] H_6-DMA (nM)/(liters)	DMN (nM)	DMN-d_6 (nM)	% yield
22	0	-	0	0	0	25	50	-	202/15.6	-	0	0
23	0	-	500	500	0	24	50	-	202/15.6	-	0	0
24	190	0	500	340	190	24	50	-	202/15.6	-	1.14	0.564
25	487	7	520	40	480	25	50	-	202/15.6	-	~3.78	1.871
26	680	180	500	0	500	25	50	-	202/15.6	-	1.93	0.955
27[a]	0	-	500	500	0	26	50	-	202/15.6	-	0.140	0.069
28[a]	220	0	510	290	220	27	50	-	202/15.6	-	0.6	0.297
29[a]	475	15	510	50	460	26	50	-	202/15.6	-	1.82	0.901
30[a]	680	180	500	0	500	26	50	-	202/15.6	-	0.34	0.168
31[b]	210	0	530	320	210	26	50	-	202/15.6	-	0.22	0.109
												Ratio: (Formed in Tube): (Formed on Cartridge)
32	690	190	500	0	500	26	50	392/0.422[c]	~388/30	2.67	8.63	3.23
33	690	190	500	0	500	26	50	392/0.422[c]	~420/32.5	2.67	8.24	3.09
34	690	190	500	0	500	26	50	392/0.422[c]	~388/30	2.44	7.06	2.89
35	700	200	500	0	500	22	50	~140/30	140/0.125[c]	lost	lost	
36	700	200	500	0	500	22	50	~140/30	140/0.125[c]	4.44	1.96	2.27

[a] Irradiated with UV lamp, 22 cm zone centered 1.7 m from downstream end of tube, see Fig. 1.

[b] Irradiation zone centered 0.6 cm from downstream end of tube.

[c] Preloaded on cartridge.

ozone was added to the air stream (Nos. 24-26). These experiments were conducted with the reaction tube covered with aluminum foil. In order to test the effect of ultra-violet radiation on formation of DMN in the flow tube, a 22 cm length near the upstream end was uncovered and irradiated with a Sylvania 110V, 275W sunlamp (Nos. 27-30). The flow tube was constructed of 40 mm o.d. standard wall (~2 mm) Pyrex® tubing. Light penetrates this thickness of Pyrex with 50% transmission at $\lambda = 3170 Å$.[13] Oxygen and NO photolyses occur only at lower wavelengths than could have penetrated the tube, but NO_2 and O_3 are photolyzed to produce oxygen atoms under these conditions, so that formation of DMN by a free radical mechanism might be possible. However, some $^2H_6$-DMN was found even in the absence of added ozone. It could have formed in a photochemical reaction, but it was more likely DMN formed in previous runs was stripped from the walls of the tube as a result of its being heated by the lamp. Regardless whether DMN is formed by a second (photochemical) mechanism, it appears significant that in general less of it was found when part of the flow tube was exposed to ultra-violet light, especially when the irradiation was done near the downstream end (No. 31). This indicates that the rate of DMN photolysis must be more rapid than the rates of its formation in any photochemical processes which might occur in the flow tube under the prevailing conditions. In order to distinguish between DMN formed <u>in situ</u> by conversion of DMA adsorbed on the Tenax cartridge and DMN formed from DMA flowing through the tube, a series of experiments was carried out in which air containing $^2H_6$-DMA, NO_x, and ozone was passed through the flow tube and sampled with a cartridge which had been preloaded with $^1H_6$-DMA (Nos. 32-34). Approximately three times as much $^2H_6$-DMN as $^1H_6$-DMA was found. This experiment was repeated in reverse fashion, with $^1H_6$-DMA being collected on a cartridge preloaded with $^2H_6$-DMA (Nos. 35 and 36), and the amount of $^1H_6$-DMN collected was more than double the $^2H_6$-DMA formed on the cartridge.

To determine the extent to which DMN that had formed in the reaction tube might have adhered to the glass wall, samples were taken after the flow tube experiments had been completed and the permeation tube had been removed. In preparation, the reaction tube was cleaned by heating it from ambient to 75°C over a period of 30 minutes while passing 5 ℓ/min of air through it. During this time a 30 ℓ sample was taken on a Tenax cartridge at the downstream end of the tube. $^{2}H_6$-Dimethylamine had last been passed through the tube eight days before. During the intervening time the tube had been used for several other experiments. When the cartridge was desorbed and analyzed for $^{2}H_6$-DMN, 7.84 nM were found. A second 30 ℓ sample was then taken (30 min sampling period) while the tube was maintained at 75°C to confirm that it had been purged free of $^{2}H_6$-DMN and none was found. The tube was cooled to room temperature and $^{2}H_6$-DMA, NO_2 and ozone was passed through it for 1 hr. Following this a 5 ℓ/min stream of clean air was again passed for 48 min while the temperature was raised to 75°C and a 45 ℓ sample was collected on a Tenax cartridge. On this cartridge only 0.20 nM of $^{2}H_6$-DMN were found. The amount of DMN that was retained during any of the experiments in Table 3 was probably small, since only a small quantity of DMN was recovered by stripping immediately after passing DMA through the tube for an hour. Since a much larger quantity of DMN was accumulated on the tube during four days of passing D_6-DMN through it, and since a substantial amount remained on the tube for eight days afterward, it would appear that desorption of DMN from a glass surface is a very slow process at room temperature. This means that (1) only a small amount of DMN is lost during the course of an experiment by adsorption on the tube, and (2) desorption of DMN from the tube at ambient temperatures is too slow to significantly affect the results of subsequent experiments. This further implies that either most of the DMN is formed in homogeneous, gas-phase reactions or that heterogeneous formation of a molecule of DMN does not usually result in its adsorption. It was apparent that formation of DMN from NO_2, ozone, and DMA was less efficient in a Tenax GC sorbent bed that it was in a glass flow tube.

Since no distinction could be made between homogeneous gas phase reactions occurring in the flow tube and heterogeneous reactions taking place on its walls, additional experiments were necessary. Also, a precise control of the permeation rate for $^{1}H_6$-DMA and $^{2}H_6$-DMA was instituted through a slight modification of the apparatus (Fig. 3) to permit thermostatic control of the environment of the permeation tube. This was done by passing the nitrogen carrier gas from a permeation chamber (30°C) down the axis of the flow tube through 316 stainless steel 1/4 in o.d. tubing to the delivery point, where it passed into the air stream through a coarse Pyrex® frit

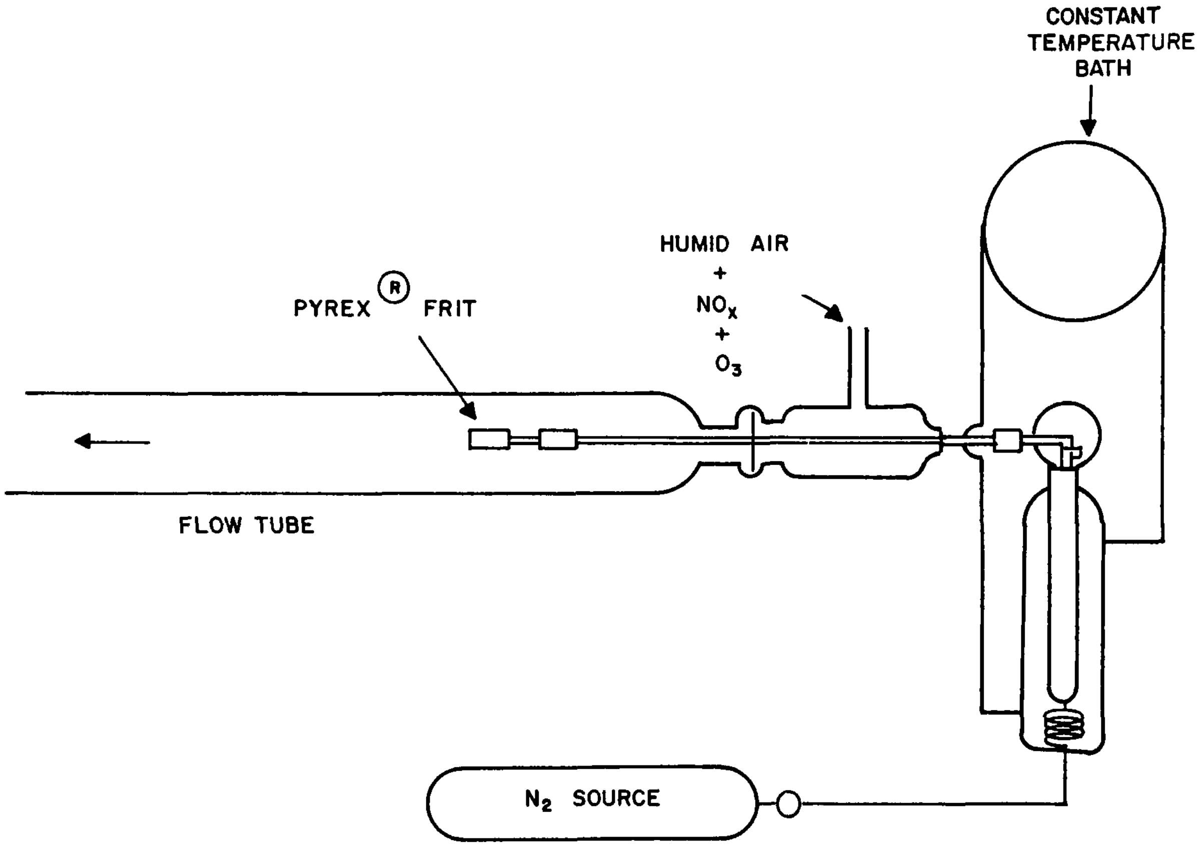

Figure 3. Thermostatically controlled chamber for permeation tube: modified flow tube for *in situ* reaction experiments.

(Fig. 3). Between experiments the walls of the flow tube were heated to 60°C for 1 hr while purging with air free of NO_x, ozone, and DMA to remove residual DMN from previous reactions.

To further examine the possibility of conversion of DMA to DMN on the sorbent itself and whether the same conversion might not occur on the walls of a sampler inlet tube, or even in the vapor phase in air, an additional series of experiments was conducted. Cartridges preloaded with DMA in the absence of reactive gases were used to sample air containing oxides of nitrogen, ozone and 151 ppb of $^{2}H_6$-DMA. The $^{1}H_6$-DMN could be formed only on the cartridge while $^{2}H_6$-DMN could form in the flow tube and on the cartridge. These results are shown in Table 4. Each experiment was also repeated in reverse fashion with the cartridges being preloaded with 202 nM of $^{2}H_6$-DMA and used to sample 131 ppb of $^{1}H_6$-DMA in the reaction tube. The mole ratio of DMN formed from the amine which passed down the tube to the DMN formed from the amine preloaded on the cartridge was consistently larger than one. This was interpreted to mean that some of the DMA must have been converted to DMN before reaching the sorbent bed (Table 4).

The length of the flow tube was increased from 15.8 cm to 130 cm without producing any significant change in the amount of DMN formed in the tube. These results suggested that the reaction occurred on a surface in the inlet of the cartridge (Table 4). Heating the flow tube and inlet to 70°C produced a substantial increase in the conversion of DMA to DMN (Expt. No. JD1).

To distinguish between homogeneous and heterogeneous reactions the flow tube was replaced with one having a larger diameter. The flow rate of air was increased to maintain the same linear velocity (520 cm/sec) as in the previous experiments. The upstream DMA permeation tube was replaced with one having a higher permeation rate in an attempt to achieve the same DMA concentration in the reaction tube. The new permeation tube provided a DMA concentration of 466 ppb or 3.5 times that which was used in the smaller i.d. flow tube. This would be expected to lead to a three-fold increase in the production of DMN in the flow tube if it were formed in a homogeneous gas-phase reaction. Also, the mole ratio of DMN formed in the tube and cartridge to the DMN formed only on the cartridge would become substantially larger than 4, since it was already larger than 1 before the change was

Table 4. EFFECT OF OZONE, NO, NO_2 AND DMA ON <u>IN SITU</u> FORMATION OF DMN

Experiment No.	O_3 added (ppb)	O_3 excess (ppb)	NO_x (ppb)	NO (ppb)	NO_2 (ppb)	T°C	Flow rate: Tube bore (liter/min)/(mm)	$^1H_6$-DMA (nM)/(liters)	$^2H_6$-DMA (nM)/(liters)	$^1H_6$-DMN (nm)	$^2H_6$-DMN (nM)	DMN formed (%)	Ratio $^1H_6$-DMN/$^2H_6$-DMN
ON1[a]	-	-	-	-	-	-			404/0.312[b]	0	0.017		
ON2	685	125	560	0	560	24	5/35	0/50	-	0	0.017	0.004	
ON3	685	125	560	0	560	24	5/35	0/10	202/0.156[b]	0	0.137	0.067	
ON4	685	125	560	0	560	24	5/35	0/30	202/0.156[b]	0	0.217	0.107	
ON5	685	125	560	0	560	24	5/35	0/50	202/0.156[b]	0	0.156	0.077	
CN1	265	45	220	0	220	23	5/35	0/10	202/0.156[b]	0	0.093	0.046	
CN2	270	50	220	0	220	23	5/35	0/30.3	202/0.156[b]	0	0.156	0.107	
CN3	270	50	220	0	220	24	5/35	0/10	404/0.312[b]	0	0.156	0.038	
CN4	270	50	220	0	220	24	5/35	0/30	404/0.312[b]	0	0.156	0.038	
CN5	920	180	740	0	740	25	5/35	0/10	202/0.156[b]	0	0.225	0.111	
CN6	920	180	740	0	740	25	5/35	0/30	202/0.156[b]	0	0.150	0.074	
CN7	905	185	720	0	720	26	5/35	0/10	404/0.312[b]	0	0.287	0.071	
CN8	905	185	720	0	720	26	5/35	0/30	404/0.312[b]	0	0.212	0.052	
HDT	0	0	0	0	0	26	5/35	202/37.6[c]	0/0	0			
HD1,2	625	95	530	0	530	25	5/35	202/37.6[c]	202/0.156[b]	0.310±0.10	0.212±0.05		1.46
HD4[a]	565	20	560	15	545	25	5/35	202/37.6[c]	202/0.156[b]	0.500	0.400		1.25
HD5	570	25	555	10	545	25	5/35	202/37.6[c]	202/0.156[b]	0.405	0.312		1.29
HD6	570	25	555	10	545	25	5/35	202/37.6[c]	202/0.156[b]	0.472	0.425		1.11
HD7[a]	620	105	515	0	515	27	5/35	202/0.176[b]	202/32.8[c]	0.189	0.437		0.43
HDC[a]	0	0	0	0	0	22	5/35	0/0	202/32.8[c]	0	0		
HD10.11	532	2	590	60	530	23	5/35	202/0.176[b]	202/32.8[c]	0.081±0.04	0.412±0.15		0.196

Table 4 (cont'd)

Experiment No.	O_3 added (ppb)	O_3 excess (ppb)	NO_x (ppb)	NO (ppb)	NO_2 (ppb)	T°C	Flow rate (liter/min)/ Tube bore (mm)	$^1H_6$-DMA (nM)/ (liters)	$^2H_6$-DMA (nM)/ (liters)	$^1H_6$-DMN (nm)	$^2H_6$-DMN (nm)	DMN formed (%)	Ratio $^1H_6$-DMN/$^2H_6$-DMN
LD1[a]	630	90	540	0	540	21	5/35	202/37.6[d]	202/0.156[b]	0.256	0.200		1.28
LD4[a]	512	7	535	30	505	23	5/35	202/37.6[d]	202/0.156[b]	0	0		
LD7[a]	635	90	545	0	545	24	5/35	202/0.176[b]	202/32.8[d]	0.189	0.287		0.66
LD10[a]	487	7	510	30	480	23	5/35	202/0.176[b]	202/32.8[d]	0.148	0.312		0.47
JD1[a,e]	469	4	500	35	465	24	5/35	202/0.176[b]	202/32.8[d]	0.243	0.625		0.38
BT1	228	3	485	260	225	22	23.6/76	202/10.6[c]	202/0.156[b]	0.391	0.137		2.85
BT4[a]	233	3	500	270	230	23	23.6/76	202/10.6[d]	202/0.156[b]	0.256	0.100		2.56
BT7[a]	242	2	515	275	240	23	23.6/76	202/10.6[f]	202/0.156[b]	0.391	0.125		3.13

[a]Flow tube heat purged 1 hour to 75°C before this run.

[b]Preloaded on cartridge in the absence of reactive gases.

[c]Amine delivered to air stream 15.8 cm from flow tube exit.

[d]Amine delivered to air stream 1.3 m from flow tube exit.

[e]Flow tube maintained at 70°C during this run.

[f]Amine delivered to air stream 70 cm from flow tube exit.

made. If the reaction were heterogeneous, then less DMN would be produced in the tube since the surface to volume ratio was decreased from 1.14 to 0.53 in going from the smaller to the larger tube. This would cause the mole ratio to decrease since the amount of amine from the tube drawn into the cartridge (1 ℓ/min) was kept constant.

The result actually obtained was a less than three-fold increase in the mole ratio (Table 4). Furthermore, the ratio was substantially independent of the length of the tube. This means that while some conversion of amine may have occurred in the flow tube, most of the DMN formation happened in front of the cartridge and it must have taken place on the glass fiber filter and/or the glass fiber plug which was used to anchor the Tenax GC in the cartridge. However, the percent conversion of DMA to DMN was in all cases very small (Table 4).

The results obtained in this study show that it is important to obtain simultaneous data on atmospheric concentrations of NO_x, O_3, and amines when sampling for nitrosoamines. A control such as the addition of $^{2}H_6$-DMA to the sampling stream should be used to determine those environmental factors which may contribute to in situ DMN formation. This would be especially necessary to any attempt to show that nitrosoamines had been formed in the atmosphere from reactants.

An examination for other potential in situ reactions on Tenax GC was also made. In all of the experiments previously described (particularly those using ~2 ppm NO_x) there was no indication of the formation of 2,6-diphenyl-p-quinone which has been reported for more corrosive atmospheres such as stationary source sampling.(14) These observations were consistent with our previous report.(4) Nevertheless, we have attempted to precisely define in this investigation the sampling conditions for which representative atmospheric samples may be procured and the limitations of the devices used, in particular the glass fiber filter. We believe that it is important to fully characterize any new sampling device prior to its widespread usage.

SECTION 6

PERMEATION SYSTEM FOR SYNTHESIZING AIR/ORGANIC VAPOR MIXTURE FOR CALIBRATING INSTRUMENTS

The four general factors which affect the sensitivity of an analytical procedure for the analysis of carcinogenic vapors in ambient air have previously been discussed.(4) A procedure for the calibration of instruments for quantitative analysis must systematically account for these factors. It is difficult to deliver aliquots of concentrations (ppt) near the lower detection limits so that calibration plots often are needed to be extrapolated out of their region of validity. Because of the long-term variation in sensitivity of the analytical system as well as the variation of the system's sensitivity to different chemical classes, numerous compounds need to be used for calibration. Sensitivities of vapors relative to standard compounds in the gc/ms system may be measured and have previously been reported for several selected compounds.

Sampling of air to which known quantities of vapors have been added would account for the errors inherent in collection and analysis procedures, but such low concentrations are subject to rapid depletion by adsorption onto surfaces of vessels used for providing calibration standards. This problem can be circumvented by the use of permeation or diffusion tubes which at a controlled temperature emit a vapor at a constant lower rate. The concept thus utilizes a stream of air or N_2 passing over a group of permeation or diffusion tubes in a thermostated chamber which picks up a low concentration of vapor from each tube. Surfaces in the flow system become equilibrated with these compounds so that they can be delivered from the system at the same rate that they were emitted by the permeation or diffusion tubes. The permeation rate can be determined gravimetrically by weighing each tube at periodic intervals.

A permeation system for synthesizing air/organic vapor mixtures for the calibration of instruments was designed and previously reported.(4) The preparation of a series of permeation tubes for calibrating the gc/ms/comp system for analysis of field samples has also been reported.[4] Permeation rates (g/min/cm) ranged from 1 x 10^{-6} to ~1 x 10^{-10} using the plastic materials TFE, FEP and polyethylene. It had also previously been determined that the permeation rate was highly dependent on the vapor pressure, the chemical properties of the substance and the plastic material chosen for the preparation of permeation tube.[4] The use of permeation tubes appears to be a feasible technique for synthesizing accurate and reproducible air/organic vapor mixtures.

The previously reported permeation flow system was modified to incorporate improvements which will be discussed in this section. The performance of this permeation flow system for accuracy and reproducibility to deliver known concentrations of air/vapor mixtures to cartridges was tested. A number of permeation tubes containing non-polar, semi-polar and polar organics for synthesizing an array of air/vapor mixtures were examined. Linear regression analysis was used to determine the permeation rate for each of the organic vapors.

The performance of several permeation tubes over an extended period of time was examined as well as the effect of cold storage on their stability of permeation rate.

EXPERIMENTAL

The design flow system is depicted in Figure 4. The components were connected with 1/8" o.d. Teflon tubing. The Pyrex permeation tube (25 mm i.d. x 44 cm in length) was enclosed in the jacket through which an ethanol/water mixture was circulated from a constant temperature bath (Haake Model FE circulating pump and thermostated heater coupled with a Haake Model C11 refrigeration unit). The carrier gas (N_2 or air) from a lecture bottle was regulated with a Matheson 8-588D regulator and passed through a scrubber (charcoal). A low pressure regulator was placed in line between the carrier gas supply and the permeation chamber in order to regulate constant upstream and downstream pressures to provide a uniform flow. The low pressure regulator was a Moore 40-2 regulator, with a Matheson 63-3101 pressure gauge placed between the Moore regulator and the permeation chamber. Before entering the permeation chamber, the carrier gas was passed through a temperature equilibration coil which was ~4 ml i.d. x 1 m in length. Upon

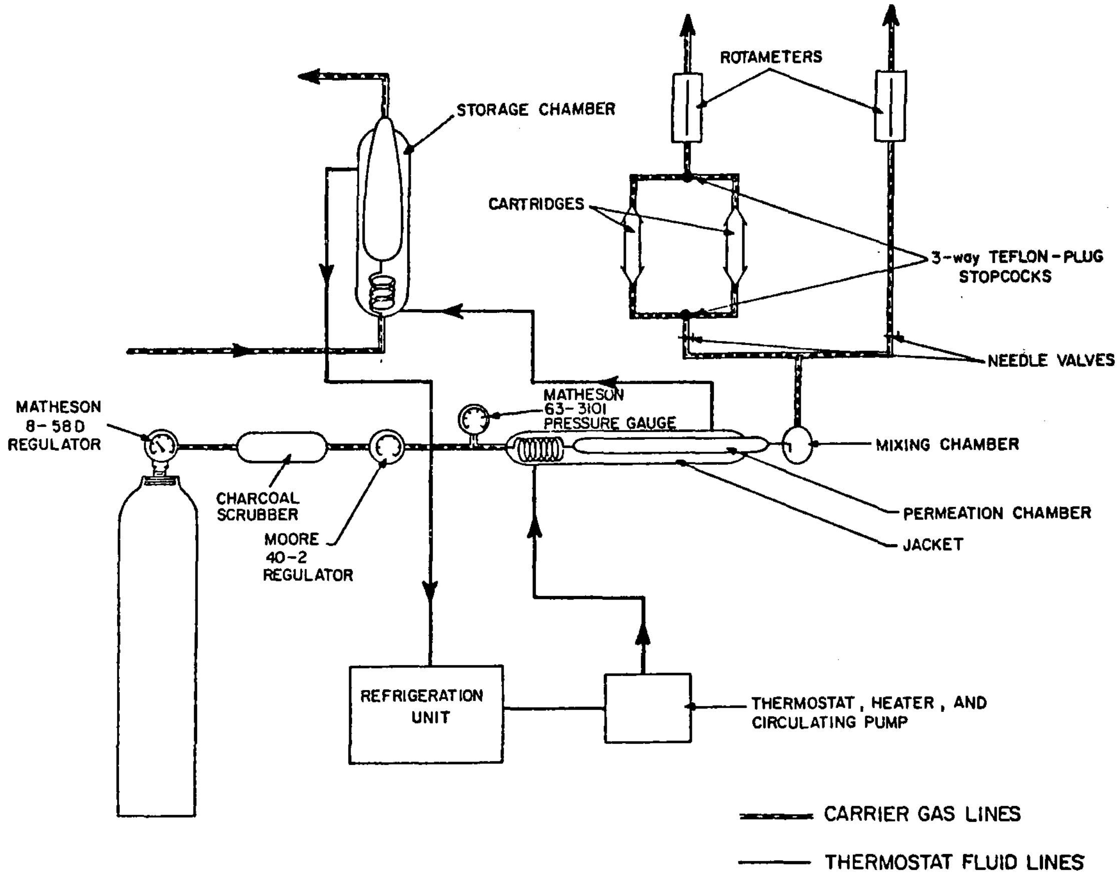

Figure 4. Schematic of permeation tube flow system for synthesizing air/vapor mixtures.

leaving the chamber, the carrier gas/vapor stream passed through a 100 ml mixing chamber before being split. The air/vapor mixture was split and regulated between two parallel lines by needle valves. On one leg of the split system, the air/vapor mixture could be directed through two additional legs via a three-way teflon plug stopcock to deliver vapors to Tenax GC cartridges in parallel. The effluents from the cartridges were monitored with a rotometer (Brooks Instrument Div., Emerson Electric Co., R-2-15-C) containing a glass float. The second leg of the system served as a method of by-passing excessive flow. The second leg of the split system was also monitored with a rotometer (Brooks Model R-2-15-D) with a Tantalum float. A type 3155 tube size R-2-15-AAA rotometer was used in each branch of the flow system. The reproducibility of the rotometer which measured flow through the cartridge and excess flow branch has previously been described.(4)

A large permeation chamber connected to the constant temperature bath was flushed continuously by a 100 ml/min N_2 stream and was used to store permeation tubes. This permitted calibration of the tubes without interfering with the operation of the flow system and the immediate use of the stored tubes without waiting for equilibration of the permeation rate.

This system could be used either to load sorbent cartridges or to deliver vapors to a stream of air entering a cartridge sampler. A cartridge holder consisting of two Beckman teflon reducing unions (No. 830511) was used for holding sampling cartridges. The upstream union was fitted with a teflon plug which had a 2 mm i.d. bore to minimize dead volume.

Permeation tubes for several typical compounds were prepared for assessing their long-term storage stability and for the calibration of instruments. They were made of ~7-15 cm lengths of plastic tubing. Three kinds of tubing were used: polyethylene (PE, 0.25 in o.d. x 0.19 in i.d.) and two types of teflon tetrafluoroethylene (TFE) and fluorinated ethylene and propylene (FEP) were used. The ends were closed with glass plugs secured by stainless steel ferrules.(4) This technique was used for the preparation of all of the permeation tubes described in this section. The plastic tubing and the end plugs withstood the pressure of compounds as volatile as dimethylamine at ambient temperatures.

RESULTS AND DISCUSSION

Performance of a Gas Flow System for Delivering Vapors from Permeation Tubes

Previously a flow system was described which consisted of a stream of N_2 gas delivered from a Matheson 8-580 regulator through a Hoke 20-turn needle valve to a thermostated chamber which could contain one or more permeation tubes.[4] In this system, the effluent stream from the chamber was split by a pair of Hoke 20-turn needle valves and part of it was delivered to a sampling cartridge while the rest was delivered to a flame ionization detector (FID). The flow rate in each branch was measured with a calibrated rotometer (Brooks Instrument Model 1355 with R-2-15-AAA tube and a glass float). The FID was used to evaluate the stability of the rate of delivery of vapors from the system. The FID-system could not be used to deliver vapors to sampling cartridges because the back pressure on the rotometer due to flow resistance of the flame tip resulted in some error in flow rate measurements above 35 ml/min when the FID was connected to the system. During the previous studies, observations of the FID signal during operation of the flow system revealed that: (1) small variation in pressure supplied by the 8-580 regulator were amplified in the branch of the flow system receiving the smaller part of the flow; (2) it was very difficult to establish and maintain a stable pressure in the system as exhibited by the sinusoidal wave in the FID signal; (3) removal and replacement of cartridges disturbed the pressure and therefore the flow rates in the system. Occasionally this disturbance as indicated by the FID signal remained evident during a substantial fraction of the sampling period. Thus, appropriate modifications to the system were made as shown in Figure 4 and their effects on performance as evaluated by observation of the FID signal are reported here. The system was modified to include an oil manometer which replaced a Matheson 63-3101 pressure gauge (0-15" water). A Moore Products Co. model 40-2 low pressure regulator was used to supply carrier gas to the system as shown in Figure 4. Parallel cartridge holders were installed and connected to the system by a pair of 2 mm teflon plug three-way stopcocks[4] which permitted removal and insertion of cartridges without interrupting the carrier gas flow.

For comparison, an initial series of experiments (Table 5) was carried out using only the 8-580 regulator with needle valves. Then a series of

Table 5. EFFECT OF METHOD OF CARRIER GAS DELIVERY ON STABILITY OF THE LEVELS OF VAPORS DELIVERED BY A FLOW SYSTEM CONTAINING PERMEATION TUBES

Method of Nitrogen Carrier Gas Supply	Chamber Pressure (in H_2O)	Flow Rates (ml/min) Discarded	To FID	Signal Level (Arbitrary Units)	Noise (% Signal)	Drift (% Signal)	Duration of Observation (min)
Matheson 8-580 regulator (7 psig) to a Hoke 20-turn needle valve[a]	9.2	0	59.8	428.0	2.2	1.5	54
	1.9	29.8	29.6	160.0	1.0	4.0	37
	1.9	44.8	14.8	30.0	1.3	6.0	69
	1.8	49.5	9.5	20.8	1.3	3.8	82
Matheson 8-580 regulator (20 psig) to a Hoke 20-turn needle valve followed by 0.8 m of 0.009 in stainless steel capillary[a]	2.0	0	56.7	483.2	0.7	2.6	70
	1.9	29.6	28.4	183.4	1.0	8.0	52
	2.0	44.7	14.4	20.2	2.0	7.5	39
	2.1	49.6	9.3	9.7	2.1	6.2	24
Matheson 8-580 regulator (20 psig) to a Moore 40-2 regulator (15" H_2O) followed by a Hoke 20-turn needle valve[a]	2.0	0	57.2	499.2	0.9	2.6	20
	2.05	30.1	29.4	190.4	1.9	9.6	28
	2.0	44.8	15.1	33.0	1.2	7.4	72
	2.0	52[b]	9.1	20.4	0.8	2.9	38
Matheson 8-580 regulator (20 psig) to a Moore 40-2 regulator set to permeation chamber pressure[a]	2.0	0	59.4	512.0	0.6	1.9	61
	2.0	30.0	29.8	211.2	0.6	2.4	54
	2.0	44.8	15.0	33.3	1.2	4.1	90
	2.0	49.7	9.2	20.2	1.0	3.4	190

(continued)

Table 5 (cont'd)

Method of Nitrogen Carrier Gas Supply	Chamber Pressure (in H_2O)	Flow Rates (ml/min) Discarded	To FID	Signal Level (Arbitrary Units)	Noise (% Signal)	Drift (% Signal)	Duration of Observation (min)
As above[c]	1.95	0	61.2	1546.0	0.8	3.6	65
	2.0	29.1	29.9	634.9	1.0	2.4	60
	2.0	45.0	15.6	112.8	0.7	2.6	47
	2.0	49.5	9.0	70.2	0.4	3.2	104
	2.0	49.7	6.3	54.8	1.2	4.4	109
As above[d]	5.0	0	58.8	675.2	1.1	2.8	44
	5.0	29.0	30.3	271.2	1.2	6.5	270
	5.0	45.3	15.0	46.7	0.7	3.2	43
	5.0	50.6	9.9	33.4	1.0	1.9	38

[a]Permeation tubes used were benzene (2.34×10^{-7} g/min), toluene (1.12×10^{-7} g/min), and benzene-d_6 (1.68×10^{-7} g/min).

[b]Estimated. Flow rate exceeded range of rotameter.

[c]Permeation tubes used were acetone (1.67×10^{-7} g/min), chlorobenzene (1.12×10^{-7} g/min), and 2-butanone (1.76×10^{-6} g/min).

[d]Permeation tubes used were acetone (1.67×10^{-7} g/min) and chlorobenzene (1.12×10^{-7} g/min).

experiments was run in which the 8-580 regulator and needle valve were augmented by a capillary flow resistor. A third series of experiments was run in which the 8-580 regulator supplied pressure to the 40-2 low pressure regulator and the flow rate from it to the permeation chamber was regulated by a needle valve. Finally a series of experiments was run in which the 40-2 regulator was used to set the pressure directly in the permeation chamber with the flow rates being controlled by the needle valves which were used to split the flow. In this series of experiments, the permeation tubes containing benzene, benzene-d_6 and toluene were employed.

Performance of the flow system was evaluated in terms of stability of the signal from the FID with respect to two criteria: "noise" and "drift". Noise was defined as variation in signal level over a period of 15 sec or less and it consisted substantially of oscillations about the mean signal level. It was expressed as a percentage of the lowest observed signal level. Part of the noise originated in the FID electrometer, but some of it also originated in the flow system. Drift consisted of variations in signal level over a period exceeding 15 sec. It also was expressed as a percentage of the lowest observed signal level. It did not generally take the form of a oscillation and apparently resulted most from variation in flow rate although other instrumental sources of signal drift were possible. The lengths of observations were recorded because a long period of observation was a more stringent test of signal stability than a short one. For each series of experiments, several different flow rates to the branches of the system were used.

The first series of runs using a 8-580 regulator with needle valve gave results substantially in agreement with those obtained earlier under these conditions.[4] There was up to 6% drift in the signal (Table 5). It was evident that much of this drift resulted from pressure instability due to the use of the combination of three needle valves to set flow rates. This instability increased with pressure and had resulted in the conclusion reached previously that it would be impractical to operate the flow system at pressures above 0.17 psi (4.7" water). Another series of experiments were carried out at low pressure (1.9" water) and time was taken to permit the pressure to equilibrate. Use of pressure gauge rather than oil manometer permitted more accurate observation of pressure equilibration.

A series of runs was carried out using the 8-580 regulator with needle valve followed by a 0.8 m of 0.09 in i.d. stainless steel capillary. The purpose of the additional flow resistor was to dampen fluctuations in the pressure output of the 8-580 regulator to produce a more stable flow rate. However, it turned out to be extremely difficult to set a predetermined chamber pressure with this arrangement. The noise level of the FID signal was reduced only if all the flow was to the FID. Due to the decrease in flow stability, the signal drift was increased.

The capillary flow resistor was removed and the Moore Products Co. Model 40-2 low pressure regulator was inserted between the 8-580 regulator and the needle valve. It was set to 15" water pressure for output pressure and the flow rate was regulated with the needle valve. A slight reduction in noise resulted, but drift was unaffected.

The 40-2 regulator was placed immediately upstream of the permeation chamber with no valve or other flow resistor between it and the chamber. It was used to set the pressure in the chamber and the flow rates were controlled only by the needle valves which were used to split the flow (Fig. 4). There was a slight decrease in noise and signal drift was reduced. Some of the percentages of signal drift recorded in Table 5 were slightly higher for this arrangement than for others, but the duration of observation was also much longer. What was more significant than the small improvements in drift and noise was the very large increase in the convenience and speed of setting pressures and flow rates. This was a most significant improvement in the system which was made by introducing the 40-2 regulator.

A series of experiments was performed using permeation tubes of polar compounds (acetone, chlorobenzene, 2-butanone) in order to determine whether slow desorption from flow tube walls by polar compounds might adversely affect the performance and background of the system. If the proportion of flow to the FID were maintained at a certain level for a while and then abruptly reduced, this would be observed as a gradual decrease in signal level until the amount of material adsorbed on the walls had equilibrated. Such an effect was observed, but it was slight and it did not significantly affect the observed signal drift if observations were started 20 min after changing the flow rates.

The effectiveness of the parallel cartridge holders for rapid changing of cartridges with minimum disturbance of the flow system was evaluated. The flow resistance of the Tenax cartridges is quite low at the flow rates which are utilized in this permeation system and only a small drop in the rotometer reading was observed when flow was switched from an empty cartridge tube to one packed with Tenax. The decrease in flow rate was generally no more than 5% and it was more evident as a drop in the FID signal than the rotometer reading. It was nevertheless a source of error which could be minimized by first establishing the flow rate with the Tenax cartridge in-line as a flow resistor since the difference in the flow resistance between two Tenax GC cartridges is normally very small. By this means a change in signal level could be reduced to 2% or less at a pressure of 2" of water. Use of gauge pressures higher than 2" water should minimize flow rate fluctuations due to differences in flow resistance of individual cartridges. On the other hand, use of elevated pressures could potentially lead to errors in the calibration of permeation tubes. If a permeation tube were subjected to very large changes in ambient pressure, gains and losses of weight due to permeation in and out of the tube of the gas in which it was immersed might occur. Changes in pressure due to natural fluctuations in barometric pressure would be too small to cause significant calibration errors. Therefore use of permeation tubes at gauge pressures which are small compared to natural fluctuations in barometric pressure could not adversely affect performance.

The performance of the modified flow system was re-evaluated at a pressure equivalent to 5" water. The signal drift and oscillation previously observed[(4)] were absent. Noise was minimal and drift was slight except for one observation which lasted for 4.5 hrs. There was no indication that the system was approaching a high pressure limit for practical operation. Behavior of the signal level when changing from one Tenax cartridge to another was observed at pressures up to 6" of water (Table 6). No signficiant fluctuations in signal level occurred at 4" of water and above. The influence of pressure on the time required for the signal level to stabilize after insertion of permeation tubes in the system was also observed (Table 6). It was found to be insignificant. The signal level approached its final level

Table 6. EFFECT OF CARRIER GAS PRESSURE IN THE PERMEATION CHAMBER ON VARIATIONS IN FLOW RATE AND TIME REQUIRED FOR STABLE DELIVERY OF VAPORS

Chamber Pressure (in H_2O)	Change in Signal Level Due to Change in Cartridges[a] (%)	Time Required to Attain Final Signal Level After Insertion of Permeation Tubes in Chamber (min)
2.0	1.7	24
2.1	2.3	-
3.5	-	20
4.0	0.5	-
5.0	-	33
6.0	0.0[b]	20

[a]Individual Tenax cartridges vary slightly in flow resistance.

[b]Signal level drifted 0.5% after 40 min.

within about 20 min and sometimes required a short additional period to stabilize completely.

In summary, the best method of delivery of carrier gas to the permeation tube flow system is to control the pressure in the chamber with a low pressure regulator and contol the flow rates only with the valves which are used to split the flow. Increasing the pressure from 2-6" of water minimizes signal fluctuation due to differences in flow resistance of individual cartridges.

Examination of Long-Term Performance of Permeation Tubes

Effect of Cold Storage--

A series of permeation tubes using several plastic tube types was prepared during the latter part of 1975. These permeation tubes were used to examine the effect of temporary storage at reduced temperature. The permeation tubes were sealed in a glass ampule and stored in the freezer at -5°C for a period of two weeks. At the end of this period, the tubes were returned to room temperature, weighed and placed in storage at 20.1°C and then weighed periodically during the subsequent months. Linear regression analyses of the data obtained on the permeation rates for the periods of February-April May-July are presented in Table 7. The tubes returned to approximately their former permeation rates after cold storage, but none of the rates after storage were precisely the same as initially. Weight losses which occurred during the first six days after the cold period was terminated indicated elevated permeation rates. This might of course have occurred as a result of moisture which could condense on the tubes while they were cold. It is apparent from these data that a calibrated tube will return to approximately its former permeation rate after cold storage, but recalibration after cold storage would be necessary for maximum accuracy.

Stability of Permeation Rates--

Some permeation tubes which had been prepared during January and February had not stabilized by April. Periodic weighings were made during the months of May-July and linear regression analysis was contrasted with that taken during February-April of 1976. These results are shown in Table 8. It is evident that with several notable exceptions, the permeation rates had actually reached their final level within four months. These tubes for which the permeation rate had not stabilized were phenylacetylene (FEP);

Table 7. RATES OF WEIGHT LOSS FOR PERMEATION TUBES BEFORE AND AFTER STORAGE AT -5°C

		Permeation Rate (g/min)		
		Determined by Linear Regression		Determined by Weight Loss
Compound	Plastic	Feb.-April	May-July	May 18-24
acetone	PE	1.74	1.67	1.68×10^{-6}
	TFE	3.97	3.83	4.45×10^{-7}
	FEP	5.87	6.37	9.01×10^{-8}
benzene	TFE	2.44	2.34	3.22×10^{-7}
	FEP	2.47	2.70	6.74×10^{-8}
dichloromethane	FEP	3.01	2.95	3.42×10^{-7}
chloroform	FEP	5.56	6.10	10.6×10^{-8}

Table 8. RATES OF WEIGHT LOSS FOR PERMEATION TUBES DETERMINED OVER TWO EXTENDED TIME PERIODS

		Permeation Rate (g/min) Determined by Linear Regression	
Compound	Plastic	Feb.-April	May-July
toluene	TFE	1.07×10^{-7}	1.12×10^{-7}
	FEP	4.07×10^{-8}	4.14×10^{-7}
phenylacetylene	TFE	4.12×10^{-8}	4.11×10^{-8}
	FEP	9.54×10^{-9}	4.73×10^{-9}
1,1,1-trichloroethane	TFE	8.75×10^{-9}	1.31×10^{-8}
	FEP	2.03×10^{-9}	1.06×10^{-9}
tetrachloroethylene	TFE	1.50×10^{-7}	1.85×10^{-7}
	FEP	6.52×10^{-8}	3.80×10^{-8}
chlorobenzene	TFE	1.07×10^{-7}	1.12×10^{-7}
	FEP	1.31×10^{-6}	1.10×10^{-6}
m-dichlorobenzene	TFE	3.40×10^{-7}	3.68×10^{-7}
	FEP	2.58×10^{-8}	Gained weight
dichloromethane	TFE	2.28×10^{-6}	1.84×10^{-6}
chloroform	TFE	1.14×10^{-6}	1.13×10^{-6}
carbon tetrachloride	TFE	5.99×10^{-9}	3.78×10^{-8}
	FEP	Gained Weight	Gained Weight

1,1,1-trichloroethane (FEP and PFE); tetrachloroethylene (FEP); m-dichlorobenzene (FEP) and carbon tetrachloride (TFE and FEP). In all cases for which tubes had not stabilized, the permeation rates were below 10^{-7} g/min.

The reason for failure of a tube to obtain a steady permeation rate in a reasonable length of time was not evident. There appeared to be several possible explanations: (1) tubes with very low permeation rates require a very long time period to stabilize. This is probably what is being observed when the permeation rate increases over a long period of time without ever approaching a steady state and without ever reaching 10^{-7} g/min. (2) Chemical reactions might occur between the vapor and the plastic material. This could explain either an increase or decrease in permeation rate but is not likely to occcur in those cases because the plastics used are relatively unreactive. (3) Chemical reaction of the liquid inside the tube might occur. This could explain either an increase or decrease in the the permeation rate. It is plausible in the cases where the compound is known to polymerize or readily decompose. (4) Chemical reactions of vapors from outside the tube with the outside surface of the tube and/or with the vapor permeating from the tube at its surface might occur. It would seem to be rather improbable at the vapor concentrations prevailing in the storage chamber which is swept by a 100 ml/min N_2 stream, but it cannot be definitely ruled out. (5) Teflon is not extremely hydroscopic, but the tubes are stored in a dry N_2 stream and when they are removed for weighing, they may pick up some moisture from the ambient air. If the permeation rate is very low, weight loss over a reasonable period of time might be obscured by gains or losses of water. This could result in a small weight gain or an erratic rate of weight loss for tubes which have a very small permeation rate. (6) It is known that polymeric materials will change structurally, i.e., swell when they come in contact with organic liquids. It is conceivable that a physical change occurs in the plastic material when it becomes saturated with the organic liquid. If swelling occurs, this could cause a change in the porosity, thus a change in the permeation rate. Of all the above explanations, the latter is probably the most significant in explaining why such a long period is required for stabilization of the permeation rate and for the changes in the permeation rate with respect to time for some of the chlorinated materials in a plastic tube. The observations described here establish some practical limits for the use of permeation tubes in an experimental apparatus for which they must be removed for weighing: (1) the tubes should be maintained at a temperature high enough so that the compound has a substantial vapor pressure in order that the permeation rate may be reasonably large; (2) unstable or highly reactive compounds may not be suited for use in permeation tubes unless the permeation rate is large enough that the rate stabilizes and the tube can be used within a suitably short period of time; (3) use of an organic liquid permeation tube under conditions in which the permeation rate is substantially below 10^{-7} g/min does not appear to be practical. The higher the permeation rate, the more quickly steady permeation is reached and the more stable is the observed permeation rate. In order to use tubes which permeate faster than 10^{-7} g/min, some form of flow splitting is required to obtain the low concentration needed for calibrating air sampling systems. (4) Compounds which permeate too fast from polyethylene tubes and too slow from teflon tubes might be handled either in very short polyethylene tubes attached to impermeable reservoirs or in teflon tubes maintained at elevated temperatures.

Several tubes which exhibited slow permeation rates were recalibrated at 30.4°C in order to determine what the effect of the resulting increase in vapor pressure would be on the permeation rates. Results for the higher temperature are contrasted with the original results in Table 9. It is seen that this increase in temperature effected only slight increases in permeation rates. The largest increase was for the 1,1,1-trichloroethane (PFE) which increased by a factor of 5.65. The FEP tubes for carbon tetrachloride and m-dichlorobenzene did not have a final permeation rate at 20.1°C. They frequently gained weight between weighings. The carbon tetrachloride also gained weight at 30.4°C, but it was possible to establish a permeation rate of 2.4×10^{-8} g/min from some of the data. The m-dichorobenzene tube had an apparently stable permeation rate of 1.26×10^{-8} g/min at 30.4°C. In general permeation rates were increased very little by increasing the temperature 10°. A more practical means of handling these compounds would probably to be using extremely short polyethylene tubes with attached reservoirs.

Table 9. PERMEATION RATES OF SOME HALOCARBON PERMEATION TUBES AT 20.1°C and 30.4°C

Compound	Plastic	Permeation Rate (g/min) 20.1°C	Permeation Rate (g/min) 30.4°C	Ratio $\frac{\text{Rate at } 30.4°}{\text{Rate at } 20.1°}$
Carbon tetrachloride	TFE	3.78×10^{-8}	1.88×10^{-7}	4.97
	FEP	$>10^{-8}$[a]	$\sim 2.4 \times 10^{-8}$[a]	-
1,1,1-Trichloroethane	TFE	1.31×10^{-8}	7.40×10^{-8}	5.65
	FEP	1.06×10^{-9}	$\sim 2 \times 10^{-8}$[a]	~1.9
Chlorobenzene	TFE	1.12×10^{-7}	2.28×10^{-7}	2.04
	FEP	1.10×10^{-6}	$\sim 3.4 \times 10^{-6}$	~3.1
_m_-Dichlorobenzene	TFE	3.68×10^{-7}	3.50×10^{-7}	0.95
	FEP	$>10^{-8}$[a]	1.26×10^{-8}	-

[a]Tube gained weight between two or more weighings during this calibration.

New permeation tubes were also prepared for chloromethane and bromomethane due to the observed vapor pressures of these compounds. The permeation rates for the TFE tubes were too high to be useful and FEP tubes reached a steady permeation rate very quickly.

Polyethylene permeation tubes with attached reservoirs were prepared for carbon tetrachloride, ethyl acetate and 2-butanone. Carbon tetrachloride had too low a permeation rate through teflon tubes while it permeated at a very rapid rate through polyethylene. By making the tube very short, a useful permeation tube was obtained. The ethyl acetate and 2-butanone tubes were made to replace longer tubes which had become depleted. Several additional permeation tubes were also prepared (Table 10).

Table 11 summarizes the permeation tubes for a series of organic compounds which have been prepared with their materials of construction and specifications.

Table 10. PERMEATION RATES OF SOME PERMEATION TUBES AT 20.1°C

Compound	Length (cm)	Plastic	Permeation Rate (g/min)
Chloromethane	9.0	TFE	1.7×10^{-5}[a]
	6.5	FEP	1.81×10^{-6}
Carbon tetrachloride	0.8[b]	PE	6.25×10^{-6}
Ethyl acetate	2.8[b]	PE	1.33×10^{-6}
2-Butanone	4.8[b]	PE	1.14×10^{-6}
1,2-Dichloroethane	8.0	TFE	2.08×10^{-7}
Bromomethane	6.0	TFE	2.44×10^{-5}[a]
	6.0	FEP	5.98×10^{-7}
Chlorine	2.0	c	2.03×10^{-6}[d]

[a]Permeation rate too high to be useful. Depleted after a few weeks.

[b]Pyrex reservoir attached to tube.

[c]Plastic type unknown. Probably FEP. Commercially prepared tube: Metronics Associates, Inc., Serial No. 98.

[d]Chlorine tube only: Calibrated at 30.4°C.

Table 11. PERMEATION TUBE SPECIFICATIONS FOR SEVERAL CHEMICAL CLASSES

Chemical Class	Compound	Length (cm)	Material	Rate g/min
Halogenated hydrocarbons	Methylene chloride	11	FEP	3.15×10^{-7}
	Trichloroethylene	7.5	FEP	1.17×10^{-8}
	Chloroform	10.2	TFE	1.12×10^{-6}
	m-Dichlorobenzene	6	TFE	1.93×10^{-7}
	m-Dichlorobenzene	5.8	FEP	6.82×10^{-9}
	Vinyl chloride	10	FEP	2.02×10^{-6}
	Vinyl chloride	4.8	FEP	8.17×10^{-7}
	1,1,1-Trichloroethane	8	TFE	3.42×10^{-8}
	Tetrachloroethylene	5.2	TFE	1.89×10^{-7}
	Chlorobenzene	5.5	TFE	1.55×10^{-7}
	Chloromethane	6.5	FEP	1.81×10^{-6}
	Carbon tetrachloride	8	PE	6.08×10^{-6}
	1,2-Dichloroethane	8	TFE	2.00×10^{-7}
	1,2-Dichloropropane	7.7	TFE	1.43×10^{-8}
	Bis-(2-chloroethyl)ether	8.3	TFE	1.74×10^{-8}
	2-Chloro-1,3-butadiene	9.5	TFE	6.74×10^{-8}
	3-Chloro-1-Butene	9	TFE	2.87×10^{-7}
	1,1,1,1-Tetrachloroethane	9	TFE	9.90×10^{-11}
	Dibromomethane	6.4	FEP	8.30×10^{-8}
	Dibromomethane	6.2	TFE	1.42×10^{-6}
	Methyl bromide	6	FEP	5.94×10^{-7}
	1,2-Dibromopropane	9.8	TFE	1.68×10^{-7}
	Bromine	4.4	TFE	2.23×10^{-6}
	Bromine	3.7	TFE	4.85×10^{-6}
	Perfluorobenzene	5.5	FEP	7.82×10^{-6}
	Perfluorotoluene	5.5	FEP	3.33×10^{-6}

(continued)

Table 11 (cont'd)

Chemical Class	Compound	Length (cm)	Material	Rate g/min
	Bromodichloromethane	5.7	FEP	5.89×10^{-9}
	Bromodichloromethane	5.2	TFE	3.93×10^{-7}
	1-Bromo-2-chloroethane	9.8	TFE	1.71×10^{-7}
Hydrocarbons	n-Heptane	12.3	TFE	2.06×10^{-7}
	1-Pentyne	10	TFE	4.33×10^{-7}
	Cyclopentane	12.2	TFE	8.89×10^{-9}
Aromatics	Benzene	12.5	TFE	2.41×10^{-7}
	Toluene	7	TFE	1.09×10^{-7}
	Benzene-d_6	8	TFE	1.70×10^{-7}
	Benzene-d_6	8	FEP	2.80×10^{-7}
	α-Methylstyrene	13.9	TFE	2.49×10^{-8}
	1,2,3-Trimethylbenzene	13.7	TFE	5.11×10^{-8}
	Phenylacetylene	6	TFE	3.81×10^{-7}
Amines	Dimethyl-d_6 amine	9	TFE	1.29×10^{-6}
	Dimethyl-d_6 amine	8	FEP	2.63×10^{-7}
	Dimethyl-d_6 amine	7.5	TFE	7.50×10^{-7}
	Dimethylamine	9.5	TFE	1.30×10^{-6}
	Dimethylamine	7	FEP	9.72×10^{-8}
	Dimethylamine	7.5	TFE	2.37×10^{-9}
	Dimethylamine	7	TFE	5.29×10^{-7}
	Dimethylamine	2	PE	4.07×10^{-6}
Nitrogenous compounds	Nitrobenzene	9	PE	8.21×10^{-3}
	N,N-Dimethylformamide	8.7	TFE	3.96×10^{-8}
	Benzonitrile		TFE	2.63×10^{-7}

(continued)

Table 11 (cont'd)

Chemical Class	Compound	Length (cm)	Material	Rate g/min
Ketones and Aldehydes	Acetone	12.5	TFE	3.87×10^{-7}
	Methyl ethyl ketone	4.8	PE	1.19×10^{-6}
	Methyl vinyl ketone	8.6	TFE	1.59×10^{-7}
	n-Heptanal	10	TFE	2.49×10^{-8}
Esters and Ethers	Ethyl Acetate	2.8	PE	1.31×10^{-6}
	Methyl Acrylate	6.9	TFE	4.79×10^{-7}
	Furan	6.2	TFE	8.51×10^{-7}
	n-Butyl ether	6.2	TFE	8.15×10^{-8}

SECTION 7

IDENTIFICATION AND QUANTIFICATION OF VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM SEVERAL GEOGRAPHICAL AREAS IN THE CONTINENTAL U. S.

Three principal criteria served as guidelines for selecting the areas for study of organic vapors in ambient air. These were: (1) to demonstrate the capability of the polypollutant analysis method developed under this contract over the past several years; (2) to determine the composition of ambient air surrounding selected industrial sites; and (3) to begin acquiring information which may explain the high incidence of certain types of cancer for these areas which have been previously reported.[16] The principal geographical areas for study were in the vicinity of Houston, TX, Baton Rouge, LA and a chemical disposal site in New Jersey. Table 12 presents the cancer mortality by county for the period of 1950-1969 for some selected metropolitan areas.[16,17]

Houston, TX was selected as an area for examination because of the high concentration of petrochemical industries.[18] In Houston are Jones Chemicals (chlorine), Tenneco (vinyl chloride), Diamond Shamrock (herbicides), Gulf Chemicals (pesticides, degreasers, industrial chemicals), Petrotex (chloroprene), Stauffer (pesticides), Unichem (pesticides) and a large number of other large chemical complexes which may produce or use halogenated organics. In the suburb of Pasadena are Ethyl Corp. (vinyl chloride and chlorinated ethylenes), Pestex (insecticides) and Rhodia (pesticides). In Texas City are Union Carbide (vinyl chloride), GAF (vinyl co-polymers and herbicides) and others. In Deer Park are Diamond Shamrock (tetrachloroethylene, trichloroethylene and PVC resins), Shell Chemical (vinyl chloride and pesticides) and others. In LaPorte are Chemetron (phosgene, benzyl chloroformate and phenylchloroformate), Upjohn (phosgene) and DuPont (pesticides and hydrofluoric acid). In Conroe are Helena Chemical Co. (pesticides), Conroe Cresoting (treated wood products) and United Creosoting

Table 12. CANCER MORTALITY BY COUNTY 1950-1969[22]: U. S. AVERAGES AND SELECTED METROPOLITAN AREAS

			Sex					
			Male			Female		
State and County Code (City)	Cancer Type[a]	Race	Total Deaths Per 20 Years	Death Rate[b]	Relative Rate[c]	Total Death Per 20 Years	Death Rate[b]	Relative Rate[c]
United States	1	White	76,070	5.16	1.00	94,229	5.34	1.00
		Nonwhite	10,021	6.91	1.00	7,261	4.59	1.00
	2	White	571,226	37.98	1.00	108,326	6.29	1.00
		Nonwhite	53,910	36.67	1.00	10,222	6.27	1.00
	3	White	252,763	17.84	1.00	-	-	-
		Nonwhite	35,397	27.39	1.00	-	-	-
	4	White	12,918	.83	1.00	-	-	-
		Nonwhite	504	.30	1.00	-	-	-
	5	White	57,780	3.86	1.00	34,204	1.99	1.00
		Nonwhite	4,072	2.67	1.00	2,429	1.42	1.00
	6	White	98,304	6.78	1.00	43,095	2.39	1.00
		Nonwhite	7,001	5.05	1.00	4,758	3.05	1.00
	All	White	2,572,035	174.04	1.00	2,258,282	130.10	1.00
		Nonwhite	264,108	184.28	1.00	228,561	139.80	1.00
48201 Harris, TX (Houston)	1	White	391	6.1	1.18	321	4.3	0.80
		Nonwhite	160	10.0	1.45	94	5.4	1.18

(continued)

Table 12 (cont'd)

State and County Code (City)	Cancer Type[a]	Race	Sex: Male — Total Deaths Per 20 Years	Male — Death Rate[b]	Male — Relative Rate[c]	Female — Total Death Per 20 Years	Female — Death Rate[b]	Female — Relative Rate[c]
	2	White	3,684	53.5	1.41	713	8.8	1.40
		Nonwhite	726	44.4	1.21	123	7.0	1.12
	3	White	939	18.9	1.06	-	-	-
		Nonwhite	388	30.1	1.10	-	-	-
	4	White	78	0.8	0.96	-	-	-
		Nonwhite	3	0.2	0.7	-	-	-
	5	White	255	3.7	0.96	165	2.1	1.06
		Nonwhite	64	3.6	1.35	28	1.4	0.99
	6	White	408	7.4	1.09	169	2.3	0.90
		Nonwhite	109	7.4	1.47	53	3.1	1.02
	All	White	12,286	188.5	1.08	10,014	124.2	0.95
		Nonwhite	3,183	203.8	1.11	2,553	139.5	1.00
48339 Montgomery, TX (Houston)	1	White	22	8.6	1.67	7	2.9	0.54
		Nonwhite	3	5.0	0.72	3	5.3	1.15
	2	White	117	46.1	1.21	14	5.6	0.89
		Nonwhite	25	41.9	1.14	3	5.1	0.81
	3	White	43	18.5	1.04	-	-	-
		Nonwhite	15	23.8	0.87	-	-	-

(continued)

Table 12 (cont'd)

State and County Code (City)	Cancer Type[a]	Race	Sex: Male — Total Deaths Per 20 Years	Male — Death Rate[b]	Male — Relative Rate[c]	Sex: Female — Total Death Per 20 Years	Female — Death Rate[b]	Female — Relative Rate[c]
	4	White	1	0.4	0.5	-	-	-
		Nonwhite	-	-	-	-	-	-
	5	White	4	1.7	0.44	3	1.2	0.60
		Nonwhite	3	5.4	2.02	-	-	-
	6	White	12	4.7	0.69	9	3.6	1.51
		Nonwhite	7	11.1	2.20	2	2.8	0.92
	All	White	376	151.5	0.87	234	94.5	0.73
		Nonwhite	45	157.5	0.85	38	107.3	0.77
34013 Essex, NJ (Newark)	1	White	536	6.7	1.30	551	5.4	1.01
		Nonwhite	69	6.4	0.93	48	3.9	0.86
	2	White	3,697	44.7	1.18	712	7.2	1.14
		Nonwhite	547	48.1	1.31	107	7.6	1.21
	3	White	1,381	19.0	1.07	-	-	-
		Nonwhite	229	27.5	1.00	-	-	-
	4	White	69	0.9	1.1	-	-	-
		Nonwhite	7	0.6	2.0	-	-	-
	5	White	366	4.5	1.17	204	2.1	1.06
		Nonwhite	33	2.9	1.09	30	1.9	1.34

(continued)

Table 12 (cont'd)

State and County Code (City)	Cancer Type[a]	Race	Sex: Male: Total Deaths Per 20 Years	Male: Death Rate[b]	Male: Relative Rate[c]	Female: Total Death Per 20 Years	Female: Death Rate[b]	Female: Relative Rate[c]
	6	White	829	10.9	1.61	272	2.6	1.09
		Nonwhite	57	5.6	1.11	50	4.3	1.41
	All	White	16,975	215.1	1.24	15,258	154.5	1.19
		Nonwhite	2,385	219.2	1.19	2,155	154.6	1.11
34039 Union, NJ (Elizabeth)	1	White	235	5.8	1.12	295	5.8	1.09
		Nonwhite	16	6.1	0.88	23	7.0	1.53
	2	White	1,811	42.0	1.11	354	6.9	1.10
		Nonwhite	123	48.8	1.33	29	10.1	1.61
	3	White	682	19.3	1.08	-	-	-
		Nonwhite	76	39.0	1.42	-	-	-
	4	White	38	0.8	1.0	-	-	-
		Nonwhite	3	0.7	2.3	-	-	-
	5	White	218	5.2	1.35	114	2.3	1.16
		Nonwhite	15	5.3	1.97	9	2.7	1.90
	6	White	369	9.9	1.46	141	2.8	1.17
		Nonwhite	10	4.7	0.93	15	4.8	1.57

(continued)

Table 12 (cont'd)

State and County Code (City)	Cancer[a] Type	Race	Sex: Male — Total Deaths Per 20 Years	Male — Death[b] Rate	Male — Relative[c] Rate	Sex: Female — Total Death Per 20 Years	Female — Death[b] Rate	Female — Relative[c] Rate
	All	White	8,311	203.4	1.17	7,757	151.6	1.17
		Nonwhite	620	252.2	1.37	534	166.3	1.19
22071 Orleans, LA (New Orleans)	1	White	220	6.3	1.22	201	4.1	0.77
		Nonwhite						
	2	White	2,371	64.1	1.69	376	7.8	1.24
		Nonwhite	1,006	60.7	1.66	179	8.7	1.39
	3	White	579	18.9	1.06	-	-	-
		Nonwhite	454	32.3	1.18	-	-	-
	4	White	34	0.9	1.08	-	-	-
		Nonwhite	2	0.1	0.3	-	-	-
	5	White	168	4.6	1.19	90	1.9	0.95
		Nonwhite	51	2.9	1.07	41	1.9	1.34
	6	White	319	9.8	1.45	146	2.9	1.21
		Nonwhite	129	8.7	1.72	103	5.3	1.74

(continued)

Table 12 (cont'd)

State and County Code (City)	Cancer[a] Type	Race	Male: Total Deaths Per 20 Years	Male: Death[b] Rate	Male: Relative[c] Rate	Female: Total Death Per 20 Years	Female: Death[b] Rate	Female: Relative[c] Rate
	All	White	8,084	230.0	1.32	6,570	135.6	1.04
		Nonwhite	4,072	255.9	1.39	3,586	175.7	1.27

[a]Code for Cancer Types: 1 = liver; 2 = trachea, lung, bronchi, etc.; 3 = prostate; 4 = testis; 5 = kidney; 6 = bladder and other urinary organs; All = all malignant neoplasma.

[b]Death Rate is the average annual age - adjusted mortality rate per 100,000 calculated for the 20-year period.

[c]Relative Rate is the County death rate divided by the national death rate for a cancer site.

(treated wood products). The presence of these and other industrial companies provide for the manufacture, use or storage of a wide variety of halogenated compounds.

Previous characterization efforts conducted under this contract for ambient air in Houston[4] have demonstrated the presence of a large number of halogenated compounds. An expanded study was conducted to include other geographical sites in order to further validate the polypollutant analysis method and to determine the composition of ambient air which may play an important role in determining the incidence of cancer in the future. Cancer statistics[16] (Table 12) indicate that Houston has had a high incidence of malignant neoplasms in the past, especially of the liver, lung and bladder.

Baton Rouge, LA has been selected as a study area due to its large industrial activity along the Mississippi River.[19] Table 13 presents the industrial complexes located in or near Geismar, LA.[20] The large number of chemical compounds produced here is ideal for validating the polypollutant analysis method. Chemicals such as glycols, anilines, nitro-compounds, and cyanates as well as halogenated compounds are produced here. Table 14 presents some potential chlorinated hydrocarbon emissions from industries in the Iberville/Ascension Parish area.[20]

In northeast New Jersey a high density of chemical industry[21] is found, much of which involves halogenated hydrocarbons. The statistics for cancer in two counties of northeast New Jersey (Table 12) are alarming. These counties have uniformly high cancer rates. The overall rate for all malignant neoplasms is significantly above the national average. The cancer incidence in New Jersey has been associated with the chemical and allied industries located there.[16,17] Because New Jersey represents a metropolitan area with a longtime chemical industry, known environmental levels of halogenated organics and abnormally high cancer rates, this area was selected for examination of the volatile organic vapors in ambient air under this program. One of the principal areas examined was in Edison, NJ where a large chemical disposal site was in operation.

Table 13. CHEMICAL PRODUCTION IN GEISMAR, LA

Company	Chemical	Production (mmlb/yr)	Raw Material
Borden Chemical	Acetic acid	115	CO, Methanol
	Methanol	160	Methane
	Urea	440	Ammonia, CO_2
	Vinyl acetate	150	Acetic acid, acetylene
Monochem, Inc.	Acetylene	180	Ethylene
	Vinyl chloride	240	Acetylene
Uniroyal	p-Tert-butyl-cresol	4.0	p-Cresol isobutylene
	Maleic Hydrizide	N.A.	N.A.
Rubicon Chemicals, Inc.	Aniline	60	Nitrobenzene
	Dinitrotoluene	N.A.	Toluene
	Methylene Dianiline	N.A.	Aniline
	Methylene Diphenyl	N.A.	-
	Nitrobenzene	52	Benzene
	Phosgene	152	CO, Cl_2
	Toluene-2,4-Diamine	N.A.	Dinitrotoluene
	Toluene Diisocyanates	40	Toluene 2-4 diamine, Phosgene
	Diphenyl Amine	N.A.	Formaldehyde, aniline

(continued)

Table 13 (cont'd)

Company	Chemical	Production (mmlb/yr)	Raw Material
BASF Wyandotte Corp.	Diethylene Glycol	21	Ethylene oxide ethylene glycol
	Ethylene Glycol	160	Ethylene oxide
	Ethylene Oxide	248	Ethylene
	Phosgene	55	CO, Cl_2
	Propylene	N.A.	Ethylene
	2,4-Toluene Diisocyanate	100	Dinitrotoluene
Shell Oil Co.	Diethylene Glycol	9	Ethylene oxide, ethylene glycol
	Diethylene Glycol Monobutyl Ether	-	Butanol, Ethylene oxide
	Diethylene Glycol Monobutyl Ethyl ether	N.A.	Ethanol, Ethylene oxide
	Diethylene Glycol Monomethyl Ether	-	Methanol, Ethylene oxide
	Ethylene Glycol	80	Ethylene oxide
	Ethylene Glycol Monobutyl Ether	-	Butanol, Ethylene Oxide
	Ethylene Glycol Monoethyl Ether	N.A.	Ethanol, Ethylene oxide
Vulcan Materials Co.	Acetaldehyde	N.A.	
	Carbon Tetrachloride	72	
	Ethylene Dichloride	276	Ethylene
	Methyl Chloroform	50	Methanol
	Methylene Chloride	80	Methanol
	Perchloroethylene	150	Propane, Ethane
	Vinylidene Chloride	N.A.	

Table 14. POTENTIAL CHLORINATED HYDROCARBON EMISSIONS FROM INDUSTRIES IN IBERVILLE-ASCENSION PARISH AREA IN LOUISIANA

Company	Chemical
Cosmar	none reported
Allied Chemical	none reported
Uniroyal	Cl_2
Rubicon	o-Dichlorobenzene Propylene Dichloride
Vulcan	Ethylene Dichloride Ethyl chloride Other Chlorinated compounds
Borden Chemical	none reported
Monochem	2-Chloroprene
Shell Chemical	none reported
BASF Wyandotte	Cl_2
Morton Chemical	HCl

EXPERIMENTAL

Sampling Techniques

The sampling procedure employed has previously been described:[4] hazardous vapors and other organic compounds are concentrated on a 1.5 x 6.0 cm bed of Tenax GC (35/60) in a glass cartridge. The sorbent was cleaned by extracting with acetone for a period of 18 hr in a Soxhlet apparatus, followed by an additional 18 hrs of extraction with *n*-hexane. The Tenax GC sorbent was then heated to 100° in a vacuum oven (12" water) for a period of 2 hrs to remove residual solvent. The solid sorbent was then meshed into a 35/60 fraction and packed into glass cartridges using silanized glass wool as support. All cartridges were preconditioned by heating to 275°C for a period of 20 min under a helium purge of 20-30 ml/min. After cooling in precleaned Kimax® culture tubes, the containers were sealed to prevent recontamination of the sorbent material. The Kimax® culture tubes containing the cartridges were then placed into a sealed metal container until ready for use. Sampling cartridges were carried by either air freight or automobile to the sampling site and 2-3 cartridges were designated as blanks to determine whether any of the cartridges might be contaminated by the packing and transportation procedure.

Ambient air samples which were collected over a 2-3 hr period were collected with a Nutech Model 221-A AC/DC portable sampler.[4,8] A portable sampling head (Pifer Industries, Durham, NC), fabricated as shown in Figure 5, housed the dual sampling cartridge train. In general, when using the Nutech sampler, a sampling rate of 1-2 ℓ/min/cartridge was used throughout the program. When an integrated sampling period of 24 hrs was required, E. I. DuPont deNemours personnel samplers were used and were housed in the sampling compartment (Fig. 5). A 6 V lantern battery equipped with a step-down transformer (to 5 V) was used for supplying power to the personnel samplers and allowed continuous operations for upto 7 days. Critical orifices (hypodermic needles, gauge No. 23) were used to balance the flow rate through each branch of the sampling train. A sampling rate of ~100 ml/min/cartridge was achieved with the DuPont personnel samplers.

Meterological conditions were recorded with hand held instruments. The wind direction, velocity, temperature and humidity were all determined. Wind direction was determined using a lensatic compass. The compass was

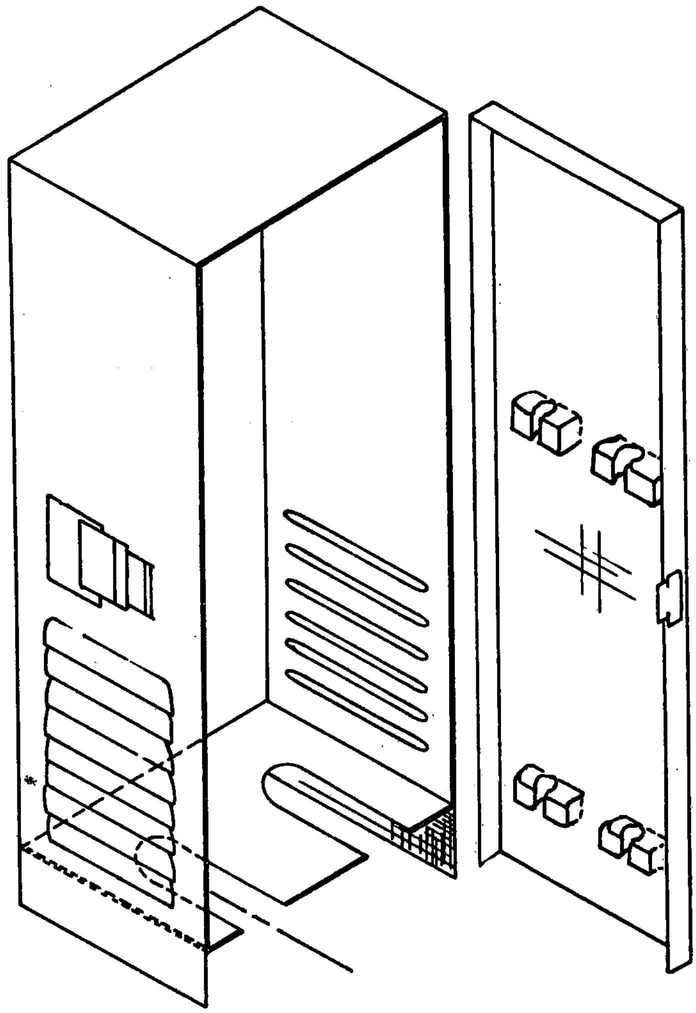

Figure 5. Sampling head for housing cartridge sampling train.

also used to describe the sampling location relative to major industrial facilities. Wind velocity was estimated with a Dwyer wind meter (Dwyer Instruments Inc., Michigan City, IN). A hand held rotometer with two scales (2-10 mph and 4-66 mph capability) was held. Barometric pressure was measured with a Pocket Altimeter (Gischard, West Germany). This aneroid barometer was compared with a mercury barometer and found to read to 0.1" of mercury high. It was calibrated from 19-31" of mercury and 0-13,000 ft of altitude. Air temperature and relative humidity were determined with a sling psychrometer (Taylor Instruments Co., Rochester, NY). Precipitation was measured volumetrically with a Nimbus Model 609-B rain gauge (Air Guide Instruments Co., Chicago, IL). At one sampling location, a Meterological Research Inc. (MRI) weather station was assembled. The weather station was positioned approximately 2 meters above ground and possessed the capability of continuous recording of wind velocity, wind direction, temperature and humidity. The hand held instrumentation was used to determine the meteorological conditions at the various locations at different times throughout the sampling period, while the MRI instrument provided continuous weather data from only one location. In addition, surface weather conditions were obtained from the local airports to supplement the meteorological data for the area sampled.

Determining distances from a suspected point source of pollution or the location of sampling was estimated with a Rangematic Distance Finder (Ranging Inc., Rochester, NY). The range finder was calibrated for 40-1,000 yds (also with approximations for 1 and 2 mile measurements). It was found to be accurate to $\pm$1% at 100 yds.

The sampling procotols employed for ambient air at the Kin-Buc Disposal Site, Houston, TX and vicinity, and Geismar, LA are given in Tables 15-17. The corresponding sampling locations for each of the sites are depicted in Figures 6-17.

Instrumental Methods of Analysis

The instrumental system (glc/ms/comp) used for the qualitative and quantitative analysis of organic vapors and the inlet-manifold used for recovering vapors trapped on Tenax GC sampling cartridges have been previously described.[4,7,8,15] The operating parameters for the glc/ms/comp system shown in Figure 18 for the analysis of samples is given in Table 18.

Table 15. SAMPLING PROTOCOL FOR KIN-BUC DISPOSAL SITE

Period	Location	Distance from Site[a]	Sampling Time	Sampling Volume[b]	Meteorological Conditions T(°F)	%RH	Wind Dir./ Speed	in Hg
6/29/76 (P1)	L1 (Tower Marina)	255°/1.65 km	1207-1359	112.5	82	69	255°/2-7 mph	30.19
	12 (Meadow Rd.)	~345°/0.4 km	1206-1355	134	82	69	240°/3-7 mph	30.19
	L3 (N of Site)	25°/0.41 km	1207-1359	156	82	69	240°/3-7 mph	30.19
	L4 (N of Site)	35°/0.29 km	1207-1359	140	82	69	210-255°/ 2-8 mph	30.19
(P2)	L1 (Tower Marina)	255°/1.65 km	1607-1737	111.4	86	57	270°/2-7 mph	30.18
	L2 (Meadow Rd.)	~345°/0.36 km	1607-1737	175	86	57	220-240°/ 0-3 mph	30.18
	L3 (E of Site)	40°/0.18 km	1607-1737	183.4	86	57	-	30.18
	L4 (E of Site)	35°/0.22 km	1607-1737	187.2	86	57	245°/0-2 mph	30.18
6/30/76 (P3)	L1 (Sayreville)	2.01 km ESE from site	1029-1229	138.5	82	76	70°/2-7 mph	30.12
	L2 (Meadow Rd.)	45 m downwind of chemical plant	1030-1230	187.5	82	76	100→140°/ 2-7 mph	30.12
	L3 (Meadow Rd.)	350°/0.46 km	1029-1229	175.9	82	76	-	30.12
	L4 (W of Site)	305°/0.34 km	1029-1229	191.2	82	76	95→120°/ 5-9 mph	30.12

(continued)

Table 15 (cont'd)

Period	Location	Distance from Site[a]	Sampling Time	Sampling Volume[b]	Meteorological Conditions			
					T (°F)	%RH	Wind Dir./ Speed	in Hg
(P4)	L1 (Tower Marina)	255°/1.65 km	1457-1646	117.7	88	57	180→200°/ 5-12, 20-35, 10-20	30.07
	L2 (Meadow Rd.)	21 m from chemical plant	1458-1646	248	88	57	190°/5-15 mph	30.07
	L3 (N of Site)	0°/0.73	1457-1646	200.3	88	57	190°/5-20 mph	30.07
	L4 (NE, then N of site)[c]	25°/0.41 km 345°/0.91 km	1457-1528 1537-1648	0.104 0.269	88	57	180→200°/ 5-35 mph	30.07
7/1/76 (P5)	L1 (Tower Marina)	255°/1.65 km	1006-1206	114.4	79	57	270°/5-9 mph	30.10
	L2 (Meadow Rd.)	~76 m from chemical plant	1006-1206	204.2	79	57	230-260°/ 4-12 mph	30.10
	L3 (On-Site)	-	1015-1038	19.8	79	57	260°/4-9 mph	30.10
	L4 (E of Site)	40°/0.18 km	1006-1206	230	79	57	230-250°/ 4-12 mph	30.10
(P6)	L1 (Tower Marina)	255°/1.65 km	1425-1625	120	84	43	270°/2-5 mph	30.12
	L2 (Meadow Rd.)	345°/0.36 km	1425-1625	181	84	43	230-260°/ 2-5 mph	30.12
	L3 (On-Site)	-	1444-1458	19.8	84	43	230-260°/ 2-5 mph	30.12

(continued)

Table 15 (cont'd)

					Meteorological Conditions			
Period	Location	Distance from Site[a]	Sampling Time	Sampling Volume[b]	T(°F)	%RH	Wind Dir./ Speed	in Hg
	L4 (E of Site)	40°/0.18 km	1425-1625	208.4	84	43	230-260°/ 2-8 mph	30.12

[a]Approximate magnetic bearing and distances relative to Kin-Buc.

[b]Volume in liters.

[c]Sampler was moved to new site during sampling period.

Table 16. AMBIENT AIR SAMPLING PROTOCOL FOR HOUSTON, TX AND VICINITY

Site	Sampling Location	Sampling Time (min)	Volume Sampled (ℓ)	Remarks
Houston, TX	Milby Park (HL1)	1670-1750	188	7/27/76 93°F 60% RH 160°/3 mph
Houston, TX	Off Goodyear Rd. on unpaved St. (HL2)	1510-1515	37	7/27/76 93°F 60% RH 160°/3 mph
Houston, TX	Steelman Ave. & El Buey Way (HL3)	1620-1750	229	7/27/76 93°F 60% RH 160°/3 mph
Pasadena, TX	Between Industrial Site and Ship Channel (HL3)	1430-1600	185	7/28/76 89°F 65% RH 160°/5-10 mph
Pasadena, TX	Tenneco Property (PL2)	1430-1600	237	7/28/76 89°F 65% RH 160°/5-10 mph
Pasadena, TX	Tenneco Property (PL3)	1430-1600	191	7/28/76 89°F 65% RH 160°/5-10 mph
Deer Park, TX	Shell Property (DSL1)	1100-1200	122	7/29/76 87°F 66% RH 180°/4-9 mph
Deer Park, TX	Shell Property (DSL2)	1100-1200	136	7/29/76 87°F 66% RH 180°/4-9 mph
Deer Park, TX	Diamond Shamrock Property (DDL1)	1455-1555	137	7/29/76 94°F 54% RH 130°/4-7 mph
Deer Park, TX	Off Tidal Road (DTL1)	1020-1035	113	7/30/76 90°F 50% RH 210°/6 mph

(continued)

Table 16 (cont'd)

Site	Sampling Location	Sampling Time (min)	Volume Sampled (ℓ)	Remarks
Deer Park, TX	Off Tidal Road (DTL2)	1115-1215	147	7/30/76 90°F 60% RH 200°/6-8 mph
Deer Park, TX	Off Tidal Road (DTL3)	1455-1555	162	7/29/76 87°F 60% RH 180°/4-9 mph
Deer Park, TX	Off Tidal Road (DTL4)	1115-1215	165	7/30/76 90°F 60% RH 200°/6-8 mph
Freeport, TX	On Dow Chem. Property (FL1)	1342-1543	116	8/9/76 90°F 65% RH 145°/5-10 mph
Freeport, TX	On Dow Chem. Property (FL2)	1348-1555	85	8/9/76 90°F 65% RH 145°/5-10 mph
Freeport, TX	On Dow Chem. Property (FL3)	1425-1508	79	8/9/76 90°F 65% RH 145°/5-10 mph
La Porte, TX	On E. I. DuPont de Nemours & Co. Property (LL1)	1645-1833	110	8/12/76 90°F 62% RH 130-150°/2-6 mph
La Porte, TX	On E. I. DuPont de Nemours & Co. Property (LL2)	1641-1824	82	8/12/76 90°F 62% RH 130-150°/2-6 mph
La Porte, TX	On E. I. DuPont de Nemours & Co. Property (LL3)	1114-1252	87	8/13/76 92°F 53% RH 240°/0-4 mph

Table 17. AMBIENT AIR SAMPLING PROTOCOL FOR GEISMAR, LA AREA

Sampling Location	Sampling Time (min)	Volume Sampled (ℓ)	Remarks	
Corner of highway 73 and 75 (L12)	1398	140	2/28-3/1/77 28→85% RH	62°F 290→240°/9 kts
Southeast of Plant R (L13)	1400	140	2/28-3/1/77 28→85% RH	62°F 290→240°/9 kts
North of Plant M (L14)	260	180	3/1/77 85% RH	63°F 180°/light
Northeast of Plant M and N (L15)	25	142	3/1/77 85% RH	63°F 180°/light
Northwest of Plant M off LA 73 (L14)	1205	120	3/1-3/2/77 52% RH	65°F 120°/light
Southwest of Plant M off LA 73 (L16)	135	91	3/2/77 52% RH	65°F 120°/light

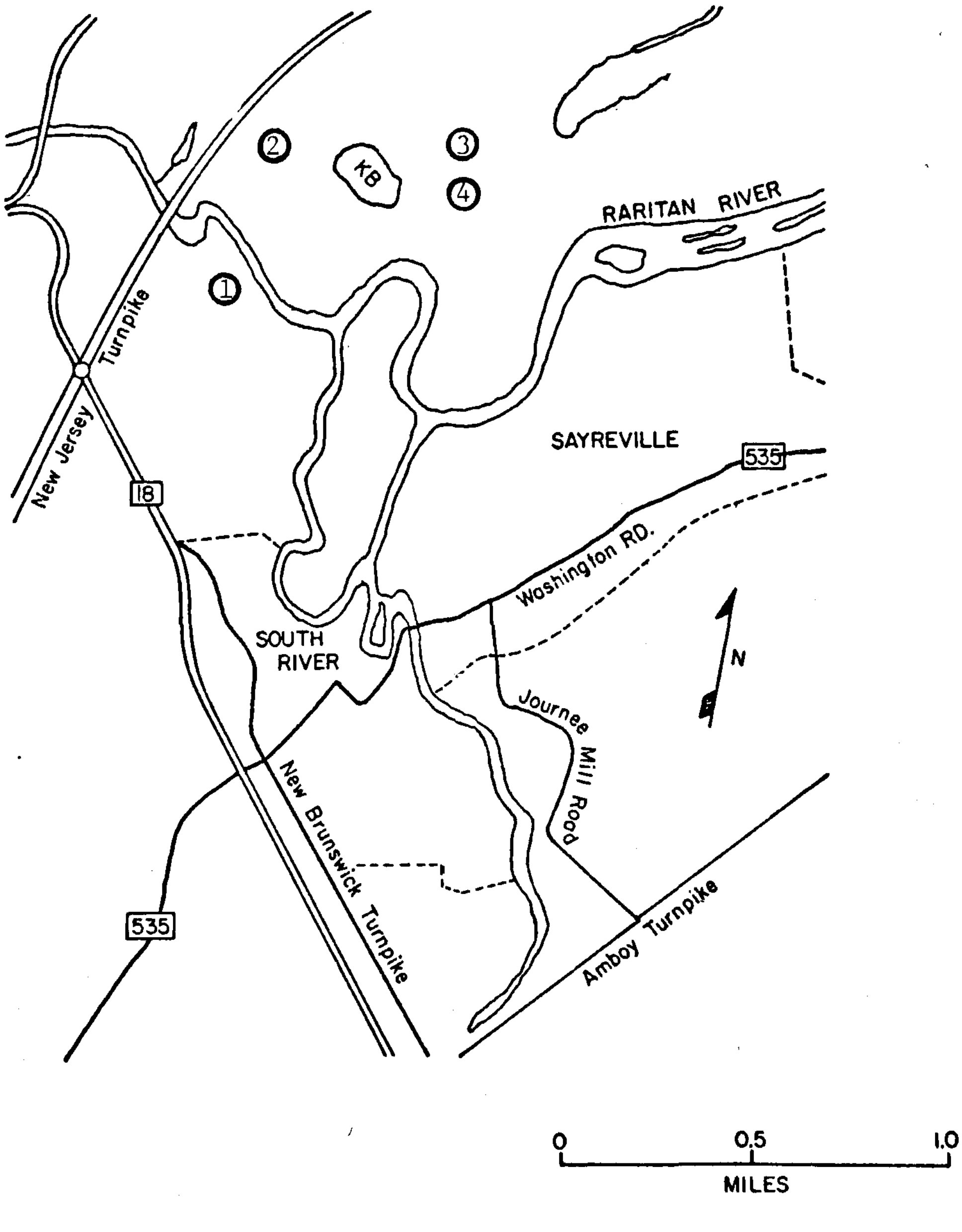

Figure 6. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 1).

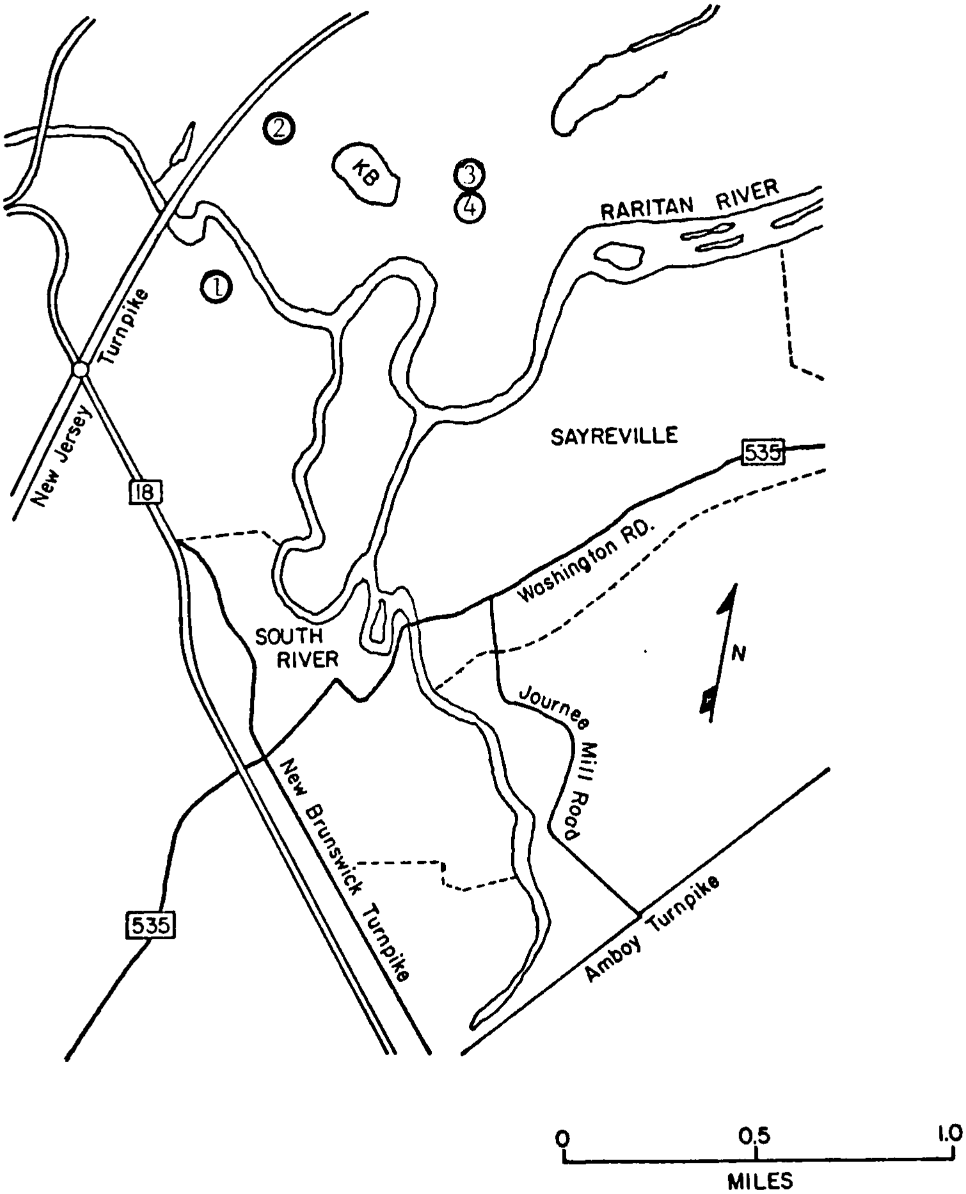

Figure 7. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 2).

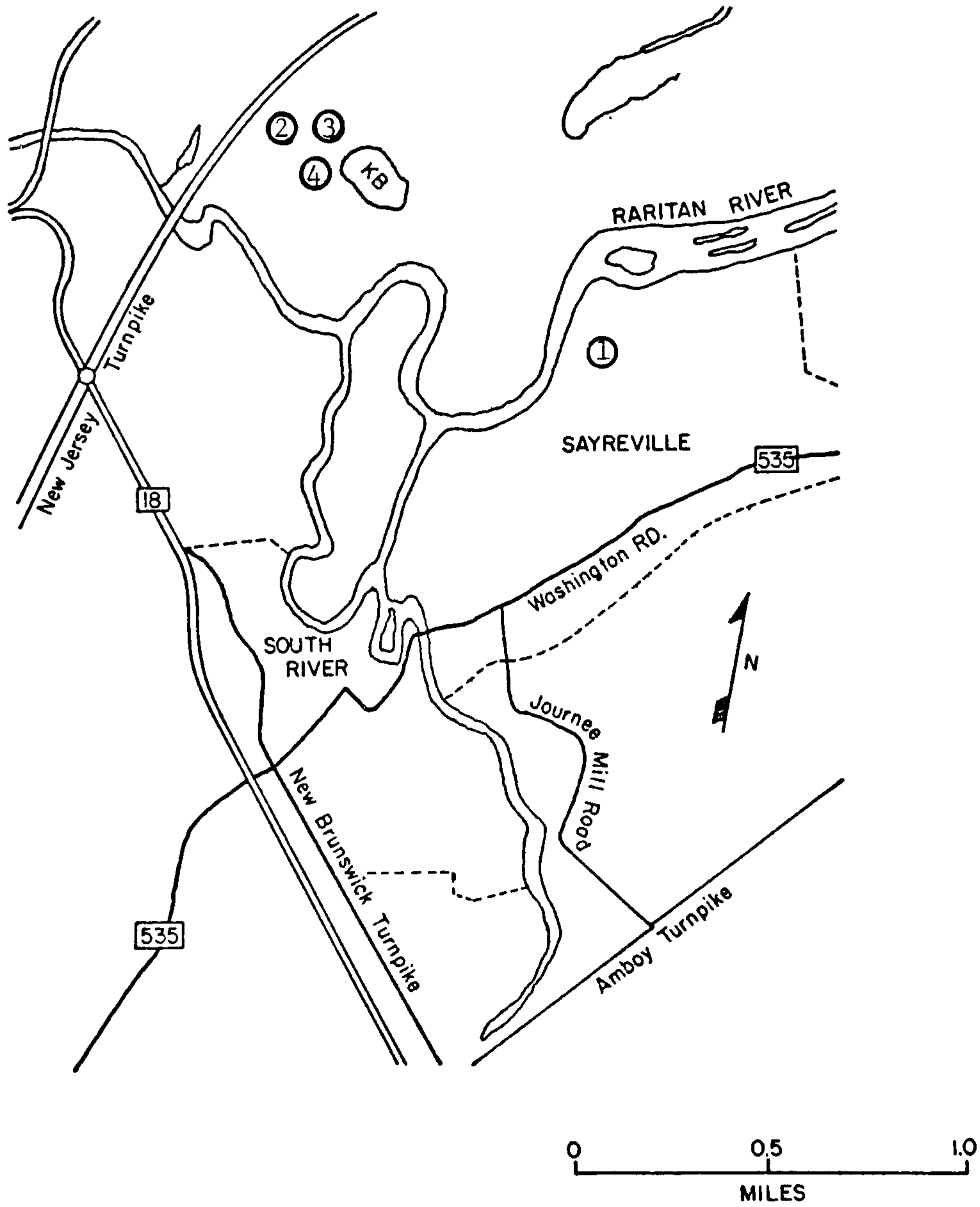

Figure 8. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 3).

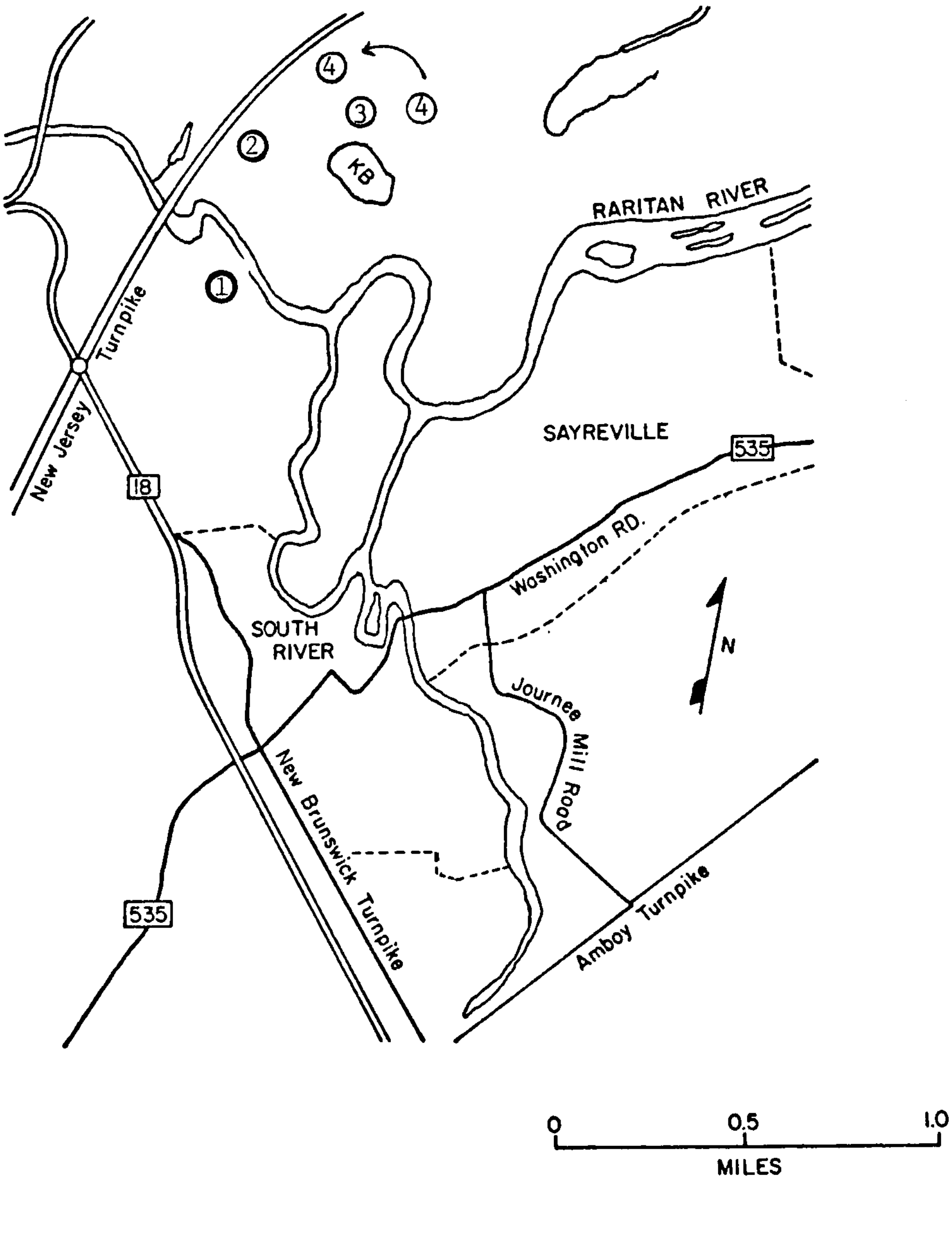

Figure 9. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 4).

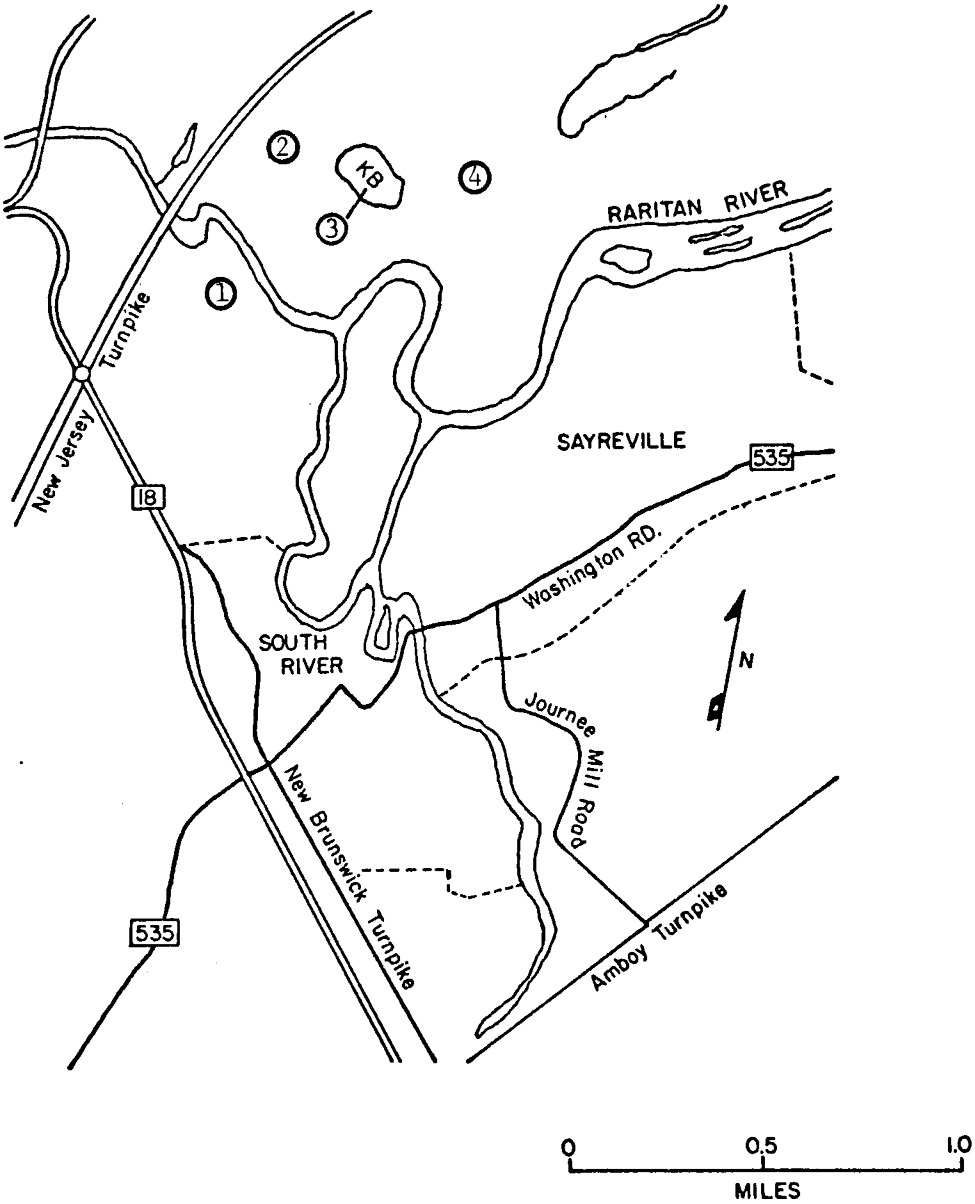

Figure 10. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 5).

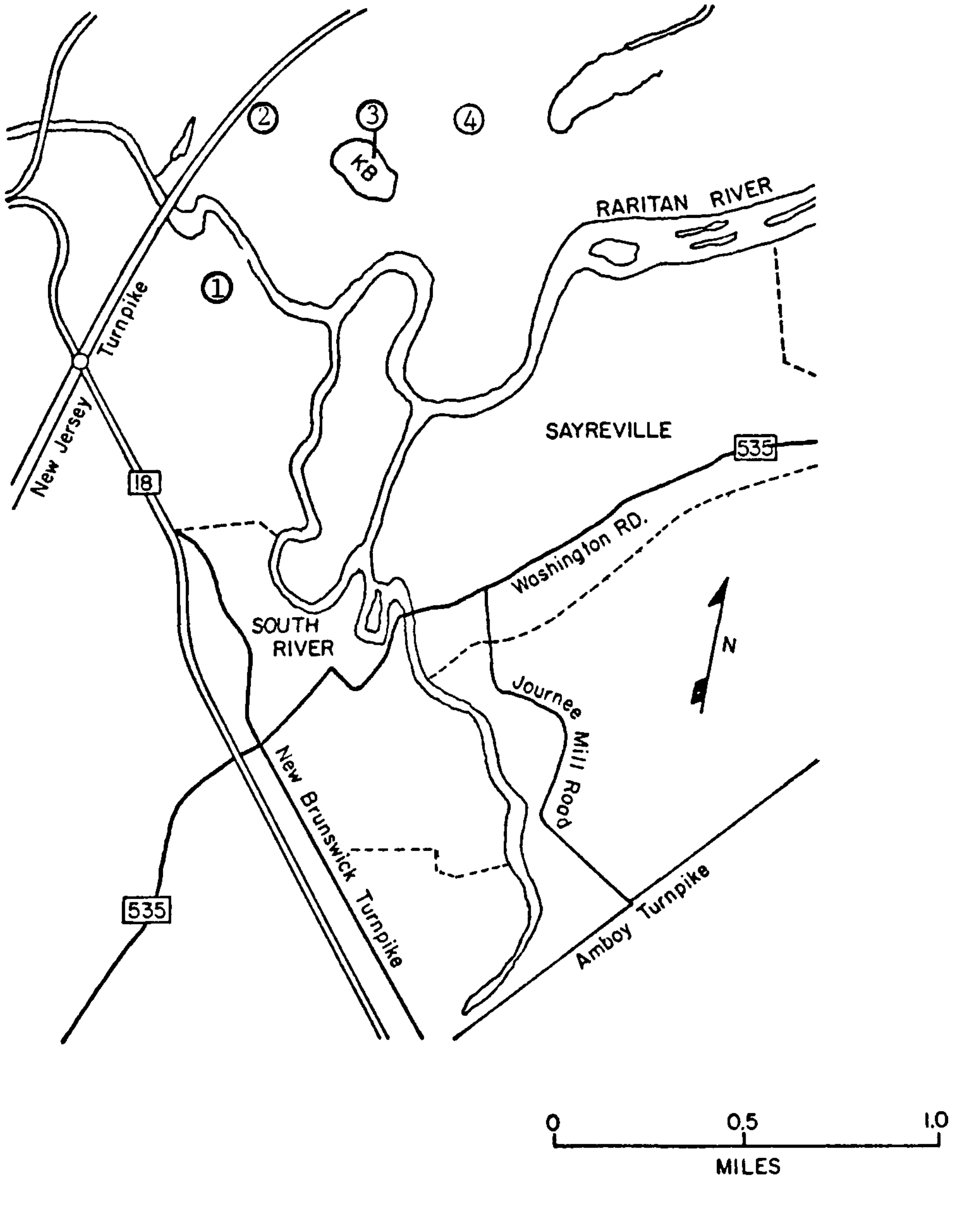

Figure 11. Sampling locations surrounding Kin-Buc Land-fill, Edison, NJ (Table 15, Period 6).

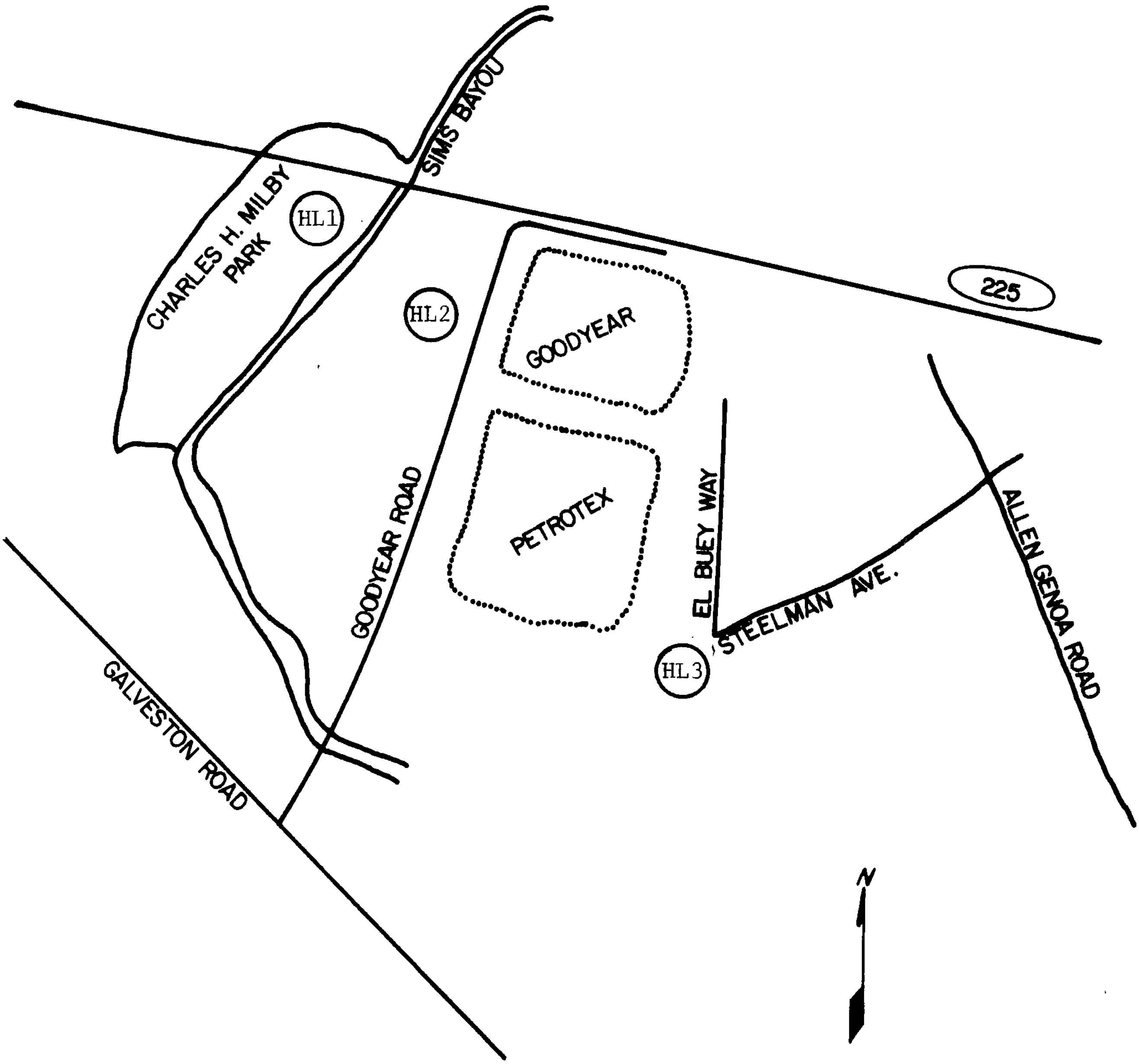

Figure 12. Sampling locations for Houston, TX site

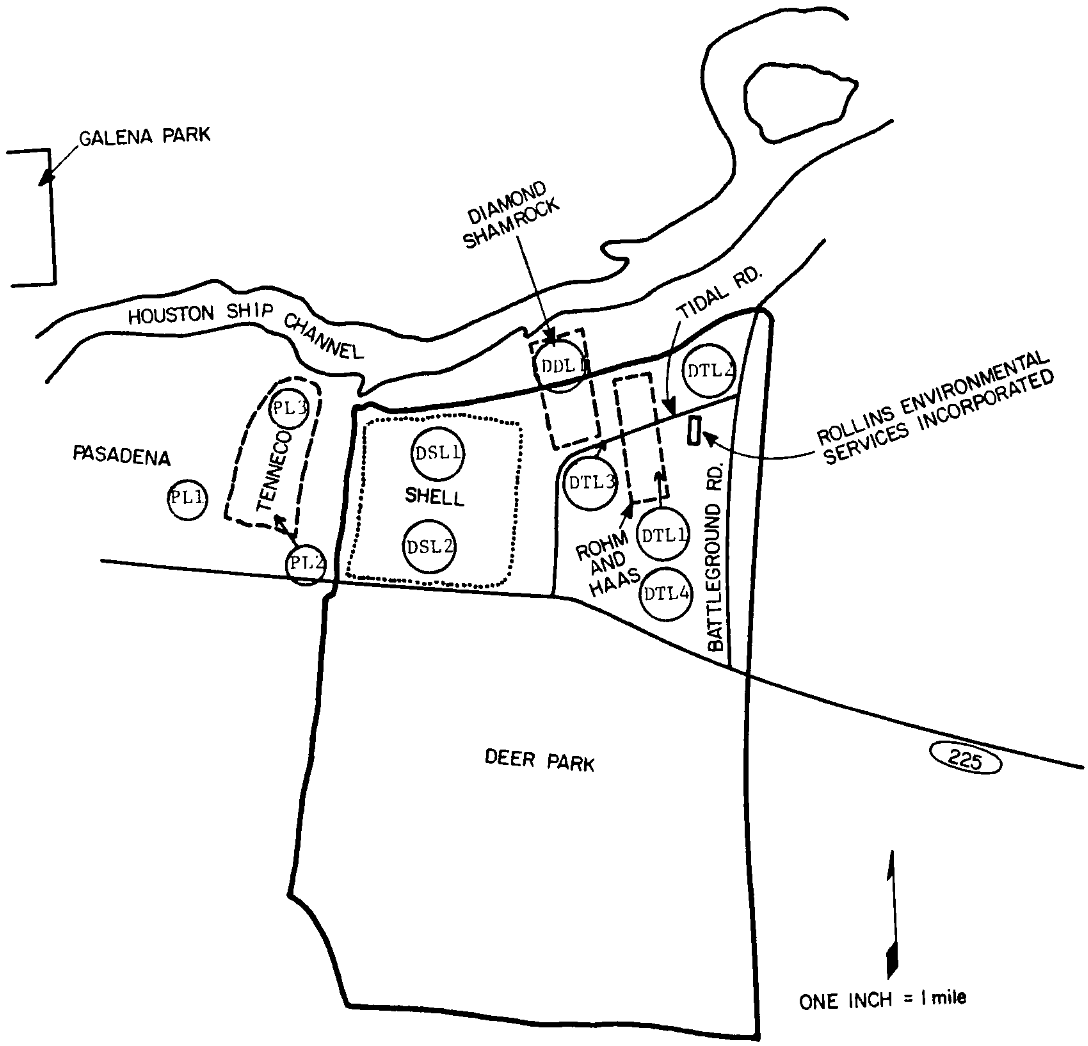

Figure 13. Sampling locations for Deer Park and Pasadena, TX sites.

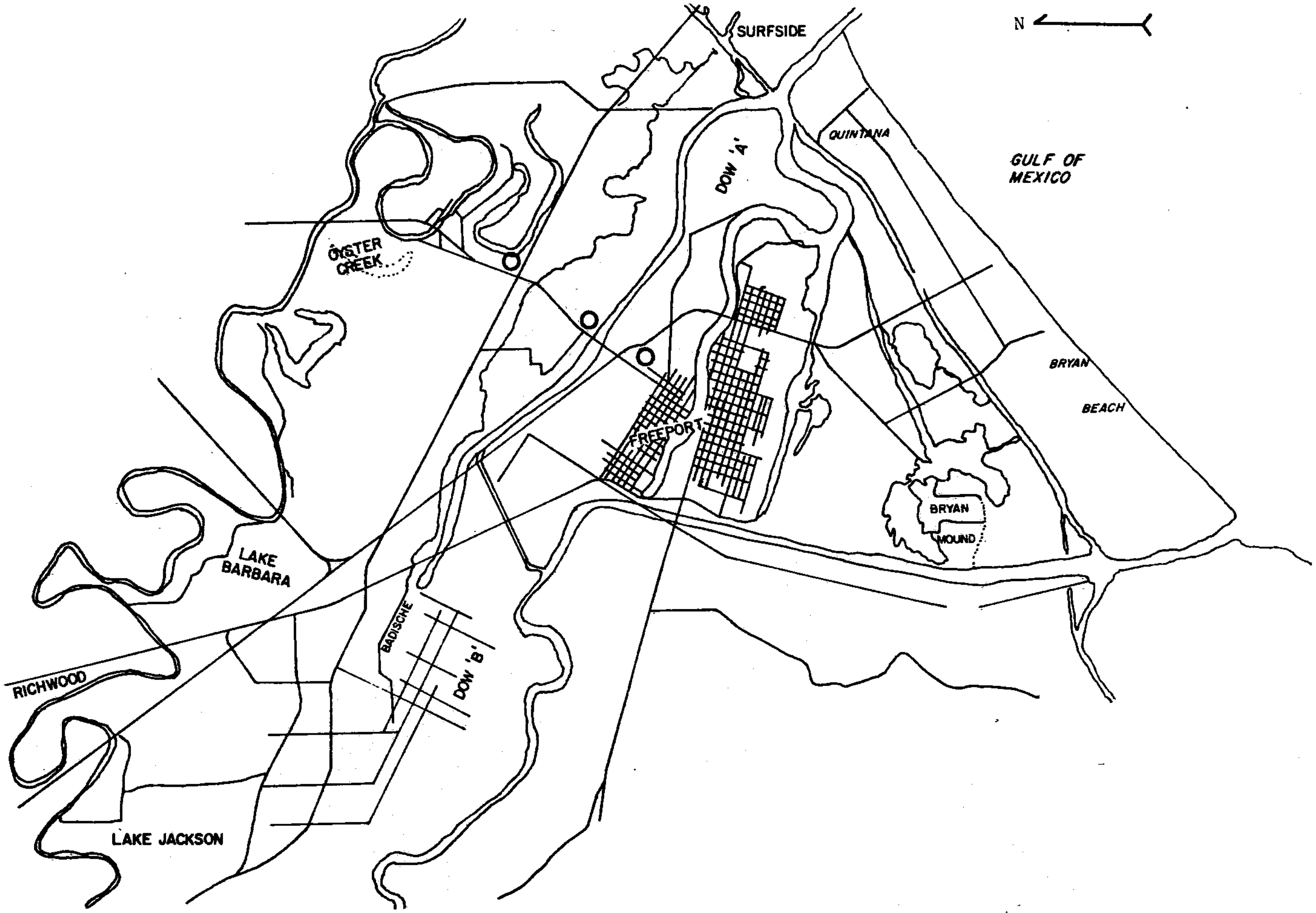

Figure 14. Sampling site in Freeport, TX (Dow 'A').

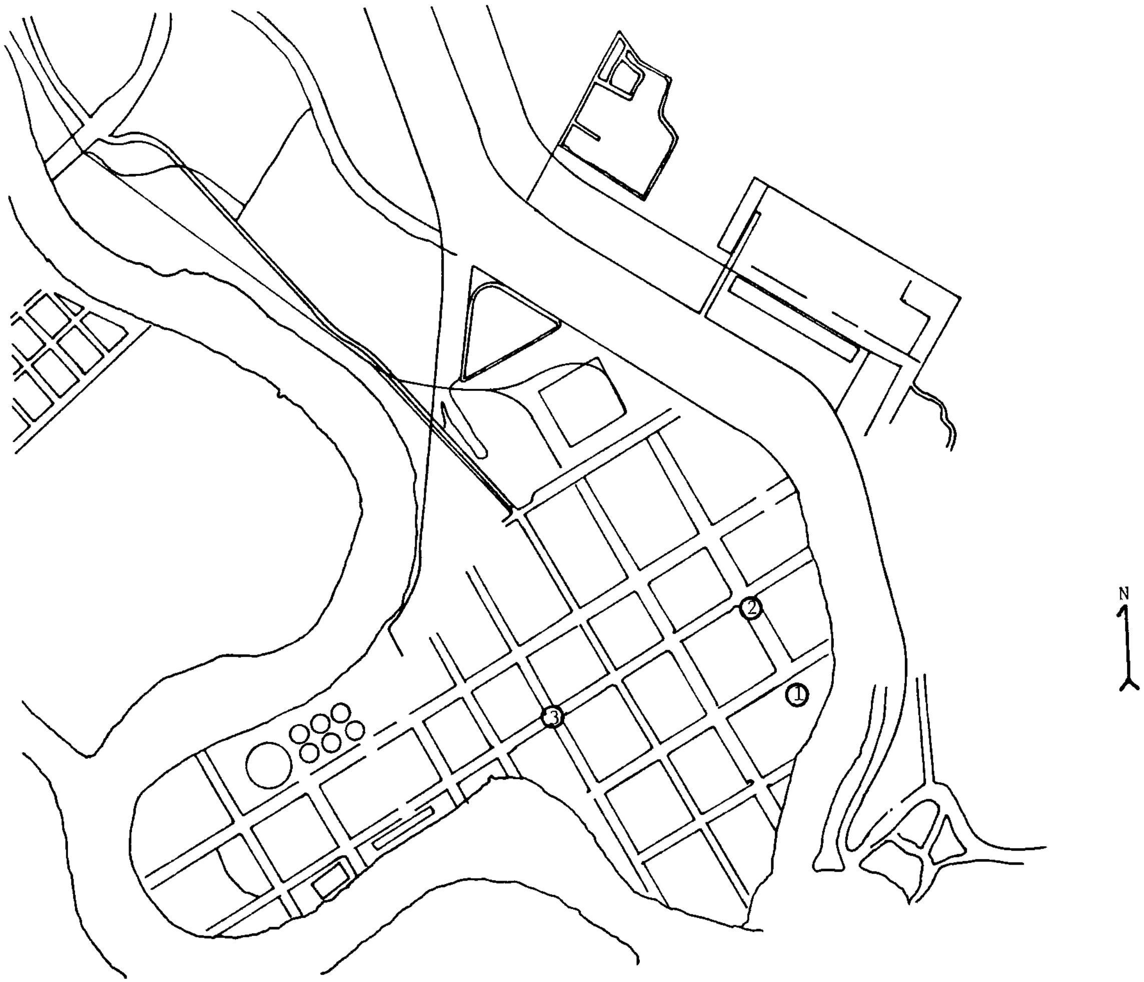

Figure 15. Sampling locations in Freeport, TX (Dow 'A').

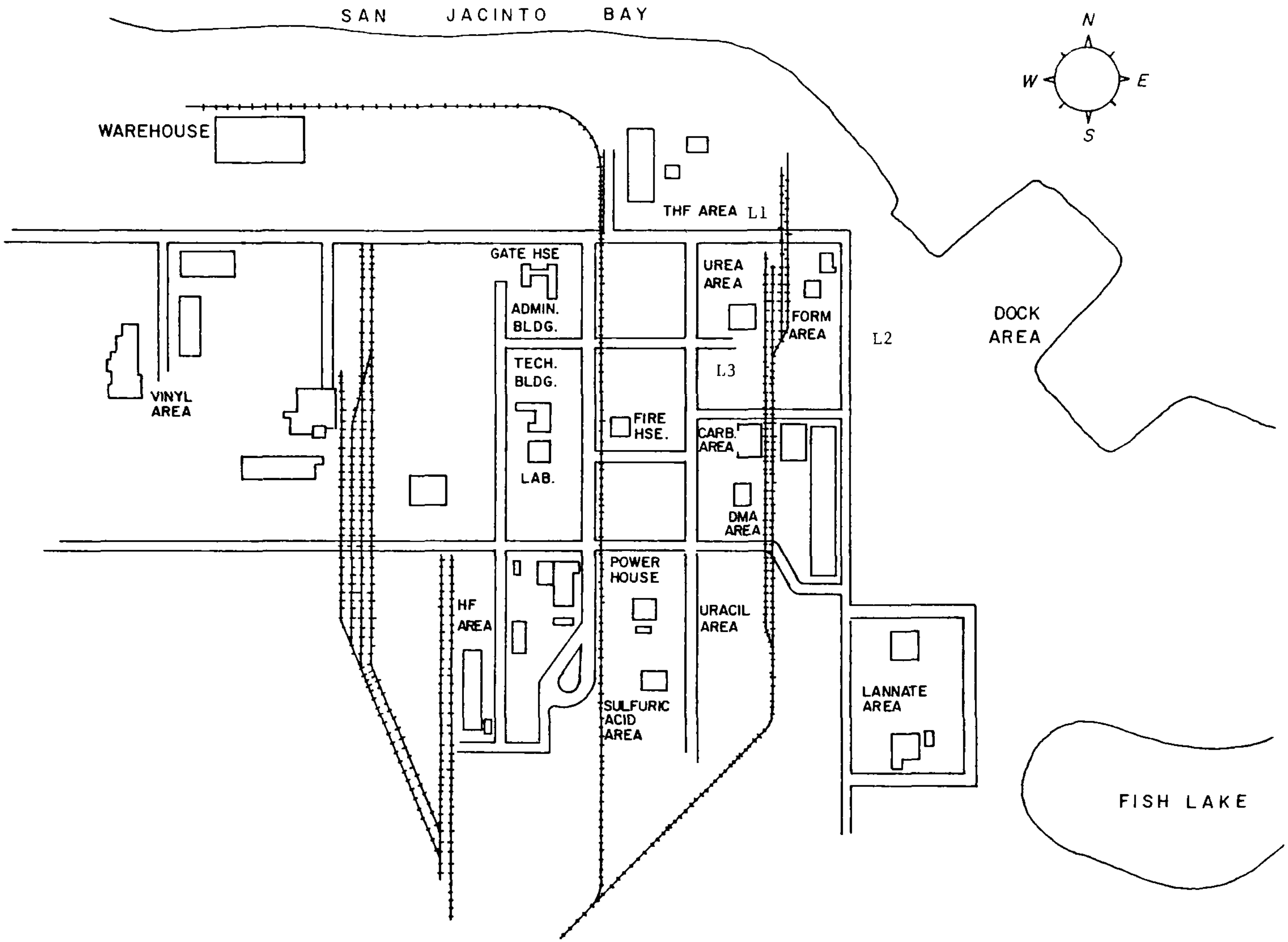

Figure 16. Sampling site and locations in La Porte, TX (E. I. DuPont de Nemours & Co.).

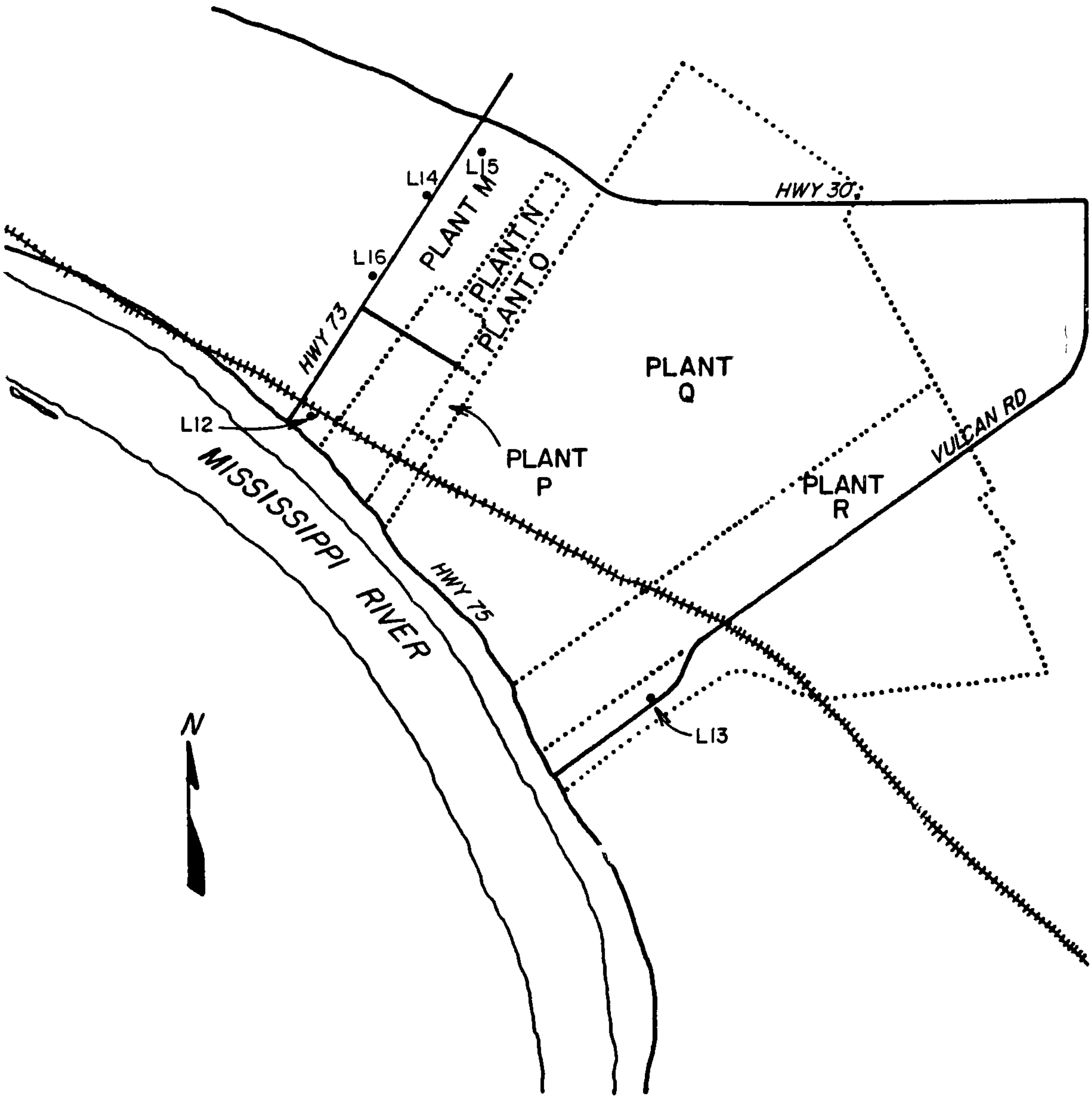

Figure 17. Sampling site and locations in Geismar, LA area. M = Borden Chemical Co., N = Monochem, Inc., O = Uniroyal Inc., P - Rubicon Chemical, Inc., Q = BASF Wyandotte Chemical Corp., R = Shell Chemical Co., S = Vulcan Materials, Inc.

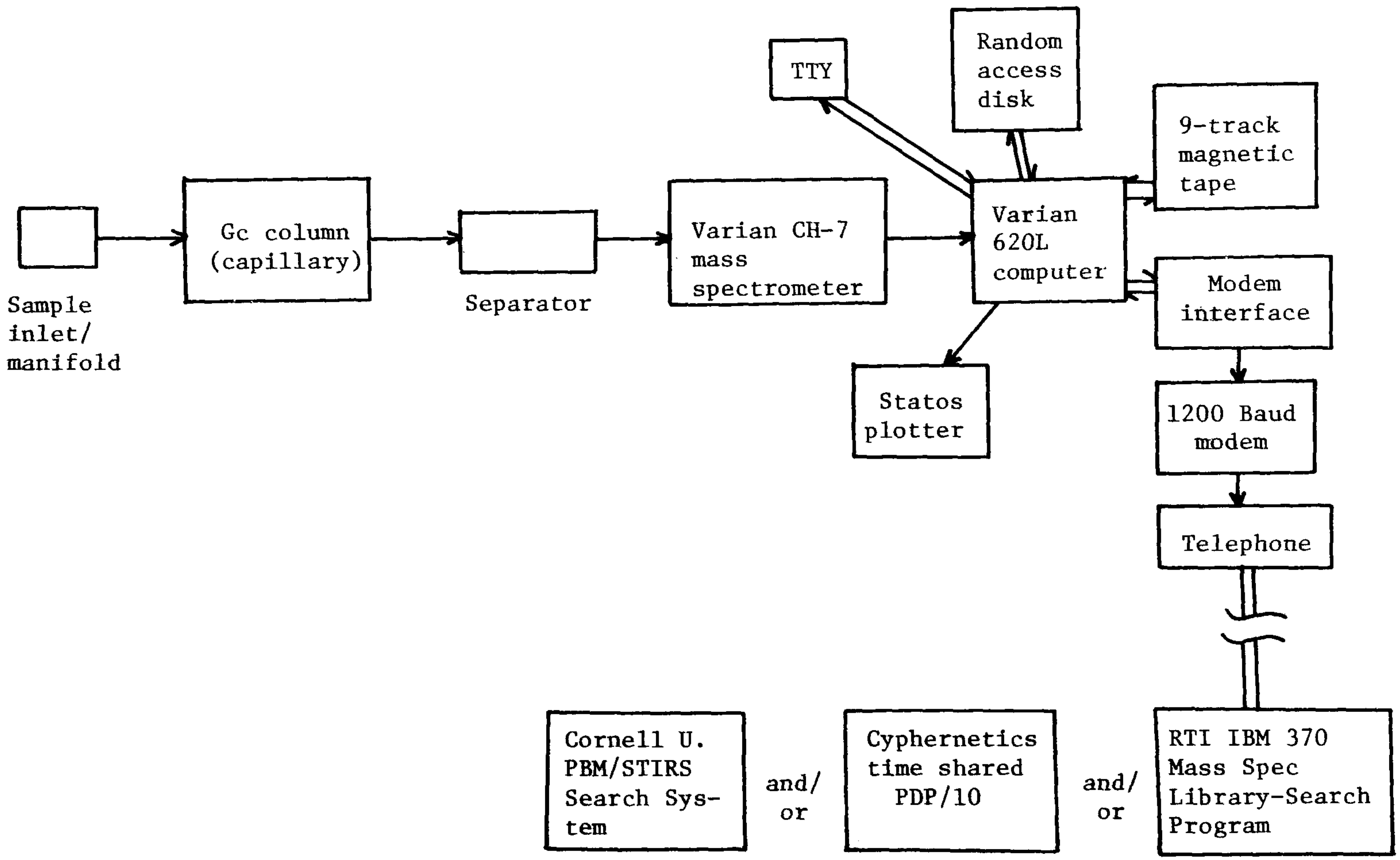

Figure 18. Schematic diagram of gc-ms computer system and library search systems.

Table 18. OPERATING PARAMETERS FOR GLC-MS-COMP SYSTEM

Parameter	Setting
Inlet-manifold	
desorption chamber	270°C
valve	220°C
capillary trap - minimum	-195°C
maximum	220°C
thermal desorption time	4 min
GLC	
100 m glass SCOT OV-101	20-240°C, 4/C° min
50 m glass SCOT Carbowax 20M	80-240°C
carrier (He) flow	~3 ml/min
transfer line to ms	240°C
MS	
scan range	_m/e_ 20 → 300
san rate, automatic-cyclic	1 sec/decade
filament current	300 μA
ion source vacuum	~4 x 10^{-6} torr

Samples were analyzed on a 100 m glass SCOT capillary coated with OV-101 stationary phase and/or a 50 m glass SCOT coated with Carbowax 20M. The desorption of vapors from the Tenax sampling cartridges was achieved at 270°C. A single stage glass jet separator which interfaced a SCOT capillary column to the mass spectrometer was maintained at 240°C. The capillary column was programmed from 20-240°C at 4°/min for the OV-101 and from 80-240°C at 4°/min for the Carbowax 20M.

Methods of Identification

Identification of the constituents in the samples was established by comparing the mass cracking pattern of the unknown mass spectra to an Eight Peak Index[22] and to the Wiley collection.[23] In many cases, the identification was confirmed by comparing the mass cracking pattern of an authentic compound run under identical conditions with that of the unknown. The elution temperatures were also compared based on the chromatography of the authentic compound under identical conditions to the unknown. In some cases, the identification was achieved using the RTI computer based mass spectral search system and/or the PBM/STIRS system located at Cornell University.

Quantitative Analysis

Utilizing either the total ion current monitor when the constituents were adequately resolved or, when necessary, the use of mass fragmentograms, the concentration of each substance was determined. In order to eliminate the need to obtain complete calibration curves for each compound for which quantitative information was desired, we used the method of relative molar response (RMR) factors. This technique has previously been reported.[15] The mass cracking ions for a number of selected compounds for quantification by mass fragmentography are shown in Table 19.

RESULTS AND DISCUSSION

Kin-Buc Disposal Site, Edison, NJ

The sampling protocol employed for the collection of pollutants in ambient air surrounding the Kin-Buc disposal area was given in Table 15. The general strategy was conducted so that four locations were selected around the disposal site which constituted upwind, downwind and crosswind directions from the dump site (Figs. 6-11). Furthermore, one location was between Stauffer Chemical Co. and the Kin-Buc disposal site with an eye

Table 19. MASS CRACKING IONS SELECTED FOR QUANTIFICATION BY MASS FRAGMENTOGRAPHY

Chemical Class	Ion (Intensity) 1st	2nd	3rd
HALOGENATED HYDROCARBONS			
chloroprene	88 (50)	90 (17)	53 (100)
1,2-dichloroethane	62 (100)	64 (32)	49 (51)
1,1,1-trichloroethane	117 (19)	119 (18)	61 (59)
carbon tetrachloride	117 (100)	121 (30)	47 (41)
trichloroethylene	130 (99)	132 (95)	95 (100)
dichlorobutene	75 (100)	89 (43)	53 (50)
tetrachloroethylene	166 (100)	168 (49)	129 (63)
dichlorobutane	55 (100)	62 (20)	90 (22)
2,3-dichloropropene 3,3-dichloropropene-1 1,3-dichloropropene-1	110 (20)	75 (100)	49 (20)
methylene bromide	172 (52)	174 (100)	93 (72)
1,2-dichloropropane	63 (100)	62 (68)	76 (30)
dibromochloromethane	129 (100)	208 (12)	127 (80)
1,1,1,2-tetrachloroethane	131 (100)	133 (97)	117 (82)
1,1,2,2-tetrachloroethane	168 (18)	166 (13)	83 (100)
bromoform	173 (100)	252 (10)	175 (49)
bis-(2-chloroisopropyl)ether	45 (100)	121 (17)	93 (8)
hexachloro-1,3-butadiene	225 (100)	229 (22)	260 (38)
1,2-dibromopropane	123 (98)	202 (2)	121 (100)
tetrachloropropane isomers	178 (18)	180 (2)	143 (100)
vinylidene chloride	96 (61)	98 (38)	61 (100)
phosgene	63 (100)	65 (32)	44 (40)
1,2,2-trichloropropane	111 (43)	61 (23)	75 (20)
1,1,2-trichloropropane	75 (100)	110 (32)	61 (30)
1,1,-trichloropropane	111 (100)	113 (80)	75 (60)
pentachloroethane	202 (0)	167 (88)	165 (69)
perchloroethane	234 (0)	201 (100)	203 (63)
1,1-dichloropropene 1,2-dichloropropene	110 (100)	112 (64)	49 (22)
OXYGENATED COMPOUNDS			
isobutyl isobutyrate	89 (20)	-	-
isobutyl *n*-butyrate	89 (12)	60 (23)	-
isoamyl benzoate	123 (28)	70 (87)	-
dimethyl phthalate	163 (100)	-	-
butyl formate	56 (100)	73 (8)	-

(continued)

Table 19 (cont'd)

Chemical Class	Ion (Intensity)		
	1st	2nd	3rd
methyl methacrylate	69 (83)	100 (51)	-
isobutyl methacrylate	69 (78)	87 (14)	-
n-butyl methacrylate	69 (58)	87 (31)	-
diethyl phthalate	177 (100)	149 (44)	222 (10)
dipropyl phthalate	149 (100)	209 (9)	-
dibutyl phthalate	149 (100)	223 (9)	-

towards distinguishing between pollutants from Stauffer and Kin-Buc. During each sampling period, meteorological conditions were recorded in order to define the wind patterns, temperature and humidity around the sampling site. In particular, the wind direction and speed were determined for documenting the positions as to upwind, downwind, and crosswind of the disposal site. The sampling protocol covered three days with two sampling periods/day. Each sampling period was approximately 2 hrs in duration and a volume of 100-150 ℓ was collected.

In addition to the use of the Tenax GC cartridge for the collection of ambient air pollutants an SKC carbon cartridge was used in tandem for the trapping of vinyl chloride. The SKC cartridge was 1.5 cm i.d. x 4.0 cm in length. The breakthrough volume for vinyl chloride on this material was previously established to be 100 ℓ at 70°F.[x] Two sets of cartridges were utilized/sampler at the four locations.

In Appendix A, Tables A1-A24 lists the volatile organic compounds which were identified in ambient air surrounding and on the Kin-Buc disposal site. Table 20 summarizes the volatile organics which were identified in terms of chemical classes for each of the six periods and four locations. A total of 28 halogenated compounds was detected in these samples. Approximately 6 of these were detected in practically all of the samples taken around the disposal site area which indicates that these pollutants are ubiquitous and not site-specific. On the other hand, the remaining 22 halogenated compounds which included many chlorinated and brominated organics appeared to be more specific to the sampling site area. Four sulfur compounds were identified (Table 20). These compounds appeared to be unique to the site area and did not represent ubiquitous background pollutants. A total of 10 nitrogen-containing compounds were detected and of these, nine were probably unique to the site area. The tenth one, cyanobenzene, appeared to be a ubiquitously occurring vapor.

Eighty-nine oxygenated compounds were identified. They represented ketones, aldehydes, ethers, esters and alcohols. The presence of many of these oxygenated compounds can be attributed to emissions from the disposal site area. The presence of ethers, alcohols and esters may be considered rather unique to the site since these compounds have not been observed as

Table 20. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR SURROUNDING KIN-BUC DISPOSAL SITE

Chemical Class	Compound	Period 1				Period 2				Period 3				Period 4				Period 5				Period 6			
		L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
Halogenated Hydrocarbons																									
	dichloromethane	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	chloroform	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	1,1,1-trichloroethane	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	carbon tetrachloride	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	trichloroethylene	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	tetrachloroethylene	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	chlorotoluenes (1-3)	-	+	-	-	-	+	+	-	-	-	-	+	+	+	+	-	-	+	-	+	-	+	-	-
	benzyl chloride	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	+	-	-
	dichlorobenzene (m or p)	+	+	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+
	bromotoluene (m or p)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methyl chloride	-	-	-	+	-	+	-	-	+	+	-	-	-	+	-	-	+	-	+	+	-	-	-	-
	chlorobenzene	-	-	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
	3-chloropropene	-	-	-	-	-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-
	1,2-dichloroethane	-	-	-	+	+	+	+	+	+	+	+	+	-	+	+	-	-	-	+	+	+	-	+	+
	1,2-dibromoethane	-	-	-	-	-	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-
	bromotoluene isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-
	bromotoluene isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
	dichlorotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-
	vinylidene chloride (tent.)	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
	2-chloropropane (tent.)	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-chloro-2-bromoethane	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-bromo-2-fluorobenzene	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	benzyl bromide (tent.)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methylene dibromide	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trichlorobenzene isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
	1,1,2,2-tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+
	bromoxylene isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
	chloroxylene	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Table 20 (cont'd)

Chemical Class	Compound	Period 1				Period 2				Period 3				Period 4				Period 5				Period 6			
		L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
Sulfur Compounds																									
	thiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
	dimethyldisulfide	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
	propylthiophene (tent.)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n-butyl thiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Nitrogen Compounds																									
	cyanobenzene	-	-	+	+	-	-	+	+	-	-	+	+	+	+	+	+	+	+	+	-	+	+	-	-
	indole	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-
	N,N-dimethylformamide	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-
	acrylonitrile	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	dimethylhydrazine (tent.)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	trimethylamine (tent.)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	acetonitrile	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	benzamide (tent.)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	dicyanobenzene (tent.)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methylcyanobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Oxygenated Compounds																									
	acetaldehyde	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
	furan	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
	propanal	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	+
	acetophenone	+	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
	2-nonanone	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	+	+	-	-	-	+	-	+
	n-nonanal	-	-	-	+	-	-	-	+	+	+	+	-	-	-	-	+	+	+	-	+	-	+	-	+

(continued)

Table 20 (cont'd)

Chemical Class	Compound	Period 1				Period 2				Period 3				Period 4				Period 5				Period 6			
		L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
Oxygenated Compounds (cont'd)																									
	terphthaldehyde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
	2- or 3-decanone	+	-	+	-	-	-	-	+	-	-	+	-	-	-	-	+	+	+	-	-	-	+	-	-
	n-decanal	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	-	-	-	+	+	-
	naphthol isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
	n-propanol	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
	ethyl acetate	-	-	-	+	+	-	+	-	-	-	-	+	-	+	+	-	+	-	+	+	+	-	+	+
	cyclopentanone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
	undecanone	-	-	+	-	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-
	3-methyl furan (tent.)	-	-	-	-	+	-	+	-	+	-	-	-	-	-	-	+	-	-	-	+	-	+	-	+
	diisopropyl ether	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	+
	methyl isopropyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	isopropyl acetate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+	+
	n-butyl acetate	-	-	+	+	-	-	-	+	-	-	+	-	-	-	-	+	-	-	-	+	-	-	+	+
	isopropanal	-	-	-	-	+	-	+	-	-	-	-	+	+	+	+	-	-	-	+	-	+	-	+	-
	2-methylfuran	+	-	-	-	-	+	-	-	-	-	+	+	-	+	+	-	-	-	+	-	+	-	-	-
	methyl isobutyl ketone	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-	+	-	+	+	+	-
	n-butylfuran	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	-	-	-	+	-	+	+	-	-
	2-ethylhexanal	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
	biphenyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-
	dimethylfuran	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-
	acrolein	-	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+
	dimethyl ether	+	-	+	+	-	-	-	-	+	+	+	-	-	+	-	+	-	+	-	+	-	+	+	+
	acetone	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
	methyl-n-propyl ether	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	+	+	-	+	-	+	+	+
	diethyl ether	-	-	-	+	-	-	+	+	-	+	-	+	+	-	+	+	+	+	+	+	+	-	+	-
	2-methylpropenal	-	-	+	+	-	-	-	-	+	+	+	-	-	-	-	+	+	+	-	+	-	-	+	+
	vinyl acetate	-	-	-	+	-	-	-	+	-	+	+	-	-	-	-	+	+	+	-	-	-	+	+	+

(continued)

Table 20 (cont'd)

Chemical Class	Compound	Period 1				Period 2				Period 3				Period 4				Period 5				Period 6			
		L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
Oxygenated Compounds (cont'd)																									
	n-butanal	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	+	+	-	+	-	+	-	+
	methyl ethyl ketone	+	-	-	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+
	methyl vinyl ketone	-	-	-	-	+	-	+	-	+	+	+	+	-	+	+	-	-	+	+	+	+	+	+	+
	n-pentanal	-	-	+	+	-	-	-	+	-	+	+	-	-	-	-	+	+	+	-	+	-	+	+	+
	2-pentanone	-	-	+	+	-	-	-	+	+	+	+	-	-	-	-	+	+	+	-	-	-	+	-	-
	4-methyl-2-pentanone	-	-	+	+	-	-	-	+	+	+	+	-	-	-	-	+	+	+	-	-	-	+	-	+
	3-methyl-2-pentanone	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+
	n-hexanal	-	-	-	+	-	-	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	-
	2-ethylbutyraldehyde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
	2-hexanone	-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	+	+	+	-	-	-	-	+	+
	2-heptanone	-	-	+	+	-	-	-	+	-	+	+	-	-	-	-	+	-	-	-	+	-	+	-	+
	n-heptanal	-	-	-	+	-	-	-	-	+	+	+	-	-	-	-	+	-	+	-	+	-	+	-	-
	octanone	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
	benzaldehyde	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
	2-octanone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-
	phenol	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+
	n-octanal	-	-	-	+	-	-	-	+	+	+	+	-	-	-	-	+	+	+	-	+	-	+	-	+
	benzyl methyl ether	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
	phenethyl alcohol (tent.)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
	dimethylphenol	-	-	-	+	+	+	+	-	+	-	-	+	+	+	-	-	-	-	+	-	+	+	-	-
	t-butanol	-	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+	+
	n-propyl acetate	-	-	-	+	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	+	+
	isoamyl acetate (tent.)	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,5-diphenylfuran	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	vinyl ethyl ether	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-epoxybutane (tent.)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	crotonaldehyde	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	tetrahydropyran	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-n-propenylfuran (tent.)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Table 20 (cont'd)

Chemical Class	Compound	Period 1 L1	L2	L3	L4	Period 2 L1	L2	L3	L4	Period 3 L1	L2	L3	L4	Period 4 L1	L2	L3	L4	Period 5 L1	L2	L3	L4	Period 6 L1	L2	L3	L4
Oxygenated Compounds (cont'd)																									
	hydroxybenzaldehyde	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	p-cresyl acetate	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	o-methoxybenzaldehyde	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	o-methyl anisole	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ethyl phenol	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ethyl phenol	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	dipropylene glycol methyl ether (tent.)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	di-n-amylphthalate	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n-butyl formate	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	furfuryl alcohol	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2,3-benzofuran	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-heptanol	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2-methyl-2-pentanol (tent.)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	dibenzofuran	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	diethylphthalate	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	benzophenone	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methyl 2-methylallyl ether (tent.)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methyl allyl alcohol	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	benzyl acetate	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methyl benzoate	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-dioxane (tent.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
	trimethylfuran isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
	dioxane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-
	tetrahydrofuran	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
	acetic acid	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	methyl isopropyl ketone	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
	p-methyl benzyl alcohol	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ubiquitous pollutants in samples taken at many other geographical areas within the Continental U.S.

The compounds which were selected for quantification were primarily those appearing in significant concentrations in or downwind from the Kin-Buc disposal site. In several cases, compounds which were found to be unique in the air collected downwind from the Stauffer Chemical Co. and upwind from the disposal site were also quantified. The levels of organic vapors which were estimated in ambient air surrounding the site are listed in Tables 21-26. Significant concentrations of benzene were detected in each of the sampling periods near the disposal site area. Also, many halogenated hydrocarbons were also represented in these samples.

Analysis of the SKC carbon cartridges which had been taken in tandem with the Tenax GC cartridges indicated that no vinyl chloride was present in concentrations above 16 ppt (Table 27). The samples which were selected for analysis represented downwind locations from the disposal site. Since vinyl chloride was not detected in these samples, the values were expressed in terms of the detection limit of the method. Two samples (P5/L3 and P6/L3) represented samples taken on the dump site. Likewise, these samples did not contain vinyl chloride above 40 ppt. Since these samples did not contain vinyl chloride, the remaining sampling cartridges were not analyzed.

Houston, TX and Vicinity Sites

The ambient air sampling protocol for Houston, TX and vicinity was given in Table 16. A total of five sites was studied. At the first site in Houston, TX, three locations were sampled. These were indicated in Figure 12. Two additional sites were Pasadena and Deer Park, TX. These sites are indicated in Figure 13. The last two sites were in Freeport and La Porte, TX. The sampling locations on Dow Chemical and E. I. Dupont deNemours properties are shown in Figures 14, 15 and 16, respectively.

A principal reason for returning to the first site (Milby Park, Houston, TX) was our previous report of finding chloroprene. The sampling method employed was intended to establish the presence of chloroprene as well as determine the levels in ambient air. The two additional sites, Pasadena and Deer Park, TX were selected because of the many petroleum refineries and chemical industries located in this area as well as the services for the destruction of chemical wastes.

Table 21. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P1/L1	P1/L2	P1/L3	P1/L4
acetaldehyde	trace	~10,250	trace	~3,125
acetic acid	ND	ND	~91	trace
acrolein	ND	ND	trace	4,000
allyl acetate	ND	30,697	ND	ND
benzaldehyde	80	trace	trace	trace
benzene	20,343	93,750	9,687	13,406
benzyl methyl ether	ND	1,000	ND	ND
n-butyl acetate	ND	ND	129	4,774
n-butyl butyrate	ND	ND	43	525
carbon tetrachloride	ND	ND	1,312	750
chloroform	6,389	ND	trace	trace
chlorotoluene	ND	2,593	ND	ND
cyanobenzene	ND	ND	trace	1,169
1,2-dichloroethane	ND	ND	ND	217
dimethyl ether	trace	ND	trace	10,500
ethyl phenyl acetate	ND	trace	ND	ND
2-hexanone	ND	ND	trace	ND
3-heptanone	ND	ND	trace	trace

(continued)

Table 21 (cont'd)

Compound	Sampling Period/Location[b]			
	P1/L1	P1/L2	P1/L3	P1/L4
isopropyl ether	ND	ND	trace	trace
methallyl alcohol	ND	800	ND	trace
methylbromobenzene	ND	507	ND	ND
methyl ethyl ketone	trace	ND	1,500	trace
4-methyl-2-pentanone	ND	ND	2,125	5,958
3-methyl-2-pentanone	ND	ND	45	1,140
1-methyl-2-chlorobenzene	ND	1,873	ND	ND
_n_-nonanal	ND	ND	ND	2,661
tetrachloroethylene	354	1,527	trace	trace
trichloroethylene	trace	210	1,315	10,052
1,1,1-trichloroethane	trace	trace	trace	trace
vinyl acetate	ND	ND	ND	583

[a] ng/m^3.

[b] Refer to Table 15.

Table 22. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P2/L1	P2/L2	P2/L3	P2/L4
acetaldehyde	trace	∿7,000	∿9,000	trace
acrolein	trace	714	trace	trace
benzene	7,718	14,093	10,656	11,343
n-butyl formate	1,902	ND	ND	ND
benzophenone	1,540	ND	ND	ND
3-chloropropene	ND	ND	28,667	ND
carbon tetrachloride	12,687	13,687	7,250	trace
chloroform	1,999	trace	trace	ND
chlorobenzene	ND	ND	trace	trace
cyanobenzene	2,892	ND	3,473	trace
1,2-dichloroethane	trace	434	trace	2,173
ethyl acetate	trace	ND	trace	ND
methylene dibromide	42	ND	ND	ND
methylene chloride	trace	trace	trace	trace
methyl ethyl ketone	ND	ND	trace	trace
3-methylhexanal	1,042	ND	ND	ND
methyl isobutyl ketone	ND	ND	604	ND
1-methylnaphthalene	440	trace	ND	trace

(continued)

Table 22 (cont'd)

Compound	Sampling Period/Location[b]			
	P2/L1	P2/L2	P2/L3	P2/L4
methyl vinyl ketone	ND	ND	trace	ND
tetrachloroethylene	1,187	trace	2,896	trace
dichloroethylene	4,947	4,500	5,263	trace

[a] ng/m^3

[b] Refer to Table 15.

Table 23. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P3/L1	P3/L2	P3/L3	P3/L4
acetaldehyde	~18,750	~51,250	~6,500	~6,250
acrolein	trace	1,750	trace	trace
benzene	8,687	6,875	5,906	8,968
benzylchloride	ND	413	ND	ND
n-butyl acetate	ND	ND	371	ND
carbon tetrachloride	3,875	trace	trace	2,000
1-chloro-2-bromoethane	10,071	ND	ND	ND
chlorobenzene	ND	167	480	1,807
2-chloropropane (tent.)	4,067	ND	ND	ND
3-chloropropene	ND	ND	trace	trace
cyanobenzene	ND	ND	trace	323
chloroform	9,000	1,944	12,333	3,445
1,2-dibromoethane	591	ND	ND	trace
1,2-dichloroethane	37,913	ND	trace	347
dichloromethane	7,600	trace	trace	trace
diethyl ether	ND	17,750	ND	3,600
ethyl acetate	ND	ND	ND	trace
methyl isopropyl ketone	ND	ND	trace	ND

(continued)

Table 23 (cont'd)

Compound	Sampling Period/Location[b]			
	P3/L1	P3/L2	P3/L3	P3/L4
methyl vinyl ketone	10,727	trace	trace	2,100
methyl ethyl ketone	14,556	trace	trace	1,278
4-methyl-2-pentanone	trace	trace	trace	ND
2-pentanone	1,742	459	ND	ND
<u>n</u>-pentanal	ND	477	trace	ND
<u>n</u>-propyl acetate	ND	trace	trace	ND
1,1,1-trichloroethane	ND	ND	19,167	trace
1,1,2-trichloroethane	3,500	ND	ND	ND
trichloroethylene	3,737	trace	6,895	10,315
vinyl acetate	ND	trace	trace	ND

[a] ng/m^3.

[b] Refer to Table 15.

Table 24. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P4/L1	P4/L2	P4/L3	P4/L4
acetaldehyde	~24,000	trace	~25,000	~14,000
benzaldehyde	2,753	trace	trace	ND
benzene	trace	24,718	5,375	10,031
carbon tetrachloride	1,937	1,875	7,625	trace
chlorobenzene	1,127	trace	607	610
chloroform	186	5,834	8,999	2,778
3-chloropropene	ND	ND	2,428	ND
cyanobenzene	4,553	trace	trace	ND
1,2-dibromoethane	ND	ND	535	ND
1,2-dichloroethane	ND	trace	1,130	ND
ethyl acetate	ND	trace	4,133	trace
_n_-hexanal	ND	trace	trace	800
_n_-heptanal	ND	ND	ND	713
methylene chloride	trace	trace	trace	trace
methyl ethyl ketone	5,111	trace	trace	trace
methyl vinyl ketone	ND	trace	3,500	trace
methyl isobutyl ketone	ND	trace	5,472	ND

(continued)

Table 24 (cont'd)

	Sampling Period/Location[b]			
Compound	P4/L1	P4/L2	P4/L3	P4/L4
n-nonanal	ND	ND	ND	2,265
tetrachloroethylene	2,722	527	9,173	1,389
1,1,1-trichloroethane	trace	trace	7,684	trace
trichloroethylene	trace	394	5,289	trace
benzyl chloride	ND	4,513	ND	ND

[a] ng/m^3.

[b] Refer to Table 15.

Table 25. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P5/L1	P5/L2	P5/L3	P5/L4
acetaldehyde	trace	∿20,833	trace	∿3,125
acrolein	trace	3,125	trace	4,000
benzaldehyde	trace	3,400	trace	2,888
benzene	15,969	7,343	trace	7,000
benzyl chloride	ND	6,560	ND	ND
bromobenzene	ND			
bromotoluene	ND	472	ND	ND
n-butyl butyrate	trace	ND	ND	ND
chloroform	17,222	11,111	19,444	8,334
1,2-dichloroethane	ND	ND	7,575	9,565
dichloromethane	trace	trace	40,000	100,000
ethyl acetate	trace	ND	trace	9,467
n-hexanal	trace	1,200	ND	2,288
isopropyl acetate	ND	ND	ND	6,517
methyl ethyl ketone	trace	trace	8,535	1,389
methyl vinyl ketone	ND	trace	trace	7,091
n-nonanal	trace	3,080	ND	2,223
n-octanal	trace	1,250	ND	789

(continued)

Table 25 (cont'd)

Compound	Sampling Period/Location[b]			
	P5/L1	P5/L2	P5/L3	P5/L4
n-pentanal	trace	ND	ND	15,018
tetrachloroethylene	1,360	trace	25,560	34,632
1,1,2-trichloroethane	ND	ND	ND	4,467
1,1,1-trichloroethane	trace	trace	3,417	∿150,000
trichloroethylene	trace	trace	18,940	3,684
1,2-dibromoethane	ND	ND	757	ND

[a] ng/m^3.

[b] Refer to Table 15.

Table 26. CONCENTRATIONS OF ORGANIC VAPORS SURROUNDING KIN-BUC DISPOSAL SITE[a]

Compound	Sampling Period/Location[b]			
	P6/L1	P6/L2	P6/L3	P6/L4
acetaldehyde	∿14,750	∿25,000	NQ	∿625
acrolein	trace	trace	NQ	ND
benzaldehyde	trace	3,400	2,525	2,888
benzene	10,156	6,875	191,000	27,343
benzyl chloride	ND	8,033	ND	ND
bromotoluene	ND	472	ND	ND
n-butyl butyrate	ND	trace	ND	1,517
carbon tetrachloride	3,125	625	10,600	7,000
chloroform	944	2,500	27,200	28,334
1,2-dichloroethane	trace	ND	27,700	260
dichloromethane	3,000	trace	260,000	∿42,000
ethyl acetate	trace	ND	232,000	4,066
n-hexanal	trace	1,200	trace	2,288
isopropyl acetate	ND	ND	NQ	6,517
methyl ethyl ketone	trace	555	33,300	400
methyl vinyl ketone	trace	trace	trace	7,091
n-nonanal	ND	3,080	ND	trace

(continued)

Table 26 (cont'd)

Compound	Sampling Period/Location[b]			
	P6/L1	P6/L2	P6/L3	P6/L4
n-octanal	ND	1,250	ND	ND
n-pentanal	ND	trace	38,000	15,018
tetrachloroethylene	694	1,229	394,000	12,500
1,1,2-trichloroethane	ND	ND	ND	4,467
1,1,1-trichloroethane	trace	417	121,000	75,000
trichloroethylene	trace	trace	trace	10,606
1,1-dichloroethane	ND	ND	22,700	ND
methyl isobutyl ketone	ND	ND	444,500	ND
1,1,2,2-tetrachloroethane	ND	ND	15,000	1,389
bromoxylene	ND	ND	50,500	ND

[a] ng/m^3.

[b] Refer to Table 15.

Table 27. AMBIENT AIR SAMPLES FROM KIN-BUC DISPOSAL SITE ANALYZED FOR VINYL CHLORIDE

Sampling Period/Location[2]	VC (ppb)[b]
P2/L4	<.016
P3/L3	<.016
P4/L3	<.016
P5/L3	<.036
P6/L3	<.036

[a]See Table 15 for protocol.

[b]Since vinyl chloride was not detected, values are expressed in terms of detection limit of method.

In Appendix A, Tables A25-A41 list the volatile organic compounds which were identified in ambient air samples taken from these sites. Table 28 summarizes the volatile halogenated compounds identified in samples from each of these sites. A total of 42 halogenated compounds was detected. Among them were vinyl chloride, bis-(chloromethyl)ether, bromoform, ethylene dibromide (1,2-dibromoethane), phosgene and several chlorinated ethanes, propanes, propenes, butanes and aromatics. We again detected the presence of 3-chloro-1,3-butadiene (chloroprene) in samples taken at Milby Park, Houston, TX. The location HL1 (Fig. 12) represents a downwind position from the industrial complex in this area. Of particular interest in this sample was the identification of t-butanol, isopropanol, crotonaldehyde, and 4-vinylcyclohexene. The presence of 4-vinylcyclohexene was particularly intriguing because of the possibility that the corresponding oxide could be present from photochemical reactions; however, it was not detected in these samples.

In the Pasadena, Deer Park area, several esters were identified. These were butyl formate, methyl methacrylate, isobutyl methacrylate, n-butyl methacrylate, an alkyl butyrate isomer and an alkyl thialate isomer.

Samples which were collected on Dow Chemical property were analyzed and found to contain many halogenated compounds. Among them were 1,2-dichloroethane, 1,1,1,-trichloroethane, carbon tetrachloride, 1,2-dichloropropane, dibromomethane, 1,1,2-trichloroethane, 1,1,1,2-tetrachloroethane, bromoform and bis-(2-chloroisopropyl)ether. Several esters were also identified. These were: 2-butyl-n-butyrate, n-butyrate, dimethyl phthalate, diethyl phthalate, 2,6-di-t-butyl-4-phenoxyphenol and dipropyl phthalate. A second sample taken at a different location on Dow property also contained bis-(2-chloroisopropyl)ether. Furthermore, 2 alcohols, 2-t-cyclohexanol and tripropylene glycol were identified. This sample also contained hexachloro-1,3-butadiene. At a third location on Dow property, other compounds of interest were detected. These were chloroethane, vinylidene chloride, phosgene, ethylene glycol dimethyl ether, 1,1,2-trichloroethane, 1,2-dibromoethane, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, pentachloroethane, perchloroethane, tripropylene glycol, dibutoxyethane and diphenyl ether.

Table 28. SUMMARY OF VOLATILE HALOGENATED COMPOUNDS IN AMBIENT AIR IN HOUSTON, PASADENA, DEER PARK, FREEPORT AND LA PORTE, TX AREAS

Chemical Class	Locations[a] HL1	HL2	HL3	PL1	PL2	PL3	DSL1	DSL2	DDL1	DTL2	DTL3	DTL4	FL1	FL2	FL3	LL1	LL2	LL3
HALOGENATED HYDROCARBONS																		
dichlorodifluoromethane	+	-	+	-	-	+	+	-	-	-	-	-	-	+	+	-	+	-
dichlorofluoromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trichlorofluoromethane	+	-	+	-	-	+	+	-	-	-	-	-	-	+	+	-	+	-
1,1,1,2-tetrachlorodifluoroethane	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
dichloromethane	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	-
chloroethane	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-
2-chloro-1,3-butadiene (chloroprene)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dichloropropene isomer (tent.)	-	-	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-	-
chloroform	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
phosgene	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
vinylidene chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-
1,2-dichloroethane	+	-	-	-	-	+	+	-	+	+	+	-	-	-	+	-	-	-
dibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-trichloroethane	+	-	+	+	+	-	-	+	-	+	+	-	+	+	-	+	+	+
carbon tetrachloride	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
dichloropropane isomer	-	-	-	-	-	-	+	-	-	+	-	-	+	+	+	-	-	+
trichloroethylene	+	-	+	+	+	-	+	-	-	-	-	-	+	+	+	-	+	+
dichlorobutane isomer	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dichlorobutene isomer	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-trichloroethane	-	-	-	-	-	-	+	-	-	+	-	-	-	+	+	-	-	-
tetrachloroethylene	+	+	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+
dibromochloromethane	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
dichlorobutane isomer	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
dichloropropene isomer(s)	-	-	-	-	-	+	+	-	-	++++[b]	-	-	-	-	++[b]	-	-	-
dichlorobenzene isomer	+	-	+	-	-	+	+	+	-	-	-	-	+	+	+	+	+	-
dichlorobenzene isomer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
1,1,1,2-tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
tetrachlorohexafluorobutane (tent.)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Table 28 (cont'd)

Chemical Class	Locations																	
	HL1	HL2	HL3	PL1	PL2	PL3	DSL1	DSL2	DDL1	DTL2	DTL3	DTL4	FL1	FL2	FL3	LL1	LL2	LL3
bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis-(2-chloroisopropyl)ether	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
1,3-hexachlorobutadiene	-	-	-	-	-	-	-	-	+	+	-	+	+	+	-	-	+	+
chlorobenzene	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	+	+	+
1,2-dibromopropane	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
tetrachloropropene isomer	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
1,2-dibromoethane	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
1,1,2,2-tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
1,2,3-trichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
pentachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
perchloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
chloropropene isomer	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-
dichloroethylene	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-
trichloropropene isomer(s)	-	-	-	-	-	-	-	-	-	++[b]	-	-	-	-	-	-	-	-
2,3-dichloro-1-propanol	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
1,2-bis-(2-chloroethoxy)ethane	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
1,3-dichloro-2-methylene propane	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
trichloro-2-methylpropene	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
tetrachlorobutadiene isomer	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
pentachlorobutadiene isomer(s)	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
trichlorobenzene	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
vinyl chloride	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
bis-(chloromethyl)ether (tent.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

[a] See Fig. 12-16 for sampling locations.

[b] More than one isomer was detected.

The ambient air levels of halogenated and other organics in samples from Houston, Pasadena, Deer Park, Freeport and La Porte, TX areas are given in Tables 29 and 30. The concentration of 2-chloro-1,3-butadiene (chloroprene) was found to be 4,000 ng/m^3 in the ambient air samples taken in Milby Park, Houston, TX. Many other halogenated compounds were also detected and quantified (Table 29). The concentrations of several oxygenated compounds are also presented in this table. All of the compounds were esters and principally esters of butyric acid, phthalic acid or acrylates. Table 30 presents the minimum total weight of the ambient air levels of volatile organics for the two chemical classes listed in Table 29. It is interesting to note that the higher concentrations generally occur for those samples collected downwind from the industrial complexes.

Organic Vapors in Ambient Air from the Iberville Parish Area, LA

The area near Geismar, LA was selected for study since it contained chemical industry known to be involved in the production of many chemical classes of compounds for which our analytical methodology had not yet been validated. This geographical area provided an opportunity to examine the performance of the collection and analysis methods developed under this contract program. Table 31 presents the chemical production occurring at these industrial sites in Geismar, LA. In general, oxygenated and nitrogen-containing compounds were the predominant materials which were or had been synthesized. Many potential chlorinated hydrocarbons could also be emitted from some of these industries principally on the basis of their production activities. Thus, on the basis of the suspected presence of the oxygen-, nitrogen- and halogenated-containing compounds in the atmospheres in the Geismar area, we proceeded to employ a sampling network for collection and analysis.

Table 17 presented the sampling protocol which principally consisted of two types of sampling strategies. The first was the collection of organic vapors using a sampling period with the integration over a period of 24 hrs and the second utilized short sampling periods of 2-3 hrs. Additional information on the surface weather conditions were obtained from the airport in Baton Rouge, LA. These data are summarized in Table 31. Table 32 presents the ozone concentrations which were monitored in Baton Rouge, LA concurrently during the sampling efforts which were expended in the Geismar

Table 29. AMBIENT AIR LEVELS OF HALOGENATED AND OTHER ORGANICS IN HOUSTON, PASADENA, DEER PARK, FREEPORT AND LA PORTE, TX AREAS

Chemical Class	HL1	HL2	HL3	PL1	PL2	DSL1	DSL2	DDL1	DTL1
HALOGENATED HYDROCARBONS									
2-chloro-1,3-butadiene (chloroprene)	4,000[a]	266	-	-	-	-	-	-	-
dichloropropene isomer (tent.)	-	-	-	-	-	-	-	-	-
chloroform	11,539	-	11,538	T	T	53,846	6,420	7,692	1,923
vinylidene chloride	-	-	-	-	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	555	-	-	-
1,2-dichloroethane	T	-	-	-	158	66,300	-	6,722	T
dibromoethane	-	-	-	158	-	-	-	-	-
1,1,1-trichloroethane	522	-	900	-	T	-	144	-	-
carbon tetrachloride	238	114	T	T	146	846	T	T	T
dichloropropane isomer	-	-	-	-	-	T	-	-	-
trichloroethylene	75	-	39	76	5,071	321	-	2,535	-
dichlorobutane isomer	-	700	-	-	-	-	-	-	-
dichlorobutene isomer	262	-	-	-	-	-	-	-	-
1,1,2-trichloroethane	-	-	-	-	-	6,700	-	-	-
tetrachloroethylene	29	T	21	20	18	-	T	2,019	75
dichlorobutane isomer	52	-	-	-	-	-	-	-	-
dichloropropene isomer(s)	-	-	-	-	-	180 90 90	-	-	T,T
1,1,1,2-tetrachloroethane	-	-	-	-	-	-	-	-	-
bis-(2-chloroisopropyl)-ether	-	-	-	-	-	-	-	-	-
hexachloro-1,3-butadiene	-	-	-	-	-	-	-	334	-
1,2-dibromopropane	-	-	-	-	-	-	-	-	-
1,1,2,2-tetrachloroethane	-	-	-	-	-	-	-	-	-
1,2,3-trichloropropane	-	-	-	-	-	-	-	-	-
pentachloroethane	-	-	-	-	-	-	-	-	-
perchloroethane	-	-	-	-	-	-	-	-	-

Chemical Class	DTL2	DTL3	DTL4	FL2	FL3	LL1	LL2	LL3
HALOGENATED HYDROCARBONS								
2-chloro-1,3-butadiene (chloroprene)	-	-	-	-	-	-	-	-
dichloropropene isomer (tent.)	-	-	-	-	-	-	-	-
chloroform	8,846	T	15,384	280	T	8,461	8,850	7,692
vinylidene chloride	-	-	-	-	531	-	-	-
1,1-dichloroethane	-	-	-	-	-	-	-	-
1,2-dichloroethane	4,055	T	T	3,300	4,500	778	-	-
dibromoethane	-	-	-	-	T	-	-	-
1,1,1-trichloroethane	1,000	400	400	16,600	15,200	3,889	27,700	T
carbon tetrachloride	T	276	69	11,538	T	T	1,230	T
dichloropropane isomer	2,586	-	-	69	1,478	-	-	T
trichloroethylene	-	-	-	107	200	-	43	T
dichlorobutane isomer	-	-	-	-	-	-	-	-
dichlorobutene isomer	T	-	-	-	-	-	-	-
1,1,2-trichloroethane	3,334	-	-	-	3,821	-	-	-
tetrachloroethylene	68	-	72	94	1,585	17	83	T
dichlorobutane isomer	-	-	-	-	-	-	-	-
dichloropropene isomer(s)	241 1,293 72 1,293 345	-	T	-	-	-	-	-
1,1,1,2-tetrachloroethane	-	-	-	-	21	-	-	-
bis-(2-chloroisopropyl)-ether	-	-	-	27	333	-	-	T
hexachloro-1,3-butadiene	2,066	-	25	13.3	8.3	-	T	T
1,2-dibromopropane	-	-	-	-	T	-	-	-
1,1,2,2-tetrachloroethane	19	-	-	-	33	-	-	-
1,2,3-trichloropropane	-	-	-	-	298	-	-	-
pentachloroethane	-	-	-	-	3,984	-	-	-
perchloroethane	-	-	-	-	2,903	-	-	-

(continued)

Table 29 (cont'd)

Chemical Class	HL1	HL2	HL3	PL1	PL2	DSL1	DSL2	DDL1	DTL1	DTL2	DTL3	DTL4	FL2	FL3	LL1	LL2	LL3
tetrachlorobutadiene isomer	-	-	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-
pentachlorobutadiene isomer(s)	-	-	-	-	-	-	-	67	-	T 100	-	-	-	-	-	-	-
vinyl chloride	-	-	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-
trichloropropene isomer(s)	-	-	-	-	-	-	-	-	-	T,T	-	-	-	-	-	-	-
OXYGENATED COMPOUNDS																	
isobutyl isobutyrate	T	1,233	-	-	?	-	T	-	-	33	T	-	-	-	-	-	T
2-butyl-n-butyrate	330	-	-	-	-	-	-	-	-	-	-	-	1,291	1,586	-	1,334	2,066
n-butyl-n-butyrate	-	600	-	-	-	-	T	230	-	-	T	670	1,435	1,010	3,334	7,300	4,167
dimethyl phthalate	T	-	-	-	-	-	-	-	-	T	-	T	-	-	100	-	-
diethyl phthalate	-	113	-	T	-	134	T	-	-	-	T	330	-	-	500	1,000	-
amyl benzoate	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibutyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	567	-	-
methyl methacrylate	-	-	-	-	-	-	-	547	T	-	-	-	-	-	-	-	-
isobutyl methacrylate	-	-	-	-	-	-	-	333	1,334	67	-	-	-	-	-	-	-
n-butyl methacrylate	-	-	-	-	-	-	-	-	2,380	-	-	-	-	-	-	-	-
sec-butyl acrylate	-	-	-	-	-	-	-	167	-	-	-	-	-	-	-	-	-
n-butyl acrylate	-	-	-	-	-	-	-	2,670	-	-	-	-	-	-	-	-	-
n-hexyl acrylate	-	-	-	-	-	-	-	3,000	-	-	-	-	-	-	-	-	-

[a]Values are in ng/m^3.

Table 30. ESTIMATED MINIMUM TOTAL AMBIENT AIR LEVELS OF VOLATILE ORGANIC CHEMICAL CLASSES

Chemical Class	HL1	HL2	HL3	PL1	PL2	DSL1	DSL2	DDL1	DTL1	DTL2	DTL3	DTL4	FL2	FL3	LL1	LL2	LL3
Halogenated hydrocarbons	16,737[a]	1,100	12,518	294	5,433	128,948	6,604	19,409	2,078	25,398	716	15,990	32,028	40,026	13,165	37,926	7,832
Oxygenated Compounds	370	1,966	-	20	-	134	60	6,947	3,734	120	60	1,020	2,726	2,596	4,601	9,634	6,253

Table 31. SURFACE WEATHER OBSERVATIONS FOR BATON ROUGE, LA

Date	Time	Sky & Ceiling	Temperature (°F)	Wind Direction (00-36)	Wind Speed (Kts.)
2/28/77	0053	CLR	41	00	00
	0152	CLR	37	00	00
	0252	CLR	37	00	00
	0355	CLR	36	05	03
	0453	CLR	36	00	00
	0555	CLR	35	00	00
	0652	CLR	36	00	00
	0717	CLR	40	00	00
	0852	CLR	46	12	06
	0953	CLR	51	12	04
	1052	CLR	53	05	05
	1152	CLR	58	08	07
	1252	CLR	59	33	05
	1352	CLR	61	30	05
	1452	CLR	62	26	08
	1651	CLR	62	29	09
	1751	CLR	61	29	08
	1857	CLR	59	27	05
	1951	CLR	53	00	00
	2051	CLR	51	24	03
	2152	CLR	51	24	03
	2251	CLR	50	23	06
	2351	CLR	49	24	03
3/1/77	0051	CLR	45	00	00
	0152	CLR	41	00	00
	0252	CLR	40	00	00

(continued)

Table 31 (cont'd)

Date	Time	Sky & Ceiling	Temperature (°F)	Wind	
				Direction (00-36)	Speed (Kts.)
	0353	CLR	39	00	00
	0451	CLR	39	00	00
	0551	CLR	39	00	00
	0651	CLR	38	00	00
	0752	CLR	43	00	00
	0852	CLR	54	23	07
	0952	CLR	59	21	09
	1052	CLR	62	23	06
	1152	CLR	64	27	07
	1252	CLR	66	27	06
	1352	300-SCT	68	21	05
	1454	E300 BKN	67	11	06
	1552	E300 BKN	66	17	07
	1651	E300 BKN	66	16	05
	1751	E300 BKN	62	22	09
	1853	E300 BKN	58	22	08
	1953	E300 BKN	57	18	07
	2057	E300 BKN	55	17	05
	2151	300 SCT	52	18	08
	2251	300 SCT	52	18	06
	2351	300 SCT	50	14	04
3/2/77	0053	300 SCT	48	14	04
	0152	300 SCT	46	11	07
	0253	300 BKN	44	14	05
	0354	300 BKN	45	14	08
	0454	300 BKN	45	08	07
	0552	100 SCT 300 SCT	44	08	08

(continued)

Table 31 (cont'd)

Date	Time	Sky & Ceiling	Temperature (°F)	Wind Direction (00-36)	Wind Speed (Kts.)
	0652	E50 BKN 300 BKN	47	08	08
	0752	E45 OVC	50	11	08
	0852	E45 OVC	45	13	09
	0952	E45 BKN 100 BKN 300 BKN		13	15
	1052	E45 BKN 100 OVC	46	15	15
	1152	E45 BKN 100 OVC	42	14	12
	1252	E45 BKN 100 OVC	44	14	16
	1352	45 SCT E 100 OVC	45	13	20
	1453	40 SCT E 80 OVC	45	13	18
	1553	E 75 OVC	45	13	14
	1655	40 SCT E60 OVC	46	14	15
	1752	40 SCT E70 OVC	49	12	11
	1853	E50 OVC	51	12	11
	1951	M32 BKN 70 OVC	52	11	12
	2056	M32 OVC	53	12	13
	2151	M32 OVC	53	12	12
	2209	M25 OVC	-	12	10
	2253	M28 OVC	54	12	09
	2351	M23 OVC	54	12	08
3/3/77	0053	17 SCT E60 OVC	60	10	08
	0130	M14 BKN 60 OVC		09	06
	0152	M14 BKN 60 OVC	60	09	06
	0254	M17 BKN 60 OVC	60	12	08
	0352	M11 OVC	60	12	07
	0405	M9 OVC	-	10	06
	0453	M7 OVC	62	13	13
	0555	M7 OVC	64	13	11

(continued)

Table 31 (cont'd)

Date	Time	Sky & Ceiling	Temperature (°F)	Wind Direction (00-36)	Wind Speed (Kts.)
	0652	M10 OVC	65	14	12
	0751	M10 OVC	68	12	16
	0851	M17 OVC	68	16	20
	0943	M17 OVC	-	15	18
	0955	M17 OVC	68	15	17
	1058	M17 OVC	67	15	14
	1144	M17 OVC	-	16	14
	1152	M17 OVC BKN 100 OVC	69	18	16
	1255	M17 OVC	70	17	12
	1352	M19 OVC	71	18	15
	1455	11 SCT M20 OVC	72	17	23
	1554	11 SCT M25 BKN 70 OVC	72	19	18
	1657	11 SCT M19 BKN 70 OVC	72	18	18
	1756	M19 OVC	72	18	19
	1856	M19 OVC	72	19	20
	1951	M19 OVC	73	20	17
	2051	M23 OVC	73	18	15
	2152	M19 OVC	71	21	15
	2206	M11 OVC	-	21	15
	2253	M11 OVC	71	21	16
	2319	M7 OVC	-	27	14
	2330	M5 OVC	-	01	15
	2355	M7 OVC	56	35	16

Table 32. OZONE CONCENTRATIONS IN BATON ROUGE, LA

Hour	Date 2/28	3/1	3/2	3/3
1	0.004[a]	0.007	0.022	0.069
2	0.013	0.009	0.016	0.063
3	0.015	0.019	0.009	0.061
4	0.005	0.021	0.008	0.057
5	0.008	0.008	0.033	0.050
6	0.001	0.006	0.042	0.043
7	0.000	0.005	0.020	0.032
8	0.001	0.009	0.007	0.030
9	0.003	0.094	0.018	0.034
10	0.022	0.071	0.041	0.035
11	-[b]	0.087	0.063	0.030
12	-	0.011	0.067	0.033
13	0.136	0.117	-	0.029
14	0.115	0.115	-	0.034
15	0.095	0.125	-	0.038
16	0.083	0.115	-	0.038
17	0.087	0.110	0.062	0.031
18	0.071	0.097	0.073	0.030
19	0.019	0.063	0.064	0.032
20	0.006	0.045	0.062	0.033
21	0.005	0.050	0.059	0.037
22	0.015	0.025	0.065	0.035
23	0.010	0.014	0.067	0.033
24	0.006	0.008	0.068	0.031

[a]Values in ppm.

[b]Period during instrument calibration.

area. As expected, the highest concentrations of ozone were observed through the mid-day period with levels reaching an excess of 100 ppb between the periods of 1200-1700 hrs. On the fourth day of sampling (March 3, 1977), the levels of ozone were rather constant between 30-60 ppb. Considerable overcast during these sampling periods was observed.

In Appendix A, Tables A42-A46 list the volatile organic vapors which were identified in ambient air from Geismar, LA. Table 33 summarizes the halogenated, oxygenated, nitrogenous and sulfur-containing compounds detected in these samples. A total of 16 halogenated hydrocarbons was identified. Among these were carbon tetrachloride, methyl chloroform, methylene chloride and vinylidene chloride. These chemicals were reported to be produced by industry in this area (Table 13).

Four nitrogenous compounds were identified in samples taken downwind from Rubicon Chemicals, Inc. These were nitrobenzene, 2-dinitrobenzene isomers and diphenylamine. These compounds were also chemicals which were reported to be produced by Rubicon.

Three sulfur compounds and approximately 26 oxygenated compounds were characterized in ambient air samples. Several ethers and alcohols were present. However, we did not detect any glycol ethers which were reported to be produced by Shell Oil Co. in this area. From previous research, we of course have shown that the collection, thermal desorption and analysis of ethylene glycol and its analogs can not be achieved using the standard methods which we have been employing.

Table 34 presents the estimated levels of ambient air pollutants in samples from the Iberville Parish area. The relatively higher concentrations of the halogenated compounds appeared to be associated with the downwind positions of the industrial activity. Only trace quantities of the nitrogeneous compounds and sulfur-containing organics were present.

SUMMARY

The three principal geographical areas (New Jersey, Texas, and Louisiana) afforded many different types of chemical industry producing a large array of chemical classes of compounds for the determination of the performance of the collection and analysis method developed under this contract program. As evident by the results previously discussed, the technique is capable of collecting and analyzing compounds containing a wide variety of

Table 33. SUMMARY OF VOLATILE ORGANIC VAPORS IDENTIFIED IN AMBIENT AIR FROM GEISMAR, LA

Chemical Class	Compound	Sampling Locations				
		L-12	L-14	L-15	L-16	L-R[a]
Halogenated hydrocarbon	dichloromethane	+	+	+	+	+
	chloroethane	-	+	-	-	-
	dichloroethylene isomer	-	+	-	-	-
	chloroform	+	+	+	+	+
	dichloroethylene isomer	-	+	-	-	-
	1,1-dichloroethane	-	+	-	-	-
	1,1,1-trichloroethane	+	+	-	+	-
	1,2-dichloroethane	+	+	+	+	+
	carbon tetrachloride	+	+	+	+	+
	trichloroethylene	+	-	+	-	-
	1,2-dichloropropane	-	-	-	+	+
	tetrachloroethylene	+	+	+	+	-
	1,1,2-trichloroethane	-	+	+	-	-
	chlorobenzene	-	+	+	+	+
	dichlorobenzene isomer	-	+	+	-	+
	dichlorobenzene isomer	-	+	+	-	+
Oxygenated Compounds	benzaldehyde	+	+	+	+	+
	phenol	+	+	-	+	+
	acetophenone	+	+	+	+	+
	_n_-nonanal	+	-	+	-	-
	cresol isomer	+	+	+	+	+
	_n_-decanal	+	-	+	-	-
	isobutyl isobutanoate	+	+	+	-	-
	butyl butanoate	+	+	+	-	-
	furan	-	+	+	-	-

(continued)

Table 33 (cont'd)

Chemical Class	Compound	Sampling Locations L-12	L-14	L-15	L-16	L-R[a]
	acetone	-	+	+	+	+
	biphenyl ether	-	+	+	-	-
	isopropanol	-	-	+	-	-
	t-butanol	-	-	+	-	-
	2-methyl-3-pentanol (tent.)	-	-	+	-	-
	dimethyl-3-pentanol isomer	-	-	+	-	-
	vinyl acetate	-	-	-	+	-
	propionic acid (tent.)	-	-	-	+	-
	acetaldehyde	+	+	+	-	+
	propanal	+	+	-	+	+
	propenal	+	+	-	+	+
	dimethyl ether	+	-	+	+	+
	diethyl ether	+	-	+	-	-
	n-butanal	+	-	-	-	-
	methyl ethyl ketone	+	-	-	-	-
	n-pentanal	+	-	-	-	-
	n-hexanal	+	-	-	-	-
Nitrogenous compounds	nitrobenzene	-	-	-	-	+
	dinitrobenzene isomer	-	-	-	-	+
	2,4-dinitrobenzene	-	-	-	-	+
	diphenylamine (tent.)	-	-	-	-	+
Sulfur compounds	carbon disulfide	-	-	+	-	-
	2,5-diisobutylthiophene	-	-	+	-	-
	benzothiazole	-	-	-	-	+

[a]Downwind of Rubicon Chemicals, Inc., see Figure 17 for sampling locations.

Table 34. ESTIMATED LEVELS OF AMBIENT AIR POLLUTANTS IN GEISMAR, LA AREA[a]

Compound	L-12	L-13	L-14A	L-15	L-R1	L-14B	L-16	L-R2	L-S	L-B
nitrobenzene	ND[b]	ND	ND	ND	T	ND	ND	107	ND	ND
2,4-dinitrobenzene	ND	ND	ND	ND	T	ND	ND	27	ND	ND
dinitrobenzene isomer	ND	ND	ND	ND	T	ND	ND	T	ND	ND
diphenylamine	ND	ND	ND	ND	T	ND	ND	T	ND	ND
1,2-dichloroethane	683	ND	10333	7844	232	4689	1555	100	800	1444
carbon tetrachloride	400	1133	1433	300	183	4667	10100	300	286	2633
tetrachloroethylene	46	86	43	86	11	100	36	7	32	100
chloroform	1571	3057	3000	11742	857	9943	999	943	10355	1257
1,1,2-trichloroethane	120	150	5450	9611	ND	6900	ND	ND	320	ND
methylene chloride	1700	1909	727	1714	700	545	772	442	2333	454
1,1,1-trichloroethane	T	250	200	200	75	175	400	ND	80	675
1,2-dichloropropane	ND	1163	ND	121	ND	71	39	3999	ND	36
1,1-dichloroethane	ND	ND	235	75	ND	550	133	ND	ND	167
chlorobenzene	ND	ND	93	93	T	143	171	900	ND	ND
vinylidene chloride	ND	ND	T	ND	ND	200	ND	ND	ND	ND
benzene	287	3712	1562	1363	975	575	261	1212	520	712
benzothiazole	ND	ND	ND	ND	T	ND	ND	T	ND	ND
2,5-diisobutylthiophene	ND	ND	ND	T	ND	ND	ND	ND	ND	ND

[a]See Table 17 and Fig. 17 for sampling protocol and locations, respectively. Values are in ng/m^3.

[b]ND = not detected.

heteroatoms in various oxidation states. The chemical classes varied from non-polar to polar compounds with a large array of different types of chemical functionalities. Frequently, the analytical data obtained on samples collected from these geographical areas and the chemical data for which the industry was producing, using or storaging compared favorably which assisted in the evaluation and validation of the collection and analysis system. Often the chemicals which were reported as potential emissions from chemical industry were indeed detected and identified by the Tenax GC/SKC carbon sampling device coupled with thermal desorption and high resolution glass capillary column gas chromatography/mass spectrometry/computer analysis.

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APPENDIX A

VOLATILE ORGANIC VAPORS IDENTIFIED AND QUANTIFIED IN AMBIENT AIR

Table A1. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR UPWIND FROM KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	53	1-butene		45	126	toluene	
1A	53	n-butane		46	129	C_8H_{18} (3-methylheptane)	
1B	55	acetaldehyde	trace	47	131	dimethylcyclohexane isomer	
2	62	isopentane		48	133	C_8H_{14} isomer	
4	64	furan		49	134	C_8H_{16} isomer	
5	65	C_5H_{10} isomer		50	135	n-octane	
6	66	n-pentane		51	136	C_8H_{14} isomer	
7	67	propanal		52	137	C_8H_{16} isomer	
8	68	C_5H_{10} isomer		53	138	tetrachloroethylene	354
9	69	dichloromethane		55	144	C_9H_{20} isomer	
10	73	acetone		56	145	C_8H_{16} isomer	
11	75	dimethyl ether	trace	57	146	C_9H_{20} isomer	
12	79	C_6H_{14} isomer		58	147	C_9H_{18} isomer	
13	82	C_6H_{12} isomer		59	149	ethylbenzene	
14	83	3-methylpentane		60	150	C_9H_{20} isomer	
15	84	C_6H_{12} isomer		61	151	p-xylene	
16	85	hexafluorobenzene (eI)		62	152	C_9H_{20} isomer	
17	86	2-methylfuran		63	154	$C_{10}H_{22}$ isomer	
18	87	n-hexane		64	155	trimethylhexane isomer	
19	88	chloroform	6,389	65	156	o-xylene	
20	90	C_6H_{12} isomer		66	157	C_9H_{18} isomer	
21	91	methyl ethyl ketone		67	158	n-nonane	
22	92	perfluorotoluene (eI)		68	159	3,3,5-trimethylheptane	
23	94	2,2-dimethylpentane		69	162	methylnonane isomer	
24	95	2,4-dimethylpentane		70	163	isopropylbenzene + 4-methylnonane	
25	96	2,2,3-trimethylbutane					
26	97	1,1,1-trichloroethane		71	166	2,2,5,5-tetramethylhexane	
27	98	C_7H_{14} isomer		72	167	$C_{10}H_{20}$ isomer	
28	100	benzene	20,343	73	168	n-propylbenzene	
29	102	3,3-dimethylpentane		74	170	benzaldehyde and 2,3-dimethyloctane	80
30	103	cyclohexane					
31	104	2-methylhexane		75	171	m-ethyltoluene	
32	105	2,3-dimethylpentane		76	172	2,2,4-trimethylheptane	
33	106	3-methylhexane		77	174	$C_{10}H_{20}$ isomer	
34	108	C_7H_{14} isomer (tent.)		78	175	$C_{10}H_{22}$ isomer	
35	109	dimethylcyclopentane (tent.)		79	177	ter-butylcyclohexane (tent.)	
35A	109	trichloroethylene	trace	80	178	phenol	
36	110	C_7H_{14} isomer		80A	178	1,2,4-trimethylbenzene	
37	111	n-heptane		81	179	n-decane	
38	113	C_7H_{14} isomer		82	180	methyldecane isomer	
39	115	C_8H_{18} isomer		83	181	m-dichlorobenzene	
40	117	2,2,4-trimethylpentane		84	184	$C_{11}H_{24}$ + C_4-alkyl benzene isomers	
41	118	methylcyclohexane					
42	119	C_8H_{16} isomer		85	185	1,2,3-trimethylbenzene + $C_{11}H_{24}$ isomer	
43	120	C_8H_{18} isomer					
44	122	C_8H_{18} isomer		86	189	$C_{11}H_{24}$ isomer	

(continued)

Table A1 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
87	190	sec-butylbenzene					
87A	190	C_4-alkyl benzene + $C_{11}H_{24}$ isomer					
88	191	acetophenone					
89	193	$C_{12}H_{26}$ isomer					
90	194	C_5-alkyl benzene + $C_{11}H_{22}$ isomer					
91	196	C_4-alkyl benzene isomer					
92	198	n-undecane					
93	204	C_5-alkyl benzene isomer					
95	209	$C_{12}H_{24}$ isomer					
97	214	$C_{12}H_{24}$ isomer					
98	215	n-dodecane					
99	216	naphthalene					
100	225	$C_{13}H_{26}$ isomer					
101	230	2-undecanone (tent.)					
102	232	$C_{13}H_{26}$ isomer					
103	233	n-tridecane					
104	236	β-methylnaphthalene					
105	240	$C_{14}H_{30}$ isomer					
105A	240	$C_{14}H_{28}$ isomer					
105B	240	n-tetradecane					
105C	240	$C_{15}H_{32}$ isomer					

[a]Sampling was conducted on 6/29/76 from 1207 to 1359, see Table 15 for protocol (P1/L1).

Table A2. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND OF STAUFFER CHEMICAL CO., EDISON, NJ[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	N_2, O_2	
2	43	CO_2	
3	48	n-butane	
4	49	unknown	
5	49	unknown	
6	50	isobutane	
7	53	C_5H_8 isomer	
8	54	acetaldehyde	~10,250
9	62	methylbutene isomer	
10	63	furan	
11	63	pentene isomer	
12	68	tetramethylethylene oxide (tent.)	
13	69	C_6H_{14} isomer	
14	71	C_7H_{14} isomer	
15	73	acetone	
16	79	C_5H_{12} isomer	
17	82	methyl-2-methylallyl ether (tent.)	
18	84	C_6H_{14} isomer	
19	86	perfluorobenzene (es)	
20	88	C_6H_{14} isomer	
22	90	methylallyl alcohol	880
23	91	C_5H_{10} isomer	
24	91	C_5H_{12} isomer	
25	93	C_5H_{12} isomer	
26	94	perfluorotoluene (es)	
27	95	C_6H_{14} isomer	
28	97	1,1,1-trichloroethane	trace
29	101	benzene	93,750
30	102	C_6H_{14} isomer	
31	102	thiophene	
32	104	C_6H_{12} isomer	
33	104	C_7H_{16} isomer	
34	105	C_8H_{18} isomer	
35	106	C_7H_{14} isomer	
36	106	C_8H_{18} isomer	
37	108	C_6H_{12} isomer	
38	110	trichloroethylene	210
39	111	allyl acetate	30,697
40	112	C_7H_{16} isomer	
41	113	C_7H_{10} isomer	
42	114	C_7H_{16} isomer	
43	116	tetramethylpentane	
44	117	C_7H_{14} isomer	
45	118	C_8H_{18} isomer	
46	120	C_8H_{18} isomer	
47	123	C_7H_{12} isomer	
48	128	toluene	
49	130	C_8H_{18} isomer	
50	132	C_8H_{14} isomer	
51	132	C_8H_{16} isomer	
52	132	C_8H_{18} isomer	
53	133	C_8H_{16} isomer	
54	136	C_8H_{18} isomer	
55	138	tetrachloroethylene	1,527
57	142	C_8H_{16} isomer	
58	145	C_7H_{16} isomer	
59	147	C_8H_{16} isomer	
60	150	ethylbenzene	
61	152	p- or m-xylene	
62	153	C_8H_{18} isomer	
63	155	C_9H_{16} isomer	
64	156	styrene	
65	157	o-xylene	
66	159	C_9H_{20} isomer	
67	162	$C_{10}H_{20}$ isomer	
68	164	C_3-alkyl benzene	
69	164	C_9H_{14} isomer	
70	166	C_8H_{18} isomer	
71	170	chlorotoluene	2,593
72	171	benzaldehyde	
73	171	C_3-alkyl benzene	
74	172	C_3-alkyl benzene	
75	174	C_8H_{16} isomer	
76	175	benzyl acetate	
77	176	benzamide (tent.)	
78	178	benzyl methyl ether	1,000
79	178	$C_{10}H_{18}$ isomer	
80	178	C_8H_{14} isomer	
81	179	phenol	
82	179	C_3-alkyl benzene	
83	180	$C_{10}H_{22}$ isomer	
84	181	1-methyl-2-chlorobenzene	1,873
85	182	dichlorobenzene	
86	184	$C_{10}H_{20}$ isomer	
87	185	C_4-alkyl benzene	
88	187	methylbromobenzene	507
89	189	$C_{10}H_{20}$ isomer	
90	190	C_4-alkyl benzene	
91	191	C_3-alkyl benzene	
92	193	C_9H_{16} isomer	

(continued)

Table A2 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
93	195	C_4-alkyl benzene					
94	198	methylbenzoate (tent.)					
95	199	$C_{11}H_{24}$ isomer					
96	202	$C_{12}H_{24}$ isomer					
97	204	C_4-alkyl benzene					
98	204	indole (?)					
99	206	$C_{11}H_{22}$ isomer					
100	208	$C_{11}H_{22}$ isomer					
102	212	C_4-alkyl benzene					
103	214	C_4-alkyl benzene					
104	215	C_5-alkyl benzene					
105	216	$C_{12}H_{26}$ isomer					
106	217	naphthalene					
107	219	benzophenone					
108	222	ethyl phenyl acetate	trace				
109	229	$C_{10}H_{20}$ isomer					
110	231	dimethylchlorobenzene (tent.)					
111	232	propylthiophene (tent.)					
112	234	$C_{13}H_{28}$ isomer					
113	237	dicyanobenzene (tent.)					
114	238	$C_{11}H_{20}$ isomer					
115	240	$C_{12}H_{24}$ isomer					
116	↓	$C_{13}H_{26}$ isomer					
117	↓	$C_{13}H_{28}$ isomer					
118	↓	dimethylindane					
119	↓	$C_{11}H_{22}$ isomer					
120	↓	C_4-alkyl tetrahydronaphthalene					
121	↓	$C_{14}H_{30}$ isomer					
122	↓	$C_{11}H_{22}$ isomer					
123	↓	$C_{11}H_{22}$ isomer					
124	↓	$C_{15}H_{32}$ isomer					

[a]Sampling was conducted on 6/29/76 from 1206 to 1355, see Table 15 for protocol (P1/L2).

Table A3. ORGANIC VOLATILES IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$	
2	42	CO_2	
4	49	chloromethane	
4A	50	propane (tent.)	
5	51	1-butene	
5A	52	n-butane	
6	55	acetaldehyde	trace
7	61	isopentane	
7A	63	C_5H_{10} isomer	
8	64	furan	
8A	64	C_5H_{10} isomer	
9	67	n-pentane	
10	69	propanal	
10A	70	acrolein	trace
11	72	acetonitrile (tent.)	
12	76-81	acetone	
12A	80	dimethyl ether	trace
12B	81	2-methylpentane	
13	82	2-methylpropenal (tent.) + C_6H_{12} isomer	
14	86	hexafluorobenzene (es)	
14A	87	n-hexane	
14B	88	butanal	
14C	89	chloroform	trace
14D	90	isopropyl ether	trace
14E	92	C_7H_{16} isomer	
15	93	perfluorotoluene (es)	
16	95	methyl ethyl ketone	1,500
17	97	1,1,1-trichloroethane	
18	101	benzene	9,687
18A	103	carbon tetrachloride	1,312
19	104	2-methylhexane + cyclohexane	
20	105	2,3-dimethylpentane	
21	106	3-methylhexane	
22	109	C_7H_{16} isomer	
22A	110	dimethylcyclopentane	
23	111	trichloroethylene	1,315
23A	111	C_7H_{14} isomer	
24	112	n-heptane	
24A	113	n-pentanal	
25	115	2-pentanone	
25A	116	acetic acid	~91
25B	117	C_8H_{18} isomer	
26	119	methylcyclohexane	
26A	120	2-methylheptane	
26B	121	3-methylheptane	
27	122	4-methyl-2-pentanone	2,125
28	125	2-methyl-2-pentanone	45
29	128	toluene	
30	130	2,4-dimethylhexane	
31	132	dimethylcyclohexane isomer	
32	134	C_8H_{16} isomer	
33	136	n-octane	
34	138	n-butyl acetate	129
35	139	tetrachloroethylene	
37	141	C_8H_{16} isomer	
37A	143	2-hexanone	trace
37B	144	C_9H_{20} isomer	
38	145	C_9H_{20} isomer	
38A	146	C_8H_{16} isomer	
39	147	chlorobenzene	
40	150	ethylbenzene	
40A	151	2-methyloctane	
41	152	p-xylene	
42	153	3-methyloctane	
42A	154	3-heptanone	trace
42B	155	2-heptanone	trace
42C	156	styrene	
43	157	1,1,3,3-tetramethylcyclopentane	
44	157	o-xylene	
44A	158	C_9H_{18} isomer	
45	159	n-nonane	
45A	160	C_9H_{18} isomer	
45B	162	C_9H_{18} isomer	
46	164	2,2,4-trimethylheptane	
47	165	isopropylbenzene	
47A	165	$C_{10}H_{22}$ isomer	
47B	166	$C_{10}H_{22}$ isomer	
48	167	2,6-dimethyloctane	
48A	167	isopropylcyclohexane	
49	168	$C_{10}H_{20}$ isomer	
49A	168	4-methylnonane	
50	169	$C_{10}H_{20}$ isomer	
51	171	n-propylbenzene	
51A	171	benzaldehyde	
52	172	m-ethyltoluene	
52A	173	$C_{10}H_{22}$ isomer	
53	174	$C_{11}H_{24}$ isomer	
54	175	phenol	
54A	175	cyanobenzene	trace
55	176	o-ethyltoluene	

(continued)

Table A3 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
56	177	$C_{10}H_{22}$ isomer	
57	178	$C_{10}H_{20}$ isomer	
58	179	1,2,4-trimethylbenzene	
59	180	n-decane	
59A	182	$C_{10}H_{20}$ isomer	
60	183	m-dichlorobenzene or (p)	
60A	184	$C_{11}H_{24}$ isomer	
61	185	$C_{11}H_{24}$ + C_4-alkyl benzene isomers	
61A	186	$C_{11}H_{24}$ isomer	
61B	187	$C_{11}H_{24}$ isomer	
62	188	butylcyclohexane	
62A	189	$C_{11}H_{22}$ isomer	
62B	189	$C_{12}H_{26}$ isomer	
63	190	p-propyltoluene	
64	191	diethylbenzene isomer + $C_{11}H_{24}$ isomer	
65	192	acetophenone	
66	194	$C_{12}H_{26}$ isomer	
67	196	o-propyltoluene	
67A	197	C_4-alkyl benzene isomer	
67B	197	$C_{10}H_{18}$ isomer (tent.)	
68	198	$C_{10}H_{16}$ isomer + $C_{12}H_{26}$ isomer	
68A	199	$C_{11}H_{22}$ isomer	
69	200	n-undecane	
69A	201	$C_{12}H_{24}$ isomer	
70	202	$C_{12}H_{26}$ isomer	
70A	204	$C_{12}H_{26}$ isomer	
71	205	tetramethylbenzene isomer	
72	209	$C_{12}H_{24}$ isomer	
72A	210	$C_{12}H_{26}$ isomer	
73	211	C_4-alkyl benzene isomer	
73A	212	tetramethylbenzene isomer	
73B	213	$C_{13}H_{28}$ isomer	
74	214	5-decanone	
74A	215	$C_{12}H_{24}$ isomer	
75	216	$C_{13}H_{28}$ isomer	
76	217	n-dodecane	
76A	218	naphthalene	
77	220	$C_{13}H_{28}$ isomer	
77A	230	phenylhexane	
80	231	undecanone isomer	
81	233	$C_{13}H_{28}$ isomer	
82	234	$C_{13}H_{26}$ isomer	
83	235	n-tridecane	
84	236	$C_{14}H_{28}$ isomer	
85	239	$C_{14}H_{30}$ isomer	
87	240	dodecanone isomer	
87A	240	n-butyl butyrate	43
88	240	n-tetradecane	

[a]Sampling was conducted on 6/29/76 from 1207 to 1359, see Table 15 for protocol (P1/L3).

Table A4. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$	
2	43	CO_2	
3	44	propene (tent.)	
4	47	chloromethane	
5	49	propane	
5A	52	1-butene	
6	53	*n*-butane	
6A	54	2-butene	
7	55	acetaldehyde	~3,125
9	61	isopentane	
9A	63	C_5H_{10} isomer	
9B	64	furan	
10	65	*n*-pentane	
11	67	propanal	
12	69	acrolein	4,000
12A	70	dichloromethane	
13	72	C_6H_{12} isomer	
14	76	acetone	
15	78	dimethyl ether	10,500
16	80	2-methylpentane	
16A	81	diethyl ether (tent.)	
17	82	2-methylpropenal	
17A	83	3-methylpentane	
17B	84	vinyl acetate	583
18	85	hexafluorobenzene (es)	
18A	85	2-methylpropanal	
19	86	*n*-hexane	
19A	87	*n*-butanal	
20	88	chloroform + isopropyl ether	trace
20A	90	C_5H_{10} isomer	
20B	91	methyl ethyl ketone	trace
21	92	perfluorotoluene (es) and ethyl acetate	
22	93	C_6H_{12} isomer	
22A	95	1,2-dichloroethane	217
23	96	1,1,1-trichloroethane	
24	99	methyl isopropyl ketone	
24A	100	C_7H_{14} isomer	
25	101	benzene	13,406
25A	102	carbon tetrachloride	750
26A	103	cyclohexane	
26	103	2-methylhexane	
27	104	2,3-dimethylpentane	
28	105	3-methylhexane	
28A	107	C_7H_{14} isomer	
29	108	3-ethylpentane and dimethyl-cyclopentane isomer	
30	109	trichloroethylene	10,052
30A	110	*n*-pentanal	
31	111	*n*-heptane	
31A	113	2-pentanone	
31B	115	acetic acid (tent.)	trace
32	117	*n*-propyl acetate	
32A	117	C_8H_{18} isomer	
33	118	methylcyclohexane	
33A	119	C_8H_{16} isomer	
33B	119	C_8H_{18} isomer	
34	120	4-methyl-2-pentanone	5,958
35	122	3-methyl-2-pentanone	1,140
36	125	C_8H_{16} isomer	
37	127	toluene	
	128	2-methylheptane	
38	129	3-methylheptane	
38A	131	C_7H_{12} isomer	
39	132	dimethylcyclohexane isomer	
40	133	*n*-hexanal	
40A	134	C_8H_{16} isomer	
41	135	*n*-octane	
42	137	*n*-butyl acetate	4,774
43	138	tetrachloroethylene	
45	141	C_8H_{18} isomer + unknown	
46	143	C_9H_{20} isomer	
47	144	C_9H_{20} isomer	
47A	145	ethylcyclohexane	
48	146	chlorobenzene	507
48A	147	C_9H_{18} isomer	
49	149	ethylbenzene	
49A	149	C_9H_{18} isomer	
49B	150	C_9H_{20} isomer	
50	151	*p*-xylene	
50A	152	C_9H_{20} isomer	
51	152	C_9H_{20} isomer	
51A	153	3-heptanone	trace
51B	154	2-heptanone	trace
51C	155	styrene	
52	156	heptanal	
53	157	*o*-xylene	
53A	157	C_9H_{18} isomer	
54	158	*n*-nonane	
55	163	$C_{10}H_{22}$ isomer	

(continued)

Table A4 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
56	164	isopropylbenzene	
56A	164	4-methylnonane	
56B	165	C_3-alkyl cyclohexane isomer	
57	166	2,6-dimethyloctane	
58	167	isopropylcyclohexane	
59	169	α-pinene + $C_{10}H_{22}$ isomer	
59A	169	n-propylbenzene	
60	170	benzaldehyde	
61	171	m-ethyltoluene	
61A	172	$C_{10}H_{22}$ isomer	
62	173	3-methylnonane	
62A	173	$C_{10}H_{20}$ isomer	
63	174	cyanobenzene	1,169
63A	175	phenol	
64	176	o-ethyltoluene	
65	177	$C_{10}H_{20}$ isomer + octanal	
66	178	1,2,4-trimethylbenzene	
67	179	n-decane	
68	181	$C_{10}H_{20}$ isomer	
69	182	m-dichlorobenzene	
69A	183	$C_{10}H_{24}$ isomer	
69B	184	$C_{12}H_{26}$ isomer	
70	185	C_4-alkyl benzene isomer	
71	186	1,2,3-trimethylbenzene	
71A	186	$C_{11}H_{24}$ isomer	
72	187	$C_{11}H_{22}$ isomer	
73	188	o-dichlorobenzene and $C_{11}H_{24}$ isomer	
73A	188	n-butylcyclohexane	
73B	189	$C_{11}H_{24}$ isomer	
74	189	p-propyltoluene	
75	191	$C_{12}H_{26}$ isomer + C_4-alkyl benzene isomer	
76	192	acetophenone	
77	194	$C_{11}H_{24}$ isomer	
77A	195	$C_{11}H_{18}$ isomer	
78	196	C_4-alkyl benzene isomer	
78A	196	C_4-alkyl benzene isomer	
79	197	nonanal	2,661
79A	198	$C_{11}H_{22}$ isomer	
80	199	n-undecane	
81	200	$C_{12}H_{26}$ (tent.)	
82	201	$C_{12}H_{26}$ (tent.)	
83	204	methylundecane isomer	
84	209	dimethylphenol (tent.)	
85	211	C_5-alkyl benzene isomer	
87	216	$C_{13}H_{28}$ isomer	
88	217	n-dodecane and naphthalene	
89	220	$C_{12}H_{24}$ isomer	
93	232	undecanone isomer	
94	233	$C_{13}H_{28}$ isomer	
95	234	n-tridecane	
96	239	β-methylnaphthalene	
97	240	α-methylnaphthalene	
98	240	$C_{14}H_{30}$ isomer	
101	240	$C_{14}H_{28}$ isomer	
102A	240	n-butyl butyrate	525
102	240	n-tetradecane	

[a] Sampling was conducted on 6/29/76 from 1207 to 1359, see Table 15 for protocol (P1/L4).

Table A5. VOLATILE ORGANICS IN AMBIENT AIR UPWIND OF KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	CO_2	
2	45	CF_2Cl_2	
3	47	propane	
4	56	acetaldehyde	trace
5	58	*n*-butane	
6	59	2-butane	
7	59	isopentane	
9	62	furan	
10	63	C_5H_{10} isomer	
11	63	*n*-pentane	
12	64	isoprene	
13A	67	propanal	
13B	67	acrolein	trace
14	68	C_5H_{10} isomer	
15	70	methylene chloride	trace
16	72	acetone	
17	77	isopropanol	
18	77	*t*-butanol	
19	82	2-methylpentane	
20	85	perfluorobenzene (eS)	
21	87	3-methylfuran	
22	88	3-methylpentane	
23	90	*n*-hexane	
24	91	chloroform	1,999
25	92	methyl vinyl ketone	
26	93	methyl ethyl ketone	
27	94	perfluorotoluene (eS)	
28	95	C_7H_{16} isomer	
29	97	ethyl acetate	trace
30	98	1,2-dichloroethane	trace
31	100	1,1,1-trichloroethane	
32	101	C_7H_{16} isomer	
33	102	benzene	7,718
34	102	carbon tetrachloride	12,687
35	103	cyclohexane	
36	105	C_7H_{16} isomer	
37	106	C_7H_{16} isomer	
38	107	C_7H_{16} isomer	
39	108	methylene dibromide	42
40	109	C_7H_{16} isomer	
41	110	trichloroethylene	4,947
42	112	*n*-heptane	
43	119	C_8H_{18} isomer	
44	120	C_7H_{14} isomer	
45	122	C_8H_{18} isomer	
46	128	toluene	
47	129	C_8H_{18} isomer	
48	130	C_8H_{18} isomer	
49	134	C_8H_{16} isomer	
50	136	*n*-octane	
51	138	N,N-dimethylformamide	
52	140	tetrachloroethylene	1,187
54	146	trimethylamine (tent.)	
55	150	ethylbenzene	
56	152	*p*-xylene	
57	153	C_9H_{20} isomer	
59	156	*n*-butyl formate	1,902
60	157	3-methylhexanal	1,042
61	160	*o*-xylene	
62	161	*n*-nonane	
63	162	$C_{10}H_{22}$ isomer	
64	164	furfuryl alcohol	
65	165	$C_{10}H_{22}$ isomer	
66	166	$C_{10}H_{22}$ isomer	
67	167	2,3-benzofuran	
68	169	C_3-alkyl benzene	
69	172	benzaldehyde	
70	174	C_3-alkyl benzene	
71	176	$C_{11}H_{24}$ isomer	
72	178	benzonitrile	2,892
73	180	phenol	
74	181	C_3-alkyl benzene	
75	181	C_3-alkyl benzene	
76	182	$C_{11}H_{24}$ isomer	
77	182	dichlorobenzene	
78	183	C_4-alkyl benzene	
79	183	C_4-alkyl benzene	
80	184	$C_{12}H_{26}$ isomer	
81	184	$C_{12}H_{24}$ isomer	
82	185	C_3-alkyl benzene	
83	186	3-heptanol	
84	187	$C_{11}H_{24}$ isomer	
85	188	C_4-alkyl benzene	
86	188	cresol isomer	
87	191	C_4-alkyl benzene	
88	192	C_4-alkyl benzene	
89	194	acetophenone	
90	197	2-methyl-2-pentanol (tent.)	
92	199	$C_{11}H_{24}$ isomer	
93	200	$C_{11}H_{24}$ isomer	
94	202	dimethylphenol isomer	
95	203	$C_{12}H_{26}$ isomer	

(continued)

Table A5 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
96	205	C_5-alkyl benzene	
97	206	C_4-alkyl benzene	
98	208	dimethylphenol isomer	
99	210	dimethylphenol isomer	
100	213	$C_{13}H_{26}$ isomer	
101	217	n-dodecane	
102	218	$C_{12}H_{24}$ isomer	
103	219	naphthalene	
104	220	C_4-alkyl benzene	
105	222	$C_{13}H_{26}$ isomer	
106	226	$C_{12}H_{24}$ isomer	
107	228	phenyl phenol isomer	
108	230	dibenzofuran	
109	232	C_6-alkyl benzene	
110	234	n-tridecane	
111	238	2-methylnaphthalene	
112	239	diethylphthalate	
113	240	1-methylnaphthalene	440
114	isothermal	C_6-alkyl benzene	
115	↓	$C_{14}H_{30}$ isomer	
116	↓	$C_{14}H_{30}$ isomer	
117	↓	unknown	
118	↓	n-tetradecane	
119	↓	$C_{15}H_{32}$ isomer	
120	↓	unknown	
121	240	benzophenone	1,540
122	isothermal	$C_{15}H_{30}$ isomer	
123	↓	$C_{15}H_{32}$ isomer	
124	↓	n-pentadecane	
126	↓	n-hexadecane	
127	↓	$C_{17}H_{34}$ isomer	
128	↓	$C_{17}H_{36}$ isomer	
129	↓	$C_{17}H_{36}$ isomer	
130	↓	n-heptadecane	
131	↓	$C_{17}H_{34}$ isomer	
132	↓	n-octadecane	

[a]Sampling was conducted on 6/29/76 from 1607 to 1737, see Table 15 for protocol (P2/L1).

Table A6. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF STAUFFER CHEMICAL CO[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	37	N_2, O_2		49	98	benzene	14,093
2	38	C_3H_6 isomer		50	100	trimethylpentane	
3	39	CO_2		51	101	CCl_4	13,687
4	42	CH_3Cl		52	101	cyclohexane	
6	44	C_4H_{10} isomer		53	102	C_7H_{16} isomer	
7	45	unknown		54	103	C_7H_{14} isomer	
8	47	acrylonitrile (tent.)		55	105	C_7H_{14} isomer	
9	48	unknown		56	105	C_7H_{16} isomer	
10	49	cyclobutane		57	106	C_7H_{14} isomer	
11	50	unknown		58	106	acetic acid (tent.)	
12	51	acetaldehyde	~7,000	59	107	trichloroethylene	4,500
13	54	vinyl ethyl ether		60	107	C_7H_{14} isomer	
14	57	unknown		61	108	C_7H_{16} isomer	
15	58	C_5H_{12} (isopentane)		62	108	C_7H_{14} isomer	
17	60	furan		63	110	C_7H_{14} isomer	
18	61	1-pentane		64	110	dimethylfuran	
19	61	1,2-epoxybutane (tent.)		65	110	dimethylhydrazine (tent.)	
20	62	cyclopentane		66	114	trimethylpentane	
21	62	propanol		67	115	C_7H_{14} isomer	
22	64	acrolein	714	68	116	C_8H_{16} isomer	
23	66	C_5H_{10} isomer		69	116	C_8H_{18} isomer	
24	67	dichloromethane	trace	70	117	C_7H_{14} isomer	
25	68	acetone		71	119	C_8H_{16} isomer	
26	71	C_5H_{10} isomer		72	124	toluene	
27	72	C_7H_{14} isomer		73	125	C_8H_{18} isomer	
28	74	C_7H_{14} isomer		74	126	C_8H_{18} isomer	
29	76	C_7H_{12} isomer		75	127	C_8H_{16} isomer	
30	77	C_6H_{14} isomer		76	128	C_8H_{16} isomer	
31	78	crotonaldehyde		77	128	C_8H_{14} isomer	
32	80	n-hexane		78	129	C_7H_{16} isomer	
33	82	perfluorobenzene (es)		79	130	C_8H_{16} isomer	
34	84	methylpentane		80	132	C_8H_{18} isomer	
35	84	methyl furan		81	134	tetrachloroethylene	trace
36	84	2-methyl-2-propen-1-ol (?)		83	137	C_8H_{16} isomer	
37	84	C_6H_{14} isomer		84	137	C_8H_{12} isomer	
38	86	chloroform	trace	85	139	C_9H_{18} isomer	
39	86	unknown		86	141	C_8H_{16} isomer	
40	88	C_7H_{12} isomer		87	141	C_9H_{18} isomer	
41	88	ethyl hexanal		88	144	ethylbenzene	
42	89	C_6H_{12} isomer		89	146	C_9H_{18} isomer	
43	90	perfluorotoluene (es)		90	147	C_9H_{20} isomer	
44	90	C_7H_{14} isomer		91	148	m- or p-xylene	
45	91	C_7H_{16} isomer		92	148	C_7H_{14} isomer	
46	93	1,2-dichloroethane	434	93	149	C_9H_{20} isomer	
47	93	tetrahydropyran		94	150	C_9H_{16} isomer	
48	94	1,1,1-trichloroethane		95	151	C_9H_{16} isomer	

(continued)

Table A6 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
96	152	cyclooctatetraene	
97	153	C_9H_{18} isomer	
98	154	o-xylene	
99	154	C_9H_{18} isomer	
100	154	C_9H_{20} isomer	
101	155	C_9H_{18} isomer	
102	158	C_9H_{18} isomer	
103	159	C_9H_{18} isomer	
104	160	C_3-alkyl benzene	
105	160	p-methyl benzyl alcohol (tent.)	
106	161	$C_{10}H_{20}$ isomer	
107	163	C_9H_{20} isomer	
108	164	C_9H_{18} isomer	
109	164	$C_{10}H_{20}$ isomer	
110	165	C_9H_{20} isomer	
111	165	C_9H_{18} isomer	
112	165	C_3-alkyl benzene	
113	165	benzaldehyde	
114	167	C_3-alkyl benzene	
115	168	$C_{12}H_{24}$ isomer	
116	169	2-n-propenylfuran (tent.)	
117	169	phenol	
118	169	2-ethyl-4-methylol-1,3-dioxolane (tent.)	
119	170	C_3-alkyl benzene	
120	170	hydroxybenzaldehyde	
121	170	benzyl bromide (tent.)	
122	171	unknown	
123	172	C_9H_{14} isomer	
124	173	C_3-alkyl benzene	
125	174	$C_{10}H_{22}$ isomer	
126	175	o-chlorotoluene	
127	176	dichlorobenzene	
128	177	$C_{10}H_{20}$ isomer	
129	178	C_3-alkyl benzene	
130	179	$C_{11}H_{20}$ isomer	
131	180	C_3-alkyl benzene	
132	180	C_3-alkyl benzene	
133	182	dichlorobenzene	
134	183	p-cresyl acetate	
135	184	C_4-alkyl benzene	
136	185	$C_{12}H_{26}$ isomer	
137	186	C_4-alkyl benzene	
138	187	C_4-alkyl benzene	
139	188	C_3-alkyl benzene	
140	189	C_4-alkyl benzene	
141	189	cresol	
142	190	C_4-alkyl benzene	
143	190	$C_{10}H_{18}$ isomer	
144	190	$C_{10}H_{22}$ isomer	
145	190	$C_{11}H_{20}$ isomer	
146	192	$C_{11}H_{20}$ isomer	
147	194	C_4-alkyl benzene	
148	194	o-methoxybenzaldehyde	
149	196	C_4-alkyl benzene	
150	196	cresol	
151	196	$C_{11}H_{24}$ isomer	
152	197	o-methyl anisole	
153	197	C_5-alkyl benzene	
154	199	1-phenyl-2-butene	
155	200	C_4-alkyl benzene	
156	201	ethylphenol	
157	203	ethylphenol	
158	204	C_5-alkyl benzene	
159	208	C_5-alkyl benzene	
160	208	dimethylphenol	
161	209	C_5-alkyl benzene	
162	210	diisopropylbenzene	
163	213	$C_{13}H_{22}$ isomer	
164	213	$C_{12}H_{26}$ isomer	
165	214	naphthalene	
166	214	$C_{11}H_{16}$ isomer	
167	216	dimethylphenol	
168	218	unknown	
169	220	unknown	
170	221	$C_{12}H_{26}$ isomer	
171	224	dipropylene glycol methyl ether (tent.)	
172	225	$C_{13}H_{24}$ isomer	
173	229	$C_{13}H_{26}$ isomer	
174	230	$C_{13}H_{28}$ isomer	
175	232	$C_{14}H_{28}$ isomer	
176	233	methylnaphthalene	
177	236	$C_{15}H_{28}$ isomer	
178	237	dinonylphthalate (tent.)	
179	239	$C_{15}H_{28}$ isomer	
180	240	$C_{14}H_{26}$ isomer	
181	240	$C_{13}H_{20}$ isomer	
182	240	$C_{13}H_{28}$ isomer	
183	240	$C_{14}H_{26}$ isomer	
184	240	biphenyl	

(continued)

Table A6 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
185	240	$C_{14}H_{30}$ isomer					
186	240	$C_{16}H_{32}$ isomer					
187	240	$C_{14}H_{26}$ isomer					
188	240	$C_{17}H_{37}$ isomer					
189	240	$C_{17}H_{32}$ isomer					
190	240	$C_{14}H_{26}$ isomer					
191	240	$C_{16}H_{34}$ isomer					
192	240	$C_{15}H_{32}$ isomer					
193	240	$C_{14}H_{26}$ isomer					
194	240	$C_{14}H_{30}$ isomer					

[a]Sampling was conducted on 6/29/76 from 1607 to 1737, see Table 15 for protocol (P2/L2).

Table A7. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	CO_2		39	105	cyclohexane	
2	43	ethylene oxide		40	106	C_7H_{16} isomer	
3	46	CF_2Cl_2		41	107	C_7H_{16} isomer	
4	50	cyclopropane		42	108	C_7H_{16} isomer	
5	52	propane		43	111	C_7H_{14} isomer	
6	53	2-methylpropene		44	113	trichloroethylene	5,263
7	56	acetaldehyde	~9,000	45	114	_n_-heptane	
8	57	_n_-butane		46	115	C_7H_{14} isomer	
9	58	2-butene		47	116	C_7H_{14} isomer	
10	62	isopentane		48	117	C_8H_{18} isomer	
11	64	$CFCl_3$		49	120	C_7H_{14} isomer	
12	65	C_5H_{10} isomer		50	122	C_7H_{14} isomer	
13A	68	furan		51	123	C_8H_{16} isomer	
13B	68	C_5H_{10} isomer		52	123	C_8H_{18} isomer	
14	69	_n_-pentane		53	125	methyl isobutyl ketone	604
15	70	isoprene		54	126	C_8H_{16} isomer	
16A	71	propanal		55	128	isoamyl acetate (tent.)	
16B	71	acrolein	trace	56	131	toluene	
17A	73	methylene chloride	trace	57	133	C_8H_{18} isomer	
17B	73	diethyl ether		58	135	C_8H_{16} isomer	
18	75	3-chloropropene	28,667	59	139	_n_-octane	
19	75	C_6H_{14} isomer		60	140	C_8H_{16} isomer	
20	78	acetone		61	142	tetrachloroethylene	2,896
21A	80	isopropanol		63	144	C_9H_{20} isomer	
21B	80	t-butanol		64	146	C_9H_{20} isomer	
22	82	cyclopentane		65	147	C_9H_{18} isomer	
23	83	C_6H_{14} isomer		66	149	chlorobenzene	trace
24	84	C_6H_{12} isomer		67	150	C_9H_{18} isomer	
25	86	2-methylpentane		68	151	C_9H_{20} isomer	
26	88	perfluorobenzene (eI)		69	153	ethylbenzene	
27	89	3-methylfuran		70	154	C_9H_{20} isomer	
28	89	3-methylpentane		71	155	_p_-xylene	
29	90	_n_-hexane		72	158	$C_{10}H_{22}$ isomer	
30	91	chloroform	trace	73	160	styrene	
31	91	C_7H_{16} isomer		74	161	_o_-xylene	
32A	92	methyl vinyl ketone	trace	75	162	_n_-nonane	
32B	92	methyl ethyl ketone	trace	76	163	$C_{10}H_{22}$ isomer	
33	96	perfluorotoluene (eI)		77	164	$C_{10}H_{20}$ isomer	
34	98	C_7H_{16} isomer		78	166	$C_{10}H_{22}$ isomer	
35	99	1,2-dichloroethane	trace	79	167	cumene	
36A	100	1,1,1-trichloroethane		80	170	$C_{10}H_{22}$ isomer	
36B	100	ethyl acetate		81	171	$C_{10}H_{20}$ isomer	
37	101	C_7H_{16} isomer		82	172	alpha-pinene	
38	104	benzene	10,656	83	174	_n_-propylbenzene	
38A	104	C_6H_{16} isomer		84	175	benzaldehyde	
38B	104	carbon tetrachloride	7,250	85	176	C_3-alkyl benzene	

(continued)

Table A7 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m[3]
86	177	C_3-alkyl benzene	
87	178	$C_{11}H_{24}$ isomer	
88	179	phenol	
89	180	benzonitrile	3,473
90	182	$C_{11}H_{24}$ isomer	
91A	183	C_3-alkyl benzene	
91B	183	n-decane	
92	185	$C_{11}H_{24}$ isomer	
93	186	$C_{11}H_{24}$ isomer	
94A	187	m-dichlorobenzene	
94B	187	$C_{11}H_{24}$ isomer	
95	188	1,2,3-trimethylbenzene	
96	190	$C_{11}H_{24}$ isomer	
97	192	$C_{11}H_{24}$ isomer	
98	193	$C_{11}H_{24}$ isomer	
99	193	C_4-alkyl benzene	
100A	195	C_4-alkyl benzene	
100B	195	acetophenone	
101	196	C_4-alkyl benzene	
102	198	cresol isomer	
103	200	C_4-alkyl benzene	
104	201	C_4-alkyl benzene	
105	203	n-undecane	
106	204	$C_{12}H_{26}$ isomer	
107	206	C_4-alkyl benzene	
108	208	$C_{12}H_{26}$ isomer	
109	208	C_4-alkyl benzene	
110	212	dimethylphenol isomer	
111	213	C_4-alkyl benzene	
112	215	dimethylphenol isomer	
113	217	$C_{12}H_{26}$ isomer	
114	220	n-dodecane	
115	221	naphthalene	
116	222	$C_{13}H_{28}$ isomer	
117	224	C_4-alkyl benzene	
118	226	$C_{13}H_{28}$ isomer	
119	229	C_5-alkyl benzene	
120	232	C_5-alkyl benzene	
121	234	C_5-alkyl benzene	
122	236	$C_{13}H_{26}$ isomer	
123	238	n-tridecane	
124	240	$C_{13}H_{26}$ isomer	
125	isothermal	2-methylnaphthalene	
126	↓	chlorotoluene isomer	
127	↓	C_6-alkyl benzene	
128	↓	$C_{14}H_{30}$ isomer	
129	isothermal	C_6-alkyl benzene	
130	↓	$C_{14}H_{28}$ isomer	
131	↓	$C_{14}H_{30}$ isomer	
132	↓	n-tetradecane	
133	↓	chlorotoluene isomer	
134	↓	2,5-diphenylfuran	
135	↓	$C_{15}H_{32}$ isomer	
137	↓	n-pentadecane	
138	↓	$C_{16}H_{34}$ isomer	
139	↓	$C_{16}H_{34}$ isomer	
140	↓	$C_{16}H_{32}$ isomer	
141	↓	$C_{16}H_{34}$ isomer	
142	↓	$C_{16}H_{34}$ isomer	
143	↓	n-hexadecane	

[a] Sampling was conducted on 6/29/76 from 1607 to 1737, see Table 15 for protocol (P2/L3).

Table A8. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$		28	114	*n*-heptane	
2	43	CO_2		28A	116	2-pentanone and C_7H_{14} isomer	
4	51	propane		28B	117	C_7H_{12} isomer	
5	53	1-butene		29	120	C_8H_{18} isomer	
5A	54	*n*-butane		30	121	methylcyclohexane	
5B	57	2-butene		30A	121	C_8H_{16} isomer	
6	57	acetaldehyde	trace	31A	122	C_8H_{18} isomer	
7	63	isopentane		31	123	2,4-dimethylhexane	
8A	65	C_5H_{10} isomer		31A	123	C_8H_{12} isomer	
8B	66	pentadiene		31B	124	C_8H_{18} isomer	
8C	66	furan and C_5H_{10} isomer		32	124	4-methyl-2-pentanone	
9	67	*n*-pentane		33	125	C_8H_{16} isomer	
10	70	propanal		34	127	C_8H_{16} isomer	
10A	71	C_5H_{10} isomer		34A	128	C_8H_{18} isomer	
11	72	acrolein	trace	34B	129	C_8H_{14} isomer	
11A	72	C_5H_{10} isomer		35	130	toluene	
11B	73	dichloromethane	trace	35A	131	C_8H_{18} isomer	
11C	75	diethyl ether		36	132	3-methylheptane	
12	76	acetone		36A		C_8H_{14} isomer	
12A	79	methyl propyl ether		37	135	dimethylcyclohexane	
13	80	2-methylpentane		38	137	hexanal	
14	83	2-methylpropanal		39	138	*n*-octane	
14A	84	3-methylpentane		39A	140	C_8H_{16} and C_8H_{14} isomer	
14B	85	C_6H_{12} isomer		40	141	tetrachloroethylene	
15	86	vinyl acetate		41A	144	*n*-butyl acetate (tent.)	
15A	87	hexafluorobenzene (es)		42	146	hexanone	
16	96	methylcyclopentane and		43A	147	ethyl cyclohexane	
		2,4-dimethylpentane		43	148	chlorobenzene	trace
17	97	methyl ethyl ketone (tent.)		44	152	ethylbenzene	
18	98	1,2-dichloroethane	2,173	44A	153	C_9H_{18} isomer	
		and C_7H_{14} isomer		44B	153	C_9H_{20} isomer	
19	99	1,1,1-trichloroethane		45	154	*m*-xylene	
20	103	benzene and	11,343	46	155	C_9H_{20} isomer	
		3,3-dimethylpentane		46A	156	*p*-xylene	
21	104	carbon tetrachloride		47	158	3-heptanone (tent.)	
22A	105	cyclohexane		47A	158	C_9H_{16} isomer	
23	106	2-methylhexane		48	159	styrene or cycloocta-	
24	107	2,3-dimethylpentane				tetraene and 2-heptanone	
25	108	3-methylhexane		49	160	*o*-xylene and heptanone	
25A	109	C_7H_{14} isomer		49A	161	C_9H_{18} isomer	
25B	110	methyl isopropyl ketone		50	161	*n*-nonane	
26	111	3-ethylpentane and 1,2-		50A	162	$C_{10}H_{22}$ isomer	
		dimethylcyclopentane		50B	164	C_9H_{18} isomer	
27	112	1,3-dimethylcyclopentane		51	166	$C_{10}H_{20}$ isomer	
27A	113	trichloroethylene	trace	51A	166	$C_{10}H_{22}$ isomer	
27B	113	pentanal (tent.)		52	167	isopropylbenzene	

(continued)

Table A8 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
52A	168	C_9H_{18} isomer	
53	170	$C_{10}H_{22}$ isomer	
53A	170	C_3-alkyl cyclohexane	
53B	171	octanone (tent.)	
53C	172	n-propylbenzene and chlorotoluene	
54	174	benzaldehyde	
55	175	m-ethyltoluene	
56	177	$C_{10}H_{22}$ isomer	
56A	178	$C_{10}H_{22}$ isomer	
57	179	phenol	
57A	179	cyanobenzene	trace
57B	180	1,3,5-trimethylbenzene	
58	181	octanal	
59	182	1,2,4-trimethylbenzene and $C_{10}H_{20}$ isomer	
60	183	n-decane	
61	184	m-dichlorobenzene	
62	186	$C_{11}H_{24}$ isomer	
63	188	1,2,3-trimethylbenzene	
64	191	o-dichlorobenzene	
64A	192	$C_{11}H_{24}$ isomer	
65	193	butylcyclohexane	
65A	193	$C_{11}H_{24}$ isomer	
66	194	sec-butylbenzene or p-propyltoluene	
66A	195	C_4-alkyl benzene	
67	196	acetophenone	
68	197	$C_{11}H_{24}$ isomer and C_4-alkyl benzene	
68A	198	C_4-alkyl benzene and nonanone	
68B	199	$C_{11}H_{20}$ isomer	
69	201	nonanal	
69A	201	$C_{11}H_{22}$ isomer	
70	202	n-undecane	
70A	203	C_5-alkyl benzene	
70B	205	$C_{11}H_{22}$ isomer	
70C	207	C_4-alkyl benzene	
70D	210	C_5-alkyl benzene	
71A	212	$C_{12}H_{24}$ isomer and 1,2,3,4-tetrahydronaphthalene	
72	214	C_4-alkyl benzene	
	216	C_4-alkyl benzene	
	217	C_5-alkyl benzene	
73	218	decanone	
73A	219	$C_{12}H_{22}$ isomer	
74	220	decanal and $C_{12}H_{24}$ isomer	
75	221	n-dodecane	
76	222	naphthalene	
77	224	$C_{13}H_{28}$ isomer	
77A	225	$C_{13}H_{26}$ isomer	
79	230	$C_{13}H_{26}$ isomer	
79A	231	$C_{13}H_{28}$ isomer	
79B	232	undecanone (tent.)	
80	234	$C_{15}H_{32}$ isomer	
81	236	2-undecanone	
82	237	tridecane	
83	238	n-tridecane	
84	240	β-methylnaphthalene	
86	240	α-methylnaphthalene	
87	240	$C_{14}H_{30}$ isomer	
88	240	dodecanone	
88A	240	$C_{14}H_{28}$ isomer	
89	240	n-tetradecane	
89A	240	n-butyl butyrate	336
89B	240	$C_{15}H_{32}$ isomer	
90	240	$C_{16}H_{34}$ isomer	
91	240	$C_{15}H_{30}$ isomer	
92	240	$C_{15}H_{30}$ isomer	
93	240	n-pentadecane	

[a] Sampling was conducted on 6/29/76 from 1607 to 1737, see Table 15 for protocol (P2/L4).

Table A9. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR UPWIND FROM KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
2	44	CO_2	
3	50	chloromethane	
4	51	propane	
5	53	1-butene	
5A	54	n-butane	
6	57	acetaldehyde	~18,750
7	60	C_5H_{10} isomer	
7A	61	isopentane	
8	64	furan and C_5H_{10} isomer	
9	65	n-pentane	
10	66	acrolein	
10A	66	propanal	
10B	67	isopropene	
10C	67	dimethyl ether and C_5H_{10} isomer	
11A	68	dichloromethane	7,600
11	69	acetone	
12	70	ethanol or methyl propyl ether	
14	74	2-methylpentane	
15	75	2-methylpropenal	
16	77	3-methylpentane	
16A	80	C_6H_{12} isomer	
17	82	hexafluorobenzene (e[illegible])	
17A	84	n-butanal and 3-methylfuran	
18	86	n-hexane	
18A	87	C_6H_{12} isomer	
19	88	chloroform	9,000
19A	90	methyl vinyl ketone	10,727
20	92	methyl ethyl ketone	14,556
20A	93	C_6H_{12} isomer	
21	94	perfluorobenzene (e[illegible])	
23	97	1,2-dichloroethane	37,913
23A	99	2-chloropropane (tent.)	4,067
24	103	benzene	8,687
24A	104	carbon tetrachloride and C_7H_{16} isomer	3,875
24B	105	cyclohexane	
25A	106	C_7H_{14} isomer	
25	106	2-methylhexane	
26	107	2,3-dimethylpentane	
27	109	3-methylhexane	
27A	110	C_7H_{14} isomer	
27B	110	3-ethylpentane	
28	111	C_7H_{14} isomer	
28A	112	dimethylcyclopentane isomer	
29	113	trichloroethylene and n-pentane	3,737
30	114	n-heptane	
30A	115	C_7H_{14} isomer and 2-pentanone	1,742
31	117	1-chloro-2-bromoethane	10,071
31A	118	4-methyl-2-pentanone	trace
32	120	2,2-dimethylhexane	
32A	121	C_7H_{14} isomer	
33	122	methylcyclohexane	
33A	122	C_8H_{16} isomer	
34	123	C_8H_{18} isomer	
34A	124	2,4-dimethylhexane	
35	126	3-methyl-2-pentanone (tent.) and C_9H_{20} isomer	
35A	128	C_9H_{18} isomer	
36	129	1,1,1-trichloroethane	3,500
37	130	toluene	
37A	131	C_8H_{18} isomer	
38	133	3-methylheptane	
38A	135	1-bromo-2-fluorobenzene and trifluorobromopropane (tent.)	
39	136	C_8H_{16} isomer	
40	137	n-hexanal	
40A	138	dibromoethane isomer	591
41	139	n-octane	
42	142	tetrachloroethylene	
43	145	trimethylhexane or C_9H_{20} isomer	
44	146	C_9H_{20} isomer	
45	148	C_9H_{20} isomer	
45A	149	C_9H_{18} isomer	
45B	150	ethylcyclohexane	
45C	151	C_9H_{18} isomer	
45D	152	C_9H_{18} isomer	
46	153	ethylbenzene	
46A	154	C_9H_{18} isomer	
46B	154	2-methyloctane or C_9H_{20} isomer	
47	155	m-xylene	
47A	155	C_9H_{18} isomer	
48	156	3-ethylheptane	
49	158	trimethylhexane isomer	
49A	159	styrene	
49B	159	C_9H_{20} isomer	
49C	160	heptanal	
50	160	o-xylene	

(continued)

Table A9 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
51	161	C_9H_{18} isomer	
52	162	n-nonane	
53	163	3,3,5-trimethylheptane	
54	164	bromo compound (tent.)	
55	166	$C_{10}H_{22}$ isomer	
56	167	isopropylbenzene	
56A	169	$C_{10}H_{22}$ isomer	
57	170	$C_{10}H_{22}$ isomer	
57A	170	$C_{10}H_{20}$ isomer	
57B	171	$C_{10}H_{20}$ isomer	
58	172	$C_{10}H_{16}$ isomer	
58A	173	n-propylbenzene	
59	174	benzaldehyde	
60	175	m-ethyltoluene	
60A	176	$C_{11}H_{24}$ isomer	
61	177	$C_{10}H_{22}$ isomer	
61A	178	phenol	
62	179	$C_{10}H_{22}$ isomer and o-ethyltoluene	
63	180	$C_{10}H_{20}$ isomer and octanal	
64	181	1,2,4-trimethylbenzene	
65	183	n-decane	
65A	184	$C_{10}H_{20}$ isomer	
66	185	$C_{11}H_{24}$ isomer (tent.)	
66A	186	m-dichlorobenzene	
66B	187	C_4-alkyl benzene	
67	188	$C_{11}H_{24}$ isomer	
68	189	$C_{12}H_{26}$ isomer	
68A	189	1,2,3-trimethylbenzene	
69	190	$C_{11}H_{24}$ isomer	
70	193	$C_{11}H_{24}$ isomer	
70A	194	C_4-alkyl benzene isomer	
71	195	C_4-alkyl benzene isomer	
72	196	acetophenone	
73	197	$C_{11}H_{22}$ isomer	
73A	198	nonanone (tent.)	
73B	199	C_4-alkyl benzene isomer	
73C	200	$C_{11}H_{22}$ isomer	
74	201	nonanal	
75	203	n-undecane	
76	205	$C_{12}H_{26}$ isomer	
76A	207	C_4-alkyl benzene isomer	
77	209	C_4-alkyl benzene isomer and ethylphenol	
78	212	dimethylphenol	
78A	214	C_5-alkyl benzene isomer	
79	215	dimethylphenol isomer	
80	219	$C_{12}H_{24}$ isomer	
81	220	decanal	
82	221	n-dodecane and naphthalene	
83	230	C_3-alkyl phenol (tent.)	
84	240	tridecane	
85	240	n-butyl-norbutyrate	
86	240	$C_{16}H_{34}$ isomer	
88	240	tridecanone (tent.)	
89	240	$C_{15}H_{30}$ isomer	
90	240	n-pentadecane	

[a] Sampling was conducted from 1029 to 1229 on 6/30/76, see Table 15 for protocol (P3/L1).

Table A10. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND FROM STAUFFER CHEMICAL CO., EDISON, NJ[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
2	43	CO_2	
3	50	chloromethane (tent.)	
3A	52	1-butene	
3B	53	n-butane	
4	55	acetaldehyde	~51,250
5	59	isopentane	
6	61	C_5H_{10} isomer	
6A	62	furan	
6B	63	n-pentane	
6C	64	propanal	
6D	64	acrolein	1,750
6E	67	dimethyl ether and dichloromethane	
7	68	acetone	
7A	76	diethyl ether (tent.)	17,750
9	78	2-methylpentane	
10	80	2-methylpropenal	
11	84	3-methylpentane	
11A	85	methylpentene isomer and vinyl acetate	trace
12	87	hexafluorobenzene (es)	
12A	88	n-hexane	
13	90	chloroform	1,941
13A	91	methyl vinyl ketone	trace
13B	92	methyl ethyl ketone	trace
14	94	perfluorotoluene (es)	
15	95	methylcyclopentane	
16	98	1,1,1-trichloroethane	
17	102	benzene	6,875
17A	103	carbon tetrachloride	trace
17B	104	cyclohexane	
18	105	2-methylhexane	
19	106	2,3-dimethylpentane	
20	108	3-methylhexane	
20A	109	C_7H_{14} isomer and 3-ethylpentane	
21	110	dimethylcyclopentane isomer	
21A	111	1,trans-2-dimethyl-cyclopentane	
21B	111	trichloroethylene	trace
22	112	n-pentanal	477
23	113	n-heptane	
23A	114	2-pentanone	459
23B	116	1,2-dichloroethane (tent.)	trace
23C	119	n-propyl acetate	trace

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
24	120	methylcyclohexane	
24A	121	C_8H_{18} isomer	
24B	122	2-methyl-3-pentanone	
24C	123	C_8H_{18} isomer	
25		C_8H_{18} isomer	
25A	123	C_8H_{16} isomer	
26	125	4-methyl-2-pentanone and C_8H_{16} isomer	
26A	126	$C_5H_{10}O$ isomer	
26B	128	C_8H_{16} isomer	
27	130	toluene	
27A	131	2-methylheptane	
27B	131	4-methylheptane	
28	132	3-methylheptane	
28A	135	C_8H_{14} isomer	
28B	136	C_8H_{16} isomer	
29	137	n-hexanal	
30	139	n-octane	
31	141	tetrachloroethylene	
31A	144	C_8H_{16} isomer	
32	146	C_9H_{20} isomer	
32A	147	2,5-dimethylheptane	
32B	147	ethylcyclohexane	
33	148	chlorobenzene	167
33A	151	C_9H_{18} isomer	
34	153	ethylbenzene	
34A	154	2-methyl octane or C_9H_{20} isomer	
35	155	p or m-xylene	
36	156	3-ethylheptane or C_9H_{20} isomer	
36A	158	2-heptanone	
37	160	styrene and n-heptanal	
38	161	o-xylene	
38A	161	C_9H_{18} isomer	
39	162	n-nonane	
39A	164	C_9H_{18} isomer	
39B	167	$C_{10}H_{22}$ isomer	
40	168	isopropylbenzene	
41	170	$C_{10}H_{22}$ isomer	
41A	174	n-propylbenzene	
42	175	benzaldehyde	
43	176	m-ethyltoluene	
44	177	$C_{10}H_{22}$ isomer	
45	178	$C_{10}H_{22}$ isomer	
45A	179	$C_{10}H_{20}$ isomer	

(continued)

Table A10 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
45B	179	cyanobenzene	
46	180	phenol	
46A	181	$C_{10}H_{22}$ isomer	
47	182	octanal	
48	183	o-ethyltoluene	
49	184	n-decane	
50	185	benzylchloride	413
51	186	m-dichlorobenzene	
51A	187	$C_{11}H_{24}$ isomer and C_4-alkyl benzene isomer	
51B	188	$C_{11}H_{24}$ isomer	
52	189	1,2,3-trimethylbenzene	
52A	190	$C_{11}H_{24}$ isomer	
52B	191	o-dichlorobenzene	
52C	192	$C_{11}H_{24}$ isomer	
52D	193	$C_{11}H_{22}$ isomer and C_4-alkyl cyclohexane isomer	
53	195	m-diethylbenzene and n-butylbenzene	
53A	196	$C_{11}H_{24}$ isomer	
54	197	acetophenone	
55	198	$C_{11}H_{24}$ isomer	
56	200	C_4-alkyl benzene isomer	
56A	201	C_4-alkyl benzene isomer	
57	202	nonanal and $C_{11}H_{24}$ isomer	
57A	203	$C_{11}H_{22}$ isomer	
58	204	n-undecane	
59	209	$C_{12}H_{26}$ isomer	
60	210	C_5-alkyl benzene isomer	
61	215	C_4-alkyl benzene isomer + C_5-alkyl benzene isomer	
61A	216	$C_{12}H_{26}$ isomer	
62	218	$C_{12}H_{24}$ isomer	
63	220	decanal (tent.) and $C_{12}H_{24}$ isomer	
64	221	n-dodecane and naphthalene	
65	225	$C_{13}H_{28}$ isomer	
66	230	$C_{13}H_{26}$ isomer	
67	237	undecanone	
68	239	n-tridecane	
71	isothermal	n-tetradecane	
72		$C_{11}H_{20}$ isomer (tent.)	
76		$C_{16}H_{32}$ isomer (tent.)	
		$C_{15}H_{30}$ isomer	
78		n-pentadecane	
79		$C_{16}H_{34}$ isomer	
81	isothermal	n-hexadecane	

[a] Sampling was conducted on 6/30/76 from 1030 to 1230, see Table 15 for protocol (P3/L2).

Table A11. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$	
2	43	CO_2	
3	48	propane	
3A	49	1-butene	
3B	50	_n_-butane	
3C	51	2-butene	
4	56	acetaldehyde	∿6,500
5	59	isopentane	
6	62	furan	
6A	63	C_5H_{10} isomer	
6B	64	_n_-pentane and propanol	
6C	66	pentadiene	
6D	67	propanal	
6E	68	acrolein	trace
6F	69	dichloromethane	
6G	71	dimethyl ether	trace
6H	72	acetone	
7	78	2-methylpentane	
7A	80	2-methylpropenal	
8	82	3-methylpentane	
8A	83	vinyl acetate	trace
9	84	hexafluorobenzene (eS)	
9A	85	methylfuran	
10	87	_n_-hexane	
10A	88	_n_-butanal	
11	89	chloroform	12,333
11A	90	C_6H_{12} isomer	
11B	91	methyl vinyl ketone	trace
11C	92	methyl ethyl ketone	trace
12	92	perfluorobenzene (eS)	
12A	93	C_7H_{16} isomer	
13	94	methylcyclopentane and C_7H_{16} isomer	
14	100	dichloroethane	trace
14A	101	1,1,1-trichloroethane	19,167
14B	102	methyl isopropyl ketone	trace
14C	103	C_7H_{14} isomer and propyl acetate	trace
15	103	benzene	5,906
15A	103	3,3-dimethylpentane	
15B	104	carbon tetrachloride	
15C	104	cyclohexane	
16	105	2-methylhexane	
17	106	2,3-dimethylpentane	
18	107	3-methylhexane	
18A	108	C_7H_{14} isomer	
19	110	3-ethylpentane and dimethylcyclopentane isomer	
19A	111	dimethylcyclopentane isomer	
20	112	trichloroethylene	6,895
20A	112	C_7H_{14} isomer	
21	113	_n_-pentanal	
21A	114	_n_-pentane	
21B	116	C_7H_{14} isomer and 2-pentanone	
22	119	C_8H_{18} isomer	
22A	119	C_8H_{16} isomer	
23	120	methylcyclohexane	
24	122	C_8H_{18} isomer	
24A	123	C_8H_{18} isomer	
25	124	4-methyl-2-pentanone	trace
	126	C_8H_{16} isomer	
26	129	toluene	
26A	130	C_8H_{18} isomer	
27	132	C_8H_{18} isomer	
28	135	dimethylcyclohexane isomer	
29	137	C_8H_{16} isomer and hexanal	
29A	138	_n_-octane	
29B	140	_n_-butyl acetate	371
30	141	tetrachloroethylene	
31	145	2-hexanone	
32	147	C_9H_{30} isomer	
32	147	C_9H_{18} isomer	
32B	148	C_3-alkyl cyclohexane isomer	
32C	149	chlorobenzene (tent.)	480
33	152	ethylbenzene	
33A	153	C_9H_{20} isomer	
34	154	_p_-xylene	
35	155	C_9H_{20} isomer	
35A	156	3-heptanone	
35B	157	2-heptanone	
36	158	cyclooctatetraene	
36A	159	heptanal	
37	159	_o_-xylene	
37A	160	C_9H_{18} isomer	
38	161	_n_-nonane	
38A	162	$C_{10}H_{22}$ isomer	
38B	163	$C_{10}H_{22}$ isomer	
39	165	trimethylcyclohexane isomer	
39A	165	$C_{10}H_{22}$ isomer	
40	166	isopropylbenzene	
41	169	$C_{10}H_{20}$ isomer	
41A	171	$C_{10}H_{20}$ isomer	

(continued)

Table A11 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
42A	172	n-propylbenzene					
42	173	benzaldehyde					
43	174	m-ethyltoluene					
44	176	$C_{10}H_{22}$ isomer					
44A	178	cycanobenzene	trace				
45	179	phenol and p-ethyltoluene					
45A	179	$C_{10}H_{22}$ isomer					
46	180	$C_{10}H_{30}$ isomer and octanal					
47	181	o-ethyltoluene					
48	182	n-decane					
48A	183	1,2,4-trimethylbenzene					
48B	184	m-dichlorobenzene					
48C	187	$C_{11}H_{24}$ isomer					
49	188	1,2,3-trimethylbenzene					
50	192	$C_{11}H_{24}$ isomer					
50A	193	C_4-alkyl benzene isomer					
51	194	C_4-alkyl benzene isomer					
52	195	acetophenone					
53	196	$C_{12}H_{26}$ isomer					
54	198	C_4-alkyl benzene isomer					
		$C_{11}H_{20}$ isomer					
54A	199	$C_{11}H_{22}$ isomer					
55	200	nonanal + $C_{11}H_{24}$ isomer					
56	201	n-undecane					
56A	202	$C_{12}H_{26}$ isomer					
57	206	C_4-alkyl benzene isomer					
59	217	decanone (tent.)					
59A	218	$C_{12}H_{22}$ isomer					
60	219	decanal					
61	220	n-dodecane					
62	220	naphthalene					
64	233	$C_{13}H_{28}$ isomer					
64A	234	$C_{13}H_{26}$ isomer					
65	235	tridecane					
67	237	methylnaphthalene					
68	240	dodecanone (tent.)					
69	isothermal	n-tetradecane					
69A	isothermal	n-butyl-n-butyrate					
71	isothermal	tridecanone					
72	isothermal	$C_{15}H_{30}$ isomer					
73	isothermal	n-pentadecane					

[a] Sampling was conducted on 6/30/76 from 1029 to 1229, see Table 15 for protocol (P3/L3).

Table A12. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND FROM KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	43	CO_2	
2	47	CF_2Cl_2	
3	50	methylacetylene	
4	53	isobutene	
5	56	acetaldehyde	~6,250
6	59	n-butane	
7	61	2-butene	
8	62	C_5H_{10} isomer	
9	63	isopentane	
11	66	C_5H_{10} isomer	
12	67	furan	
13	68	n-pentane	
14	69	isoprene	
15A	71	propanal	
15B	71	acrolein	trace
16	73	methylene chloride	
17	74	diethyl ether	3,600
18	75	3-chloropropene	trace
19	76	acetone	
20	78	isopropanol	
21	79	C_6H_{14} isomer	
22	80	C_6H_{14} isomer	
23	82	2-butenal	trace
24	84	2-methylpentane	
25	85	C_6H_{14} isomer	
26	86	perfluorobenzene (e[illegible])	
27A	87	vinylidene chloride (tent.)	
27B	87	2-methylfuran	
28	87	3-methylpentane	
29	88	n-hexane	
30	89	chloroform	3,445
31	90	methyl vinyl ketone	2,100
32	91	methyl vinyl ketone	1,278
33A	92	perfluorotoluene (e[illegible])	
33B	92	C_7H_{16} isomer	
34	94	methylcyclopentane	
35	95	1,2-dichloroethane	347
36	97	1,1,1-trichloroethane	
37	98	ethyl acetate	trace
38A	101	benzene	8,968
38B	101	C_7H_{16} isomer	
38C	101	carbon tetrachloride	2,000
39	102	cyclohexane	
40	103	C_7H_{16} isomer	
41	104	C_7H_{16} isomer	
42	105	C_7H_{16} isomer	
43	108	C_7H_{16} isomer	
44	110	trichloroethylene	10,315
45	111	n-heptane	
46	117	C_8H_{18} isomer	
47	118	C_7H_{14} isomer	
48	121	C_8H_{18} isomer	
49	122	methyl isobutyl ketone	5,077
50	123	C_8H_{16} isomer	
51	125	C_8H_{16} isomer	
52	126	toluene	
53	130	C_8H_{18} isomer	
54	132	C_8H_{16} isomer	
55	133	n-hexanal	
56	135	1,2-dibromoethane	trace
57	136	n-octane	
58	137	N,N-dimethylformamide	trace
59	138	tetrachloroethylene	
60	140	C_9H_{20} isomer	
61	142	C_9H_{20} isomer	
62	144	C_9H_{18} isomer	
63	146	chlorobenzene	1,807
64	150	ethylbenzene	
65	152	p-xylene	
66	155	n-butylfuran	
67	156	styrene	
68	157	o-xylene	
69	158	C_9H_{18} isomer	
70	159	n-nonane	
71	160	$C_{10}H_{22}$ isomer	
72	163	C_9H_{18} isomer	
73	164	cumene	
74	165	$C_{10}H_{22}$ isomer	
75	166	$C_{10}H_{22}$ isomer	
76	168	C_9H_{18} isomer	
77	169	alpha-pinene	
78	170	$C_{10}H_{22}$ isomer	
79	171	n-propylbenzene	
80A	172	benzaldehyde	
80B	172	C_3-alkyl benzene	
81	174	C_3-alkyl benzene	
82	175	phenol	
83	176	benzonitrile	323
84	177	C_3-alkyl benzene	
85	178	$C_{10}H_{22}$ isomer	
86A	179	C_3-alkyl benzene	
86B	179	n-decane	

(continued)

Table A12 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
87	181	$C_{11}H_{24}$ isomer	
88	182	m-dichlorobenzene	
89	184	$C_{11}H_{24}$ isomer	
90	185	C_4-alkyl benzene	
91	186	1,2,3-trimethylbenzene	
92	186	$C_{11}H_{24}$ isomer	
93	187	$C_{10}H_{16}$ isomer	
94	188	o-dichlorobenzene	
95	189	n-butylcyclohexane	
96	190	$C_{11}H_{24}$ isomer	
97	191	C_4-alkyl benzene	
98A	192	C_4-alkyl benzene	
98B	192	acetophenone	
99	194	C_4-alkyl benzene	
100	196	C_4-alkyl benzene	
101	198	C_4-alkyl benzene	
102	199	n-undecane	
103	200	$C_{11}H_{22}$ isomer	
104	202	C_4-alkyl benzene	
105	203	$C_{12}H_{26}$ isomer	
106	205	C_4-alkyl benzene	
107	206	C_5-alkyl benzene	
108A	209	1,2,3,4-tetrahydronaphthalene	
108B	209	dimethylphenol isomer	
109	210	C_4-alkyl benzene	
110	213	C_5-alkyl benzene	
111	214	$C_{12}H_{26}$ isomer	
112	216	$C_{12}H_{26}$ isomer	
113	217	n-dodecane	
114	218	naphthalene	
115	220	$C_{13}H_{28}$ isomer	
116	221	$C_{13}H_{28}$ isomer	
117	224	$C_{13}H_{26}$ isomer	
118	226	$C_{13}H_{26}$ isomer	
119	229	$C_{13}H_{28}$ isomer	
120	230	$C_{13}H_{28}$ isomer	
121	232	$C_{13}H_{28}$ isomer	
122	234	n-tridecane	
123	236	$C_{13}H$	
124	238	chlorotoluene isomer	
125	240	2-methylnaphthalene	
126	isothermal	$C_{14}H_{30}$ isomer	
127		1-methylnaphthalene	
128		$C_{14}H_{28}$ isomer	
129		$C_{14}H_{30}$ isomer	
130		$C_{14}H_{30}$ isomer	
131	isothermal	n-tetradecane	

[a] Sampling was conducted on 6/30/76 from 1029 to 1229, see Table 15 for protocol (P3/L4).

Table A13. VOLATILE ORGANICS IN AMBIENT AIR UPWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	43	CO_2		40	123	C_8H_{18} isomer	
3	48	propane		41	126	C_8H_{16} isomer	
4	52	isobutene		42	128	C_8H_{16} isomer	
5	56	acetaldehyde	~24,000	43	129	toluene	
6	64	isopentane		44	133	C_8H_{18} isomer	
8	67	furan		45	133	C_8H_{16} isomer	
9	68	n-pentane		46	135	C_8H_{16} isomer	
10A	69	C_5H_{10} isomer		47	137	C_8H_{16} isomer	
10B	69	isoprene		48	138	n-octane	
11	71	propanal		49	140	C_8H_{16} isomer	
12A	72	C_5H_{10} isomer		50	142	tetrachloroethylene	2,722
12B	72	methylene chloride	trace	51	145	C_9H_{20} isomer	
13	74	diethyl ether		52	146	C_9H_{18} isomer	
14	75	C_6H_{14} isomer		53	147	C_9H_{20} isomer	
15	76	acetone		54	148	chlorobenzene	1,127
16A	78	isopropanol		55	150	C_9H_{18} isomer	
16B	78	t-butanol		56	153	ethylbenzene	
17	80	C_6H_{14} isomer		57	154	C_9H_{20} isomer	
18	82	C_6H_{14} isomer		58	155	p-xylene	
19	84	2-methylpentane		59	158	C_9H_{18} isomer	
20	86	C_6H_{12} isomer		60	159	styrene	
21	88	perfluorobenzene (es)		61	161	o-xylene	
22A	89	3-methylpentane		62	162	C_9H_{18} isomer	
22B	89	n-hexane		63	163	n-nonane	
23	92	chloroform	1,034	64	165	$C_{10}H_{22}$ isomer	
24	94	C_6H_{12} isomer		65	166	$C_{10}H_{22}$ isomer	
25A	96	perfluorotoluene (es)		66	168	$C_{10}H_{22}$ isomer	
25B	96	C_7H_{16} isomer		67	169	cumene	
26A	97	methyl ethyl ketone	5,111	68	170	$C_{10}H_{22}$ isomer	
26B	97	C_7H_{16} isomer		69	171	$C_{10}H_{20}$ isomer	
27	100	1,1,1-trichloroethane	trace	70	172	alpha-pinene	
28A	104	benzene		71	173	$C_{10}H_{22}$ isomer	
28B	104	C_7H_{16} isomer		72	174	n-propylbenzene	
28C	104	carbon tetrachloride	1,937	73A	175	benzaldehyde	2,753
29A	106	cyclohexane		73B	175	C_3-alkyl benzene	
29B	108	C_7H_{16} isomer		74A	177	C_3-alkyl benzene	
30	109	C_7H_{16} isomer		74B	177	$C_{11}H_{24}$ isomer	
31	112	C_7H_{16} isomer		75	178	phenol	
32	113	C_7H_{14} isomer		76A	180	benzonitrile	4,553
33	114	trichloroethylene	trace	76B	180	C_3-alkyl benzene	
34	115	n-heptane		77A	181	C_3-alkyl benzene	
35	116	C_7H_{14} isomer		77B	181	n-decane	
36	117	C_7H_{14} isomer		78	182	$C_{11}H_{24}$ isomer	
37	118	C_7H_{14} isomer		79	183	$C_{11}H_{24}$ isomer	
38	120	C_8H_{18} isomer		80	184	$C_{11}H_{22}$ isomer	
39	122	C_7H_{14} isomer		81	186	$C_{11}H_{24}$ isomer	

(continued)

Table A13 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
82	189	1,2,3-trimethylbenzene					
83	191	$C_{11}H_{24}$ isomer					
84	192	methyl styrene isomer					
85	193	C_4-alkyl benzene					
86	195	$C_{11}H_{22}$ isomer					
87	196	C_4-alkyl benzene					
88	197	acetophenone					
89	199	C_4-alkyl benzene					
90	201	C_4-alkyl benzene					
91	202	n-undecane					
92	205	cresol isomer					
93	208	C_4-alkyl benzene					
94	209	$C_{12}H_{26}$ isomer					
95A	212	1,2,3,4-tetrahydronaphthalene					
95B	212	dimethylphenol isomer					
96	213	C_4-alkyl benzene					
97	217	$C_{12}H_{26}$ isomer					
98	220	$C_{12}H_{26}$ isomer					
99	221	n-dodecane					
100	222	naphthalene					
101	225	$C_{13}H_{28}$ isomer					
102	226	$C_{13}H_{28}$ isomer					
103	228	$C_{13}H_{26}$ isomer					
104	232	$C_{13}H_{26}$ isomer					
105	233	$C_{13}H_{28}$ isomer					
106	234	$C_{13}H_{28}$ isomer					
107	235	$C_{13}H_{26}$ isomer					
108	236	$C_{13}H_{28}$ isomer					
109	238	n-tridecane					
110	240	chlorotoluene isomer					
111	isothermal	2-methylnaphthalene					
112	↓	1-methylnaphthalene					
113	↓	$C_{14}H_{30}$ isomer					
114	↓	C_6-alkyl benzene					
115	↓	$C_{14}H_{30}$ isomer					
116	↓	$C_{14}H_{30}$ isomer					
117	↓	n-tetradecane					
118	↓	biphenyl					

[a] Sampling was conducted on 6/30/76 from 1457 to 1646, see Table 15 for protocol (P4/L1).

Table A14. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF STAUFFER CHEMICAL CO[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	CO_2	
4	50	chloromethane	
4A	50	propane	
5	52	1-butene	
6	56	acetaldehyde	trace
7	60	isopentane	
9	65	C_5H_{10} isomer	
10	66	furan	
11	67	n-pentane	
12	68	isoprene	
12A	68	C_5H_{10} isomer	
13	70	propanal	
13A	70	acrolein	trace
14	72	methylene chloride	trace
15	74	acetone	
16	75	isopropanol	
17	78	C_7H_{14} isomer	
18	82	2-butenal	
19	83	2-methylpentane	
20	84	C_6H_{14} isomer	
21	86	perfluorobenzene (es)	
22	87	2-methylfuran	
22A	87	3-methylpentane	
23	89	n-hexane	
24	91	chloroform	5,834
25	93	methyl ethyl ketone	trace
25A	93	methyl vinyl ketone	trace
26	94	perfluorotoluene (es)	
27	95	C_7H_{16} isomer	
28	95	methylcyclopentane	
29	96	1,2-dichloroethane	trace
30	100	ethyl acetate	trace
30A	100	1,1,1-trichloroethane	
31	102	benzene	24,718
32	102	carbon tetrachloride	1,875
33	103	cyclohexane	
34	104	C_7H_{16} isomer	
34A	105	C_7H_{16} isomer	
35	106	C_7H_{16} isomer	
36	109	C_7H_{14} isomer	
37	111	trichloroethylene	394
38	112	n-heptane	
39	113	C_7H_{14} isomer	
40	116	dimethylfuran isomer	
41	117	C_8H_{18} isomer	
42	119	C_7H_{14} isomer	
43	121	dimethyldisulfide	
44	122	methyl isobutyl ketone	trace
45	125	C_8H_{16} isomer	
46	126	C_8H_{16} isomer	
47	128	toluene	
48	131	C_8H_{18} isomer	
49	133	C_8H_{16} isomer	
50	134	n-hexanal	
51	137	n-octane	
52	139	tetrachloroethylene	527
53	141	C_8H_{16} isomer	
54	142	C_9H_{20} isomer	
55	144	C_9H_{20} isomer	
56	145	C_8H_{16} isomer	
57	146	chlorobenzene	trace
58	148	C_9H_{18} isomer	
59	151	ethylbenzene	
60	152	C_9H_{20} isomer	
61	153	p-xylene	
62	154	C_9H_{20} isomer	
63	155	C_8H_{14} isomer	
64	156	n-butylfuran	
65	158	styrene	
66	159	o-xylene	
67	160	n-nonane	
68	161	C_9H_{18} isomer	
69	163	$C_{10}H_{22}$ isomer	
70	165	cumene	
71	167	$C_{10}H_{22}$ isomer	
72	168	alpha-pinene	
73	170	chlorotoluene isomer	
73A	171	n-propylbenzene	
74	171	benzaldehyde	
74A	172	C_3-alkyl benzene	
75	174	C_3-alkyl benzene	
76	175	$C_{10}H_{22}$ isomer	
77	176	phenol	
78	177	benzonitrile	trace
79	178	C_3-alkyl benzene	
79A	178	benzyl methyl ether	
79B	179	phenethyl alcohol (tent.)	
80	180	C_3-alkyl benzene	
80A	180	n-decane	
81	182	benzylchloride	4,513
82	183	m-dichlorobenzene	
83	184	C_4-alkyl benzene	

(continued)

Table A14 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
84	185	$C_{11}H_{24}$ isomer					
85	186	1,2,3-trimethylbenzene					
86	187	$C_{11}H_{24}$ isomer					
87	188	o-dichlorobenzene					
88	189	$C_{10}H_{20}$ isomer					
89	190	bromotoluene isomer					
90	191	bromotoluene isomer					
91	191	C_4-alkyl benzene					
92	192	C_4-alkyl benzene					
93	193	acetophenone					
94	194	$C_{11}H_{24}$ isomer					
95	196	C_4-alkyl benzene					
96	198	$C_{10}H_{16}$ isomer					
97	199	n-undecane					
98	201	$C_{11}H_{22}$ isomer					
99	202	$C_{12}H_{26}$ isomer					
100	204	indole (tent.)					
100A	204	C_4-alkyl benzene					
101	206	C_4-alkyl benzene					
102	207	dichlorotoluene					
103	208	C_5-alkyl benzene					
104	209	dimethylphenol					
105	211	$C_{12}H_{24}$ isomer					
106	213	C_5-alkyl benzene					
107	214	C_5-alkyl benzene					
108	216	$C_{13}H_{28}$ isomer					
109	218	n-dodecane					
110	219	naphthalene					
111	220	C_5-alkyl benzene					
112	221	$C_{13}H_{28}$ isomer					
113	223	C_6-alkyl benzene					
114	226	C_6-alkyl benzene					
115	228	$C_{13}H_{28}$ isomer					
116	230	$C_{13}H_{26}$ isomer					
117	231	$C_{13}H_{28}$ isomer					
118	232	$C_{13}H_{28}$ isomer					
119	235	n-tridecane					
120	237	2-methylnaphthalene					
121	239	$C_{14}H_{30}$ isomer					
122	240	1-methylnaphthalene					
123	240	$C_{14}H_{28}$ isomer					
124	isothermal	$C_{14}H_{30}$ isomer					
125	↓	$C_{14}H_{30}$ isomer					
126	↓	$C_{14}H_{30}$ isomer					
127	↓	n-tetradecane					

[a]Sampling was conducted on 6/30/76 from 1458 to 1646, see Table 15 for protocol (P4/L2).

Table A15. VOLATILE ORGANICS IN AMBIENT AIR DOWNWIND FROM KIN-BUC DUMP SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	44	CO_2		41	120	methyl isobutyl ketone	5,472
3	55	acetaldehyde	~25,000	42	122	C_8H_{16} isomer	
4	60	isopentane		43	124	C_8H_{16} isomer	
6	63	C_5H_{10} isomer		44	127	toluene	
7	63	furan		45	130	C_8H_{18} isomer	
8	64	n-pentane		46	132	C_8H_{16} isomer	
9	65	isoprene		47	133	n-hexanal	trace
10A	66	propanal		48	134	1,2-dibromoethane	535
10B	66	acrolein		49	136	n-octane	
11	67	methylene chloride	trace	50	138	C_8H_{16} isomer	
12	68	diethyl ether		51	139	tetrachloroethylene	9,173
13	69	acetone		52	143	C_9H_{20} isomer	
14	70	3-chloropropene	2,428	53	145	C_9H_{20} isomer	
15	72	isopropanol		54	146	C_9H_{18} isomer	
16	74	C_6H_{14} isomer		55	147	chlorobenzene	607
17	78	C_6H_{14} isomer		56	150	ethylbenzene	
18	80	2-butenal		57	152	p-xylene	
19	82	2-methylpentane		58	156	n-butylfuran	
20	83	C_6H_{14} isomer		59	157	styrene	
21A	84	perfluorobenzene (es)		60	158	o-xylene	
21B	84	2-methylfuran		61	159	C_9H_{18} isomer	
22	86	3-methylpentane		62	160	n-nonane	
23A	87	n-hexane		63	161	$C_{10}H_{22}$ isomer	
23B	87	chloroform	8,999	64	162	$C_{10}H_{22}$ isomer	
24	89	methyl ethyl ketone	trace	65	164	$C_{10}H_{22}$ isomer	
25	90	methyl vinyl ketone	3,500	66	165	cumene	
25A	90	ethyl acetate	4,133	67A	166	$C_{10}H_{22}$ isomer	
26A	92	perfluorotoluene (es)		67B	166	2-ethylhexanal (tent.)	
26B	92	C_7H_{16} isomer		68	168	$C_{10}H_{22}$ isomer	
27	93	C_7H_{16} isomer		69	169	C_9H_{18} isomer	
28	94	methyl cyclopentane		70	170	alpha-pinene	
29A	96	1,2-dichloroethane	1,130	71A	172	benzaldehyde	
29B	96	1,1,1-trichloroethane	7,684	71B	172	n-propylbenzene	
30A	100	benzene	5,375	72	174	C_3-alkyl benzene	
30B	100	C_7H_{16} isomer		73	175	C_3-alkyl benzene	
30C	100	carbon tetrachloride	7,625	74	176	phenol	
31	102	cyclohexane		75	177	benzonitrile	
32	103	C_7H_{16} isomer		76	178	C_3-alkyl benzene	
33	104	C_7H_{16} isomer		77	181	C_3-alkyl benzene	
34	105	C_7H_{16} isomer		78	182	n-decane	
35	108	C_7H_{16} isomer		79	183	$C_{10}H_{20}$ isomer	
36	110	trichloroethylene	5,289	80	184	m-dichlorobenzene	
37	111	n-heptane		81	186	$C_{11}H_{24}$ isomer	
38	114	C_7H_{14} isomer		82	187	1,2,3-trimethylbenzene	
39	116	C_8H_{18} isomer		83	188	o-dichlorobenzene	
40	118	C_7H_{14} isomer		84	190	n-butylcyclohexane	

(continued)

Table A15 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
85	191	$C_{11}H_{24}$ isomer	
86	193	C_4-alkyl benzene	
87	194	acetophenone	
88	195	C_4-alkyl benzene	
89	198	C_4-alkyl benzene	
90	199	C_4-alkyl benzene	
91	200	n-undecane	
92	201	C_5-alkyl benzene	
93	202	$C_{11}H_{22}$ isomer	
94	204	$C_{12}H_{26}$ isomer	
95	205	$C_{10}H_{12}$ isomer	
96	206	C_4-alkyl benzene	
97	208	C_5-alkyl benzene	
98	210	$C_{12}H_{26}$ isomer	
99	211	$C_{10}H_{12}$ isomer	
100	212	C_5-alkyl benzene	
101	214	C_4-alkyl benzene	
102	215	C_5-alkyl benzene	
103	218	$C_{12}H_{26}$ isomer	
104	219	n-dodecane	
105	220	naphthalene	
106	221	C_4-alkyl benzene	
107	222	$C_{13}H_{28}$ isomer	
108	224	$C_{13}H_{28}$ isomer	
109	226	C_6-alkyl benzene	
110	228	$C_{13}H_{28}$ isomer	
111	230	$C_{13}H_{26}$ isomer	
112	232	$C_{13}H_{28}$ isomer	
113	234	$C_{13}H_{28}$ isomer	
114	236	n-tridecane	
115	238	chlorotoluene isomer	
116	240	2-methylnaphthalene	
117	isothermal	$C_{14}H_{30}$ isomer	
118	↓	1-methylnaphthalene	
119	↓	$C_{14}H_{28}$ isomer	
120	↓	$C_{14}H_{30}$ isomer	
121	↓	$C_{14}H_{30}$ isomer	
122	↓	$C_{14}H_{30}$ isomer	
123	↓	n-tetradecane	
124	↓	biphenyl ether	
125	↓	n-pentadecane	
126	↓	n-hexadecane	

[a]Sampling was conducted on 6/30/76 from 1457 to 1646, see Table 15 for protocol (P4/L3).

Table A16. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$	
2	43	CO_2	
3	50	propane	
4	53	1-butene	
4A	54	n-butane	
4B	55	2-butene	
5	56-7	acetaldehyde	~14,000
5A	60	C_5H_{10} isomer	
6	61	isopentane	
7	64	C_5H_{10} isomer	
7A	65	furan	
7B	65	C_5H_{10} isomer	
8	67	n-pentane	
9	68	propanal	
9A	68	acrolein	
9B	69	dichloromethane	trace
10	71	dimethyl ether	
10A	71-2	acetone	
10B	79	methyl-n-propyl ether	
10C	80	diethyl ether	
11	81	2-methylpentane	
12	83	2-methylpropenal	
12A	84	3-methylpentane	
12B	85	C_6H_{12} isomer	
12C	86	vinyl acetate	
13	87	hexafluorobenzene (eS)	
13A	87	3-methylfuran (tent.)	
14	88	n-hexane	
15	91	chloroform	2,778
15A	91	diisopropyl ether (tent.)	
15B	92	methyl vinyl ketone	trace
16A	93	methyl ethyl ketone	trace
16	94	perfluorotoluene (eS)	
16B	94	2,2,3-trimethylbutane	
16C	95	C_7H_{16} isomer	
17	95	methylcyclopentane	
17A	96	ethyl acetate	trace
17B	96	C_7H_{16} isomer	
18A	97	methyl isopropyl ketone (tent.) and C_7H_{16} isomer	
18	98	1,1,1-trichloroethane	
19	100	isopropyl acetate	
20	102	benzene and 3,3-dimethylpentane	10,031
20A	103	carbon tetrachloride	trace
20B	104	cyclohexane	
21	105	2-methylhexane	
22	106	2,3-dimethylpentane	
23	107	3-methylhexane	
24	109	3-ethylpentane	
24A	110	C_7H_{14} isomer	
25	111	1,cis-2-dimethylcyclopentane	
25A	111	1,trans-2-dimethylcyclopentane	
25B	112	trichloroethylene	trace
26A	113	n-pentanal	
26	113	n-heptane	
26A	114	C_7H_{14} isomer	
27	116	2-pentanone	
28	119	C_8H_{18} isomer	
28A	119	C_8H_{16} isomer	
29	120	methylcyclohexane	
29A	121	C_8H_{16} isomer	
29B	121	C_8H_{18} isomer	
30	122	2,4-dimethylhexane	
31	124	4-methyl-2-pentanone	
32	127	C_8H_{16} isomer	
33	128-9	toluene	
33A	129	C_8H_{18} isomer	
34	131	3-methylheptane	
34B	134	dimethylcyclohexane isomer	
34C	135	C_8H_{16} isomer	
35	136	n-hexanal	800
36	137	n-octane	
36A	139	C_8H_{16} isomer	
37	140	tetrachloroethylene	1,389
37A	141	n-butyl acetate	
38	143	3-hexanone	
38A	144	2-hexanone	
39	147	C_9H_{20} isomer	
39A	147	ethylcyclohexane	
40	148	chlorobenzene	610
41	152	ethylbenzene	
41A	152	C_9H_{18} isomer	
41B	153	C_9H_{20} isomer	
42	154	m-xylene	
42A	154	C_9H_{20} isomer	
43	155	3-heptanone (tent.)	
43A	156	$C_{10}H_{22}$ isomer	
44	157	2-heptanone	
45	158	cyclooctatetraene and C_9H_{18} isomer	
46	159	heptanal and C_9H_{20} isomer	713

(continued)

Table A16 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
46A	159	o-xylene	
46B	160	C_9H_{18} isomer	
47	161	n-nonane	
48	161	3,3,5-trimethylheptane	
49	165	$C_{10}H_{22}$ isomer	
50	166	isopropylbenzene	
50A	167	$C_{10}H_{22}$ isomer	
51	168	$C_{10}H_{22}$ isomer	
51A	169	C_3-alkylcyclohexane isomer	
51B	170	$C_{10}H_{20}$ isomer and $C_{10}H_{22}$ isomer	
52	171	$C_{10}H_{16}$ isomer	
52A	172	n-propylbenzene	
53	173	benzaldehyde	NQ[b]
54	174	m-ethyltoluene	
55	175	$C_{10}H_{22}$ isomer	
56	177-9	phenol	
57	179	cyanobenzene (tent.) and $C_{10}H_{22}$ isomer	
58	180	octanal	
58A	180	$C_{10}H_{20}$ isomer	
59	181	1,2,4-trimethylbenzene	
59A	182	n-decane	
60	183	$C_{11}H_{24}$ isomer	
61	187	$C_{11}H_{24}$ isomer	
61A	187	1,2,3-trimethylbenzene and C_4-alkyl benzene isomer	
62	188	$C_{11}H_{24}$ isomer	
62A	189	$C_{12}H_{24}$ isomer	
63	190	o-dichlorobenzene	
63A	191	butylcyclohexane	
64	192	$C_{11}H_{24}$ isomer	
64A	192	p-propyltoluene	
64B	193	n-butylbenzene	
65	194	$C_{11}H_{24}$ isomer	
66	195	acetophenone	
67	196	$C_{12}H_{26}$ isomer	
67A	197	C_4-alkyl benzene isomer	
67B		and nonanone	
67C	198	$C_{11}H_{22}$ isomer	
	199	$C_{11}H_{22}$ isomer	
68	200	n-nonanal	2,265
69	201	n-undecane	
69A	202	$C_{11}H_{22}$ isomer	
69B	203	$C_{12}H_{26}$ isomer	
70	204	C_4-alkyl benzene isomer	
71	207	C_4-alkyl benzene isomer	
71A	210	$C_{12}H_{24}$ isomer	
72A	211	1,2,3,4-tetrahydronaphthalene	
72B	212	$C_{12}H_{26}$ isomer	
73	213	C_4-alkyl benzene isomer	
73A	214	C_5-alkyl benzene isomer	
74B	215	C_5-alkyl benzene isomer	
74	216	decanone	
74A	218	$C_{12}H_{24}$ isomer	
75	218	decanal	
76	219	n-dodecane	
77	220	naphthalene	
78	222	$C_{13}H_{28}$ isomer	
79	224	$C_{13}H_{26}$ isomer	
79A	235	undecanone	
79B	236	$C_{13}H_{26}$ isomer	
80	237	n-tridecane	
81	240	β-methylnaphthalene	
82	240	α-methylnaphthalene	
83	240	$C_{14}H_{28}$ isomer	
84	240	$C_{15}H_{30}$ isomer	
84A	240	$C_{14}H_{28}$ isomer	
85	240	n-tetradecane	
86	240	$C_{16}H_{34}$ isomer	

[a] Sampling was conducted on 6/30/76 from 1457 to 1528, see Table 15 for protocol (P4/L4).

[b] Not quantitated (interference).

Table A17. VOLATILE ORGANICS IN AMBIENT AIR UPWIND FROM KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
2	43	CO_2 isomer	
3	51	propane	
3A	52	1-butene	
3B	53	n-butane	
3C	54	2-butene	
3D	55	chloromethane (tent.)	
4	56	acetaldehyde	trace
6	62	isopentane	
7	66	furan	
7A	67	C_5H_{10} isomer	
8	68	n-pentane	
8A	68	C_5H_{10} isomer and pentadiene isomer	
8B	69	propanol	
8C	70	acrolein	trace
8D	71	C_5H_{10} isomer	
8E	72	dichloromethane	trace
8F	72	diethyl ether	
9	74-8	acetone	
9A	74	2,2-dimethylbutane	
9B	76	methyl propyl ether (tent.)	
9C	80	C_6H_{12} isomer	
10	80	2-methylpentane	
11	83	2-methylpropenal	
11A	84	3-methylpentane	
11B	85	C_6H_{12} isomer	
11C	86	vinyl acetate	
12	87	hexafluorobenzene (eS)	
13	88	n-hexane	
14	90	chloroform	17,222
15	92	butanal	
15A	93	methyl ethyl ketone	trace
16	95	perfluorotoluene (eS)	
16A	95	C_7H_{16} isomer	
17	96	methyl cyclopentane	
18	98	C_8H_{16} isomer and 1,1,1-trichloroethane	trace
18A	99	ethyl acetate	
19	102-3	benzene	15,969
19A	103	C_7H_{16} isomer	
19B	104	carbon tetrachloride	
19C	105	C_7H_{14} and cyclohexane	
20	105	2-methylhexane	
21	106	2,3-dimethylpentane	
22	107	3-methylhexane	
22A	108	dimethylcyclopentane isomer	
23	110	dimethylcyclopentane isomer and 3-ethylpentane	
23A	111	dimethylcyclopentane	
24	112	trichloroethylene	
25	114	n-heptane	
26	115	pentanal	
26A	116	C_7H_{14} isomer	
26B	117	2-pentanone	
27	119	C_8H_{18} isomer	
28	120	methylcyclohexane	
28A	121	C_8H_{16} isomer	
28B	121	C_8H_{18} isomer	
29	122	2,4-dimethylhexane	
29A	123	C_8H_{16} isomer	
29B	124	C_8H_{18} isomer	
30	125	4-methyl-2-pentanone	
30A	125	C_8H_{16} isomer	
30B	126	cyclopentanone (tent.)	
31	129-30	toluene	
31A	130	C_8H_{18} isomer	
31B	131	C_8H_{16} isomer	
32	132	3-methylheptane	
33	135	dimethylcyclohexane isomer	
33A	135	$C_6H_{12}O$ isomer	
33B	137	hexanal	
34	138	n-octane	
34A	140	C_8H_{16} isomer	
34B	141	3-hexanone	
35	142	tetrachloroethylene	1,360
35A	146	C_9H_{20} isomer	
35B	141	3-hexanone	
35C	148	ethyl cyclohexane	
35D	149	chlorobenzene	
35E	151	C_9H_{18} isomer	
36	153	ethylbenzene	
36A	154	C_9H_{20} isomer	
37	155	m-xylene	
37A	156	C_9H_{18} isomer	
37B	156	C_9H_{20} isomer	
37C	157	p-xylene	
37D	157	3-heptanone	
37E	158	C_9H_{16} isomer and 2-heptanone	
38	159	cyclooctatetraene	
38A	159	C_9H_{20} isomer	
39	160	o-xylene and heptanal	

(continued)

Table A17 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
40	162	n-nonane	
40A	163	$C_{10}H_{22}$ isomer	
41	165	$C_{10}H_{20}$ isomer	
41A	166	$C_{10}H_{22}$ isomer	
42	167	isopropylbenzene	
42A	168	$C_{10}H_{20}$ isomer and octanone isomer	
43	170	$C_{10}H_{22}$ isomer	
43A	170	C_3-alkyl cyclohexane isomer	
43B	172	2-octanone	
43C	173	n-propylbenzene	
44	174	benzaldehyde	trace
45	175	m-ethyltoluene	
46	177	$C_{10}H_{22}$ isomer	
46A	178	$C_{10}H_{22}$ isomer	
46B	179	$C_{10}H_{22}$ isomer	
47	180	cyanobenzene and phenol	
47A	180	1,3,5-trimethylbenzene	
47B	181	$C_{10}H_{22}$ isomer	
48	181	octanal	
49	182-3	1,2,4-trimethylbenzene and n-decane	
49A	184	m-dichlorobenzene	
49B	186	$C_{11}H_{24}$ isomer	
50	189	1,2,3-trimethylbenzene	
50A	190	$C_{11}H_{24}$ isomer	
50B	192	$C_{11}H_{22}$ isomer	
50C	193	C_4-alkylcyclohexane	
50D	193	nonanal isomer and indane	
51	194	sec-butylbenzene or p-propyltoluene	
51A	195	C_4-alkyl benzene isomer	
52	196	acetophenone	
53	197	$C_{11}H_{24}$ isomer	
54	199	C_4-alkyl benzene and nonanone isomer	
54A	200	C_4-alkyl benzene isomer	
55	201	1-nonanal	
56	202	n-undecane	
56A	207	C_4-alkyl benzene isomer	
57	212	1,2,3,4-tetrahydronaphthalene	
57A	217	C_5-alkyl benzene isomer	
57B	218	decanone	
58	220	decanal	
59	221	n-dodecane and naphthalene	
61	236	undecanone isomer	
62	238	n-tridecane	
62A	240	β-methylnaphthalene	
63	240	n-tetradecane	
63A	240	n-butylbutyrate	trace

[a]Sampling was conducted on 7/1/76 from 1006 to 1206, see Table 15 for protocol (P5/L1).

Table A18. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF STAUFFER CHEMICAL PLANT[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
1A	43	CO_2	
2	50	propane	
3	51	1-butene	
3A	51	n-butane	
3B	52	2-butene	
4	55	acetaldehyde	~20,833
5	59	isopentane	
5A	62	C_5H_{10} isomer	
5B	63	pentadiene	
5C	63	furan and C_5H_{10} isomer	
6	64	n-pentane	
7	64	propanal and acrolein	3,125
7A	66	C_5H_{10} isomer and dimethyl ether	
8A	67	dichloromethane	
8	68-70	acetone	
8A	68	methyl-n-propyl ether	
8B	69	diethyl ether	
8C	69	C_6H_{12} isomer	
9	70	2-methylpentane	
10	71	2-methylpropenal	
10A	72	C_6H_{12} isomer and 3-methyl-pentane	
10B	77	1-hexene or C_6H_{12} isomer	
10C	79	vinyl acetate	
11	82	hexafluorobenzene (e✱)	
12	83	n-hexane	
12A	84	butanal	
13	85	chloroform	11,111
14	89	methyl ethyl ketone and methyl vinyl ketone (tent.)	
14A	89	perfluorotoluene (e✱)	
15	90	methylcyclopentane	
15A	93	1,1,1-trichloroethane	
15B	95	3,3-dimethylpentane	
16	97-9	benzene	7,343
16A	98	carbon tetrachloride	
16B	98	thiophene	
17	100	cyclohexane and 2-methylhexane	
18	101	2,3-dimethylpentane	
19	103	3-methylhexane	
19A	104	C_7H_{14} isomer	
20	105	dimethylcyclopentane isomer and 3-ethylpentane	
20A	106	dimethylcyclopentane isomer	
21	1-7	trichloroethylene	
22	109	n-pentanal and n-heptane	
22A	112	2-pentanone	
22B	114	C_8H_{18} isomer	
23	116	methylcyclohexane	
23A	117	C_8H_{18} isomer	
23B	118	C_8H_{16} isomer	
24	119	C_8H_{18} isomer and 3-methyl-2-pentanone	
24A	121	4-methyl-2-pentanone	
25	125	toluene	
27	128	C_8H_{18} isomer	
27A	129	C_8H_{14} isomer	
27B	130	C_8H_{16} isomer	
27C	132	C_8H_{16} isomer	
28	133	hexanal	1,200
29	135	n-octane	
30	138	tetrachloroethylene	
31	140	cyclopentane	
31A	140	C_8H_{16} isomer	
32	141	2-ethylbutyraldehyde	
33	142	C_9H_{20} isomer	
33A	144	2-hexanone	
34	148	C_8H_{12} isomer	
35	149	ethylbenzene	
35A	150	2,5-dimethyl-hexa-2,4-diene	
35B	151	C_9H_{20} isomer	
36	152	m-xylene	
36A	153	C_9H_{20} isomer	
37	153	C_9H_{20} isomer	
38	156	C_9H_{16} isomer and 2-heptanone	
39	157	cyclooctatetraene	
39A	157	heptanal	
40	158	o-xylene	
40A	158	C_9H_{18} isomer	
41	159	n-nonane	
41A	161	C_3-alkylcyclohexane isomer	
41B	162	$C_{10}H_{22}$ isomer	
41C	163	C_9H_{18} isomer	
42	164	isopropylbenzene	
43	166	$C_7H_{14}O$ isomer and C_9H_{18} isomer	
44	167	$C_{10}H_{22}$ isomer	
44A	169	octanone	
44B	170	chlorotoluene (isomer)	
45	171	benzaldehyde	3,400
45A	172	n-propylbenzene	

(continued)

Table A18 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
45B	172	p-ethyltoluene					
45C	173	$C_{10}H_{22}$ isomer					
46	174	$C_{10}H_{22}$ isomer					
46A	176	cyanobenzene					
47	177	o-ethyltoluene and 2-octanone					
47A	178	phenol					
48	179	octanal	1,250				
48A	180	1,2,4-trimethylbenzene					
49	181	n-decane					
49A	182	$C_{11}H_{24}$ isomer					
50	183	benzyl chloride	6,560				
50A	184	dichlorobenzene (m or p)					
50B	185	$C_{11}H_{24}$ isomer					
51	186	1,2,3-trimethylbenzene and $C_{10}H_{20}$ isomer					
51A	188	$C_{11}H_{22}$ isomer					
51B	189	$C_{11}H_{24}$ isomer					
52	191	bromotoluene (m or p)	472				
53	194	acetophenone					
54	197	2-nonanone					
55	199	n-nonanal	3,080				
56	201	n-undecane					
57	207	$C_{12}H_{24}$ isomer					
58	210	1,2,3,4-tetrahydronaphthalene					
59	213	C_4-alkyl benzene isomer					
59A	215	C_4-alkyl benzene isomer					
60	216	decanone and terphthaldehyde (tent.)					
61	217	$C_{12}H_{24}$ isomer and C_4-alkyl benzene isomer					
62	218	decanal					
63	219	n-dodecane and naphthalene					
63A	224	$C_{12}H_{24}$ isomer					
63B	227	naphthol isomer					
63C	233	$C_{13}H_{28}$ isomer					
65	235	$C_{13}H_{26}$ isomer					
66	237	n-tridecane					
67	240	$C_{14}H_{30}$ isomer					
70	240	n-tetradecane					

[a]Sampling was conducted on 7/1/76 from 1006 to 1206, see Table 15 for protocol (P5/L2).

Table A19. VOLATILE ORGANICS IN AMBIENT AIR ON KIN-BUC DUMP SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	CO_2	
3	52	C_4H_8 isomer	
4	56	acetaldehyde	trace
5	57	n-butane	
6	58	methylchloride (tent.)	
7	59	isopentane	
9A	61	C_5H_{10} isomer	
9B	61	furan	
10	62	n-pentane	
11A	63	isoprene	
11B	63	C_5H_{10} isomer	
12	64	propanal	
13	65	acrolein	trace
14	68	methylene chloride	40,000
15	69	diethyl ether	
17	72	acetone	
18	76	isopropanol	
19	78	C_6H_{14} isomer	
20	80	C_6H_{14} isomer	
21	82	2-butenal	
22	83	2-methylpentane	
23	84	C_6H_{14} isomer	
24	87	perfluorobenzene (eS)	
25A	88	3-methylpentane	
25B	88	n-hexane	
25C	88	2-methylfuran	
26	89	1,3-dioxane (tent.)	
27	90	chloroform	19,444
28	91	methyl ethyl ketone	8,535
29	93	methyl vinyl ketone	trace
30A	94	perfluorotoluene (eS)	
30B	94	C_7H_{16} isomer	
31	95	methylcyclopentane	
32	96	1,2-dichloroethane	7,575
33	98	1,1,1-trichloroethane	3,417
34	99	ethyl acetate	
35A	102	benzene	
35C	102	carbon tetrachloride	
36	104	cyclohexane	
37	105	C_7H_{16} isomer	
38	107	C_7H_{16} isomer	
39	110	C_7H_{14} isomer	
40	111	trichloroethylene	18,940
41	112	n-heptane	
42	113	C_7H_{14} isomer	
43	115	dimethylfuran isomer	
45	119	C_7H_{14} isomer	
46	122	C_8H_{18} isomer	
47	122	methyl isobutyl ketone	
48	123	C_8H_{16} isomer	
49	126	C_8H_{16} isomer	
50	128	toluene	
51	129	C_8H_{18} isomer	
51	130	C_8H_{18} isomer	
53	132	C_8H_{16} isomer	
54	133	n-hexanal	
55	135	1,2-dibromoethane	757
56	136	n-octane	
57	138	C_8H_{16} isomer	
58	140	tetrachloroethylene	25,560
59	141	C_9H_{20} isomer	
60A	142	C_9H_{20} isomer	
60B	142	trimethylfuran isomer	
61	145	C_9H_{18} isomer	
62	146	chlorobenzene	
63	148	C_9H_{18} isomer	
64	151	ethylbenzene	
65	152	C_9H_{18} isomer	
66	152	p-xylene	
67	154	n-butylfuran	
68	156	styrene	
69	158	o-xylene	
70	159	n-nonane	
71	160	C_9H_{18} isomer	
72	163	C_9H_{18} isomer	
73	164	cumene	
74	167	$C_{10}H_{22}$ isomer	
75	168	C_9H_{18} isomer	
76	170	α-pinene	
77	171	n-propylbenzene	
78A	173	benzaldehyde	
78B	173	C_3-alkyl benzene	
79	174	C_3-alkyl benzene	
80	175	phenol	
81	176	benzonitrile	
82	177	C_3-alkyl benzene	
83	178	$C_{10}H_{20}$ isomer	
84A	180	C_3-alkyl benzene	
84B	180	n-decane	
85	181	$C_{10}H_{20}$ isomer	

(continued)

Table A19 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
86A	182	C_4-alkyl benzene	
86B	182	m-dichlorobenzene	
87	184	$C_{11}H_{24}$ isomer	
88	185	$C_{11}H_{24}$ isomer	
89	186	1,2,3-trimethylbenzene	
90	187	C_4-alkyl benzene	
91	188	$C_{10}H_{16}$ isomer	
92	189	o-dichlorobenzene	
93	190	$C_{10}H_{20}$ isomer	
94	191	C_4-alkyl benzene	
95	192	C_4-alkyl benzene	
96	193	C_4-alkyl benzene	
97	194	C_4-alkyl benzene	
98	196	C_4-alkyl benzene	
99	198	C_4-alkyl benzene	
100	199	$C_{11}H_{22}$ isomer	
101	200	n-undecane	
102	201	$C_{11}H_{22}$ isomer	
103	202	C_4-alkyl benzene	
104	203	indole (tent.)	
105	204	C_4-alkyl benzene	
106	206	C_5-alkyl benzene	
107	207	$C_{10}H_{12}$ isomer	
108	209	$C_{12}H_{26}$ isomer	
109	211	C_5-alkyl benzene	
110	213	$C_{12}H_{26}$ isomer	
111A	214	C_5-alkyl benzene	
111B	214	dimethylphenol isomer	
112	217	$C_{13}H_{28}$ isomer	
113	218	n-dodecane	
114	219	naphthalene	
115	221	C_4-alkyl benzene	
116	222	$C_{13}H_{28}$ isomer	
117	224	$C_{12}H_{24}$ isomer	
118	226	C_6-alkyl benzene	
119	227	$C_{13}H_{28}$ isomer	
120	230	chlorotoluene isomer	
121	231	$C_{13}H_{28}$ isomer	
122	232	$C_{13}H_{28}$ isomer	
123	235	$C_{13}H_{28}$ isomer	
124	236	n-tridecane	
125	238	2-methylnaphthalene	
126	240	$C_{14}H_{30}$ isomer	
127	isothermal	1-methylnaphthalene	
128		$C_{14}H_{28}$ isomer	
129		$C_{14}H_{30}$ isomer	
130	isothermal	$C_{14}H_{30}$ isomer	
131		$C_{14}H_{30}$ isomer	
132		$C_{14}H_{30}$ isomer	
133		n-tetradecane	
134		biphenyl	
135		diphenyl ether	
137		n-pentadecane	
138		n-hexadecane	

[a] Sampling was conducted on 7/1/76 from 1015 to 1038, see Table 15 for protocol (P5/L3).

Table A20. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND FROM KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
2	43	CO_2	
3	49	chloromethane	
3A	50	propane	
3B	51	1-butene	
3C	52	n-butane	
3D	53	2-butene	
4	55	acetaldehyde	∿3,125
4A	60	C_5H_{10} isomer	
4B	61	isopentane	
4C	65	furan and C_5H_{10} isomer	
5	66	n-pentane	
5A	66-7	propanal	
5B	67	acrolein	4,000
5C	68	dimethyl ether	
6	69-71	acetone	
7	70	dichloromethane	100,000
8	73	methyl-n-propyl ether	
9	76	diethyl ether and isobutnal	
10	80	2-methylpentane	
10A	82	2-methylpropenal	
11	83	C_6H_{14} isomer	
12	85	n-butanal and hexafluoro-benzene (e[illegible])	
12A	85	3-methylfuran	
13	86	n-hexane	
13A	87	diisopropyl ether	
14	88	chloroform	8,334
14A	89	methyl ethyl ketone	1,389
15	91	ethyl acetate and methyl vinyl ketone	9,467 7,091
16	93	perfluorotoluene (e[illegible])	
17	94	methylcyclopentane	
18	95	1,2-dichloroethane	9,565
19	97	1,1,1-trichloroethane	∿150,000
20	100-1	benzene	7,000
20A	101	CCl_4	
21	102	isopropyl acetate	6,517
21A	103	cyclohexane	
22	104	2-methylhexane	
23	105	2,3-dimethylpentane	
24	106	3-methylhexane	
25	109	1,3-dimethylcyclopentane	
26	110	trichloroethylene and n-pentanal	3,684 15,018
27	112	n-heptane	
28	114	C_7H_{14} isomer	
29	115	n-propyl acetate	
30	117	1-butanol (tent.)	
31	118	dioxane	
32	119-20	methylcyclohexane and 4-methyl-2-pentanone	
32A	120	3-methyl-2-pentanone	
33	121-2	C_7H_{14} isomer	
34	125	C_8H_{16} isomer	
34A	126	1,1,2-trichloroethane	4,467
35	217-8	toluene	
35A	129	C_8H_{18} isomer	
36	131	C_8H_{18} isomer	
36A	132	C_8H_{18} isomer	
37	133	dimethylcyclohexane isomer	
38	134	n-hexanal	2,288
38A	135	C_8H_{16} isomer	
39	137	n-octane and n-butyl acetate	
40	140	tetrachloroethylene	34,632
42	143	3-hexanone	
43	144	C_9H_{20} isomer	
44	146	C_9H_{20} isomer	
45	147	ethylcyclohexane	
45A	147	chlorobenzene	
46	149	C_9H_{18} isomer	
47	151	ethylbenzene	
47A	152	C_9H_{18} isomer	
47B	152	C_9H_{20} isomer	
48	153	p-xylene	
49	154	C_9H_{20} isomer	
50	156	2-heptanone	
51	157	cyclooctatetraene	
51A	158	heptanal	
52	159	o-xylene and 1,1,2,2-tetrachloroethane	
52A	159	C_9H_{18} isomer	
53	160	n-nonane	
54	162	C_9H_{18} isomer	
54A	163	$C_{10}H_{20}$ isomer	
54B	163	C_9H_{18} isomer and $C_{10}H_{22}$ isomer	

(continued)

Table A20 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
55	164	$C_{10}H_{22}$ isomer	
55A	165	isopropylbenzene	
56	166	$C_{10}H_{22}$ isomer	
57	167	C_9H_{16} isomer and C_9H_{18} isomer	
58	168	$C_{10}H_{22}$ isomer	
58A	168	propylcyclohexane	
59	169	$C_{10}H_{22}$ isomer	
59A	169	α-pinene	
60	170	$C_{10}H_{20}$ isomer	
61	172	benzaldehyde	2,888
61A	172	n-propylbenzene and chlorotoluene isomer	
62	173	$C_{10}H_{22}$ isomer	
63	173	m-ethyltoluene and $C_{10}H_{22}$ isomer	
64	175	$C_{11}H_{24}$ isomer and 1,3,5-trimethylbenzene	
64A	175	$C_{11}H_{24}$ isomer and 1,3,5-trimethylbenzene	
65	176	$C_{10}H_{32}$ isomer	
65A	177	$C_{10}H_{20}$ isomer	
65B	177	$C_{10}H_{22}$ isomer	
66	178	o-ethyltoluene	
67	179	$C_{10}H_{18}$ isomer	
		n-octanal	789
67A	179	$C_{10}H_{20}$ isomer	
67B	180	isobutylthiophene	
68	181	1,2,4-trimethylbenzene	
69	181	n-decane	
69A	182	$C_{11}H_{24}$ isomer	
69B	182	$C_{10}H_{20}$ isomer	
70	183	dichlorobenzene (m or p) and n-butylthiophene	
70A	183	$C_{11}H_{24}$ isomer	
71	184	$C_{11}H_{24}$ isomer	
71A	184	C_4-alkyl benzene isomer	
71B	185	1,2,3-trimethylbenzene	
72	185	$C_{11}H_{24}$ isomer	
73	186	$C_{10}H_{16}$ isomer	
74	187	o-dichlorobenzene	
75	188	$C_{11}H_{24}$ isomer	
76	189	butylcyclohexane isomer	
77	190	$C_{11}H_{22}$ isomer	
78	190	$C_{12}H_{26}$ isomer	
79	191	C_4-alkyl benzene isomer	
80	193	$C_{11}H_{24}$ isomer	
81	194	C_4-alkyl benzene isomer	
82	194	acetophenone	
82A	195	$C_{11}H_{24}$ isomer	
83	196	$C_{11}H_{24}$ isomer	
84	197	$C_{11}H_{22}$ isomer	
84A	198	C_4-alkyl benzene isomer	
84B	198	$C_{10}H_{16}$ isomer	
84C	198	$C_{11}H_{22}$ isomer	
85	199	n-nonanal	2,223
85A	200	$C_{11}H_{22}$ isomer	
86	201	n-undecane	
86A	201	C_5-alkyl benzene isomer and $C_{11}H_{22}$ isomer	
87	202	$C_{12}H_{26}$ isomer and C_5-alkyl benzene isomer	
88	203	C_5-cyclohexane isomer	
89	205	$C_{12}H_{26}$ isomer	
89A	206	$C_9H_{14}O$ isomer	
90	207	C_4-alkyl benzene isomer and $C_{12}H_{26}$ isomer	
90A	208	$C_{10}H_{14}O$ isomer	
90B	208	C_5-alkyl benzene isomer	
91	209	C_5-alkyl benzene isomer	
93	211	C_5-alkyl cyclohexane isomer	
94	212	$C_{12}H_{26}$ isomer	
95	213	tetramethylbenzene isomer	
96	214	$C_{12}H_{26}$ isomer + C_5-alkyl benzene isomer	
97	215	$C_{13}H_{28}$ isomer	
98	218	trichlorobenzene isomer and undecanal	
99	219	n-dodecane	
100	220	naphthalene	
101	222	$C_{13}H_{28}$ isomer	
103	228	$C_{13}H_{28}$ isomer	
104	230	$C_{13}H_{26}$ isomer	
105	232	$C_{14}H_{30}$ isomer	
105A	233	$C_{11}H_{22}O$ isomer	
106	235	C_6-alkyl benzene isomer	
106A	236	$C_{13}H_{26}$ isomer	
107	237	n-tridecane	
107A	238	$C_{13}H_{26}$ isomer	
108	240	$C_{14}H_{28}$ isomer	
109	240	β-methylnaphthalene	
110	240	α-methylnaphthalene	
113	240	$C_{14}H_{28}$ isomer	

(continued)

Table A20 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m[3]	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m[3]
113A	240	biphenyl					
114	240	tetradecane					
115	240	n-butyl butyrate	1,517				
116	240	$C_{15}H_{30}$ isomer					
117	240	$C_{13}H_{26}O$ isomer					
118	240	$C_{16}H_{34}$ isomer					
119	240	n-pentadecane					
121	240	n-hexadecane					

[a]Sampling was conducted on 7/1/76 from 1006 to 1206, see Table 15 for protocol (P5/L4).

Table A21. VOLATILE ORGANICS IN AMBIENT AIR UPWIND OF KIN-BUC DISPOSAL SITE[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	44	CO_2	
3	52	propane	
4	54	1-butene	
5	56	acetaldehyde	∿14,750
6	60	isopentane	
8	63	C_5H_{10} isomer	
9	64	furan	
10	66	n-pentane	
11	67	isoprene	
12	68	propanal	
12A	68	acrolein	trace
13	70	C_6H_{14} isomer	
14	71	methylene chloride	3,000
15	72	diethyl ether	
16	74	acetone	
17	76	isopropanol	
18	80	C_6H_{14} isomer	
19	82	2-butenal	
20	84	2-methylpentane	
21	85	C_6H_{14} isomer	
22	87	perfluorobenzene (es)	
23	89	2-methylfuran	
23A	89	3-methylpentane	
24	90	n-hexane	
25	91	chloroform	944
26	92	C_6H_{12} isomer	
27	94	methyl ethyl ketone	trace
27A	94	methyl vinyl ketone	trace
28	95	perfluorotoluene (es)	
29	96	methylcyclopentane	
30	98	ethyl acetate	trace
31	100	1,2-dichloroethane	trace
32	102	1,1,1-trichloroethane	trace
33	103	benzene	10,156
34	104	carbon tetrachloride	3,125
35	105	cyclohexane	
36	106	C_7H_{16} isomer	
37	107	C_7H_{16} isomer	
38	108	C_7H_{16} isomer	
39	110	C_7H_{14} isomer	
40	111	C_7H_{14} isomer	
41	113	trichloroethylene	trace
42	114	n-heptane	
43	116	C_7H_{14} isomer	
44	119	C_7H_{14} isomer	
45	122	C_7H_{14} isomer	
46	123	C_8H_{18} isomer	
47	126	methyl isobutyl ketone	
48	128	C_8H_{16} isomer	
49	130	toluene	
50	133	C_8H_{18} isomer	
51	136	C_8H_{16} isomer	
52	138	n-hexanal	
53	140	n-octane	
54	142	N,N-dimethylformamide	
55	143	tetrachloroethylene	694
56	144	C_8H_{16} isomer	
57	146	C_8H_{18} isomer	
58	148	C_8H_{18} isomer	
59	150	chlorobenzene	
60	152	C_9H_{18} isomer	
61	154	ethylbenzene	
62	155	C_9H_{20} isomer	
63	156	p-xylene	
64	159	n-butylfuran	
65	161	styrene	
66	162	o-xylene	
67	162	C_9H_{18} isomer	
68	163	n-nonane	
69	164	C_9H_{18} isomer	
70	167	cumene	
71	170	C_9H_{18} isomer	
72	172	$C_{10}H_{22}$ isomer	
73	174	α-pinene	
74	175	n-propylbenzene	
75	176	benzaldehyde	
75A	176	C_3-alkyl benzene	
76	177	C_3-alkyl benzene	
77	178	$C_{10}H_{22}$ isomer	
78	180	phenol	
79	181	benzonitrile	
80	181	C_3-alkyl benzene	
81	182	$C_{10}H_{20}$ isomer	
82	184	C_3-alkyl benzene	
82A	184	n-decane	
83	185	m-dichlorobenzene	
84	186	C_4-alkyl benzene	
85	188	$C_{11}H_{22}$ isomer	
86	190	1,2,3-trimethylbenzene	
87	192	o-dichlorobenzene	
88	194	C_9H_{10} isomer	
89	195	C_4-alkyl benzene	

(continued)

Table A21 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
89A	195	$C_{11}H_{22}$ isomer					
90	196	C_4-alkyl benzene					
91	197	acetophenone					
92	198	C_4-alkyl benzene					
93	200	C_4-alkyl benzene					
94	202	$C_{11}H_{24}$ isomer					
95	204	n-undecane					
96	206	C_4-alkyl benzene					
97	209	C_4-alkyl benzene					
98	212	dimethylphenol isomer					
99	213	C_5-alkyl benzene					
100	215	C_4-alkyl benzene					
101	217	C_5-alkyl benzene					
102	218	C_5-alkyl benzene					
103	220	C_4-alkyl benzene					
104	221	C_6-alkyl benzene					
105	222	$C_{13}H_{28}$ isomer					
106	222	n-dodecane					
107	223	naphthalene					
108	225	C_6-alkyl benzene					
109	226	C_5-alkyl benzene					
110	228	C_5-alkyl benzene					
111	232	C_5-alkyl benzene					
112	236	C_5-alkyl benzene					
113	238	C_6-alkyl benzene					
114	239	n-tridecane					
115	240	2-methylnaphthalene					
116	isothermal	$C_{14}H_{30}$ isomer					
117		1-methylnaphthalene					
118		C_7-alkyl benzene					
119		$C_{14}H_{30}$ isomer					
120		$C_{14}H_{30}$ isomer					
121		$C_{15}H_{32}$ isomer					
122		$C_{14}H_{28}$ isomer					
123		n-tetradecane					

[a]Sampling was conducted on 7/1/76 from 1425 to 1625, see Table 15 for protocol (P6/L1).

Table A22. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND FROM AN INDUSTRIAL AREA[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	42	$N_2 + O_2$	
2	43	CO_2	
3	51	propane	
4	53	1-butene	
4A	54	_n_-butane	
4B	55	2-butene	
5	56	acetaldehyde	~25,000
5A	63	isopentane	
6A	66	C_5H_{10} isomer	
6B	66	pentadiene isomer	
6C	67	C_5H_{10} isomer and furan	
7	68	_n_-pentane	
8	69	propanal and acrolein	trace
8D	70	C_5H_{10} isomer	
8E	71	dichloromethane	trace
8F	71	dimethyl ether (tent.)	
9	72-3	acetone	
9A	76	methyl propyl ether	
10	79	2-methylpentane	
11	83	2-methylpropane	
11A	84	C_6H_{12} isomer and 3-methylpentane	
11B	85	vinyl acetate	trace
11C	85	C_6H_{12} isomer	
12	86	hexafluorobenzene (es)	
13	87	butanal and _n_-hexane	
13A	88	3-methylfuran	
14	90	chloroform	2,500
14A	91-2	methyl vinyl ketone	trace
15	93-4	methyl ethyl ketone	555
16	95	perfluorotoluene (es)	
17	96	methylcyclopentane and C_7H_{16} isomer	
18	98	1,1,1-trichloroethane	417
18A	99	C_7H_{16} isomer	
19	103	benzene and carbon tetra-chloride and thiophene	6,875
19A	105	cyclohexane	
20	106	2-methylhexane	
21	107	2,3-dimethylpentane	
22	108	3-methylhexane	
22A	108	C_7H_{14} isomer	
22B	109	methyl isopropyl ketone	
23	110	dimethylcyclopentane isomer and 3-ethylpentane	
23A	111	butanol (tent.)	
23B	111	dimethylcyclopentane	
24	112	_n_-pentanal and trichloroethylene	trace trace
25	114	_n_-heptane	
25A	116	2-pentanone	
25B	118	C_8H_{18} isomer	
26	121	methylcyclohexane	
27	123	C_8H_{18} isomer	
28	125	4-methyl-2-pentanone	
29	127	C_8H_{16} isomer	
30	129	toluene	
30A	130	C_8H_{18} isomer	
31	132	C_8H_{18} isomer	
31A	134	C_8H_{14} isomer	
31B	135	C_8H_{16} isomer	
31C	135	C_8H_{14} isomer	
32	136	_n_-hexanal	1,200
32C	137	C_8H_{16} isomer	
33	138	_n_-octane	
34	141	tetrachloroethylene	1,229
34A	143	C_8H_{12} isomer	
35	144	heptanone	
35A	146	C_9H_{20} isomer	
35B	148	ethylcyclohexane	
35C	149	chlorobenzene	
35D	151	C_9H_{18} isomer	
35E	152	C_8H_{14} isomer	
36	153	ethylbenzene	
36A	153	C_9H_{20} isomer	
37	154	_p_-xylene	
38	155	C_9H_{20} isomer	
38A	156	C_9H_{16} isomer	
38B	157	$C_7H_{14}O$ isomer	
39	158	2-heptanone and 2-_n_-butylfuran (tent.)	
39A	158	cyclooctatetraene or styrene	
40	159	_n_-heptanal	
41	160	_o_-xylene	
41A	160	C_9H_{18} isomer	
42	161	_n_-nonane	
42A	163	$C_{10}H_{22}$ isomer	
43	166	isopropylbenzene and C_9H_{18} isomer	
44	168	C_9H_{18} isomer	
45	170	$C_{10}H_{22}$ isomer	
45A	172	octanone isomer	

(continued)

Table A22 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
46	173	chlorotoluene isomer and benzaldehyde	3,400
47	174	p-ethyltoluene	
47A	175	$C_{10}H_{22}$ isomer	
48	176	$C_{11}H_{24}$ isomer	
49	178	phenol and cyanobenzene and octanone isomer	
49A	178	o-ethyltoluene	
50	179	unknown	
51	180	n-octanal	1,250
51A	181	$C_{10}H_{20}$ isomer	
52	182	1,2,4-trimethylbenzene and C_9H_{20} isomer	
53	184	benzylchloride	8,033
53A	185	dichlorobenzene (m or p)	
53B	187	$C_{11}H_{24}$ isomer	
54	188	1,2,3-trimethylbenzene and C_9H_{20} isomer	
54A	189	$C_{12}H_{26}$ isomer	
54B	190	o-dichlorobenzene and $C_{10}H_{20}$ isomer	
55	192	bromotoluene isomer	472
56	193	C_4-alkyl benzene isomer	
57	195	acetophenone	
58	197	2-nonanone	
58A	198	C_4-alkyl benzene isomer	
58B	199	$C_{11}H_{22}$ isomer	
59	201	n-nonanal	3,080
60	202	n-undecane	
60A	203	$C_{12}H_{24}$ isomer	
60B	204	$C_{12}H_{26}$ isomer	
61	206	methylcyanobenzene	
62	208	dichlorotoluene isomer	
62A	211	1,2,3,4-tetrahydronaphthalene isomer and methylphenol isomer	
62B	212	dimethylphenol (tent.)	
64	213	C_4-alkyl benzene and decanone isomer	
64A	214	$C_{12}H_{24}$ isomer	
64B	215	C_4-alkyl benzene isomer	
65	217	$C_{13}H_{28}$ isomer and dimethylphenol isomer	
66	218	2-decanone	
66A	218	C_4-alkyl benzene isomer	
67	219	decanal (tent.)	
68	220	n-dodecane	
69	221	naphthalene	
70	223	$C_{12}H_{24}$ isomer	
70A	234	2-undecanone	
71	236	$C_{13}H_{26}$ isomer	
72	238	n-tridecane	
73	240	β-methylnaphthalene	
73A	240	α-methylnaphthalene	
75	240	dodecanone	
77	240	n-tetradecane	
77A	240	n-butylbutyrate	trace
78	240	2-tridecanone	
79	240	$C_{15}H_{30}$ isomer	
80	240	n-pentadecane	
81	240	n-hexadecane	

[a]Sampling was conducted on 7/1/76 from 1425 to 1675, see Table 15 for protocol (P6/L2).

Table 23. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR ON TOP OF KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	66	dimethyl ether	
2	67	acetone	
3	68	diethyl ether	
4	70-1	dichloromethane	460,000
6	72-4	methyl propyl ether	
6A	77	C_6H_{12} isomer	
6B	80	C_6H_{12} isomer	
7	81	1,1-dichloroethane and 2-methylpentane	22,700
7A	81	ethyl isopropyl ether (tent.)	
7B	82	2-methylpropenal	
8	83	vinyl acetate	
9	84	propanol (tent.) and 3-methylpentane	
9A	85	methyl vinyl ketone and butanal	trace
10	86	methyl ethyl ketone	33,300
10A	87	hexafluorobenzene (es)	
11	87	_n_-hexane	
11A	88	chloroform	27,200
12	89-91	ethyl acetate	232,000
13	93	perfluorotoluene (es)	
14	95	methylcyclopentane	
15	96	1,2-dichloroethane	27,700
16	98	1,1,1-trichloroethane	121,000
17	100	tetrahydrofuran (tent.)	
18	101-2	benzene	191,000
18A	102	carbon tetrachloride	10,600
18B	103	isopropyl acetate	
19	104	cyclohexane	
19A	104	2-methylhexane	
20	105	2,3-dimethylpentane	
21	107	3-methylhexane	
21A	108	butanol (tent.)	
22	109	dimethylcyclopentane	
23	110	_m_-pentanal	38,000
23A	111	trichloroethylene	trace
23B	112	C_7H_{14} isomer	
24	113	_n_-heptane	
25	114	C_7H_{14} isomer	
26	115	_n_-propyl acetate	
26A	116	1-butanol	
27	117	2-methyl-3-pentanone (tent.)	
27A	117	dioxane	
29	120	methyl isobutyl ketone	444,500
30	123	sec-butyl acetate (tent.)	
31	126	isobutyl acetate	
32	129	toluene	
32A	130	C_8H_{18} isomer	
33	131	C_8H_{18} isomer	
34	133	2-hexanone and dimethylcyclohexane isomer	
34A	134	C_8H_{16} isomer	
35	136	pentanol and C_8H_{18} isomer	
35A	135	_n_-hexanal	trace
35B	136	C_8H_{16} isomer	
36	137	_n_-octane and _n_-butyl acetate	22,500
37	138	C_8H_{16} isomer	
38	140	tetrachloroethylene	394,000
39	142	C_9H_{20} isomer	
40	143	C_9H_{20} isomer	
41	145	C_9H_{20} isomer	
42	146	ethylcyclohexane	
43	147	chlorobenzene	7,500
44	149	1,3,5-trimethylcyclohexane	
44A	150	C_9H_{20} isomer	
45	151	ethylbenzene	
45A	152	C_9H_{18} isomer	
46	152-3	_p_-xylene and C_9H_{20} isomer	
47	154	C_9H_{20} isomer	
47A	155	C_9H_{20} isomer	
47B	155	C_9H_{18} isomer	
48	156	C_9H_{20} isomer	
49	158	styrene or cyclooctatetraene and C_9H_{20} isomer	
50	159	_o_-xylene and 1,1,2,2-tetrachloroethane	15,000
50A	160	1-methyl-2-ethylcyclohexane	
51	161	_n_-nonane	
52	162	$C_{10}H_{22}$ isomer	
52A	162	C_9H_{16} isomer	
53	163	$C_7H_{14}O$ isomer (tent.)	
53A	164	$C_{10}H_{22}$ isomer	
53B	164	C_9H_{18} isomer	
54	165	$C_{10}H_{22}$ isomer	
55	166	isopropylbenzene and $C_{10}H_{22}$ isomer	
55A	167	_n_-propylcyclohexane	

(continued)

Table A23 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m[3]
56	168	$C_{10}H_{22}$ isomer	
57	169	$C_{10}H_{22}$ isomer	
58	170	α-pyrene and $C_{10}H_{22}$ isomer	
59	171	diethylcyclohexane	
60	172	n-propylbenzene and $C_{10}H_{18}$ isomer	
60A	173	benzaldehyde and $C_{10}H_{22}$ isomer	5,525
61	174	m-ethyltoluene and $C_{10}H_{22}$ isomer	
62	175	$C_{11}H_{24}$ isomer	
62A	176	$C_{10}H_{22}$ isomer	
62B	176	$C_{10}H_{20}$ isomer	
63	177	$C_{10}H_{22}$ isomer and o-ethyltoluene	
64	178	$C_{11}H_{24}$ isomer	
65	180	$C_{10}H_{22}$ isomer and $C_{10}H_{16}$ isomer	
66	181	1,2,4-trimethylbenzene and n-decane	
67	183	$C_{10}H_{20}$ isomer	
68	184	dichlorobenzene (m or p)	
69	185	$C_{11}H_{24}$ isomer	
70	186	C_4-alkyl benzene and $C_{11}H_{24}$ isomer	
71	187	1,2,3-trimethylbenzene and C_4-alkyl benzene	
72	188	$C_{11}H_{24}$ isomer	
72A	188	$C_{11}H_{22}$ isomer	
73	189	limonene (or $C_{10}H_{16}$) and o-dichlorobenzene	
74	190	n-butylcyclohexane	
74A	190	$C_{12}H_{26}$ isomer	
75	191	$C_{11}H_{22}$ isomer and C_4-alkyl benzene	
75A	192	$C_{11}H_{24}$ isomer and C_4-alkyl benzene	
76	193	$C_{11}H_{22}$ isomer and acetophenone	
77	194	$C_{11}H_{24}$ isomer	
78	194	$C_{11}H_{22}$ isomer	
79	195	$C_{11}H_{24}$ isomer	
79A	197	C_4-alkyl benzene	
80	198	$C_{10}H_{18}$ isomer and $C_{11}H_{22}$ isomer	
80A	198	indan	
81	199	$C_{11}H_{22}$ isomer	
82	201	n-undecane	
83	202	C_5-alkyl benzene	
84	203	$C_{11}H_{22}$ isomer	
85	204	$C_{12}H_{26}$ isomer	
86	205	C_4-alkyl benzene	
87	207	C_4-alkyl benzene and $C_{12}H_{26}$ isomer	
88	209	C_5-alkyl benzene and $C_{11}H_{20}$ isomer	
89	210		
89A	210	$C_{10}H_{12}$ isomer	
90	211	$C_{12}H_{26}$ isomer	
91	212	$C_{11}H_{20}$ isomer	
91A	213	$C_{12}H_{26}$ isomer and C_4-alkyl benzene	
92	213	C_5-alkyl benzene	
93	214	$C_{12}H_{26}$ isomer	
94	215	$C_{12}H_{26}$ isomer and decanal (tent.)	
95	217	bromoxylene isomer (tent.)	50,500
96	218	n-dodecanane	
97	219	naphthalene	
98	221	$C_{13}H_{28}$ isomer	

[a]Sampling was conducted on 7/1/76 from 1444 to 1458, see Table 15 for protocol (P6/L3).

Table A24. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR DOWNWIND OF KIN-BUC DISPOSAL SITE[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
1	41	$N_2 + O_2$	
2	43	CO_2	
4	50	propane	
5	52	1-butene	
5A	53	n-butane	
6	54	acetaldehyde	~625
8	60	C_5H_{10} isomer	
8A	61	isopentane	
9	63	furan	
9A		C_5H_{10} isomer	
9B	64	n-pentane	
10	66	propanal and acrolein	
10A	67	dimethyl ether	
11	69-71	acetone	
12	69	dichloromethane	42,000
13	72-73	methyl propyl ether	
14	77	C_6H_{12} isomer	
15	79	2-methylpentane	
15A	81	2-methylpropenal	
16	82	vinyl acetate	14,523
16A	83	3-methylpentane	
16B	84	C_6H_{12} isomer	
17	85	n-butanal and hexafluorobenzene (eI)	
17A	86	3-methylfuran	
18	87	n-hexane	
18A	87	diisopropyl ether	
19	88	chloroform	28,334
19A	89-91	methyl ethyl ketone	
20	92	ethyl acetate and	4,066
		methyl vinyl ketone	400
21	93	perfluorotoluene (eI)	
22	94	methylcyclopentane	
22A	95	C_7H_{16} isomer	
23	96	1,2-dichloroethane	260
24	97-8	1,1,1-trichloroethane	75,000
24A	99	C_7H_{14} isomer	
25	101	benzene	27,343
25A	102	carbon tetrachloride	
25B	102	C_7H_{16} isomer	
26	103	isopropyl acetate	551
26A	103	cyclohexane	
27	104	2-methylhexane	
28	105	2,3-dimethylpentane	
29	106	3-methylhexane	
30	109	dimethylcyclopentane isomer + $C_{18}H_{16}$ isomer	
31	110	n-pentanal and trichloroethylene	10,606
31A	111	C_7H_{14} isomer	
32	112	n-heptane	
33	114	C_7H_{14} isomer	
34	115	n-propyl acetate	3,225
34A	116	1-butanol (tent.)	
34B	117	2-methyl-3-pentanone	
35	118	C_8H_{18} isomer and dioxan	
35A	119	methylcyclohexane	
36	120-2	4-methyl-2-pentanone	24,000
37	123	3-methyl-2-pentanone (tent.)	750
37A	124	C_8H_{16} isomer	
38	125	C_8H_{18} isomer	
38A	126	C_8H_{16} isomer	
39	128-130	toluene	
39A	129	C_8H_{18} isomer	
40	131	C_8H_{18} isomer	
41	133	dimethylcyclohexane	
42	134	pentanol isomer (tent.)	2,900
43	137	n-octane	
43A	137-8	n-butyl acetate	
43B	139	C_8H_{16} isomer	
44	139-40	tetrachloroethylene	12,500
45	143	C_9H_{20} isomer	
46	144	hexanone	
47	146	C_9H_{20} isomer	
48	147	ethylcyclohexane	
49	149	chlorobenzene	
49A	150	C_9H_{18} isomer	
50	151	ethylbenzene	
50A	152	C_9H_{18} isomer	
51A	152	C_9H_{20} isomer	
51	153	p-xylene	
52	154	C_9H_{20} isomer	
53	156	heptanone and m-xylene	
53A	157	C_9H_{16} isomer	
54	157	styrene or cyclooctatetraene and heptanal	
55	158	o-xylene and 1,1,2,2-tetrachloroethane	1,389
55A	159	$C_7H_{14}O$ isomer	
55B	159	1-methyl-2-ethylcyclohexane	
56	160	n-nonane	

(continued)

Table A24 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound	ng/m^3
57	161	$C_{10}H_{22}$ isomer	
59	164	C_9H_{18} isomer and $C_{10}H_{20}$ isomer	
59A	165	$C_{10}H_{22}$ isomer	
60	165	isopropylbenzene	
60A	166	$C_{10}H_{22}$ isomer	
60B	167	C_3-alkyl cyclohexane isomer	
60C	167	C_9H_{16} isomer	
61	168	$C_{10}H_{22}$ isomer	
62	169	n-propylcyclohexane	
63	170	$C_{10}H_{22}$ isomer	
63A	170	α-pinene	
63B	171	$C_{10}H_{20}$ isomer and $C_{10}H_{18}$ isomer	
64A	171	benzaldehyde	
64B	172	n-propylbenzene	
65	173	$C_{10}H_{22}$ isomer	
66	173	m-ethyltoluene	
66A	174	$C_{10}H_{18}$ isomer	
67	174	$C_{10}H_{22}$ isomer	
68	175	$C_{11}H_{24}$ + 1,3,5-trimethylbenzene	
69	176	phenol and $C_{10}H_{20}$ isomer	
70	177	$C_{10}H_{22}$ isomer	
71	178	o-ethyltoluene and $C_{10}H_{22}$ isomer	
71A	179	n-octanal	
72A	180	$C_{10}H_{18}$ and isobutylthiophene	
72	181	1,2,4-trimethylbenzene	
73	181	n-decane	
74	183	$C_{10}H_{22}$ isomer	
75	184	dichlorobenzene (m or p) and n-butylthiophene	
76	185	$C_{11}H_{24}$ isomer	
77	186	$C_{11}H_{24}$ isomer	
78	186	C_4-alkyl benzene and 1,2,3-trimethylbenzene	
79	187	$C_{11}H_{24}$ isomer	
79A	188	$C_{10}H_{16}$ isomer	
80	189	o-dichlorobenzene	3,000
80A	189	$C_{11}H_{24}$ isomer	
81	190	butylcyclohexane	
82	190	$C_{11}H_{22}$ isomer	
83	191	$C_{12}H_{26}$ isomer	
84	193	C_4-alkyl benzene and $C_{11}H_{22}$ isomer	
85	194	C_4-alkyl benzene and $C_{11}H_{24}$ isomer	
86	194	acetophenone	
87	195	$C_{11}H_{24}$ isomer	
87A	196	$C_{11}H_{22}$ isomer	
87B	197	C_4-alkyl benzene and nonanone isomer	
88	198	$C_{11}H_{22}$ isomer and $C_{11}H_{20}$ isomer	
88A	198	$C_{11}H_{22}$ isomer	
89	199	nonanal	
89A	200	$C_{11}H_{22}$ isomer	
90	201	n-undecane	
91	202	$C_{11}H_{22}$ isomer	
91A	202	$C_{12}H_{26}$ isomer	
91B	203	C_5-alkyl cyclohexane isomer	
92	203	$C_{12}H_{24}$ isomer and C_5-alkyl benzene isomer	
93	204	$C_{12}H_{26}$ isomer	
94	205	tetramethylbenzene isomer	
94A	206	$C_{11}H_{20}$ isomer	
95	206	$C_{12}H_{26}$ isomer	
96	207	C_4-alkyl benzene isomer	
96A	208	$C_{12}H_{22}$ isomer (tent.)	
98A	210	C_5-alkyl cyclohexane isomer	
99	211	$C_{12}H_{26}$ isomer	
99A	211	$C_{12}H_{24}$ isomer	
100	212	$C_{12}H_{26}$ isomer	
101	213	C_5-alkyl benzene isomer	
102	214	$C_{12}H_{24}$ isomer	
103	215	$C_{12}H_{24}$ isomer	
104	218	decane and trichlorobenzene	
105	219	n-dodecane	
106	220	naphthalene	
106A	221	$C_{12}H_{24}$ isomer	
107	222	$C_{13}H_{28}$ isomer	
108	223	$C_{13}H_{26}$ isomer	
109	227	$C_{13}H_{26}$ isomer	
109A	228	$C_{13}H_{24}$ isomer	
110	229	$C_{13}H_{28}$ isomer and C_6-alkyl benzene isomer	
110A	230	$C_{13}H_{28}$ isomer	
111	232	$C_{11}H_{22}O$ isomer (tent.)	

(continued)

Table A24 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m³	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	ng/m³
112	234	$C_{13}H_{24}$ isomer and $C_{13}H_{26}$ isomer					
113	235	$C_{13}H_{28}$ isomer					
114	236	n-tridecane					
114A	237	$C_{13}H_{26}$ isomer					
115	isothermal	$C_{14}H_{30}$ isomer					
116		$C_{14}H_{24}$ isomer					
117		C_7-alkyl benzene isomer and $C_{14}H_{30}$ isomer					
119		$C_{12}H_{24}O$ isomer (tent.)					
120		$C_{14}H_{28}$ isomer					
121		n-tetradecane					
122		n-butyl butyrate					
123		pentadecane					
124		$C_{16}H_{32}$ isomer					
125		n-hexadecane					

[a]Sampling was conducted on 7/1/76 from 1425 to 1625, see Table 15 for protocol (P6/L4).

Table A25. VOLATILE ORGANICS VAPORS IN AMBIENT AIR IDENTIFIED IN MILBY PARK[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2	29	86	toluene
2	41	dichlorodifluoromethane	30	88	C_8H_{18} isomer
2A	43	1-butene	31	89	dichlorobutene isomer
3	44	C_4H_6 isomer	31A	90	C_8H_{18} isomer
4	45	acetaldehyde	31B	91	dimethylcyclohexane isomer
5	48	trichlorofluoromethane	31C	91	2-hexanone
6	48	dimethyl ether + propanal + propenal	32	92	n-hexanal
			33	95	n-octane
7	49	acetone + C_5H_{12} isomer	33A	95	tetrachloroethylene
7A	51	dichloromethane	33B	96	C_8H_{16} + C_8H_{14} isomers
8A	54	ter-butanol + isopropanol	34	96	acetic acid (tent.)
8B	55	isobutanal	35	97	C_8H_{14} isomer
9	56	2-methylpentane	35A	98	C_8H_{16} isomer
9A	56	crotonaldehyde	35B	99	C_8H_{14} isomer
9B	57	3-methylpentane	36	100	furfural
10	58	chloroprene	37	101	4-vinylcyclohexene
10A	58	n-butanal	38	104	C_8H_{14} isomer
11	59	hexafluorobenzene (eI)	39	105	ethylbenzene
12	60	n-hexane	40	107	m-xylene
13	61	chloroform	41	108	C_9H_{20} isomer
14	64	perfluorotoluene (eI) + methyl-cyclopentane	42	109	C_9H_{20} isomer
			43	111	cyclooctatetraene
14A	64	1,2-dichloroethane	44	112	o-xylene
15	65	1,1,1-trichloroethane + dimethylpentane isomer	45	113	C_9H_{18} isomer
			45A	113	n-heptanal
15A	66	C_7H_{14} isomer	45B	114	dichlorobutene isomer
15B	67	3-methylbutanal	46	115	n-nonane
16	68	benzene	46A	117	C_9H_{18} isomer
16A	69	carbon tetrachloride + C_7H_{16} isomer	47	118	isopropylbenzene
			48	118	$C_{10}H_{22}$ isomer
17	69	cyclohexane	48A	120	$C_{10}H_{20}$ isomer
18	70	2-methylhexane	49	122	$C_{10}H_{22}$ + $C_{10}H_{20}$ isomers
19	71	2,3-dimethylpentane	50	123	benzaldehyde
20	72	3-methylhexane	50A	124	n-propylbenzene
20A	73	n-pentanal + C_7H_{14} isomer	51	125	m-ethyltoluene
20B	74	C_7H_{16} isomer	51A	126	$C_{10}H_{22}$ isomer
21	74	dimethylcyclopentane + trichloroethylene	51B	127	1,3,5-trimethylbenzene + $C_{10}H_{22}$ isomer
22	76	n-heptane	52	128	$C_{11}H_{24}$ isomer
23	77	2,2,4-trimethyl-1-pentene	53	129	$C_{10}H_{22}$ isomer
23A	79	C_7H_{14} isomer	53A	130	C_9H_{18} isomer
24	80	methylcyclohexane	54	131	$C_{11}H_{24}$ isomer
25	81	4-methyl-2-pentanone	54A	132	$C_{10}H_{20}$ isomer
26	82	C_8H_{18} + C_8H_{14} isomers	55	132	n-octanal + $C_{10}H_{20}$ isomer
27	83	C_8H_{16} isomer	55A	133	o-ethyltoluene

(continued)

Table A25 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
55B	134	$C_{10}H_{20}$ isomer
56	135	dichlorobenzene + $C_{11}H_{24}$ isomers
57	135	n-decane
58	136	$C_{12}H_{24}$ isomer
58A	136	$C_{10}H_{20}$ isomer
59	137	triisobutylene
59A	135	1,2,3-trimethylbenzene
59B	138	C_4-alkyl benzene isomer
59C	139	$C_{11}H_{24}$ isomer
60	140	$C_{12}H_{26}$ isomer + indan
60A	141	indene
61	142	$C_{11}H_{22}$ isomer
61A	143	C_4-alkyl benzene isomer
62	143	$C_{12}H_{26}$ isomer
62A	144	C_4-alkyl benzene isomer
63	144	acetophenone
63A	145	$C_{11}H_{22}$ isomer
63B	145	unknown
64	147	$C_{12}H_{26}$ isomer
64A	147	$C_{11}H_{22}$ isomer
64B	148	C_4-alkyl benzene isomer
65	148	$C_{11}H_{22}$ isomer
65A	149	methylindan (tent.)
65B	149	C_4-alkyl benzene isomer
66	151	n-nonanal
66A	152	$C_{11}H_{22}$ isomer
66B	153	C_5-alkyl benzene isomer
67	154	n-undecane
67A	155	$C_{11}H_{22}$ isomer
68	156	C_4-alkyl benzene isomer
69	159	dimethylphenol isomer
69A	161	C_4-alkyl benzene isomer
69B	162	C_5-alkyl benzene isomer
70	163	dimethylphenol isomer
70A	164	$C_{12}H_{26}$ isomer
70B	165	$C_{12}H_{24}$ isomer
70C	166	naphthalene
70D	167	C_3-alkyl phenol + $C_{11}H_{22}$ isomers
70E	168	C_5-alkyl benzene + $C_{12}H_{24}$ isomers
71	168	n-decanal
71A	169	$C_{12}H_{24}$ isomer
72	170	n-dodecane
72A	171	decanone
72B	172	$C_{10}H_{20}O$ isomer
72C	174	C_3-alkyl phenol isomer
72D	175	unknown
73	177	C_3-alkyl phenol isomer
73A	179	C_6-alkyl benzene isomer
73B	181	$C_{11}H_{22}O$ isomer (tent.)
74	182	$C_{13}H_{28}$ isomer
74A	183	undecanone
74B	185	$C_{13}H_{26}$ isomer + β-methyl-naphthalene
75	186	n-tridecane
76	189	saturated alcohol (tent.)
76A	191	tetraisobutylene
76B	193	$C_{14}H_{30}$ isomer
76C	194	isobutyl isobutyrate
76D	195	$C_{14}H_{30}$ isomer
77	196	isobutyl n-butyrate
77A	198	dodecanone + $C_{14}H_{28}$ isomers
78	200	$C_{12}H_{10}O$ isomer (tent.)
79	201	n-tetradecane
79A	204	$C_{14}H_{28}$ isomer
80	206	dimethyl phthalate
81A	208	$C_{17}H_{36}$ isomer (tent.)
82	212	$C_{15}H_{32}$ isomer
82A	214	tridecanone
83	215	$C_{15}H_{30}$ isomer
84	216	n-pentadecane
85	227	$C_9H_{18}O_2$ isomer (tent.)
86	228	n-hexadecane
87	237	tetrachlorohexafluorobutane isomer (tent.)
88	238	$C_{15}H_{30}O$ isomer
88A	240	$C_{17}H_{34}$ isomer
89	240	silane compound (BKG)
90	240	unknown
91	240	$C_{16}H_{32}O$ isomer
92	240	$C_{17}H_{34}$ isomer
93	240	$C_{18}H_{38}$ isomer
94	240	silane compound (BKG)
95	240	unknown

[a] Sampling was at HL1 (Fig. 12) as described in Table 16.

Table A26. VOLATILE ORGANICS IDENTIFIED IN AMBIENT AIR IN HOUSTON, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
1A	40	ethanol
2	43	C_4H_6 isomer
3	43	acetaldehyde
4	45	isopentane
5	46	acetone
5A	47	dimethyl ether + diethyl ether
6B	49	ter-butanol + isopropanol (tent.)
7	50	n-butanal
8	51	2-methylpentane + 2-methyl-propenal
8A	53	3-methylpentane
9	53	2-chloro-1,3-butadiene
10	54	hexafluorobenzene (eS)
11	55	n-hexane
13	57	perfluorotoluene (eS)
13A	58	methylcyclopentane
14A	61	3-methylbutanal
14B	61	C_6H_{10} isomer
15	62	benzene
15A	62	carbon tetrachloride
15B	63	cyclohexane
16	64	2-methylhexane
17	64	2,3-dimethylpentane
17A	66	C_7H_{14} isomer
18	67	n-pentanal
18A	67	C_7H_{12} isomer
18B	68	C_7H_{14} isomer
18C	68	C_7H_{12} isomer
19	70	n-heptane
19A	70	C_7H_{10} isomer
20	72	diisobutylene
21	74	methylcyclohexane
22	75	C_8H_{16} isomer
23	76	4-methyl-2-pentanone + C_8H_{18} isomer
24	78	acetic acid (tent.)
25	80	C_8H_{14} isomer
26	81	toluene
26A	82	C_8H_{16} isomer
26B	83	C_8H_{16} isomer
27	83	C_8H_{18} isomer
28	84	dichlorobutane isomer
28A	85	C_8H_{18} isomer
29	86	C_8H_{16} isomer
30	88	n-hexanal
30A	88	C_8H_{16} isomer
31	90	n-octane
31A	91	tetrachloroethylene
32	92	C_8H_{14} isomer
33	93	C_8H_{14} isomer
34	94	C_8H_{16} isomer
35	97	C_8H_{12} isomer
36	99	C_9H_{12} isomer
36A	100	C_9H_{18} isomer
36B	101	C_8H_{14} isomer
37	102	ethylbenzene
37A	102	C_9H_{18} isomer
38	104	m-xylene
39	105	C_9H_{20} isomer
40	107	C_9H_{20} isomer
41	108	cyclooctatetraene
42	109	o-xylene
43	110	n-heptaldehyde
44	111	C_9H_{18} isomer
44A	112	C_9H_{16} isomer
45	113	n-nonane
45A	114	C_9H_{18} isomer
46	116	isopropylbenzene
47	117	$C_{10}H_{22}$ isomer
48	118	$C_{10}H_{22}$ isomer
48A	119	C_9H_{18} isomer
49	120	$C_{10}H_{22}$ isomer
50	121	benzaldehyde
51	122	n-propylbenzene
52	124	m-ethyltoluene
52A	125	$C_{10}H_{22}$ isomer
53	125	1,3,5-trimethylbenzene
53A	126	$C_{10}H_{20}$ isomer
54	126	$C_{11}H_{24}$ isomer
55	127	C_9H_{18} isomer
55A	128	$C_{10}H_{22}$ isomer
56	129	$C_{10}H_{20}$ isomer + phenol
56A	130	$C_{10}H_{22}$ isomer
57	131	o-ethyltoluene
57A	131	$C_{10}H_{20}$ isomer
58	133	n-decane
59	134	$C_{12}H_{24}$ isomer
60	136	triisobutylene
60A	136	1,2,3-trimethylbenzene
61	138	$C_{10}H_{20}$ isomer

(continued)

Table A26 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
62	139	indan
63	139	$C_{11}H_{24}$ isomer
64	140	indene
64A	141	$C_{11}H_{22}$ isomer
64B	141	C_4-alkyl benzene isomer
65	142	C_4-alkyl benzene isomer
66	143	acetophenone
66A	143	C_4-alkyl benzene isomer
67	144	$C_{11}H_{24}$ + C_4-alkyl benzene isomers
67A	145	$C_{10}H_{18}$ isomer
68	146	cresol isomer
68A	147	$C_{11}H_{22}$ isomer
69	147	C_4-alkyl benzene isomer
70	149	C_4-alkyl benzene isomer
70A	149	$C_{11}H_{22}$ isomer
71	150	n-nonanal
71A	151	$C_{11}H_{22}$ isomer
71B	152	C_5-alkyl benzene isomer
71C	152	C_4-alkyl benzene isomer
72	153	n-undecane
73	155	C_4-alkyl benzene isomer
73A	156	dimethylphenol + $C_{12}H_{26}$ isomers
73B	157	$C_{12}H_{24}$ isomer
74	158	2,3-dimethylphenol
75	160	methylindan isomer (tent.)
75A	161	C_4-alkyl benzene isomer
76	162	ethylphenol isomer
77	163	ethylphenol isomer
78	166	naphthalene
78A	167	C_3-alkyl phenol isomer
79	169	n-decane
79A	169	$C_{12}H_{24}$ isomer
80	170	n-dodecane
80A	171	C_7-alkyl benzene isomer
80B	171	dimethylphenol isomer
80C	172	C_3-alkyl phenol isomer
81	173	$C_{12}H_{24}$ isomer
82	174	C_3-alkyl phenol isomer
83	175	$C_7H_{16}O$ isomer (tent.)
83A	176	$C_{13}H_{26}$ isomer
84	177	$C_{14}H_{28}$ isomer
85	179	$C_{13}H_{28}$ isomer
86	181	$C_{13}H_{26}$ isomer
87	183	undecanone isomer
88	185	β-methylnaphthalene
88A	186	$C_{13}H_{26}$ isomer
89	187	n-tridecane
90	188	α-methylnaphthalene
91	190	dimethylbutanol isomer (tent.)
92	192	$C_{14}H_{30}$ isomer
93	194	$C_{14}H_{28}$ isomer
94	195	n-butyl butyrate
95	197	isobutyl butyrate
96	199	methylheptanol (tent.) isomer
97	201	$C_{14}H_{28}$ isomer
98	202	n-tetradecane
99	203	$C_{14}H_{28}$ isomer
99A	206	$C_{15}H_{30}$ isomer
100	207	$C_{15}H_{30}$ isomer
100A	209	$C_{15}H_{30}$ isomer
100B	210	$C_{16}H_{34}$ isomer
101	212	$C_{15}H_{32}$ isomer
102	215	$C_{15}H_{30}$ isomer
103	217	n-pentadecane
104	218	alkyl alcohol (tent.)
105	219	alkyl alcohol isomer (tent.)
107	225	diethyl phthalate
109	230	$C_{16}H_{32}$ isomer
110	234	tributyl phosphate
112	240	$C_{16}H_{32}$ isomer (tent.)
114	240	isoamyl benzoate
115	240	n-hexadecane
117	240	$C_{16}H_{32}$ isomer
119	240	$C_{17}H_{34}$ isomer
121	240	$C_{17}H_{36}$ isomer
122	240	$C_{17}H_{36}$ isomer
128	240	$C_{18}H_{38}$ isomer

[a] Sampling was at HL2 (Fig. 12), see Table 16.

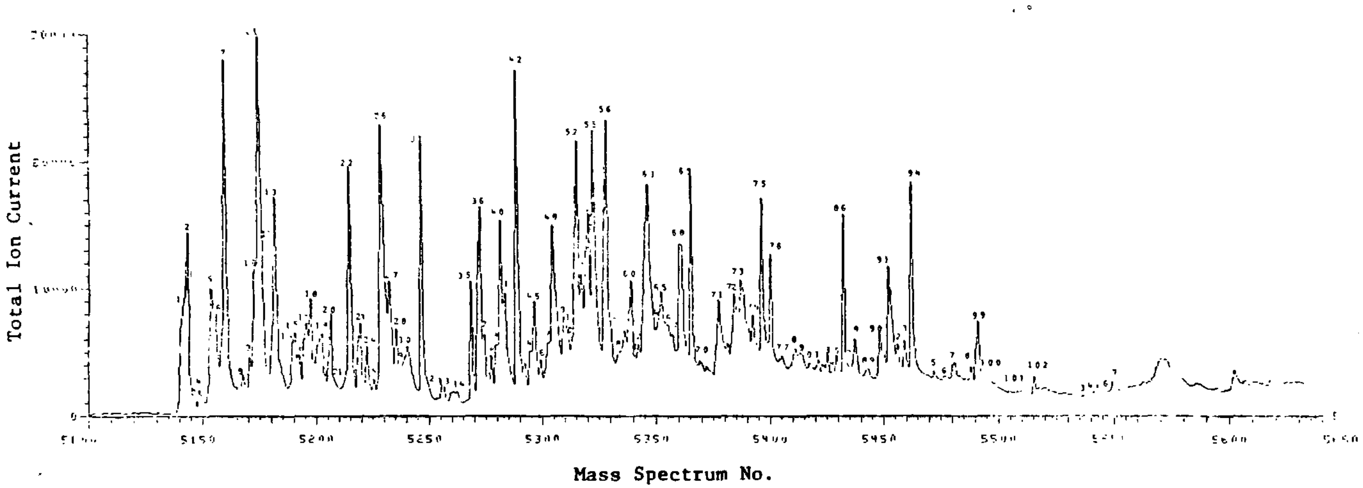

Figure A1. Pollution profile for air sample taken at HL3 (Fig. 12, Table 16).

Table A27. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM HOUSTON, TX[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
2	41	dichlorodifluoromethane
3	43	1-butene
3A	43	*n*-butane
4	44	acetaldehyde
5	46	isopentane
5A	46	$CFCl_3$
5B	47	furan + C_5H_{10} isomer + dimethyl ether
6	47	*n*-pentane + acetone
6A	48	diethyl ether
7	48	dichloromethane
7A	49	freon 113
7B	50	isopropanol
7C	50	ter-butanol
7D	51	methyl ethyl ketone
8	53	2-methylpentane
8A	53	crotonaldehyde or C_4H_8O isomer
8B	54	$C_4H_{10}S$ isomer (tent.)
9	55	3-methylpentane
9A	55	*n*-butanal
10	56	hexafluorobenzene (es)
11	57	*n*-hexane
12	57	chloroform
13	61	perfluorotoluene (es)
13A	62	methylcyclopentane
13B	63	C_7H_{16} isomer
13C	63	1,1,1-trichloroethane
13D	64	C_7H_{14} isomer
13E	64	$C_5H_{10}O$ isomer
14	65	benzene
14A	65	carbon tetrachloride
15	66	C_7H_{16} isomer
16	66	cyclohexane
16A	67	2-methylhexane
17	68	2,3-dimethylpentane
18	69	3-methylhexane
19	70	*n*-pentanal
19A	71	C_7H_{14} isomer
19B	72	trichloroethylene
20	73	*n*-heptane
21	74	C_7H_{12} isomer
22	77	methylcyclohexane
22A	79	C_8H_{16} isomer
23	79	C_8H_{18} isomer
23A	80	4-methyl-2-pentanone
23B	80	C_8H_{16} isomer
24	81	C_8H_{18} isomer
25	82	C_8H_{16} isomer
26	83	toluene
27	86	C_8H_{18} isomer
28	87	C_8H_{18} isomer
29	88	C_8H_{16} isomer
29A	89	C_8H_{14} isomer + 2-hexanone
30	90	*n*-hexanal
30A	92	C_8H_{16} isomer
31	93	*n*-octane
32	93	tetrachloroethylene
32A	96	C_8H_{16} isomer
33A	99	C_9H_{20} isomer
34	100	C_9H_{18} isomer
34A	101	C_9H_{20} isomer
34B	103	$C_7H_{14}O$ isomer
35	104	ethylbenzene
36	105	t-xylene
37	107	C_9H_{20} isomer
38	108	*m*-xylene
38A	108	C_9H_{20} isomer
39	109	2-heptanone + styrene
39A	110	$C_{10}H_{22}$ isomer
40	110	*o*-xylene
40A	111	*n*-heptanal
41	111	$C_{10}H_{22}$ isomer
41A	112	C_9H_{18} isomer
42	114	*n*-nonane
43	116	$C_{10}H_{20}$ isomer
44	117	isopropylbenzene
45	117	$C_{10}H_{22}$ isomer
45A	118	C_2-alkyl phenol isomer (tent.)
46	119	$C_{10}H_{22}$ isomer
46A	120	$C_{10}H_{22}$ isomer
46B	120	C_3-alkyl cyclohexane isomer
47	121	$C_{10}H_{22}$ isomer
48	122	benzaldehyde
48A	123	*n*-propylbenzene
49	124	*p*-ethyltoluene
50	125	$C_{10}H_{22}$ isomer
51	126	1,3,5-trimethylbenzene
51A	126	cyanobenzene + $C_{10}H_{20}$ isomer
52	127	$C_{11}H_{24}$ isomer
53	128	$C_{10}H_{22}$ isomer

(continued)

Table A27 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
53A	129	2-octanone
53B	129	phenol
54	130	$C_{10}H_{22}$ isomer
55	131	_n_-octanal
55A	131	_o_-ethyltoluene
56	133	dichlorobenzene isomer
56A	134	_n_-decane
57	135	$C_{10}H_{20}$ isomer
57A	136	1,2,3-trimethylbenzene
58	137	$C_{11}H_{24}$ isomer
59	138	$C_{11}H_{24}$ isomer
60	139	$C_9H_{18}O$ isomer
61	140	$C_{10}H_{20}$ isomer
62	141	$C_{11}H_{24}$ isomer
62A	141	$C_{11}H_{22}$ isomer
62B	142	C_4-alkyl benzene isomer
63	143	acetophenone
63A	143	C_4-alkyl benzene isomer
64	144	$C_9H_{18}O$ isomer
64A	145	$C_{10}H_{18}$ isomer
65	146	$C_{11}H_{24}$ isomer
65A	146	$C_{11}H_{22}$ isomer
66	147	C_4-alkyl benzene isomer
67	148	2-nonanone
67A	149	$C_{10}H_{12}$ + $C_{11}H_{20}$ isomers
68	150	_n_-nonanal
68A	151	$C_{11}H_{22}$ isomer
69	152	_n_-undecane
70	154	C_4-alkyl benzene isomer
70A	156	$C_{11}H_{22}$ isomer
71	158	dimethylphenol isomer
71A	159	C_5-alkyl benzene isomer
71B	160	C_5-alkyl benzene isomer
71C	161	C_4-alkyl benzene isomer
72	162	ethylphenol isomer
72A	163	$C_{12}H_{24}$ isomer
73	164	$C_{12}H_{26}$ isomer
74A	166	C_3-alkyl phenol isomer
74B	167	$C_{12}H_{22}$ isomer
75	168	_n_-decanal
75A	169	$C_{12}H_{24}$ isomer
76	170	_n_-dodecane
77	172	$C_{13}H_{28}$ isomer
77A	174	$C_{12}H_{24}$ isomer
78	175	$C_6H_{14}O_2$ isomer (tent.)
80	178	C_6-alkyl benzene isomer
81	180	$C_{13}H_{26}$ isomer
82	181	$C_{13}H_{28}$ isomer
83	182	$C_{11}H_{22}O$ isomer
84	183	$C_{13}H_{24}$ isomer
85	184	β-methylnaphthalene
85A	185	$C_{13}H_{26}$ isomer
86	186	_n_-tridecane
87	187	α-methylnaphthalene
88	188	$C_{10}H_{20}O_2$ isomer (tent.)
89	191	$C_{14}H_{30}$ isomer
90	194	butyl butyrate (tent.)
91	196	$C_{12}H_{24}O_3$ isomer (tent.)
91A	196	biphenyl
92	198	$C_{12}H_{24}O$ isomer
93	199	$C_{12}H_{10}O$ + $C_{14}H_{28}$ isomers
94	201	_n_-tetradecane
94A	203	$C_{14}H_{28}$ isomer
95	206	$C_{15}H_{32}$ isomer
96	208	$C_{14}H_{28}$ isomer
97	210	C_8-alkyl benzene isomer
97A	210	$C_{15}H_{32}$ isomer
97B	212	$C_{13}H_{26}O$ isomer
98	214	$C_{15}H_{30}$ isomer
99	215	_n_-pentadecane
102	227	$C_{16}H_{34}$ isomer
102A	228	C_6-alkyl phenol isomer (tent.)
103	239	$C_{14}H_{28}O$ isomer
104	239	C_4-alkyl phenol isomer
105	240	$C_{16}H_{34}$ isomer

[a]Sampling was at HL3 (Fig. 12) as described in Table 16.

Table A28. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM PASADENA, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
2A	43	1-butene + n-butane
2B	44	ethanol (tent.)
3	44	acetaldehyde
4	46	isopentane
4A	47	propanal + propenal
5	47	acetone + furan
5A	48	n-pentane
5B	48	dimethyl ether + diethyl ether
5C	49	C_5H_{10} isomer
5D	49	dichloromethane
6A	50	C_6H_{14} isomer + tet-butanol
6B	51	isopropanol
7	52	ethyl acetate + methyl ethyl ketone
7A	53	C_3H_4O isomer
8	53	2-methylpentane
9	55	3-methylpentane
9A	55	n-butanal
10	56	hexafluorobenzene (eI)
11	57	n-hexane
12	57	chloroform
13	60	perfluorotoluene (eI)
13A	61	methylcyclopentane
13B	62	1,1,1-trichloroethane
13C	63	$C_5H_{10}O$ isomer
14	64	benzene
14A	65	carbon tetrachloride + C_7H_{16} isomer
15	66	cyclohexane
16	67	2-methylhexane
16A	67	2,3-dimethylpentane
17	68	3-methylhexane
18	70	n-pentanal
18A	70	C_7H_{14} isomer
18B	71	trichloroethylene
18C	71	C_7H_{12} isomer
18D	72	C_7H_{14} isomer
19	73	n-heptane
20	77	methylcyclohexane
20A	79	C_8H_{16} isomer
21	79	4-methyl-2-pentanone + C_8H_{18} isomer
22	81	C_8H_{16} isomer
23	83	acetic acid
24	84	toluene
25	86	C_8H_{18} isomer
26	88	C_8H_{18} isomer
26A	89	C_8H_{16} isomer
26B	90	2-hexanone
27	90	n-hexanal
27A	91	C_8H_{16} isomer
27B	93	C_8H_{16} isomer
28	93	n-octane
28A	94	tetrachloroethylene
28B	97	C_8H_{16} isomer
29	100	C_9H_{20} isomer
30	100	C_8H_{16} isomer
31	101	C_9H_{20} isomer
32	103	C_9H_{18} isomer
32A	104	$C_7H_{14}O$ isomer
33	104	ethylbenzene
33A	105	C_9H_{18} isomer
33B	106	C_9H_{20} isomer
34	106	p-xylene
34A	107	phenylacetylene
35	107	C_9H_{20} isomer
36	109	C_9H_{20} isomer
36A	110	C_9H_{18} isomer
37	110	styrene + 2-heptanone
37A	111	C_9H_{16} isomer
38	111	o-xylene
38A	112	dimethylheptene isomer
39	112	methylethylcyclohexane isomer
40	113	C_9H_{18} isomer
41	114	C_9H_{18} isomer
42	115	n-nonane
43	116	C_9H_{18} isomer
44	117	$C_{10}H_{20}$ isomer
44A	118	isopropylbenzene
45	119	hexahydroindan + $C_{10}H_{22}$ isomers
45A	120	C_3-alkyl cyclohexane isomer
46	121	$C_{10}H_{22}$ isomer
46A	121	$C_{10}H_{20}$ isomer
47	122	propylcyclohexane
48	123	$C_{10}H_{22}$ isomer
48A	124	benzaldehyde
49	124	$C_{10}H_{20}$ isomer
49A	125	n-propylbenzene
49B	125	$C_{10}H_{20}$ + $C_{10}H_{22}$ isomers
50	126	m-ethyltoluene

(continued)

Table A28 (cont'd)

Chromatographic Peak No.	Elution Temp. (°C)	Compound
51	127	$C_{10}H_{22}$ isomer
51A	128	1,3,5-trimethylbenzene
52	128	$C_{10}H_{22}$ isomer
53	129	$C_{10}H_{20}$ isomer
53A	130	o-ethyltoluene
54	130	$C_{10}H_{22}$ isomer
55	131	$C_{10}H_{18}$ isomer
56	132	$C_{10}H_{20}$ isomer
57	133	1,2,4-trimethylbenzene + $C_{10}H_{20}$ isomer
57A	134	$C_{11}H_{22}$ isomer
57B	135	$C_{10}H_{20}$ isomer
58	136	n-decane
58A	138	$C_{10}H_{20}$ isomer
58B	138	$C_{10}H_{18}$ + $C_{11}H_{22}$ isomers
59	139	1,2,3-trimethylbenzene + C_4-alkyl benzene isomer
59A	139	$C_{11}H_{22}$ isomer
59B	140	$C_{11}H_{20}$ isomer
60	141	$C_{11}H_{24}$ isomer
60A	142	$C_{10}H_{20}$ isomer
61	142	$C_{11}H_{20}$ isomer
62	143	C_4-alkyl cyclohexane isomer
62A	143	C_4-alkyl benzene isomer
62B	144	$C_{11}H_{22}$ isomer
63	144	C_4-alkyl benzene isomer
63A	145	C_4-alkyl benzene isomer
64	146	C_4-alkyl benzene + $C_{11}H_{22}$ isomers
65	147	$C_{11}H_{24}$ isomer
66	148	$C_{10}H_{18}$ isomer
66A	148	$C_{11}H_{24}$ isomer
67	149	$C_{11}H_{20}$ + C_4-alkyl benzene isomers
68	149	$C_{11}H_{24}$ isomer
68A	150	$C_{11}H_{22}$ + $C_{12}H_{26}$ isomers
68B	150	$C_{12}H_{22}$ isomer
69	151	$C_{11}H_{22}$ isomer
70	151	$C_{11}H_{20}$ isomer
70A	152	$C_{11}H_{22}$ isomer
71	152	$C_{11}H_{22}$ isomer
71A	153	C_5-alkyl benzene isomer
72	154	C_5-alkyl benzene + $C_{11}H_{22}$ isomers
73	155	n-undecane
73A	156	$C_{11}H_{18}$ + C_5alkyl benzene isomers
74	157	C_4-alkyl benzene isomer
75	158	$C_{12}H_{26}$ isomer
76	159	$C_{11}H_{20}$ isomer
76A	159	$C_{12}H_{20}$ isomer
77	160	$C_{12}H_{26}$ + C_5-alkyl benzene isomers
77A	160	$C_{11}H_{14}$ isomer
77B	161	$C_{12}H_{22}$ isomer
78	161	$C_{11}H_{22}$ + $C_{11}H_{20}$ isomer
78A	162	$C_{13}H_{22}$ isomer
79	162	C_5-alkyl benzene + $C_{12}H_{24}$ isomers
79A	163	C_4-alkyl benzene isomer
80	163	C_5-alkyl benzene isomer
80A	164	C_5-alkyl benzene + $C_{12}H_{24}$ isomers
81	164	$C_{12}H_{26}$ isomer
81A	165	C_5-alkyl benzene isomer
82	165	$C_{12}H_{24}$ isomer
82A	166	$C_{12}H_{26}$ isomer
83	166	C_5-alkyl benzene isomer
83A	167	$C_{12}H_{26}$ isomer
84	167	$C_{11}H_{18}$ isomer
84A	168	$C_{12}H_{22}$ isomer
85	168	naphthalene
85A	169	C_6-alkyl benzene isomer
85B	169	$C_{11}H_{20}$ isomer
86	170	$C_{12}H_{24}$ isomer
86A	170	$C_{12}H_{20}$ isomer
86B	171	$C_{12}H_{24}$ isomer
87	172	n-dodecane
87A	172	$C_{12}H_{24}$ isomer
87B	173	$C_{12}H_{16}$ isomer
88	174	$C_{13}H_{28}$ isomer
88A	176	$C_{12}H_{22}$ isomer
89	176	$C_{13}H_{28}$ isomer
90	177	$C_{13}H_{26}$ + C_5-alkyl benzene isomers
90A	178	$C_{13}H_{24}$ isomer
91	178	$C_{13}H_{26}$ isomer
92	179	C_6-alkyl cyclohexane isomer
92A	180	$C_{13}H_{26}$ isomer
92B	180	$C_{13}H_{24}$ isomer

(continued)

Table A28 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
92C	181	$C_{13}H_{28}$ isomer
93	181	$C_{13}H_{26}$ isomer
94	182	$C_{14}H_{30}$ isomer
94A	182	$C_{13}H_{26}$ isomer
95	183	$C_{13}H_{28}$ isomer
96	184	$C_{13}H_{28}$ isomer
97	184	$C_{14}H_{30}$ isomer
97A	185	$C_{13}H_{24}$ isomer
97B	186	$C_{13}H_{22}$ isomer
98	186	$C_{13}H_{26}$ + $C_{14}H_{28}$ isomers
99	187	n-tridecane
99A	188	$C_{14}H_{26}$ isomer
99B	189	$C_{14}H_{28}$ isomer
100	189	$C_{14}H_{30}$ isomer
101	190	$C_{14}H_{26}$ + $C_{14}H_{30}$ isomers
101A	191	$C_{14}H_{28}$ isomer
101B	192	$C_{14}H_{28}$ isomer
102	193	$C_{14}H_{30}$ isomer
103	194	C_7-alkyl cyclohexane isomer
104	196	$C_{14}H_{30}$ isomer
104A	198	$C_{13}H_{26}O$ isomer
105	199	$C_{14}H_{30}$ isomer
105A	200	$C_{14}H_{28}$ isomer
106	202	n-tetradecane
106A	204	$C_{15}H_{30}$ isomer
106B	206	$C_{16}H_{32}$ isomer
107	224	diethyl phthalate
108	228	butyl butyrate
109	240	n-heptadecane

[a]Sampling was at PL1 (Fig. 13) as described in Table 16.

Table A29. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM PASADENA, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2	20B	87	C_8H_{16} isomer
1A	42	dichlorodifluoromethane	21	88	$C_6H_{12}O$ isomer
2	44	1-butene	21A	89	2-hexanone + C_8H_{16} isomer
2A	45	n-butane	22	90	C_8H_{18} isomer
3	46	diacetylene	22A	90	n-hexanal
3A	46	acetaldehyde	23	91	C_8H_{18} isomer
3B	47	trichlorofluoromethane	23A	92	C_8H_{16} isomer
4	48	propanal + propenal + furan + dimethyl ether	24	93	n-octane
			24A	94	tetrachloroethylene
4A	48	acetone	24B	94	C_8H_{16} isomer
5	50	dichloromethane + freon 113 (BKG)	25	95	C_9H_{18} isomer
5A	51	isopropanol + ter-butanol	26	97	C_9H_{20} isomer
5B	52	isobutanal	26A	97	C_9H_{18} isomer
5C	53	2,5-dihydrofuran or butenal	27	98	2,4-dimethylheptane
5D	54	dichloropropene isomer (tent.)	28	100	2,6-dimethylheptane
5E	55	C_6H_{14} isomer	28A	100	C_9H_{18} isomer
6	56	n-butanal	29	101	2,5-dimethylheptane
7	56	hexafluorobenzene (eI)	30	103	C_9H_{18} isomer
8	57	n-hexane	30A	103	C_8H_{16} isomer
9	58	chloroform	30B	104	2,3-dimethylheptane + C_9H_{18} isomer
9A	59	methyl ethyl ketone			
10	60	perfluorotoluene (eI)	31	104	ethylbenzene
10A	61	methylcyclopentane	31A	105	C_9H_{18} isomer
10B	61	1,2-dichloroethane	32	106	ethylheptane isomer
11	62	C_7H_{16} isomer	32A	106	m-xylene
11A	63	C_7H_{14} isomer	33	107	phenylacetylene
12	64	benzene	33A	107	C_9H_{20} isomer
12A	66	carbon tetrachloride	34	108	3-methyloctane
12B	67	C_7H_{16} isomer	34A	108	C_9H_{20} isomer
13	68	butyl formate or $C_6H_{12}O$ isomer	34B	109	C_9H_{18} isomer
13A	69	$C_5H_{10}O_2$ isomer (tent.)	35	109	styrene or cyclooctatetraene + 2-heptanone
14	70	3-methylbutanal			
14A	71	n-pentanal + C_7H_{14} isomer	35A	110	C_9H_{18} isomer
14B	71	2-butanol	36	110	o-xylene
15	72	n-heptane	37	111	n-heptanal
15A	73	C_7H_{14} isomer	38	112	C_9H_{18} isomer + dichloropropene isomer
15B	73	methyl methacrylate			
16	77	methylcyclohexane	38A	113	C_9H_{18} isomer
17	78	4-methyl-2-pentanone	39	114	n-nonane
18	81	acetic acid (tent.) + 2-methyl-3-pentanone	40	115	C_9H_{18} isomer
			41	117	isopropylbenzene
18A	83	C_8H_{16} isomer	42	117	$C_{10}H_{22}$ isomer
19	84	toluene	42A	118	C_9H_{18} isomer
19A	85	C_8H_{16} isomer + unknown	43	119	isobutyl methacrylate
20	86	C_8H_{18} isomer	44	121	$C_{10}H_{20}$ isomer
20A	87	C_8H_{18} isomer	45	122	benzaldehyde + $C_{10}H_{22}$ isomer

(continued)

Table A29 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
45A	123	n-propylbenzene
45B	123	$C_{10}H_{20}$ isomer
46	124	m-ethyltoluene
47	125	$C_{10}H_{20}$ isomer
47A	126	$C_{11}H_{22}$ isomer
47B	126	p-ethyltoluene + $C_{10}H_{20}$ + $C_{10}H_{22}$ isomers
48	127	n-butyl methacrylate
49	128	C_3-alkyl benzene + $C_{11}H_{22}$ isomer
50	129	$C_8H_{16}O$ isomer
50A	131	methylstyrene isomer
51	131	C_3-alkyl benzene isomer + n-octanal
51A	132	$C_{10}H_{20}$ isomer
52	133	dichlorobenzene isomer (tent.)
53	134	n-decane
53A	135	$C_{11}H_{22}$ isomer
54	137	1,2,3-trimethylbenzene
55	138	$C_{10}H_{20}$ isomer
55A	138	$C_{11}H_{24}$ isomer
55B	139	$C_{11}H_{22}$ isomer
56	139	$C_{11}H_{24}$ isomer
57	140	indene
58	142	C_4-alkyl benzene + $C_{12}H_{24}$ isomer
58A	142	C_4-alkyl benzene + $C_{11}H_{22}$ isomers
59	143	acetophenone
59A	144	C_9H_{18} isomer
60	145	$C_9H_{18}O$ isomer (tent.)
61	146	$C_{12}H_{24}$ isomer
62	147	C_4-alkyl benzene + $C_{11}H_{24}$ isomers
63	148	2-nonanone
64	150	n-nonanal
65	151	$C_{11}H_{22}$ isomer
66	153	n-undecane
66A	154	$C_{12}H_{24}$ isomer
67	155	C_4-alkyl benzene isomer
68	156	$C_{11}H_{20}$ isomer
69	159	dimethylphenol isomer
70	161	C_5-alkyl benzene isomer
71	162	$C_{12}H_{26}$ isomer
72	163	$C_{12}H_{24}$ isomer
73	166	naphthalene
74	168	$C_{12}H_{24}$ isomer + n-decanal
75	170	n-dodecane
75A	171	$C_{12}H_{24}$ isomer
76	173	$C_{13}H_{28}$ isomer
77	177	$C_{12}H_{24}$ isomer
77A	178	$C_{12}H_{22}$ isomer
77B	179	C_6-alkyl benzene isomer
78	180	$C_{11}H_{24}$ isomer
79	182	$C_{13}H_{28}$ isomer
80	183	$C_{10}H_{18}O_2$ isomer
81	184	$C_{13}H_{26}$ isomer
82	186	n-tridecane
82A	189	$C_{14}H_{30}$ isomer
83	192	silane compound
85	201	n-tetradecane
88	218	saturated alkyl alcohol isomer
89	224	alkyl phthalate isomer
90	227	alkyl butyrate isomer
91	228	n-pentadecane
92	237	alkyl ketone isomer
93	240	$C_{17}H_{34}$ isomer
94	240	n-heptadecane

[a] Sampling was at PL3 (Fig. 13), see Table 16.

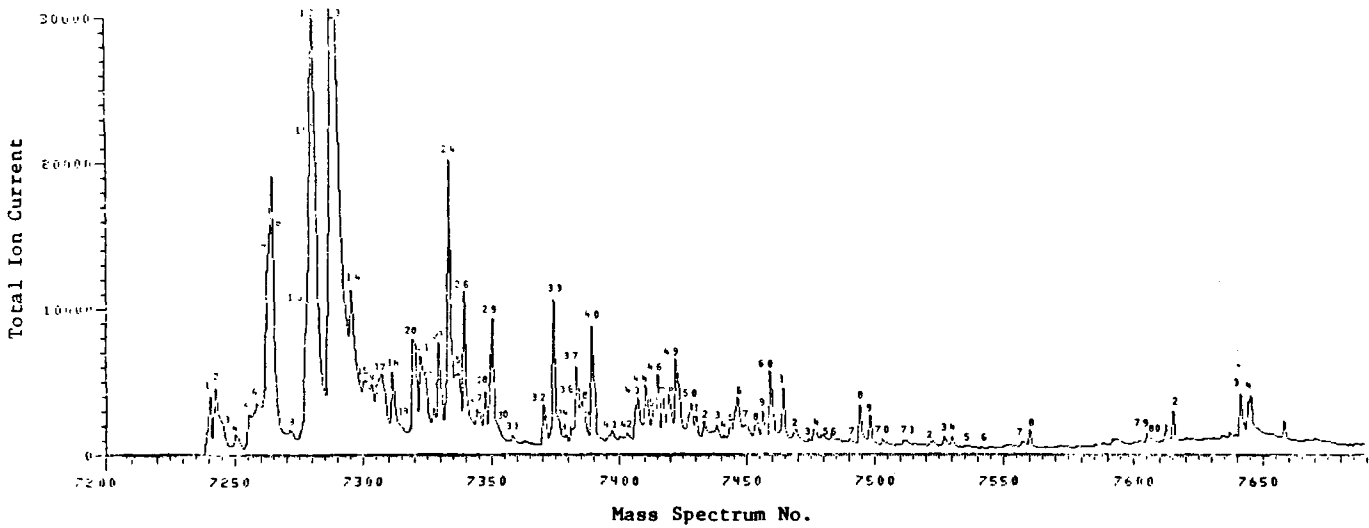

Figure A2. Profile of ambient air sample taken at DSL1 (Fig. 13, Table 16).

Table A30. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound	Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2	22A	84	C_8H_{16} isomer
2	42	dichlorodifluormethane	22B	85	C_8H_{16} isomer
3A	45	1-butene	23	85	1,1,2-trichloroethane
4	46	chloroethane + acetaldehyde	24	87	toluene
4A	47	isopentane	24A	88	C_8H_{16} isomer
5	48	trichlorofluormethane	25	89	C_8H_{18} isomer
6	50	acetone	25A	89	methylethylcyclopentane isomer
7	52	isopropanol + dichloromethane	26	90	methylethylcyclopentane isomer
8	53	freon 113 (BKG) + chloropropene isomer	26A	92	C_8H_{16} isomer
			27	93	n-hexanal + C_8H_{16} isomer
8A	55	C_4H_8O isomer	28	94	$C_8H_{18}O$ isomer
8B	56	dichloroethylene	28A	95	C_8H_{16} isomer
8C	56	isobutanal	29	96	n-octane
9	57	1,1-dichloroethane	30	97	n-butyl acetate (tent.)
9A	57	2-methylpentane	30A	98	C_9H_{18} isomer
9B	58	dichloropropene (tent.) isomer	31	100	C_9H_{18} isomer
9C	58	3-methylpentane	31A	102	ethylcyclohexane
9D	59	n-butanal	32	106	ethylbenzene
10	60	hexafluorobenzene (eS)	33	107	p-xylene
10A	60	methyl ethyl ketone	34	108	C_9H_{20} isomer
11	61	n-hexane	34A	108	C_9H_{18} isomer
12	61	chloroform	35	109	C_9H_{20} isomer
12A	62	2-butanol	35A	110	$C_7H_{14}O$ isomer
12B	63	C_4H_6O isomer (tent.)	36	110	styrene
12C	64	perfluorotoluene (eS)	36A	111	$C_{10}H_{22}$ isomer
13	65	1,2-dichloroethane	37	111	o-xylene
13A	67	methylcyclopentane	37A	112	n-heptanal
14	68	benzene	38	112	C_9H_{18} isomer
14A	69	carbon tetrachloride + C_7H_{16} isomer	39	113	dichloropropene
			40	114	n-nonane
14B	70	cyclohexane	40A	116	C_9H_{18} isomer
15	71	2-methylhexane	40B	116	$C_{10}H_{20}$ isomer
15A	71	2,3-dimethylpentane	40C	117	isopropylbenzene + $C_{10}H_{22}$ isomer
16	72	3-methylhexane			
16A	73	dichloropropane + C_7H_{14} isomers	41	118	$C_{10}H_{22}$ isomer
			41A	119	$C_8H_{10}O$ isomer (tent.)
17	74	dichloropropene isomer	41B	120	$C_{10}H_{20}$ isomer
17A	74	n-pentanal	41C	121	C_9H_{18} isomer
17B	75	trichloroethylene + C_7H_{14} isomer	42	122	$C_{10}H_{22}$ isomer
			43	123	benzaldehyde
18	76	n-heptane	43A	123	n-propylbenzene
19	78	C_8H_{18} isomer	43B	124	$C_{10}H_{22}$ isomer
19A	79	C_8H_{16} isomer	44	125	p-ethyltoluene
20	80	methylcyclohexane	44A	126	$C_{10}H_{22}$ isomer
21	82	4-methyl-2-pentanone	45	127	1,3,5-trimethylbenzene
22	83	C_8H_{18} isomer	46	128	$C_{11}H_{24}$ isomer

(continued)

Table A30 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
47	129	$C_{10}H_{22}$ isomer
47A	129	$C_{10}H_{20}$ isomer
48	130	$C_{10}H_{22}$ isomer
49	131	o-ethyltoluene + n-octanal
49A	132	$C_{10}H_{20}$ isomer
50	134	n-decane + dichlorobenzene (tent.) isomer
50A	135	C_4-alkyl benzene isomer
51	135	$C_{10}H_{20}$ isomer
52	137	1,2,3-trimethylbenzene
52A	137	C_4-alkyl benzene isomer
52B	138	$C_{11}H_{24}$ isomer
53	139	$C_{11}H_{24}$ isomer
54	141	$C_{11}H_{22}$ isomer
55	142	C_4-alkyl benzene + $C_{11}H_{24}$ isomers
56	143	acetophenone
56A	144	C_4-alkyl benzene isomer
56B	144	$C_{11}H_{22}$ isomer
57	145	$C_9H_{18}O$ isomer (tent.)
57A	146	$C_{10}H_{18}$ isomer
58	147	C_4-alkyl benzene isomer
59	148	C_4-alkyl benzene isomer
60	150	n-nonanal
60A	151	$C_{11}H_{22}$ isomer
60B	152	C_4-alkyl benzene isomer
61	153	n-undecane
61A	154	C_5-alkyl benzene isomer
61B	155	n-pentylbenzene
62	155	tetramethylbenzene isomer
62A	156	$C_{12}H_{24}$ isomer
62B	156	$C_{11}H_{20}$ isomer
63	157	$C_{12}H_{25}$ + C_5-alkyl benzene isomers
64	157	$C_{12}H_{26}$ isomer
64A	158	$C_{11}H_{22}$ isomer
65	159	methylindan isomer
65A	159	C_4-alkyl benzene isomer
65B	160	C_5-alkyl benzene isomer
66	161	$C_{12}H_{26}$ isomer
66A	163	C_5-alkyl benzene isomer
67	164	2-decanone + naphthalene
67A	165	$C_{12}H_{24}$ isomer
68	166	n-decanal
68A	167	$C_{12}H_{24}$ isomer
69	168	n-dodecane
69A	170	$C_{12}H_{24}$ isomer
70	171	$C_{13}H_{28}$ isomer
72	181	$C_{13}H_{28}$ isomer
72A	182	$C_{11}H_{22}O$ isomer
73	185	$C_{13}H_{26}$ isomer
74	187	n-tridecane
76	191	$C_{12}H_{24}$ isomer (tent.)
77	199	$C_{14}H_{28}$ isomer
78	200	m-tetradecane
78A	212	$C_{15}H_{32}$ isomer
79	222	diethyl phthalate
81	226	$C_{16}H_{34}$ isomer
82	227	n-hexadecane
82A	228	$C_{15}H_{32}$ isomer
82B	238	$C_{15}H_{30}O$ isomer (tent.)
83	240	n-hexadecane
84	240	$C_{18}H_{38}$ isomer

[a]Sampling was on Shell property at DSL1 (Fig. 13) as described in Table 16

Table A31. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	39	CO_2
5	48	acetaldehyde
6	50	propanal + propenal
6A	50	isopentane + dimethyl ether
7	51	acetone
8	52	dichloromethane
8B	54	isopropanol
8C	55	C_4H_8O isomer
8D	56	2-methylpentane
8E	57	C_4H_8O isomer
8F	58	3-methylpentane
8G	59	*n*-butanal
9	59	hexafluorobenzene (es)
10	60	*n*-hexane
11	61	chloroform
12	63	perfluorotoluene (es)
12A	64	methylcyclopentane
12B	65	1,1,1-trichloroethane
13	66	benzene
13A	67	C_7H_{16} isomer + carbon tetrachloride
13B	68	cyclohexane
14	69	2-methylhexane
14A	69	2,3-dimethylpentane
14B	70	C_7H_{14} isomer
14C	70	3-methylhexane
15	71	4-methyl-2-pentanone
15B	72	C_7H_{14} isomer
15C	72	C_7H_{12} isomer
15D	73	*n*-pentanal + C_7H_{14} isomer
16	74	*n*-heptane
16A	75	C_8H_{16} isomer
17	77	methylcyclohexane
17A	79	C_7H_{12} isomer
17B	79	C_8H_{18} isomer
18	80	C_8H_{18} isomer
19	83	$C_6H_{12}O$ isomer
19A	85	C_7H_{14} isomer
20	83	acetic acid
21	86	toluene
22	88	C_8H_{18} isomer
23	90	C_8H_{18} isomer
23A	91	C_8H_{16} isomer
24	92	*n*-hexanal
25	96	*n*-octane
25A	96	tetrachloroethylene (tent.)
26	99	C_8H_{16} isomer
27	104	C_8H_{16} isomer
28	106	ethylbenzene
29	108	*p*-xylene
30	109	C_9H_{20} isomer
31	110	$C_7H_{14}O$ isomer
31A	111	C_9H_{20} isomer
31B	112	styrene
32	112	*o*-xylene
33	113	*n*-heptanal + C_9H_{16} isomer
34	115	C_9H_{18} isomer
35	116	*n*-nonane
36	120	$C_{10}H_{22}$ isomer
37	121	$C_{10}H_{22}$ isomer
37A	122	C_9H_{18} isomer
38	123	$C_{10}H_{22}$ isomer
39	124	benzaldehyde
39A	125	*n*-propylbenzene
40	126	*p*-ethyltoluene
40A	128	1,3,5-trimethylbenzene
41	129	$C_{11}H_{24}$ isomer
41A	130	C_9H_{18} isomer + anisole
42	130	$C_{10}H_{22}$ isomer
42A	131	phenol
43	131	C_9H_{20} isomer
43A	132	$C_{10}H_{18}$ isomer
44	133	*n*-octanal + 1,2,4-trimethylbenzene
44A	134	$C_{10}H_{20}$ isomer
45	135	*n*-decane + dichlorobenzene isomer
46	138	1,2,3-trimethylbenzene
46A	139	$C_{10}H_{20}$ isomer
47	140	$C_{11}H_{24}$ isomer
48	141	$C_{12}H_{26}$ isomer
49	144	C_4-alkyl benzene isomer
50	145	acetophenone
50A	147	$C_{11}H_{24}$ isomer
51	148	cresol isomer
51A	148	C_4-alkyl benzene isomer
51B	149	$C_{11}H_{22}$ isomer
52	150	2-nonanone
52A	150	C_4-alkyl benzene isomer
53	152	*n*-nonanal
53A	153	$C_{11}H_{22}$ isomer
54	154	*n*-undecane

(continued)

Table A31 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
55	157	C_4-alkyl benzene isomer
55A	158	C_2-alkyl phenol isomer
56	160	C_2-alkyl phenol isomer
56A	162	$C_{10}H_{12}$ isomer
57	163	C_2-alkyl phenol isomer
58	164	C_4-alkyl benzene + dimethyl-phenol isomers
58A	165	C_5-alkyl benzene isomer
59	167	2-decanone
59A	168	C_3-alkyl phenol isomer + naphthalene
60	169	n-decanal
60A	171	$C_{12}H_{24}$ isomer
61	172	n-dodecane
62	175	C_3-alkyl phenol isomer
62A	176	$C_{12}H_{24}$ isomer
63	179	C_4-alkyl phenol isomer
63A	181	$C_{12}H_{24}$ isomer
64	184	2-undecanone
65	185	$C_{10}H_{18}O_2$ isomer
66	186	β-methylnaphthalene + $C_{13}H_{26}$ isomer
67	187	n-tridecane
68	189	α-methylnaphthalene
70	196	isobutyl butyrate
71	197	n-butyl butyrate
73	201	$C_{14}H_{28}$ isomer
74	202	n-tetradecane
74A	206	$C_{14}H_{28}$ isomer
75	212	$C_{15}H_{32}$ isomer
75A	213	$C_{15}H_{30}$ isomer
76	214	$C_{13}H_{26}O$ isomer
76A	125	$C_{15}H_{30}$ isomer
77	217	n-pentadecane
79	225	diethyl phthalate
80	229	$C_{16}H_{30}O_4$ isomer
81	230	n-hexadecane
81A	236	$C_{18}H_{38}$ isomer
83	240	$C_{15}H_{30}O$ isomer
84	240	$C_{17}H_{34}$ isomer
85	240	n-heptadecane
86	240	$C_{18}H_{38}$ isomer
87	240	$C_{18}H_{38}$ isomer
88	240	$C_{18}H_{36}$ isomer
89	240	n-octadecane

[a] Sampling was on Shell property at DSL2 (Fig. 13) as described in Table 16.

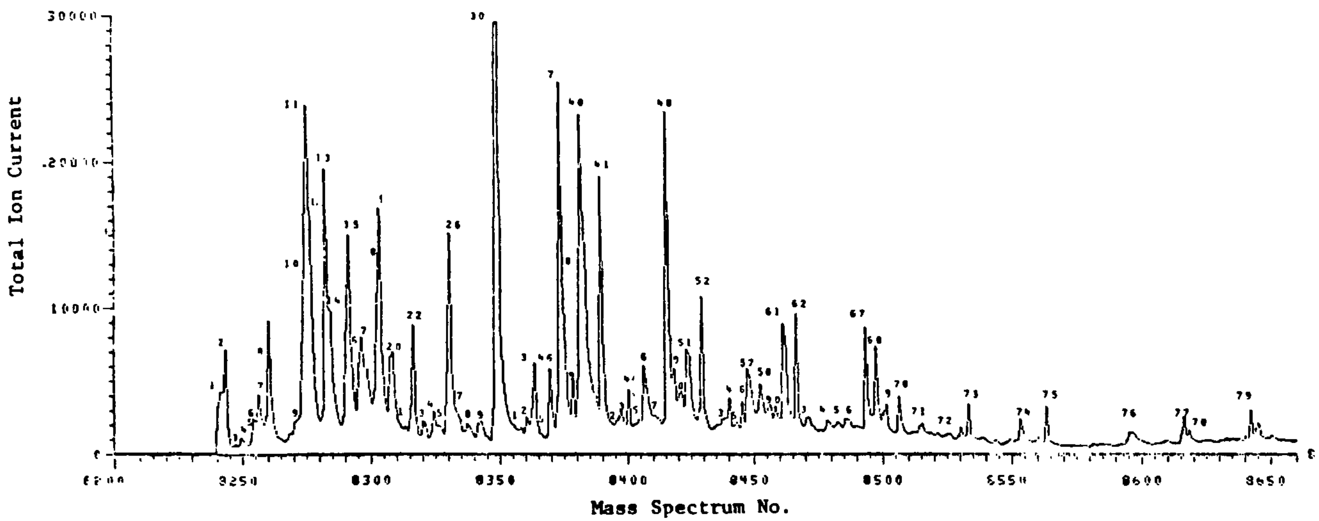

Figure A3. Profile of ambient air taken at DDL1 (Fig. 13, Table 16).

Table A32. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	41	carbon dioxide
3	43	vinyl chloride
4	44	acetaldehyde
5	47	isopentane
6A	48	propanal
6B	48	acrolein
7	49	acetone
8	50	methylene chloride
9	55	vinyl acetate (tent)
10	57	perfluorobenzene (ext. std.)
11	58	n-hexane
12	58	chloroform
13	61	perfluorotoluene (ext. std.)
14	62	1,2-dichloroethane
15A	66	benzene
15B	66	carbon tetrachloride
16	67	cyclohexane
17	68	n-butyl formate (tent)
18	71	sec-butyl acrylate (tent)
19	72	trichloroethylene
20A	74	n-heptane
20B	74	methyl methacrylate
21	76	C_8H_{18} isomer
22	78	C_7H_{14} isomer
23	80	C_8H_{18} isomer
24	82	acetic acid
25	83	C_8H_{16} isomer
26	85	toluene
27	87	C_8H_{18} isomer
28	89	dibromochloromethane
30A	94	n-octane
30B	94	tetrachloroethylene
31	98	C_9H_{20} isomer
32	100	C_9H_{20} isomer
33	101	chlorobenzene
34	102	C_9H_{20} isomer
35	103	C_9H_{18} isomer
36	105	ethylbenzene
37	107	p-xylene
38	108	phenylacetylene
39	109	C_9H_{20} isomer
40	111	n-butyl acrylate (tent)
41	115	n-nonane
42	118	cumene
43	118	$C_{10}H_{22}$ isomer
44	120	isobutyl methacrylate (tent)
45	122	α-pinene
46	123	benzaldehyde
47	126	o-ethyltoluene
48	128	n-hexyl acrylate (tent)
49	129	$C_{10}H_{22}$ isomer
50	130	phenol
51	132	1,2,4-trimethylbenzene
52	134	n-decane
53	138	$C_{11}H_{24}$ isomer
54	140	m/e 57
55	141	C_4-benzene isomer
56	142	C_4-benzene isomer
57	144	acetophenone
58	146	m/e 57
59	148	C_4-benzene isomer
60	149	C_4-benzene isomer
61	150	m/e 57
62	153	n-undecane
63	155	C_4-benzene isomer
64	161	C_5-benzene isomer
65	162	C_6-benzene isomer
66	164	pentachlorobutadiene isomer
67	166	naphthalene
68	168	$C_{13}H_{28}$ isomer
69	170	n-dodecane
70	173	hexachloro-1,3-butadiene
71	178	m/e 59
72	182	$C_{14}H_{30}$ isomer
73	186	n-tridecane
74	196	n-butyl-n-butyrate (tent)
75	202	n-tetradecane
76	216	m/e 59
77	227	m/e 71
78	229	m/e 57
79	240	m/e 83

[a]Sampling was on Diamond Shamrock property at DDL1 (Fig. 13) as described in Table 16.

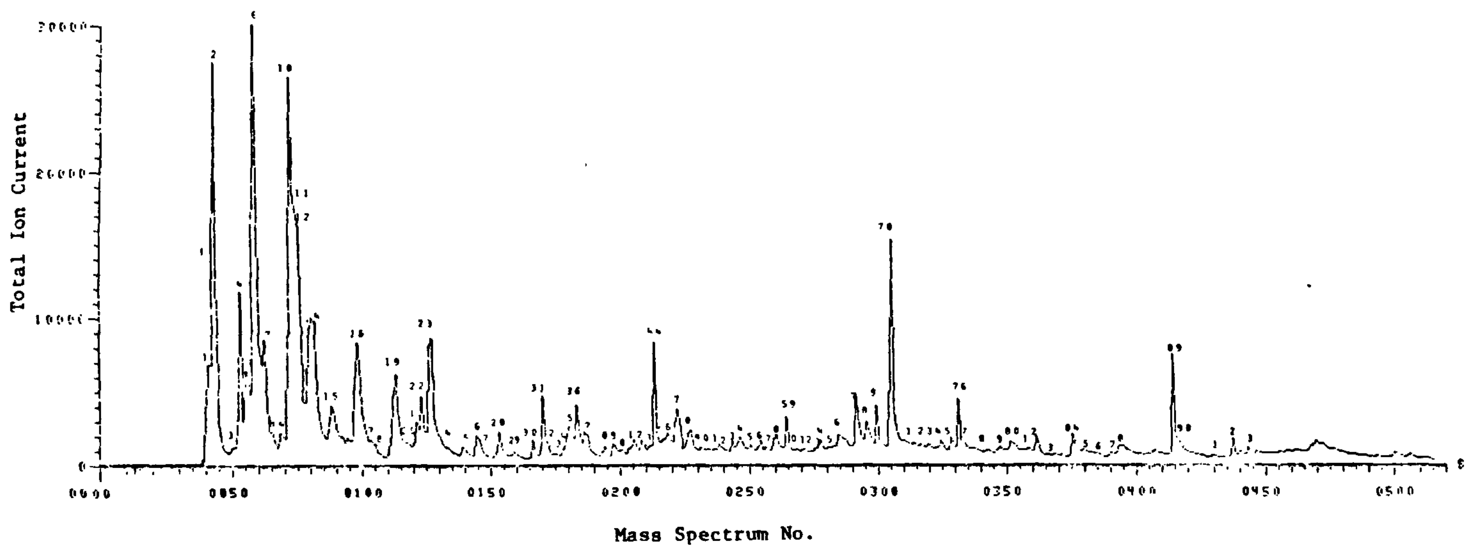

Figure A4. Profile of ambient air sample taken at DTL2 (Fig. 13, Table 16).

Table A33. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
2A	43	n-propane
2B	43	1-butene
3	45	acetaldehyde
4	46	isopentane
4B	47	C_5H_{10} isomer
5	48	acetone + n-pentane
5A	48	dimethyl ethyl + diethyl ether
5B	49	dichloromethane
7	51	ter-butanol (tent.)
8	53	2-methylpentane
8A	54	C_4H_8O isomer
9	55	3-methylpentane
9A	55	n-butanal
10	56	hexafluorobenzene (eI)
11	57	n-hexane
12	57	chloroform
13	59	perfluorotoluene (eI)
14	60	methylcyclopentane
14A	61	1,2-dichloroethane
14B	62	1,1,1-trichloroethane + C_6H_8 isomer (tent.)
14C	63	1,1-dichloropropene (tent.)
15	64	benzene
15A	65	carbon tetrachloride
15B	65	cyclohexane
15C	66	C_7H_{16} isomer
15D	68	C_7H_{16} isomer
16	69	1,2-dichloropropane
16A	70	dichloropropene isomer
17	72	C_7H_{16} isomer
18	73	C_7H_{16} isomer
18A	75	acetic acid (tent.)
18B	76	C_7H_{14} isomer
19	76	dichloropropene isomer
19A	77	methylcyclohexane
20	79	C_8H_{18} isomer
21	81	dichloropropene isomer
22	82	1,1,2-trichloroethane
23	83	toluene
23A	85	C_8H_{16} isomer
23B	86	C_8H_{18} isomer
24	87	C_8H_{18} isomer
24A	88	C_8H_{16} isomer
25	90	$C_6H_{12}O$ isomer
26	92	n-octane
27	93	tetrachloroethylene
27A	96	trichloropropene isomer (tent.)
29	100	chlorobenzene
29A	102	C_8H_{16} isomer
29B	103	trichloropropene isomer
30	103	ethylbenzene
30A	104	dichlorobutene isomer (tent.)
31	105	p-xylene
32	106	C_9H_{20} isomer
32A	107	C_9H_{18} isomer
33	108	C_9H_{20} isomer
33A	109	styrene
34	109	C_9H_{20} isomer
34A	110	o-xylene
35	110	1,1,2,2-tetrachloroethane
35A	111	$C_7H_{14}O$ isomer
35B	111	C_9H_{18} isomer
36	112	cis-1,3-dichloropropene
37	113	n-nonane
37A	115	$C_{10}H_{20}$ isomer
37B	117	isopropylbenzene
38	117	$C_{10}H_{22}$ isomer
39	119	isobutyl methacrylate
39A	119	2,3-dichloro-1-propanol
40	120	$C_{10}H_{22}$ isomer
41	123	benzaldehyde + n-propylbenzene
42	124	p-ethyltoluene
42A	125	$C_{10}H_{22}$ isomer
43	126	1,3,5-trimethylbenzene + 1,2-bis-(2-chloroethoxy)ethane
44	127	$C_{11}H_{24}$ isomer
44A	128	o-ethyltoluene
45	128	$C_{11}H_{24}$ isomer
45A	129	phenol
46	129	$C_{11}H_{24}$ isomer
47	131	1,2,4-trimethylbenzene
47A	131	$C_{10}H_{22}$ isomer
48	133	n-decane
48A	134	dichlorobenzene isomer
49	136	1,3-dichloro-2-methylene propane
49A	136	C_4-alkyl benzene isomer
49B	137	1,2,3-trimethylbenzene + $C_{10}H_{20}$ isomer
50	137	$C_{11}H_{24}$ isomer
51	138	$C_{11}H_{24}$ isomer

(continued)

Table A33 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
51A	139	indan + $C_{11}H_{22}$ isomer
51B	139	$C_{11}H_{24}$ isomer
52	140	trichloro-z-methylpropene isomer
53	142	C_4-alkyl benzene + $C_{11}H_{24}$
53A	142	$C_{11}H_{22}$ isomer
54	143	acetophenone + C_4-alkyl benzene isomer
55	145	$C_{11}H_{24}$ isomer
56	147	C_4-alkyl benzene isomer + tetrachlorobutadiene isomer
57	148	C_4-alkyl benzene + $C_9H_{18}O$ isomers
57A	149	$C_{11}H_{22}$ + methylindan isomers
58	150	n-nonanal
58A	151	$C_{11}H_{22}$ isomer
59	152	n-undecane
60	154	C_4-alkyl benzene isomer
61	155	$C_{12}H_{24}$ isomer
62	156	$C_{11}H_{22}$ isomer
63	157	pentachlorobutadiene isomer
63A	158	C_2-alkyl phenol isomer
63B	158	$C_{10}H_{12}$ + $C_{11}H_{18}$ isomers
63	159	$C_{11}H_{22}$ isomer
64A	159	C_6-alkyl benzene isomer
64B	160	C_5-alkyl benzene isomer
65	161	$C_{10}H_{12}$ isomer
66	163	pentachlorobutadiene isomer
66A	164	C_2-alkyl phenol isomer
66B	165	trichlorobenzene isomer
67	166	naphthalene
68	168	n-decanal
68A	169	$C_{12}H_{24}$ isomer
69	170	n-dodecane
70	172	1,3-hexachlorobutadiene
71	176	$C_{13}H_{26}$ isomer
72	178	C_6-alkyl benzene isomer
73	179	$C_{12}H_{26}$ isomer
73A	179	$C_{13}H_{28}$ isomer
74	181	2-undecanone
74A	183	$C_{13}H_{26}$ isomer
75	183	β-methylnaphthalene
75A	184	$C_{13}H_{26}$ isomer
76	185	n-tridecane
77	186	α-methylnaphthalene
78	191	$C_{14}H_{28}$ isomer
79	193	$C_{14}H_{30}$ isomer
79A	194	C_8-alkyl benzene isomer
80	195	isobutyl isobutyrate
81A	197	2-dodecanone
81B	198	C_6-alkyl phenol isomer
81C	199	$C_{14}H_{28}$ isomer
82	200	n-tetradecane
83	202	$C_{15}H_{30}$ isomer
83A	203	dimethyl phthalate
84	207	biphenylene
86	211	$C_{13}H_{26}$) isomer
87	214	n-pentadecane + $C_{15}H_{24}O$ isomer
89	226	alkyl butyrate isomer
90	227	$C_{16}H_{34}$ isomer
92	238	$C_{14}H_{28}O$ isomer
93	240	$C_{17}H_{36}$ isomer

[a] Sampling was off Tidal road at DTL2 (Fig. 13) as described in Table 16.

Table A34. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromato- graphic Peak No.	Elution Temp. (°C)	Compound	Chromato- graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2	23	95	n-octane
3	43	1-butene	24	97	n-butyl acetate
3A	44	n-butane	24A	98	C_8H_{16} isomer
4	45	acetaldehyde	24B	101	$C_7H_{14}O$ isomer
4A	46	isopentane	24C	102	C_8H_{16} isomer
5A	47	propanal + propenal +	24D	102	C_9H_{20} isomer
		dimethyl ether	25	105	ethylbenzene
6	48	acetone	26	107	p-xylene
6A	49	diethyl ether (tent.)	26A	108	C_9H_{20} isomer
6B	50	dichloromethane	26B	110	C_9H_{20} isomer
8	52	isopropanol	26C	110	styrene
8A	54	C_4H_8O isomer	27	111	$C_7H_{14}O_2$ isomer
8B	55	2-methylpentane	27A	111	$C_7H_{14}O$ + $C_{10}H_{22}$ isomers
8C	56	C_4H_6O isomer	28	112	o-xylene
9	57	3-methylpentane	28A	112	n-heptanal
9A	58	n-butanal	28B	113	$C_{10}H_{22}$ isomer
10	58	hexafluorobenzene (eS)	29	115	n-nonane
11	59	n-hexane	29A	117	C_9H_{18} isomer
12	60	chloroform	29B	118	isopropylbenzene
13	62	perfluorotoluene (eS)	30	119	$C_{10}H_{22}$ isomer
14	63	methylcyclopentane	31	120	sec-butyl methacrylate
14A	64	1,2-dichloroethane	32	122	$C_{10}H_{22}$ isomer
14B	64	$C_3H_6O_2$ isomer	33	123	benzaldehyde
14C	65	1,1,1-trichloroethane	33A	124	n-propylbenzene
15	67	benzene	34	125	p-ethyltoluene
15A	68	carbon tetrachloride	35	126	$C_{10}H_{20}$ isomer
16	69	cyclohexane	36	127	n-butyl methacrylate
16A	70	2-methylhexane	36A	129	phenol
16B	71	3-methylhexane	37	130	$C_{11}H_{24}$ isomer
16C	72	n-pentanal	38	132	C_3-alkyl benzene isomer
17	73	C_7H_{14} isomer	39	134	n-decane
18	75	n-heptane	40	135	$C_{11}H_{24}$ isomer
19	79	methycyclohexane	41	137	$C_{11}H_{24}$ isomer
19A	80	C_8H_{14} isomer	41A	138	1,2,3-trimethylbenzene
19B	80	C_8H_{16} isomer	42	138	$C_{10}H_{20}$ isomer
19C	81	C_8H_{18} isomer	43	140	$C_{12}H_{26}$ isomer
19D	82	C_8H_{18} isomer	43A	141	$C_9H_{16}O_2$ isomer
19E	84	C_8H_{16} isomer	44	141	$C_{11}H_{24}$ isomer
20	86	toluene	45	142	$C_{12}H_{26}$ + C_4-alkyl benzene
					isomers
20A	87	C_8H_{16} isomer			
20B	88	C_8H_{18} isomer	46	143	acetophenone
20C	89	acetic acid	46A	144	C_4-alkyl benzene isomer
21	90	C_8H_{18} isomer	47	145	$C_8H_{14}O_2$ isomer
21A	91	C_8H_{16} isomer	48	146	$C_{11}H_{24}$ isomer
21B	92	$C_6H_{12}O$ isomer	48A	148	2-nonanone
22	92	n-hexanal	49	149	C_4-alkyl benzene isomer

(continued)

Table A34 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
50	150	n-nonanal			
51	152	n-undecane			
51A	154	C_4-alkyl benzene isomer			
52	155	$C_{11}H_{22}$ isomer			
53	157	dimethylphenol isomer			
53A	159	C_6-alkyl benzene isomer			
54	160	dimethylphenol isomer			
55	163	$C_{12}H_{24}$ isomer			
55A	165	C_4-alkyl benzene isomer			
56	165	naphthalene + 2-decanone			
56A	166	C_3-alkyl phenol isomer			
57	167	n-decanal			
57A	168	$C_{12}H_{24}$ isomer			
58	169	n-dodecane			
58A	170	C_3-alkyl phenol isomer			
59	172	C_3-alkyl phenol + $C_{13}H_{26}$ isomers			
60	176	C_4-alkyl phenol isomer (tent.)			
61	180	$C_{13}H_{26}$ isomer			
62	181	$C_{11}H_{22}O$ isomer			
63	183	$C_{13}H_{26}$ isomer			
64	185	n-tridecane			
64A	185	methylnaphthalene isomer			
66	192	isobutyl butyrate			
67	194	n-butyl butyrate			
68	196	$C_{14}H_{30}$ isomer			
69	198	$C_{14}H_{28}$ isomer			
70	199	n-tetradecane			
70A	212	$C_{15}H_{30}$ isomer			
71	215	unknown			
72	216	unknown			
73	222	diethyl phthalate			
74	226	$C_{16}H_{30}O_4$ isomer			
75	227	n-hexadecane			
77	238	$C_{15}H_{30}O$ isomer			
78	239	$C_{17}H_{34}$ isomer			

[a] Sampling was off Tidal Road at DTL3 (Fig. 13) as described in Table 16.

Table A35. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM DEER PARK, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2	23	82	C_8H_{18} isomer
3	44	1-butene	23A	82	4-methyl-2-pentanone
3A	45	n-butane	24	83	C_8H_{16} isomer
4	46	acetaldehyde	24A	84	C_7H_{14} isomer
5	48	isopentane	25	85	C_7H_{12} + C_8H_{18} isomers
5A	49	C_5H_{10} isomer	25A	86	C_8H_{16} isomer
6	49	propanal + propenal + furan dimethyl ether	26	86	toluene
			27	89	2,5-dimethylhexane
6A	50	acetone + C_5H_{12} isomer	28	90	2,4-dimethylhexane
6B	51	diethyl ether (tent)	28A	91	C_8H_{16} isomer
7	51	dichloromethane + C_5H_{12} isomer	28B	91	C_8H_{14} + $C_6H_{12}O$ isomers
8	53	C_6H_{14} isomer + isopropanol	29	92	C_8H_{18} isomer
8A	54	ter-butanol	29A	93	n-hexanal
8B	55	2-methylpropanol	30	93	dimethylcyclohexane isomer
8C	55	2-methylpentane	31	95	n-octane
9	56	cyclopentane (tent)	31A	96	tetrachloroethylene
9A	57	2-methylpropenal	32	97	C_8H_{16} + C_8H_{14} isomers
10	58	3-methylpentane	33	98	C_8H_{16} isomer
10A	58	n-butanal	34	99	C_9H_{20} isomer
11	59	hexafluorobenzene (es)	35	100	C_9H_{20} isomer
12	60	n-hexane	35A	101	C_9H_{18} isomer
13	61	chloroform	36	102	C_9H_{20} isomer
13A	62	methyl ethyl ketone	37	103	C_9H_{20} isomer
13B	63	C_6H_{12} isomer	37A	104	C_9H_{18} isomer
14	63	perfluorotoluene (es)	38	106	ethylbenzene
14A	64	methylcyclopentane	39	108	p-xylene
14B	67	3-methylbutanal	40	109	C_9H_{20} isomer
15	68	benzene	41	110	C_9H_{20} isomer
15A	69	C_7H_{16} isomer + carbon tetra-chloride	42	111	styrene + 2-heptanone
			42A	112	C_9H_{18} isomer
16	69	cyclohexane	43	113	o-xylene
17	70	2-methylhexane	44	114	C_9H_{18} isomer
17A	71	2,3-dimethylpentane + C_7H_{14} isomer	45	115	C_9H_{18} isomer
			46	116	n-nonane
18	72	3-methylhexane	47	117	C_9H_{19} isomer
19	73	n-pentanal	48	119	isopropylbenzene
19A	74	1-heptene	49	120	$C_{10}H_{22}$ isomer
19B	74	1,2-dimethylcyclopentane	49A	121	$C_{10}H_{22}$ isomer
19C	75	C_7H_{14} isomer	50	121	$C_{10}H_{22}$ isomer
20	76	n-heptane	50A	122	$C_{10}H_{22}$ isomer
21	77	C_7H_{14} isomer	51	122	propylcyclohexane
21A	78	C_7H_{12} isomer	52	123	$C_{10}H_{22}$ isomer
21B	79	C_7H_{10} isomer	53	124	benzaldehyde
22	80	methylcyclohexane	54	125	n-propylbenzene
22A	81	C_8H_{16} isomer	55	126	m-ethyltoluene
22B	81	3-methylpentanal	56	128	1,3,5-trimethylbenzene

(continued)

Table A35 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
57	128	$C_{10}H_{22}$ isomer
57A	129	$C_{11}H_{24}$ isomer
58	130	o-ethyltoluene
58A	130	$C_{10}H_{22}$ isomer
58B	131	2-octanone
59	131	phenol
59A	132	$C_{10}H_{18}$ isomer
59B	132	α-methylstyrene
59C	133	n-octanal
60	133	1,2,4-trimethylbenzene
60A	134	$C_{10}H_{20}$ isomer
61	135	n-decane
61A	136	isobutylbenzene
62	136	$C_{10}H_{22}$ isomer
62A	138	ter-butylbenzene
63	138	1,2,3-trimethylbenzene + $C_{11}H_{24}$ isomer
63A	139	o-xylene + $C_{11}H_{22}$ isomer
64	139	$C_{11}H_{24}$ isomer
64A	140	$C_{11}H_{22}$ isomer
65	141	indan
65A	141	C_4-alkyl benzene isomer
66	142	butylcyclohexane
67	143	m-propyltoluene
68	144	C_4-alkyl benzene isomer
69	145	p-propyltoluene
70	146	n-butylbenzene + $C_{11}H_{22}$ isomer
70A	146	$C_{11}H_{24}$ isomer
71	147	C_4-alkyl benzene isomer
72	148	$C_{11}H_{24}$ isomer
73	148	1,3-dimethyl-5-ethylbenzene
74	149	2-nonanone + methyl indan isomer
75	150	1,4-dimethyl-2-ethylbenzene
75A	150	methyl indan isomer
75B	151	$C_{12}H_{26}$ isomer
76	151	n-nonanal
77	152	$C_{11}H_{22}$ isomer
77A	153	C_4-alkyl benzene isomer
78	153	C_5-alkyl benzene
79	154	n-undecane
79A	155	$C_{11}H_{22}$ isomer
79B	155	$C_{12}H_{24}$ + C_5-alkyl benzene isomers
80	156	1,2,4,5-tetramethylbenzene
81	157	C_5-alkyl benzene isomer
82	157	$C_{12}H_{26}$ + $C_{11}H_{20}$ isomers
83	158	$C_{12}H_{24}$ isomer
83A	159	C_5-alkyl benzene isomer
83B	159	dimethylphenol + dimethylindan isomers
84	160	ethylindan + C_5-alkyl benzene isomers
85	160	C_5-alkyl benzene isomer
96	161	$C_{11}H_{20}$ + $C_{12}H_{24}$ isomers
96A	161	$C_{11}H_{12}$ isomer
87	162	C_6-alkyl benzene isomer
87A	162	tetramethylbenzene isomer
88	163	dimethylphenol + C_5alkyl benzene isomers
89	164	1,2,3,4-tetrahydronaphthalene
89A	164	C_5-alkyl benzene + $C_{12}H_{26}$ isomers
90	165	$C_{12}H_{24}$ isomer
90A	165	C_6-alkyl benzene isomer
91	166	C_5-alkyl benzene isomer
91A	166	$C_{12}H_{26}$ isomer
92	167	2-decanone
93	168	naphthalene
94	168	$C_{11}H_{14}$ + C_6-alkyl benzene isomers
95	169	n-decanal + $C_{12}H_{24}$ isomers
96	170	C_5-alkyl benzene + $C_{12}H_{22}$ isomers
96A	170	$C_{12}H_{24}$ isomer
97	171	n-dodecane
98	172	C_5-alkyl benzene isomer
98A	172	$C_{13}H_{26}$ + C_6-alkyl benzene isomers
98B	173	methyl-1,2,3,4-tetrahydro-naphthalene isomer
98C	173	$C_{13}H_{28}$ isomer
99	174	1,3-hexachlorobutadiene
99A	174	$C_{13}H_{26}$ isomer
99B	175	$C_{13}H_{28}$ isomer
100	176	$C_{11}H_{14}$ + $C_{13}H_{26}$ isomers
101	177	$C_{13}H_{28}$ + C_6-alkyl benzene isomers
101A	178	$C_{13}H_{28}$ isomer
102	178	$C_{13}H_{26}$ + $C_{11}H_{14}$ isomers
102A	179	C_6-alkyl benzene isomer
103	180	$C_{13}H_{28}$ isomer

(continued)

Table A35 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
104	181	$C_{14}H_{30}$ isomer
104A	182	$C_{13}H_{26}$ isomer
105	182	C_6-alkyl benzene isomer
105A	183	$C_{13}H_{28}$ isomer
106	183	2-undecanone
106A	185	C_6-alkyl benzene + $C_{13}H_{26}$ isomers
107	186	β-methylnaphthalene
107A	186	$C_{13}H_{26}$ + $C_{13}H_{24}$ isomers
108	187	n-tridecane
108A	188	$C_{13}H_{26}$ isomer
109	188	α-methylnaphthalene
110	190	$C_{14}H_{30}$ isomer
111	192	$C_{14}H_{28}$ isomer
111A	194	C_7-alkyl cyclohexane isomer
112	195	$C_{14}H_{30}$ isomer
113	196	C_7-alkyl benzene isomer
113A	197	$C_{14}H_{30}$ isomer
114	197	$C_{14}H_{28}$ isomer
114A	198	$C_{15}H_{32}$ isomer
115	199	dodecanone isomer
116	200	$C_{14}H_{28}$ isomer
116A	201	$C_{15}H_{32}$ isomer
117	202	n-tetradecane
117A	205	dimethylnaphthalene isomer
118	206	dimethyl phthalate
119	207	$C_{15}H_{30}$ isomer
120	209	biphenylene
121	211	$C_{16}H_{34}$ isomer
121A	212	$C_{15}H_{30}$ isomer
122	215	$C_{15}H_{30}$ isomer
123	216	n-pentadecane
125	219	unknown
126	224	diethyl phthalate
127	226	$C_{14}H_{28}O$ isomer
128	227	butyl n-butyrate
129	229	n-hexadecane
130	236	$C_{18}H_{38}$ isomer
131	240	$C_{17}H_{34}$ isomer
132	240	n-heptadecane
135	240	unknown

[a]Sampling was at DTL4 (Fig. 13) as described in Table 16.

Table A36. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM LAPORTE, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
2A	43	1-butene
3	44	n-butane
5	46	isopentane
7	48	acetone
7A	49	n-pentane
7B	49	dimethyl ether + diethyl ether
9	54	C_5H_{10} isomer
10	55	2-methylpentane
11	56	3-methylpentane
12	58	hexafluorobenzene (es)
12A	58	n-hexane
13	59	chloroform
14	62	perfluorotoluene (es)
14A	63	methylcyclopentane
15	64	1,1,1-trichloroethane
16	66	benzene
16A	67	carbon tetrachloride
16B	68	cyclohexane
17	68	2-methylhexane
17A	70	2,3-dimethylpentane
18	70	3-methylhexane
18A	72	C_7H_{14} isomer
19	73	2,2,4-trimethylpentane
20	75	n-heptane
20A	76	C_7H_{14} isomer
21	79	methylcyclohexane
21A	80	C_8H_{16} isomer
22	81	4-methyl-2-pentanone
22A	82	C_8H_{18} isomer
22B	83	C_8H_{16} isomer
22C	83	acetic acid (tent.)
22D	84	C_8H_{16} isomer
23	86	toluene
24	88	C_8H_{18} isomer
25	89	C_8H_{18} isomer
26	91	C_8H_{16} isomer
27	92	n-hexanal
27A	93	C_8H_{16} isomer
27B	94	C_8H_{14} isomer
27C	94	C_8H_{16} isomer
28	95	n-octane
28A	96	tetrachloroethylene
28B	96	C_8H_{16} isomer
29	97	C_9H_{18} isomer
30A	100	C_9H_{20} isomer
31	101	chlorobenzene
31A	102	C_9H_{20} isomer
31B	103	C_9H_{20} isomer
31C	103	C_9H_{18} isomer
32	105	ethylbenzene
33	107	p-xylene
34	108	C_9H_{20} isomer
35	109	C_9H_{20} isomer
35A	110	m-xylene
36	111	styrene or cyclooctatetraene
37	112	o-xylene
38	113	C_9H_{18} isomer
39	115	n-nonane
40	116	C_9H_{18} isomer
40A	118	C_9H_{18} isomer
41	118	isopropylbenzene
42	119	$C_{10}H_{22}$ isomer
43	121	$C_{10}H_{22}$ isomer
43A	121	C_9H_{18} isomer
43B	122	propylcyclohexane
44	122	$C_{10}H_{22}$ isomer
44A	123	$C_{10}H_{20}$ isomer
45	124	benzaldehyde
46	125	n-propylbenzene
47	126	m-ethyltoluene
48	127	p-ethyltoluene
49	128	$C_{11}H_{24}$ isomer
50	130	1,3,5-trimethylbenzene
50A	130	phenol
51	131	$C_{10}H_{20}$ isomer
51A	132	$C_{10}H_{18}$ isomer
52	133	o-ethyltoluene
52A	134	$C_{10}H_{20}$ isomer
52B	135	dichlorobenzene isomer (tent.)
53	135	n-decane
54	136	$C_{10}H_{20}$ isomer
54A	138	C_4-alkyl benzene isomer
55	138	1,2,3-trimethylbenzene
56	139	$C_{10}H_{20}$ isomer
56A	140	$C_{11}H_{24}$ isomer
57	140	indan
57A	141	$C_{11}H_{24}$ isomer
57B	142	butylcyclohexane + indene
58	143	$C_{11}H_{24}$ isomer
59	143	C_4-alkyl benzene isomer
60	144	p-propyltoluene

(continued)

Table A36 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
60A	144	n-butylbenzene
61	145	acetophenone + n-propyltoluene
61A	146	$C_{12}H_{24}$ isomer
62	147	o-cresol + $C_{10}H_{18}$ isomer
63	148	C_4-alkyl benzene + $C_{11}H_{22}$ isomers
64	149	dimethylethylbenzene isomer
65	150	dimethylethylbenzene + $C_{12}H_{26}$ isomers
65A	150	methylindan
65B	151	$C_{11}H_{22}$ isomer
66	152	n-nonanal
66A	153	$C_{11}H_{22}$ isomer
67	154	n-undecane
67A	155	$C_{12}H_{24}$ isomer
68	156	C_4-alkyl benzene + $C_{12}H_{26}$ isomers
68A	157	1,2,4,5-tetramethylbenzene
69	157	$C_{11}H_{20}$ isomer
70	159	dimethylphenol isomer
70A	161	methylindan isomer
70B	162	C_4-alkyl benzene isomer
71	163	ethylphenol isomer
72	164	dimethylphenol isomer
72A	166	naphthalene
73	167	C_3-alkyl phenol isomer
74	169	n-decanal
74A	169	$C_{12}H_{24}$ isomer
75	170	n-dodecane
75A	171	ethylphenol isomer
75B	172	C_3-alkyl phenol isomer
76	174	C_3-alkyl phenol + $C_{12}H_{24}$ isomers
76A	175	$C_{13}H_{26}$ isomer
77	176	alkyl alcohol (tent.)
78	177	$C_{13}H_{26}$ isomer
78A	178	C_2-alkyl phenol isomer
79	179	C_3-alkyl phenol isomer
80	183	undecanone isomer
81	185	β-methylnaphthalene
81A	186	$C_{13}H_{26}$ isomer
82	187	n-tridecane
83	188	α-methylnaphthalene
84	189	2-ethyl-4-methyl-1,3-dioxolane (tent.)
85	192	$C_{13}H_{26}$ isomer
85	192	$C_{13}H_{26}$ isomer
86	195	n-butyl-nor-butyrate
87	197	2,2,4-trimethylpenta-1,3-diol 1-isobutyrate
88	199	$C_{14}H_{30}$ isomer
88A	200	C_6-alkyl phenol isomer
89	201	$C_{14}H_{28}$ isomer
90	202	n-tetradecane
91	204	$C_{15}H_{30}$ isomer
92	205	dimethyl phthalate
92A	206	$C_{15}H_{30}$ isomer
93	207	$C_{15}H_{32}$ isomer
93A	208	$C_{15}H_{30}$ isomer
95	211	$C_{16}H_{34}$ isomer
95A	212	$C_{16}H_{32}$ isomer
95B	213	$C_{15}H_{30}$ isomer
96	215	$C_{15}H_{30}$ isomer
96A	216	n-pentadecane
97	217	2,6-di-tert-butyl-4-methyl phenol
101	221	$C_{16}H_{32}$ isomer
101A	223	$C_{16}H_{34}$ isomer
102	225	diethyl phthalate
103	228	nor-decyl thiol nor-butyrate (tent.) + $C_{16}H_{32}$ isomer
104	230	n-hexadecane
105	232	$C_{17}H_{34}$ isomer
107	237	$C_{18}H_{38}$ isomer
108	240	$C_{17}H_{34}$ isomer
109	240	$C_{15}H_{30}O$ isomer
110	240	$C_{18}H_{36}$ isomer
111	240	amyl benzoate + n-heptadecane
112	240	$C_{19}H_{40}$ isomer
113	240	4-methoxy-2,6-di-t-butylphenol
114	240	$C_{18}H_{38}$ isomer
117	240	n-octadecane
125	240	dibutyl phthalate

[a] Sampling was at LL1 (Fig. 16), see Table 16.

Table A37. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM LAPORTE, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1A	41	carbon dioxide
1B	41	dimethyl ether
2A	42	methyl chloride
2B	42	difluorodichloromethane
3	44	propane
4	46	acetaldehyde
5	47	isopentane
6	48	trichlorofluoromethane
7	49	acetone
9	52	m/e 59
10	54	C_5H_{10} isomer
11	56	C_6H_{14} isomer
12	57	perfluorobenzene (es)
13A	58	*n*-hexane
13B	58	chloroform
14	62	perfluorotoluene (es)
15	63	1,1,1-trichloroethane
16A	66	benzene
16B	66	carbon tetrachloride
16C	66	cyclohexane
17	68	C_7H_{16} isomer
18	70	C_7H_{16} isomer
19	72	3-methylbutanal
20A	74	trichloroethylene
20B	74	*n*-heptane
20C	74	isopropylamine (tent.)
21	78	C_7H_{14} isomer
22	80	methyl isobutyl ketone
23	85	toluene
24	87	acetic acid
25	91	dimethylpropiolactone isomer (tent.)
26A	94	*n*-octane
26B	94	tetrachloroethylene
27	99	m/e 131
28	102	chlorobenzene
29	106	ethylbenzene
30	107	*p*-xylene
31	109	C_9H_{20} isomer
32	110	styrene
33	112	*o*-xylene
34	115	*n*-nonane
35	118	cumene
36	123	benzaldehyde
37	124	*n*-propylbenzene
38	126	*m*-ethyltoluene
39	127	1,3,5-trimethylbenzene
40	128	$C_{10}H_{22}$ isomer
41	130	*o*-ethyltoluene
42	131	phenol
43	133	1,2,4-trimethylbenzene
44A	135	*n*-decane
44B	135	*m*-dichlorobenzene
45	136	C_4-alkyl benzene isomer
46	138	1,2,3-trimethylbenzene
47	139	C_4-alkyl benzene isomer
48	140	*o*-dichlorobenzene
49	141	C_9H_{10} isomer
50	142	trimethylhexanol isomer
51	143	C_4-alkyl benzene isomer
52	144	C_4-alkyl benzene isomer
53	146	C_4-alkyl benzene isomer
54	147	*p*-cresol
55	148	C_4-alkyl benzene isomer
56	150	C_4-alkyl benzene isomer
57	152	$C_{12}H_{26}$ isomer
58	153	*n*-undecane
59	155	C_4-alkyl benzene isomer
60	157	C_4-alkyl benzene isomer
61	159	dimethylphenol isomer
62	162	C_4-alkyl benzene isomer
63	163	C_5-alkyl benzene isomer
64	164	C_5-alkyl benzene isomer
65	167	naphthalene
66	169	trimethylphenol isomer
67	171	*n*-dodecane
68	174	hexachloro-1,3-butadiene
69	175	m/e 59
70	177	m/e 101
71	179	C_5-alkyl benzene isomer
72	181	C_5-alkyl benzene isomer
73	183	$C_{14}H_{30}$ isomer
74	186	2-methylnaphthalene
75	187	*n*-tridecane
76	189	1-methylnaphthalene
77	190	m/e 87
78	195	2-butyl-*n*-butyrate (tent.)
79	197	*n*-butyl-*n*-butyrate (tent.)
80	200	$C_{14}H_{28}$ isomer
81	202	*n*-tetradecane
82	211	$C_{15}H_{32}$ isomer
83	216	2,6-di-*t*-butyl-*p*-cresol

(continued)

Table A37 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
84	218	m/e 59			
85	225	diethylphthalate			
86	227	m/e 71			
87	229	$C_{15}H_{32}$ isomer			

[a]Sampling was at LL2 (Fig. 16), see Table 16.

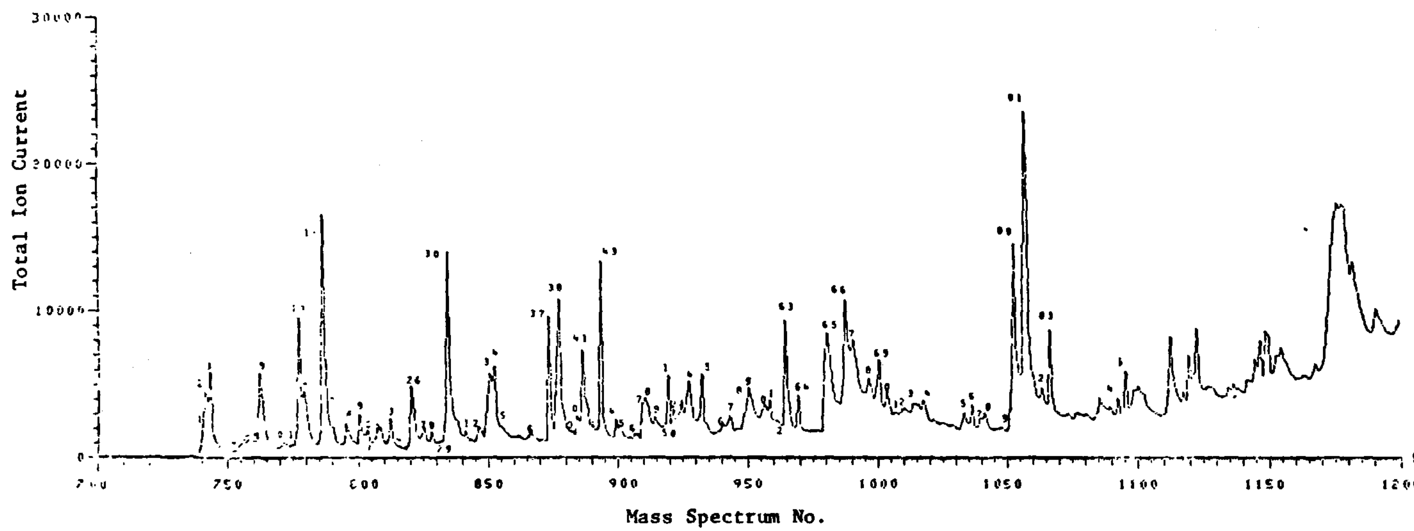

Figure A5. Profile of ambient air sample taken at LL3 (Fig. 16, Table 16).

Table A38. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM LAPORTE, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	argon	46	122	α-pinene
2	42	carbon dioxide	47	124	benzaldehyde
4	46	acetaldehyde	48	125	n-propylbenzene
5	47	isopentane	49	126	m-ethyltoluene
7A	49	propanal	50	127	benzonitrile
7B	49	acrolein	51	129	$C_{11}H_{24}$ isomer
8	50	acetone	52	130	$C_{10}H_{22}$ isomer
10	55	2-butenal (tent)	53	131	phenol
12	58	C_6H_{14} isomer	54	132	1,2,4-trimethylbenzene
13	59	perfluorobenzene (ext. std.)	55	135	n-decane
14	60	chloroform	56	138	C_4-benzene isomer
15	61	methyl ethyl ketone	57	140	$C_{11}H_{24}$ isomer
16	63	perfluorotoluene (ext. std.)	58	143	$C_{11}H_{24}$ isomer
17	65	1,1,1-trichloroethane	59	144	acetophenone
18A	68	benzene	60	147	p-cresol
18B	68	carbon tetrachloride	61	148	$C_{11}H_{24}$ isomer
18C	68	cyclohexane	62A	150	4-octanol (tent)
19	71	C_7H_{16} isomer	62B	150	propiophenone (tent)
20	72	C_7H_{16} isomer	63	151	n-nonanal (tent)
21	73	1,2-dichloropropane	64	153	n-undecane
22A	74	C_7H_{14} isomer	65	158	dimethylphenol isomer
22B	74	trichloroethylene	66	162	dimethylphenol isomer
23	76	n-heptane	67	164	dimethylphenol isomer
24	77	bis-(chloromethyl)ether (tent)	68A	167	trimethylphenol isomer
25	79	pentanal isomer (tent)	68B	167	naphthalene
26	81	C_7H_{14} isomer	69	168	dimethylphenol isomer
27A	82	dimethyl disulfide	70	170	n-dodecane
27B	82	methyl isobutyl ketone	71	172	trimethylphenol isomer
28	83	C_7H_{14} isomer	72	174	hexachloro-1,3-butadiene
29	84	C_7H_{14} isomer	73	176	m/e 59
30	86	toluene	74	177	m/e 101
31	87	C_8H_{18} isomer	75	185	$C_{13}H_{26}$ isomer
32	92	n-hexanal (tent)	76	186	n-tridecane
33	95	acetic acid	77	188	isobutyl isobutyrate (tent)
34	96	n-octane	78	190	ethyl methyl dioxalane (tent)
35	97	tetrachloroethylene	79	192	$C_{14}H_{30}$ isomer
36	102	chlorobenzene	80	195	2-butyl-n-butyrate (tent)
37	106	ethylbenzene	81	197	n-butyl-n-butyrate (tent)
38	108	p-xylene	82	200	$C_{14}H_{28}$ isomer
39	110	C_9H_{20} isomer	83	202	n-tetradecane
40	112	styrene	84	214	$C_{14}H_{28}$ isomer
41	113	o-xylene	85	216	n-pentadecane
42	114	C_9H_{18} isomer			
43	116	n-nonane			
44	118	cumene			
45	119	C_9H_{18} isomer			

[a]Sampling was at LL3 (Fig. 16), see Table 16.

Table A39. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM FREEPORT, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
2	41	dichlordifluoromethane
2A	43	n-propane
3	43	1-butene
3A	44	n-butane
3B	44	chloromethane
4	45	acetaldehyde
4A	46	dichlorofluoromethane
5	47	isopentane
6	47	acetone
7	48	trichlorofluoromethane
8	49	n-pentane
9	50	butanol isomer (tent.)
10	51	dichloromethane
10A	51	ter-butanol
10B	52	C_6H_{14} isomer
11	55	C_5H_{10} isomer
12	56	2-methylpentane
13	58	3-methylpentane
13A	58	butanal
14	59	hexafluorobenzene (eS)
15	60	n-hexane
16	61	chloroform
17	64	perfluorotoluene (eS)
18	65	1,2-dichloroethane
19	66	1,1,1-trichloroethane
20	68	benzene
21	69	carbon tetrachloride
21A	70	cyclohexane
22	71	2-methylhexane
22A	71	2,3-dimethylpentane
23	72	3-methylhexane
23A	73	dibromomethane + 1,2-dichloropropane
23B	74	methylbutanal isomer
24	75	trichloroethylene + C_7H_{14} isomer
24A	75	C_8H_{18} isomer
24B	76	n-pentanal
24C	76	C_7H_{14} isomer
25	77	n-heptane
25A	80	C_7H_{14} isomer
26	81	methylcyclohexane
26A	83	C_8H_{16} isomer
27	83	C_8H_{18} isomer
27A	84	4-methyl-2-pentanone
27B	84	methylpentanal isomer
28	85	C_8H_{16} isomer
28A	86	C_8H_{16} isomer + acetic acid
29	86	1,1,2-trichloroethane
30	88	toluene
30A	89	C_8H_{16} isomer
31	90	C_8H_{18} isomer
32	91	dibromochloromethane
32A	92	C_8H_{16} isomer
33	94	n-hexanal
33A	94	C_8H_{16} isomer
34	97	n-octane
35	98	tetrachloroethylene
36	99	n-butyl acetate (tent.)
38	104	1,1,1,2-tetrachloroethane
38A	106	C_9H_{18} isomer
39	107	ethylbenzene
40	109	p-xylene
40A	110	bromoform
41	113	styrene
42	114	o-xylene
42A	115	n-heptanal
42B	116	C_9H_{18} isomer
43	117	n-nonane
44	119	C_9H_{18} isomer
45	120	isopropylbenzene
45A	121	$C_{10}H_{22}$ isomer
45B	121	$C_8H_{10}O$ isomer
45C	122	$C_{10}H_{22}$ isomer
45D	123	$C_{10}H_{20}$ isomer
45E	124	methylstyrene
46	124	$C_{11}H_{24}$ + $C_{10}H_{16}$ isomers
47	125	benzaldehyde
48	126	n-propylbenzene
48A	127	$C_{10}H_{20}$ isomer
49	128	m-ethyltoluene
49A	129	$C_{10}H_{20}$ isomer
50	130	$C_{11}H_{24}$ isomer
50A	131	$C_{10}H_{16}$ isomer
51	131	phenol
51A	132	2-octanone
52	133	$C_{11}H_{24}$ isomer
53	134	n-octanal
53A	135	$C_{10}H_{20}$ isomer
54	136	dichlorobenzene isomer
55	137	n-decane

(continued)

Table A39 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
56	138	$C_{10}H_{20}$ isomer
56A	139	1,2,3,-trimethylbenzene
56B	140	C_4-alkyl benzene isomer
57	141	$C_{10}H_{20}$ isomer
58	142	$C_{11}H_{24}$ isomer + unknown
59	143	bis-(2-chloroisopropyl)ether or bis-(1-chloro-prop-2-yl)-ether
60	144	C_4-alkyl benzene isomer
60A	145	$C_{11}H_{24}$ isomer
61	146	acetophenone
62	148	$C_{11}H_{24}$ isomer
62A	151	nonanone isomer
63	153	n-nonanal
63A	154	$C_{11}H_{22}$ isomer
64	155	n-undecane
65	156	$C_{11}H_{22}$ isomer
65A	157	$C_{12}H_{24}$ isomer
65B	158	C_4-alkyl benzene isomer
66	159	dimethylphenol + $C_{11}H_{22}$ isomers
67	160	dimethylphenol isomer
67A	161	$C_{12}H_{24}$ isomer
67B	162	dimethylphenol isomer
67C	162	$C_{11}H_{22}$ isomer
68	163	ethylphenol + $C_{10}H_{14}O$ isomers
69	165	$C_{12}H_{24}$ isomer
70	168	naphthalene + C_3-alkyl phenol isomer
71	169	n-decanal
71A	170	$C_{12}H_{24}$ isomer
72	171	n-dodecane
72A	173	C_6-alkyl benzene isomer
73	174	1,3-hexachlorobutadiene
74	176	C_3-alkyl phenol + unknown
75	178	$C_{13}H_{28}$ isomer
75A	179	$C_{13}H_{26}$ isomer
75B	180	$C_{13}H_{26}$ isomer
76	182	$C_{13}H_{28}$ isomer
77	184	$C_{11}H_{22}O$ isomer
78	186	β-methylnaphthalene
79	187	n-tridecane
79A	189	α-methylnaphthalene
80	190	alkyl alcohol isomer (tent.)
80A	191	$C_{14}H_{30}$ isomer
81	193	$C_{14}H_{28}$ isomer
82	195	2-butyl-n-butyrate
82A	196	$C_{14}H_{28}$ isomer
83	197	n-butyl n-butyrate
84	198	$C_{14}H_{28}$ isomer
85	200	$C_{12}H_{24}O_3$ isomer
85A	201	$C_{14}H_{28}$ isomer
86	202	n-tetradecane
86A	202	dimethylnaphthalene isomer
86B	203	$C_{14}H_{28}$ isomer
86C	203	$C_{15}H_{32}$ isomer
86D	204	dimethylnaphthalene isomer
86E	205	dimethyl phthalate
86F	208	$C_{13}H_{26}O$ isomer
87	209	$C_{15}H_{30}$ isomer
88	210	$C_{15}H_{32}$ isomer
88A	214	$C_{13}H_{26}O$ isomer
89	215	$C_{15}H_{30}$ isomer
90	216	n-pentadecane
91	218	dibenzofuran
92	223	$C_{16}H_{34}$ isomer
93	224	diethyl phthalate
94	226	$C_{15}H_{30}$ isomer
94A	227	$C_{14}H_{28}O$ isomer
95	228	alkyl butyrate (tent.)
96	229	n-hexadecane
97	232	benzophenone
98	236	$C_{16}H_{34}$ isomer
100	240	$C_{15}H_{30}O$ isomer
101	240	$C_{17}H_{34}$ isomer
102	240	n-heptadecane
103	240	$C_{18}H_{38}$ isomer
104	240	2,6-di-tert-butyl-4-methoxy-phenol (tent.)
107	240	unknown
108	240	unknown
110	240	dipropyl phthalate
111	240	$C_{17}H_{36}$ isomer
112	240	$C_{18}H_{38}$ isomer
113	240	$C_{17}H_{34}O$ isomer
114	240	n-nonadecane

[a] Sampling was at FL1 (Fig. 15), see Table 16 for protocol.

Table A40. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM FREEPORT, TX[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	carbon dioxide
3B	45	acetaldehyde
4A	47	C_5H_{12} isomer
4B	47	trichlorofluoromethane
4C	47	propanal
5	48	diethyl ether
6	49	methylene chloride
7	51	1,1,1,2-tetrachlorodi-fluoroethane
8	54	C_5H_{10} isomer
9	55	C_6H_{14} isomer
10	57	3-methylpentane
11	58	n-hexane
12	59	perfluorobenzene (eS)
13	60	chloroform
14	63	perfluorotoluene (eS)
15	64	1,1,1-trichloroethane
16A	67	benzene
16B	67	carbon tetrachloride
17	68	cyclohexane
18	69	C_7H_{16} isomer
19	71	C_7H_{16} isomer
20	72	1,2-dichloropropane
21	73	trichloroethylene
22	75	n-heptane
23	78	C_7H_{14} isomer
24	80	C_7H_{14} isomer
25	81	C_8H_{18} isomer
26	83	C_8H_{18} isomer
27	84	C_8H_{16} isomer
28	86	toluene
29	87	C_8H_{18} isomer
30	89	C_8H_{16} isomer
31	92	C_8H_{16} isomer
32	95	n-octane
33	95	tetrachloroethylene
34	99	4,4-dichlorohexafluoro-1-butene (tent.)
35	102	chlorobenzene
36	103	1,2-dibromopropane
37	104	C_9H_{20} isomer
38	105	ethylbenzene
39	107	p-xylene
40	110	C_9H_{20} isomer
41	111	styrene
42	112	o-xylene
43	116	n-nonane
44	118	cumene
45	119	$C_{10}H_{22}$ isomer
46	120	$C_{10}H_{22}$ isomer
47	122	$C_{10}H_{16}$ isomer
48	123	benzaldehyde
49	124	C_3-alkyl benzene
50	126	C_3-alkyl benzene
51	127	C_3-alkyl benzene
52	128	$C_{11}H_{24}$ isomer
53	129	C_3-alkyl benzene
54A	130	$C_{11}H_{24}$ isomer
54B	130	phenol
55	132	C_3-alkyl benzene
56	133	dichlorobenzene isomer
57	134	n-decane
58	135	$C_{11}H_{24}$ isomer
59	137	$C_{11}H_{24}$ isomer
60	138	acetophenone
61	140	$C_{12}H_{26}$ isomer
62	141	bis-(2-chloroisopropyl)ether
63	142	$C_{11}H_{24}$ isomer
64	142	$C_{12}H_{26}$ isomer
65	143	C_4-alkyl benzene
66	146	$C_{12}H_{26}$ isomer
67	147	C_4-alkyl benzene
68	147	C_4-alkyl benzene
69	148	C_4-alkyl benzene
70	149	C_4-alkyl benzene
71	150	$C_{12}H_{26}$ isomer
72	153	n-undecane
73	154	C_4-alkyl benzene
74	158	dimethyl phenol isomer
75	162	dimethyl phenol isomer
76	165	$C_{12}H_{26}$ isomer
77	165	naphthalene
78A	168	$C_{12}H_{22}$ isomer
78B	168	2-t-butylcyclohexanol (tent.)
79	170	n-dodecane
80	172	hexachloro-1,3-butadiene
81	175	tripropyleneglycol (tent.)
82	176	diisobutoxy ethane (tent.)
83	178	$C_{13}H_{28}$ isomer
84	180	$C_{13}H_{28}$ isomer
85	182	$C_{13}H_{28}$ isomer
86	184	methylnaphthalene isomer

(continued)

Table A40 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
87	185	n-tridecane			
88	188	m/e 87			
89	191	$C_{14}H_{30}$ isomer			
90A	194	tetrachloropropene isomer			
90B	194	2-butyl-n-butyrate (tent.)			
91	195	$C_{14}H_{30}$ isomer			
92	196	n-butyl-n-butyrate (tent.)			
93	199	$C_{14}H_{28}$ isomer			
94	200	$C_{14}H_{30}$ isomer			
95	213	$C_{15}H_{30}$ isomer			
96	215	$C_{15}H_{32}$ isomer			

[a]Sampling was at FL2 (Fig 15), see Table 16.

Table A41. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM FREEPORT, TX[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	40	methyl ether
2	41	difluorodichloromethane
3	42	methyl chloride
4	43	m/e 62 (?)
5	44	chloroethane
6	45	acetaldehyde
7	46	2-butene
8	46	trichlorofluoromethane
9	47	isopentane
10	48	vinylidene chloride
11	49	methylene chloride
12	50	Freon 113 (BKd.)
13	51	acetone
14	53	phosgene
15	56	3-methyl pentane
16	57	perfluorobenzene (ext. std.)
17	58	chloroform
18	60	C_7H_{16} isomer
19	61	perfluorotoluene (ext. std.)
20	62	1,1,1-trichloroethane
21	62	1,2-dichloroethane
22	63	methyl ethyl ketone
23	65	carbon tetrachloride
24	65	benzene
25	68	C_7H_{16} isomer
26	69	1,2-dichloropropane
27	70	trichloroethylene
28	73	p-dioxane
29	76	C_7H_{14} isomer
30	78	n-heptane
30A	78	ethylene glycol dimethyl ether
31	82	1,1,2-trichloroethane
32	84	toluene
33	89	1,2-dibromoethane
34	92	n-octane
34A	92	tetrachloroethylene
35	97	C_9H_{20} isomer
36	99	1,1,1,2-tetrachloroethane
37	103	ethylbenzene
38	105	p-xylene
39	109	styrene
40	110	1,1,2,2-tetrachloroethane
40A	110	o-xylene
40B	110	1,2,3-trichloropropane
41	113	n-nonane
42	114	$C_{10}H_{22}$ isomer
43	116	cumene
44	118	$C_{11}H_{24}$ isomer
45	120	$C_{10}H_{22}$ isomer
46	122	benzaldehyde
46A	122	n-propylbenzene
47	124	C_3benzene isomer
48	126	pentachloroethane
49	216	$C_{10}H_{22}$ isomer
50	217	C_3benzene isomer
51	128	phenol
52	130	C_3benzne isomer
53	132	n-decane
53A	132	m-dichlorobenzene
54	136	C_3benzene isomer
55	138	m/e 57
56	139	bis(2-chloroisopropyl)ether
57	140	C_4benzene isomer
58	142	C_4benzene isomer
58A	142	acetophenone
59	144	C_4benzene isomer
59A	144	m-cresol
60	145	perchloroethane
61	147	C_4benzene isomer
62	149	m/e 57
63	151	$C_{11}H_{24}$ isomer
64	153	C_4benzene isomer
65	154	C_4benzene isomer
66	156	dimethyl phenol isomer
66A	156	$C_{10}H_{15}N$ isomer
67	160	dimethyl phenol isomer
68	163	$C_{12}H_{26}$ isomer
69	164	naphthalene
70	166	$C_{10}H_{16}$ isomer
71	168	$C_{12}H_{26}$ isomer
72	169	$C_{12}H_{26}$ isomer
73	171	hexachloro-1,3-butadiene
74	173	tripropylene glycol (tent)
75	175	dibutoxyethane (tent)
76	177	$C_{13}H_{28}$ isomer
77	181	$C_{13}H_{28}$ isomer
78	182	beta-methylnaphthalene
79	184	$C_{15}H_{32}$ isomer
80	185	alpha-methylnaphthalene
81	187	m/e 87
82	188	$C_{12}H_{24}$ isomer
83	190	$C_{14}H_{30}$ isomer

(continued)

Table A41 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
84	192	2-butyl n-buryrate (tent)			
85	194	n-butyl n-butyrate (tent)			
86	198	diphenyl ether			
87	199	n-tetradecane			
88-100	200-240	Column Background			

[a]Sampling was at FL3 (Fig. 15), see Table 16.

Table A42. VOLATILE ORGANIC VAPORS IN AMBIENT AIR IN GEISMAR, LA AT LOCATION #14[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2
1A	43	propane (tent.)
1B	44	butene isomer
1C	44	n-butane
2	48	isopentane
2A	49	C_5H_{10} isomer (tent.)
2B	49	n-pentane
2C	51	acetaldehyde
3	52	dichloromethane
3A	53	propanal
3B	53	propenal
4	54	dimethyl ether + diethyl ether
4A	54	acetone
5	55	2-methylpentane
6	57	3-methylpentane
7	59	hexafluorobenzene (eS)
8	60	n-hexane
9	61	chloroform
10	63	perfluorotoluene (eS)
10A	64	methylcyclopentane
10B	65	n-butanal (tent.)
10C	66	1,1,1-trichloroethane
10D	67	1,2-dichloroethane
11	69	benzene + carbon tetrachloride
11A	70	cyclohexane
12	71	2-methylhexane
12A	71	2,3-dimethylpentane
13	73	3-methylhexane
14	75	C_7H_{14} isomer
14A	76	methyl ethyl ketone
15	77	n-heptane
15A	78	trichloroethylene (tent.)
16	80	n-pentanal
17	82	methylcyclohexane
18	84	C_8H_{18} isomer
18A	86	C_8H_{16} isomer
18B	87	C_8H_{16} isomer
19	89	toluene
20	90	C_8H_{18} isomer
21	92	C_8H_{18} isomer
22	93	dimethylcyclohexane isomer
22A	94	C_8H_{18} isomer
22B	95	C_8H_{16} isomer
23	97	n-octane
23A	99	C_8H_{16} isomer
23B	99	tetrachloroethylene
23C	102	C_9H_{20} isomer
23D	103	n-hexanal (tent.)
23E	104	C_9H_{20} isomer
23F	105	C_8H_{16} isomer
24	105	C_9H_{20} isomer
24A	106	C_9H_{18} isomer
24B	108	C_9H_{18} isomer
25	109	ethylbenzene
25A	110	C_9H_{20} isomer
26	110	p-xylene
27	112	C_9H_{20} isomer
27A	113	C_9H_{20} isomer
28	115	o-xylene + styrene or cyclo-octatetraene
28A	116	C_9H_{18} isomer
29	117	n-nonane
29A	119	C_9H_{18} isomer
30	121	$C_{10}H_{20}$ isomer
31	124	propylcyclohexane
31A	127	n-propylbenzene
32	128	ethyltoluene isomer
33	130	$C_{10}H_{22}$ isomer
33A	132	C_3-alkyl benzene isomer
34	132	$C_{10}H_{20}$ isomer
34A	134	$C_{10}H_{20}$ isomer + benzaldehyde
35	135	C_3-alkyl benzene isomer
36	136	n-decane
36A	139	C_4-alkyl benzene isomer
37	140	1,2,3-trimethylbenzene
37A	141	phenol (tent.)
38	142	$C_{11}H_{24}$ isomer
39	143	C_4-alkyl cyclohexane isomer
40	144	$C_{11}H_{24}$ + C_4-alkyl benzene isomers
40A	145	C_4-alkyl benzene isomer
41	146	C_4-alkyl benzene isomer
41A	147	$C_{11}H_{24}$ isomer
42	148	C_4-alkyl benzene isomer
43	149	$C_{11}H_{24}$ isomer
43A	150	C_4-alkyl benzene isomer
44	151	acetophenone
44A	152	$C_{11}H_{22}$ isomer
45	153	n-nonanal
46	153	n-undecane
47	157	C_4-alkyl benzene isomer
47A	158	cresol isomer

(continued)

Table A42 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
48	160	C_5-alkyl benzene + $C_{11}H_{22}$ isomers			
48A	161	C_5-alkyl benzene isomer			
48B	162	C_4-alkyl benzene isomer			
49	163	C_2-alkyl phenol isomer			
50	164	$C_{12}H_{26}$ isomer (tent.)			
51	165	C_2-alkyl phenol isomer (tent.)			
51A	167	naphthalene			
51B	168	$C_{12}H_{24}$ isomer			
52	169	n-decanal			
53	170	n-dodecane			
54	172	$C_{13}H_{28}$ isomer			
54A	175	$C_{13}H_{26}$ isomer			
54B	176	C_6-alkyl cyclohexane or $C_{12}H_{24}$ isomer			
55	178	$C_{13}H_{28}$ isomer (tent.)			
56	179	$C_{13}H_{26}$ isomer			
57	181	$C_{13}H_{28}$ isomer			
57A	184	$C_{13}H_{26}$ isomer			
58	185	n-tridecane			
58A	185	methylnaphthalene isomer			
59	187	$C_{13}H_{26}$ isomer (tent.)			
61	192	C_7-alkyl cyclohexane isomer			
62	193	isobutyl isobutanoate			
63	195	butyl butanoate			
64	196	$C_{14}H_{30}$ isomer			
64A	197	$C_{14}H_{28}$ isomer			
65	198	n-tetradecane			
66	200	C_2-alkyl naphthalene isomer			
66A	201	C_2-alkyl naphthalene isomer			
66B	203	$C_{15}H_{30}$ isomer			
67	205	$C_{14}H_{28}$ isomer			
68	207	$C_{15}H_{32}$ isomer			
70	212	n-pentadecane			
72	219	$C_{15}H_{30}$ isomer			
73	221	diethyl phthalate (BKG)			
74	223	2,2,4-trimethyl penta-1,3-diol di-isobutyrate (BKG)			
75	224	n-hexadecane			
76	230	$C_{17}H_{36}$ isomer			
77	232	$C_{16}H_{32}$ isomer			
78	235	alkyl ketone isomer (tent.)			
79	236	n-heptadecane			
80	238	saturated hydrocarbon isomer			
83	240	unknown			

[a]See Table 17 for sampling protocol.

Table A43. VOLATILE ORGANICS IN AMBIENT AIR FROM GEISMAR, LA AT LOCATION #14[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2
1A	44	propane (tent.)
1B	45	1-butene
1C	46	_n_-butane
1D	49	chloroethane
2	50	isopentane
2A	52	C_5H_{10} isomer
3	52	_n_-pentane
3A	53	furan
3B	54	dichloroethylene isomer + C_5H_{10} isomer + dimethyl ether
4	55	acetaldehyde
4A	56	dichloromethane
4B	58	propanal
4C	58	propenal (tent.)
4D	59	dichloroethylene + C_5H_{10} isomers
5	59	2-methylpentane
5A	60	1,1-dichloroethane
6	61	acetone + 3-methylpentane
7	62	hexafluorobenzene (eS)
7A	63	_n_-hexane
8	65	chloroform
9	67	perfluorotoluene (eS)
10	68	1,2-dichloroethane
10A	69	1,1,1-trichloroethane (tent.)
11	72	benzene + carbon tetrachloride
11A	73	cyclohexane
12	74	2-methylhexane
12A	74	2,3-dimethylpentane
13	75	3-methylhexane
14	78	dimethylcyclopentane
15	80	_n_-heptane
16	84	methylcyclohexane
17	86	C_8H_{18} isomer
18	90	C_8H_{18} isomer
19	91	1,1,2-trichloroethane
20	92	toluene
21	93	C_8H_{18} isomer
22	94	C_8H_{18} isomer
22A	95	C_8H_{16} isomer
22B	96	3-hexanone
23	98	2-hexanone
24	99	_n_-octane
24A	100	C_8H_{16} isomer
25	101	tetrachloroethylene
26	104	C_9H_{20} isomer (tent.)
27	105	C_9H_{20} isomer
28	106	ethylcyclohexane
28A	106	C_9H_{20} isomer
28B	107	C_9H_{18} isomer
28C	107	$C_7H_{16}O$ alcohol isomer (tent.)
29	108	chlorobenzene
29A	109	C_9H_{18} isomer
30	110	ethylbenzene
30A	111	C_9H_{20} isomer
31	112	_p_-xylene
32	113	C_9H_{20} isomer
33	114	phenylacetylene + C_9H_{18} isomer
33A	115	2-heptanone
34	116	_o_-xylene + styrene
34A	117	C_9H_{18} isomer
35	118	_n_-nonane
36	120	C_9H_{18} isomer
36A	122	isopropylbenzene
37	122	cyclohexanone or methylcyclopentanone isomer
37A	124	C_9H_{18} isomer
38	125	$C_{10}H_{22}$ isomer
38A	128	_n_-propylbenzene
39	129	ethyltoluene isomer
40	130	$C_{11}H_{24}$ isomer
40A	131	1,3,5-trimethylbenzene
41	132	$C_{10}H_{22}$ isomer
41A	132	_o_-ethyltoluene
41B	134	$C_{10}H_{22}$ isomer
41C	134	benzaldehyde + $C_{10}H_{20}$ isomer
42	135	1,2,4-trimethylbenzene
43	137	_n_-decane
43A	138	phenol
43B	139	dichlorobenzene isomer (tent.)
43C	140	C_4-alkyl benzene isomer
44	140	1,2,3-trimethylbenzene
44A	141	$C_{11}H_{24}$ isomer
44B	142	indan (tent.)
45	143	C_4-alkyl cyclohexane isomer
45A	143	dichlorobenzene isomer (tent.)
46	144	$C_{11}H_{24}$ isomer
46A	144	C_4-alkyl benzene isomer
47	145	C_4-alkyl benzene isomer
47A	146	$C_{11}H_{22}$ isomer

(continued)

Table A43 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
48	147	$C_{11}H_{24}$ + C_4-alkyl benzene isomers
49	148	$C_{11}H_{24}$ isomer
49A	149	C_4-alkyl benzene isomer
50	150	acetophenone + C_4-alkyl benzene isomer
50A	151	$C_{11}H_{22}$ isomer
50B	152	$C_{11}H_{22}$ isomer
51	153	n-undecane
51A	154	C_5-alkyl benzene isomer
52	156	C_4-alkyl benzene isomer
52A	157	cresol isomer
52B	158	$C_{12}H_{26}$ isomer
52C	159	C_5-alkyl benzene isomer
53	159	C_5-alkyl cyclohexane isomer
54	162	C_2-alkyl phenol + C_5-alkyl benzene isomer
54A	162	$C_{12}H_{26}$ isomer
55	164	$C_{12}H_{26}$ isomer
56	166	naphthalene
56A	167	$C_{12}H_{24}$ isomer
56B	167	$C_{12}H_{22}$ isomer
56C	168	$C_{12}H_{24}$ + C_5-alkyl benzene isomers
57	169	n-dodecane
58	171	$C_{12}H_{24}$ isomer
59	173	$C_{13}H_{28}$ isomer (tent.)
59A	174	$C_{13}H_{26}$ isomer
60	175	C_6-alkyl cyclohexane isomer
60A	179	$C_{13}H_{26}$ isomer
61	180	$C_{14}H_{30}$ isomer
61A	183	$C_{13}H_{26}$ isomer
62	184	n-tridecane
62A	185	methylnaphthalene isomer
63	186	$C_{13}H_{18}$ isomer
63A	187	$C_{14}H_{28}$ isomer
65	189	$C_{10}H_{18}$ isomer (tent.)
66	191	C_7-alkyl cyclohexane isomer
67	192	isobutyl isobutyrate
68	194	butyl butanoate
69	195	$C_{14}H_{30}$ isomer
69A	196	$C_{14}H_{28}$ isomer
69B	196	biphenyl ether
70	197	n-tetradecane
70A	198	$C_{14}H_{28}$ isomer
71A	203	$C_{15}H_{30}$ isomer
72	204	C_8-alkyl cyclohexane isomer
73	206	$C_{15}H_{32}$ isomer
74	209	$C_{15}H_{30}$ isomer
75	211	n-pentadecane
76	213	$C_{15}H_{30}$ isomer
78	218	C_9-alkyl cyclohexane isomer
79	220	diethyl phthalate (BKG)
79A	221	$C_{16}H_{32}$ isomer
81	223	n-hexadecane
82	226	$C_{16}H_{32}$ isomer
83	230	$C_{17}H_{36}$ isomer
84	231	C_{10}-alkyl cyclohexane isomer
86	235	n-heptadecane
87	237	$C_{18}H_{38}$ isomer
		C_{11}-alkyl cyclohexane isomer
88	240	$C_{18}H_{38}$ isomer
89	240	$C_{18}H_{38}$ isomer
90	240	alkyl phthalate (?)
91	240	$C_{19}H_{40}$ isomer
91A	240	alkyl phthalate (?)

[a]See Table 17 for sampling protocol.

Table A44. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM GEISMAR, LA AT LOCATION #15[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	40	CO_2
3	44	1-butene + n-butane
4	48	isopentane
4A	48	C_5H_{10} isomer
5	49	n-pentane
5A	50	furan
5B	51	acetaldehyde
6	51	dichloromethane
6A	51	diethyl ether
6B	52	dimethyl ether + carbon disulfide
7	53	acetone
8	56	2-methylpentene
8A	57	isopropanol
9	58	C_4H_8O isomer + 3-methylpentane
9A	58	ter-butanol
10	59	hexafluorobenzene (es)
10A	60	n-hexane
11	61	chloroform
12	64	perfluorotoluene (es)
13	65	1,2-dichloroethane
14	69	benzene
14A	69	carbon tetrachloride
14B	70	cyclohexane
15	71	C_7H_{16} isomer
16	73	3-methylhexane
17	75	C_7H_{14} isomer
17A	76	trichloroethylene
18	77	n-heptane
19	81	methylcyclohexane
19A	83	C_8H_{18} isomer
19B	86	C_8H_{16} isomer (tent.)
20	88	1,1,2-trichloroethane
21	89	toluene
21A	92	C_8H_{18} isomer
21B	93	C_8H_{16} isomer
21C	94	C_8H_{18} isomer
22	96	2-methyl-3-pentanol (tent.)
22A	96	C_8H_{16} isomer
23	97	n-octane
24	98	tetrachloroethylene
25	105	dimethyl-3-pentanol isomer
25A	106	chlorobenzene
25B	108	C_9H_{20} isomer
26	109	ethylbenzene
27	110	p-xylene
28	111	phenylacetylene
28A	113	C_9H_{18} isomer
29	115	C_9H_{20} isomer + o-xylene
30	117	n-nonane
31	119	C_9H_{18} isomer
32	121	isopropylbenzene
32A	122	$C_{10}H_{22}$ isomer
33	124	$C_8H_{18}O$ alcohol (tent.)
33A	126	n-propylbenzene
33B	127	$C_{10}H_{20}$ isomer
34	128	ethyltoluene isomer
35	130	$C_{11}H_{24}$ isomer
35A	131	$C_{10}H_{22}$ isomer
36	132	benzaldehyde
37	134	1,2,4-trimethylbenzene
37A	135	$C_{10}H_{20}$ isomer
38	136	n-decane
38A	137	dichlorobenzene isomer
39	139	1,2,3-trimethylbenzene
40	142	o-dichlorobenzene
41	143	$C_{11}H_{24}$ isomer
41A	144	C_4-alkyl benzene isomer
41B	145	$C_{11}H_{22}$ isomer
42	145	C_4-alkyl benzene isomer
43	147	$C_{11}H_{24}$ isomer
43A	149	C_4-alkyl benzene isomer
44	150	acetophenone
44A	152	$C_{11}H_{22}$ isomer
45	153	n-nonanal
46	154	n-undecane
46A	155	cresol isomer
47	156	$C_{11}H_{22}$ isomer
47A	156	C_4-alkyl benzene isomer
47B	157	$C_{12}H_{26}$ isomer
48	159	C_5-alkyl benzene + C_5-alkyl cyclohexane isomers
48A	161	C_2-alkyl phenol isomer
49	162	$C_{12}H_{24}$ isomer
50	163	$C_{11}H_{22}$ isomer
50A	164	C_5-alkyl benzene + C_2-alkyl phenol isomers
50B	166	C_2-alkyl phenol isomer
51	167	naphthalene
51A	168	$C_{12}H_{24}$ isomer
52	169	n-decanal
53	170	n-dodecane

(continued)

Table A44 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound	Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
53A	171	$C_{12}H_{24}$ isomer			
53B	172	$C_{12}H_{24}$ isomer			
54	173	$C_{13}H_{28}$ isomer			
55	175	C_6-alkyl cyclohexane isomer			
55A	177	alkyl alcohol isomer			
56	178	$C_{13}H_{28}$ isomer			
57	181	$C_{14}H_{30}$ isomer			
57A	183	β-methylnaphthalene			
58	184	n-tridecane			
58A	185	$C_{13}H_{26}$ isomer			
58B	186	α-methylnaphthalene			
60	190	$C_{14}H_{30}$ isomer (tent.)			
61	193	isobutyl isobutyrate			
62	194	butyl butyrate			
63	195	$C_{14}H_{30}$ isomer			
63A	197	$C_{14}H_{28}$ isomer			
64	198	biphenyl ether			
64A	199	n-tetradecane			
65	200	$C_{14}H_{28}$ isomer			
65A	201	C_2-alkyl naphthalene isomer			
66	203	$C_{15}H_{30}$ isomer			
67	205	C_8-alkyl cyclohexane isomer			
68	207	$C_{15}H_{32}$ isomer			
69	209	$C_{15}H_{30}$ isomer			
70	211	n-pentadecane			
70A	211	$C_{15}H_{24}O$ isomer			
70B	212	$C_{15}H_{30}$ isomer			
72	217	2,5-diisobutylthiophene (tent.)			
73	219	C_9-alkyl cyclohexane isomer			
74	220	diethyl phthalate (BKG)			
74A	222	$C_{16}H_{32}$ isomer			
76	224	n-hexadecane			
76A	226	$C_{16}H_{32}$ isomer			
77	230	$C_{17}H_{36}$ isomer			
78	232	$C_{16}H_{32}$ isomer			
79	234	alkyl ketone isomer (tent.)			
80	236	n-heptadecane			
80A	236	$C_{17}H_{34}$ isomer			
81	237	$C_{18}H_{38}$ isomer			
82	240	$C_{18}H_{38}$ isomer			
83	240	$C_{18}H_{38}$ isomer			
83A	240	alkyl phthalate isomer (BKG)			
84	240	$C_{19}H_{40}$ isomer (tent.)			
86	240	alkyl phthalate isomer (BKG)			

[a] See Table 17 for sampling protocol.

Table A45. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM GEISMAR, LA AT LOCATION #16[a]

Chromatographic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2
1A	44	butene
1B	45	1-buten-3-yne
2	46	1,3-butadiyne
3	49	dimethyl ether
5A	51	dichloromethane
5B	52	propenylacetylene _or_ C_5H_6 isomer
5C	53	propanal + propenal
5D	54	acetone
6	55	2-methylpentane
7	56	vinyl acetate
7A	57	3-methylpentane (tent)
8	58	hexafluorobenzene (es)
8A	59	_n_-hexane
9	60	chloroform
10	63	perfluorotoluene (es)
10A	63	methylcyclopentane
11	65	1,1,1-trichloroethane
11A	66	1,2-dichloroethane
12	67	benzene
12A	68	carbon tetrachloride
12B	70	C_7H_{16} isomer
12C	71	C_7H_{16} isomer
13	74	1,2-dichloropropane
14	76	_n_-heptane
14A	78	C_8H_{18} isomer (tent)
14B	79	2-pentanone (tent)
14C	80	propionic acid (tent)
15	81	methylcyclohexane
15A	83	C_8H_{18} isomer (tent)
16	88	toluene
16A	90	C_8H_{18} isomer
16B	91	$C_6H_{12}O$ isomer
16C	92	C_8H_{16} isomer
16D	94	$C_6H_{12}O$ isomer
17	96	_n_-octane
18	98	tetrachloroethylene
19	105	chlorobenzene
19A	108	ethylbenzene
20	109	xylene isomer
21	110	phenylacetylene
22	114	styrene _or_ C_8H_8 isomer
22A	115	_o_-xylene
23	117	_n_-nonane
24	120	$C_{10}H_{22}$ isomer (tent)
24A	121	$C_{10}H_{22}$ isomer (tent)
24B	122	C_9H_{18} isomer
24C	127	C_3-alkyl benzene isomer
25	129	$C_{10}H_{22}$ isomer
25A	133	C_3-alkyl benzene isomer
25B	134	benzaldehyde
26	135	$C_{10}H_{22}$ isomer
	137	$C_{10}H_{20}$ isomer
27	140	saturated hydrocarbon
28	143	indene _or_ methylphenylacetylene
29	145	phenol + $C_{11}H_{24}$ isomer
	150	acetophenone
30	152	_n_-undecane
	157	cresol isomer
	159	cresol isomer
31	161	C_2-alkyl phenol isomer + unsaturated hydrocarbon
32	166	naphthalene
33	168	_n_-dodecane
34	171	unsaturated hydrocarbon
36	183	_n_-tridecane
	183	β-methylnaphthalene
	185	α-methylnaphthalene (tent)
37	186	$C_6H_{14}O$ alcohol (tent)
40	197	_n_-tetradecane
41	204	biphenylene
	205	sat. hydrocarbon (tent)
42	210	_n_-pentadecane
45A	223	_n_-hexadecane
46	223	$C_{15}H_{30}O$ isomer (tent)
47	235	_n_-heptadecane
48	240	_n_-octadecane

[a]See Table 17 for sampling protocol.

Table A46. VOLATILE ORGANIC VAPORS IN AMBIENT AIR FROM GEISMAR, LA[a]

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
1	41	CO_2
2	42	propane
2A	44	butene + n-butane
2B	48	isopentane (tent)
2C	49	n-pentane
2D	50	acetaldehyde
3A	52	dichloromethane
3B	54	propanal
3C	55	propenal
3D	56	2-methylpentane
3E	58	dimethyl ether
3F	59	acetone
4	60	3-methylpentane (tent)
5	62	hexafluorobenzene (es)
5A	63	n-hexane
5B	64	$C_4H_{10}O$ isomer (tent)
6	64	chloroform
7	67	perfluorotoluene (es)
7A	70	C_7H_{16} isomer (tent)
7B	71	1,2-dichloroethane (tent)
8	71	benzene
8A	72	carbon tetrachloride
8B	72	cyclohexane (tent)
9	73	2-methylhexane
9A	75	3-methylhexane
10	76	1,2-dichloropropane
11	79	n-heptane
11A	84	methylcyclohexane
11B	85	C_8H_{18} isomer
11C	89	C_8H_{18} isomer
11D	90	aldehyde (tent)
12	91	toluene
13	94	C_8H_{18} isomer
13A	95	C_8H_{18} isomer
13B	96	C_8H_{16} isomer (tent)
14	99	n-octane
14A	104	$C_6H_{12}O$ ketone + C_9H_{20} isomers
15	106	chlorobenzene
15A	109	ethylbenzene
16	111	xylene isomer
17	112	C_9H_{20} isomer (tent)
18	115	o-xylene
18A	116	C_9H_{18} isomer
19	117	n-nonane
20	121	$C_{10}H_{22}$ isomer (tent)
21	124	$C_{10}H_{22}$ isomer
21A	126	C_9H_{18} isomer (tent)
22	128	n-propylbenzene
23	129	ethyltoluene
24	130	1,3,5-trimethylbenzene + $C_{11}H_{24}$ isomer
25	132	benzaldehyde
25A	132	o-ethyltoluene
26	133	1,2,4-trimethylbenzene
27	135	n-decane
28	136	m or p-dichlorobenzene
28A	137	phenol
29	138	1,2,3-trimethylbenzene
30	140	o-dichlorobenzene
31	142	$C_{11}H_{24}$ isomer
31A	143	C_4-alkyl benzene
31B	144	C_4-alkyl benzene
32	146	unsat. hydrocarbon (tent)
33	148	acetophenone
34	149	nitrobenzene
35	152	n-undecane
36	154	C_4-alkyl benzene + $C_{11}H_{22}$ isomers
36A	155	$C_{12}H_{26}$ isomer
36B	156	cresol (tent)
37	158	C_5-alkyl benzene isomer
38	161	C_5-alkyl benzene isomer
39	163	C_2-alkyl phenol + hydrocarbon isomers
40	166	naphthalene
41	167	n-dodecane
42	170	$C_{13}H_{28}$ isomer (tent)
42A	171	$C_{12}H_{24}$ isomer
43	177	benzothiazole (tent)
44	178	$C_{13}H_{28}$ isomer
44A	181	$C_{13}H_{26}$ isomer
45	182	n-tridecane
45A	183	β-methylnaphthalene
46	185	α-methylnaphthalene + $C_{13}H_{26}$ isomer
47A	190	$C_{14}H_{30}$ isomer
50	193	$C_{14}H_{30}$ isomer
50A	195	$C_{14}H_{28}$ isomer
51	196	n-tetradecane
52	198	C_2-alkyl naphthalene isomer
52A	200	dimethylnaphthalene isomer
53	201	dinitrobenzene isomer

(continued)

Table A46 (cont'd)

Chromato-graphic Peak No.	Elution Temp. (°C)	Compound
54	203	C_8-alkyl cyclohexane or $C_{14}H_{28}$ isomer
55	204	$C_{15}H_{32}$ isomer
56	205	$C_{15}H_{30}$ isomer
57	208	n-pentadecane
57A	210	C_3-alkyl naphthalene isomer
58	212	2,4-dinitrotoluene
58A	214	$C_{16}H_{34}$ isomer (tent)
59	216	$C_{15}H_{30}$ isomer
59A	217	$C_{16}H_{34}$ isomer
60	218	diethyl phthalate (BKG)
62	221	n-hexadecane
62A	223	diphenylamine (tent)
63	227	$C_{17}H_{36}$ isomer
64	230	$C_{16}H_{32}$ isomer
65	232	$C_{17}H_{34}$ isomer (tent)
66	233	n-heptadecane
67	234	$C_{19}H_{40}$ isomer
68	239	$C_{18}H_{36}$ isomer
69	240	n-octadecane
70	240	sat. hydrocarbon

[a]Sample taken downwind of Rubicon Chemicals, Inc.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-78-062		

4. TITLE AND SUBTITLE	5. REPORT DATE / 6. PERFORMING ORGANIZATION CODE
MEASUREMENT OF CARCINOGENIC VAPORS IN AMBIENT ATMOSPHERES Final Report	5. April 1978 6.
7. AUTHOR(S) Edo D. Pellizzari	**8. PERFORMING ORGANIZATION REPORT NO.**
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Triangle Institute Research Triangle Park North Carolina 27711	**10. PROGRAM ELEMENT NO.** 1NE 625 EB-07 (FY-77) **11. CONTRACT/GRANT NO.** 68-02-1228
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Sciences Research Laboratory-RTP, NC Office of Research and Development U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	**13. TYPE OF REPORT AND PERIOD COVERED** Final **14. SPONSORING AGENCY CODE** EPA/600/09

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Analytical methods and instrumentation were evaluated for collecting and analyzing carcinogenic and mutagenic vapors occurring in ambient air. The areas of investigation included (a) the evaluation of Tenax GC sorbent for in situ reactions that may occur during the collection of organic vapors from ambient air; (b) the development and evaluation of a permeation system for delivering precise quantities of organic vapors for calibrating instruments; and (c) the characterization and quantification of hazardous organic vapors in ambient air collected at several different geographical areas within the Continental U.S.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*Air pollution *Collection methods *Carcinogens *Vapors *Sorption *Field tests		13B 06E 07D 14B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
RELEASE TO PUBLIC	UNCLASSIFIED	238
	20. SECURITY CLASS *(This page)*	**22. PRICE**
	UNCLASSIFIED	

EPA Form 2220-1 (9-73)