O. H. Materials Co.

Oil and Hazardous Material Spill Containment and Clean-Up

Survey of Chemical Contamination in Love Canal Storm Sewers

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FOR

U.S.E.P.A. REGION II

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CONFIDENTIAL

SURVEY OF CHEMICAL CONTAMINATION IN LOVE CANAL STORM SEWERS

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Survey of Chemical Contamination in Love Canal Storm Sewers Prior to Decontamination

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SECTION I

Executive Summary

I. Introduction

This report contains the results of an analytical survey performed between March 25 and May 30, 1980. The survey dealt with storm sewers flowing from the Love Canal area northward into Black Creek, and was undertaken as an emergency action for the U.S. EPA, Region II.

A. Purpose

The ultimate goal of the project was to minimize the flow of contaminants from the storm sewers into Black Creek. This survey was a necessary prerequisite to a storm sewer decontamination effort. The immediate purpose of the study was to determine the extent and distribution of Love Canal chemical contamination in those storm sewers.

A second purpose of the study was to assess the chemical contamination of the air inside the storm sewers. This part of the study would provide data to be used in planning the decontamination efforts so as to minimize the risk to the health and safety of workers and area residents.

B. Scope

The work performed during this survey included the sampling of storm sewer sediments and storm sewer air from manhole structures within the area of consideration and from control manhole structures well outside the area of known contamination. The analyses included quantitative analysis of samples and qualitative analysis of duplicate samples from selected key sites.

Samples of Black Creek sediment were also taken and analyzed to correlate the presence of contaminants in the stream to the body of data from the storm sewer survey.

The scope of this work was limited geographically as defined above, limited in purpose as defined in I-A, and limited economically both by the purpose of the study and by the emergency nature of the available funding. It was not intended, nor is it here presented, as an exhaustive study of the lateral migration of Love Canal chemical contamination.

II. Sampling

Sampling was performed in strict adherence to a pre-determined protocol, as further detailed in this report, in order to fulfill the intended purposes of the study.

A. Sampling Media

Two media were selected to be sampled; air and sediment. Air was chosen because of the need to evaluate the workspace environment during the cleaning and decontamination of the storm sewers, and to estimate the potential for contaminant release into the outside air. Sediment was chosen because it presented the greater probability for long term retention of contaminants within the storm sewers. Water was not chosen because flow could not be observed in the system, and because when rain water was present it only provided a medium for transporting contaminants, without being completely indicative of the actual level of storm sewer residual contamination.

B. Sampling Locations

Forty-six (46) sampling locations were selected for this survey, including 28 manholes, 13 catch basins, and 5 locations in Black Creek.

The manholes that were sampled were chosen because of their functional position in the storm sewer system, because of a history of prior contamination, or because of the presence of adequate sediment on the main line of flow. Control locations were selected north of Cayuga Drive, outside the area of known contamination. The catchbasins selected were those in near proximity to the Love Canal, and thus the most likely to have been contaminated by past surface runoff from that site.

The Black Creek locations were selected to provide up-stream, midstream, and downstream data with respect to the storm sewer outfalls.

C. Sampling Methodology

1. Air Sampling

Three portable meters were used to measure the general quality of the air, about 2-3 meters (6-10 ft.) downwind of each manhole location and within each manhole structure.

C. Sampling Methodology (cont'd)

Percent oxygen, the presence of explosive gases and the relative amount of organic vapors were measured in the air at street level, 0.3 meters below the closed manhole cover and, after the lid had been removed, 1.3 meters below street level.

Discrete air samples from the same manholes were collected for laboratory quantitative analysis by pumping 25 liters of air through cartridges containing adsorbent Porapak N. Each set of cartridges was positioned 1.3 meters into the open manhole.

In an attempt to simulate future decontamination procedures, the sediment in 5 manhole structures was manually stirred with an aluminum pole to learn if volatile organic compounds were released into the airspace. Immediately after the stirring operation, a second set of air samples were collected on Porapak N cartridges.

2. Sediment Sampling

All samples were taken with separate scoops that had been specially fabricated, cleaned and rinsed with hexane solvent. At each catch basin and manhole that was sampled, scoops of sediment were collected from several locations within the structure and composited into a 6 ounce sample jar.

Samples of Black Creek sediment are also composites of grab samples. At each of the five sample locations sediment was taken from across the width of the creekbed.

III. Results

A. Air Samples

Readings from the hand held meters were not remarkable (Table 1). No explosive gas mixtures were detected at any location. The oxygen content of the air ranged from 14.0 (in a control manhole) to 20.0 percent. Hydrocarbon concentration ranged from not detected, in 39% of the readings, to 13.6 ppm (also in a control manhole).

Concentrations of volatile indicator compounds in manhole airspaces are relatively low (Table 2). Only 35% of the samples were above levels of reportability.

Table 1. Meter Readings Adjacent to and within Selected Storm Sewer Manhole Structures

Manhole Number		PID Responses Ambient	1'	4'	One foot under Manhole Cover O_2%	Combust. Gases
96-5		0.2	1.8	ND	17.5	ND[4]
96-6		ND	0.2	ND	19.5	ND
96-7 (K)[1]		0.2	2.5	0.8	20.0	ND
96-11(K)		0.5	0.5	0.6	18.0	ND
97-1		0.2	1.5	1.0	18.5	ND
97-4 (K)	4/23	ND	1.0	1.4	17.0	ND
97-4	5/1	0.4	0.4	0.4	19.0	ND
97-6[2]		ND	ND	0.5	19.5	ND
97-7		0.2	1.2	0.4	19.5	ND
97-11		ND	ND	ND	18.0	ND
98-3		0.3	0.3	0.3	19.0	ND
98-7		0.3	0.3	0.3	19.0	ND
99-2	4/24	0.1	3.8	ND	17.0	ND
99-2(K)	5/1	0.4	0.2	1.0	20.0	ND
99-6		ND	ND	0.2	20.0	ND
99-7	4/24	0.3	2.7	0.5	16.5	ND
99-7(K)	5/1	0.2	0.2	0.2	19.0	ND
100-1		ND	0.2	ND	18.0	ND
100-7		ND	ND	ND	18.0	ND
101-1		ND	ND	1.2	19.0	ND
101-4		0.3	ND	ND	19.0	ND
101-8		ND	ND	ND	17.0	ND
102-3		ND	ND	0.9	19.0	ND
102-8		ND	ND	ND	20.0	ND
CS-1 (K)		0.7	0.5	0.5	18.0	ND
CS-2		0.5	0.2	0.2	18.0	ND
CS-3	4/23	0.2	1.9	0.6	14.0	ND
CS-3(K)		0.2	0.8	0.2	19.0	ND
CS-4		ND	13.6	ND	19.0	ND
CS-5		ND	ND	0.4	19.0	ND
CS-6		ND	ND	ND	20.0	ND

1 k = Key manhole; GC/MS analysis will be performed
2 Moderate chemical odor detected 10' from open manhole
Street had been recently repaved
4 ND - Not Detected

Table 2 Volatile Indicator Compounds in the Airspace in Selected Storm Sewer Manholes Expressed in micrograms per cubic meter

Location	Date Collected	Chloroform	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
Col-3	4-23	<3	<1	<1	<1	<10	<10	<10	<10
96-5	4-23	<3	<1	<1	<1	28.9	<10	<10	<10
96-6 Key[1]	5-1	<3	1.4	<1	1.7	44.8	<10	<10	<10
96-7	4-23	<3	<1	<1	<1	27.3	<10	10.0	<10
96-7	5-1	<3	2.9	2.5	3.9	<10	<10	10.0	<10
96-11	4-25	<3	<1	<1	<1	51.0	<10	16.0	<10
96-11	5-2	<3	1.3	<1	2.2	45.9	<10	15.7	<10
97-1	4-23	<3	<1	<1	1.7	<10	<10	<10	38.6
97-4	4-23	<3	<1	<1	<1	37.2	<10	14.5	48.5(H)[2]
97-4(Dup)	4-23	<3	<1	<1	1.0	35.0	<10	<10	<10
97-4	5-1	<3	1.4	1.4	1.8	76.5 (H)	22.9	19.6	34.7
97-6 Key	5-2	<3	1.0	2.8	3.1	<10	<10	14.3	32.1
97-7	4-23	<3	<1	<1	<1	<10	<10	<10	<10
97-7(Dup)	4-23	<1	<1	<1	<1	<10	<10	<10	<10
97-11	4-25	<3	<1	4.5	1.2	<10	<10	<10	<10
97-11(Dup)	4-25	<3	<1	4.5	1.2	<10	<10	<10	<10
98-3	4-25	<3	<1	<1	1.7	75.8	48.7 (H)	38.4	<10
98-7	4-25	<3	<1	<1	1.2	69.4	<10	<10	<10
99-2 Key	4-24	8.3	1.6	<1	<1	14.2	<10	16.1	13.0
99-2	5-1	<3	1.1	<1	1.8	47.6	<10	22.4	<10
99-6 Key	5-1	33.0	7.6	5.0	2.1	<10	<10	13.9	<10
99-7	4-24	36.9	11.3	3.0	<1	<10	<10	12.5	<10
99-7	5-1	<3	<1	ND	2.2	<10	<10	18.8	<10

Table 2 (cont'd) Volatile Indicator Compounds in the Airspace in Selected Storm Sewer Manholes Expressed in micrograms per cubic meter

Location	Date Collected	Chloro-form	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
100-1	4-24	<3	<1	<1	<1	31.7	<10	13.4	11.2
100-7	4-24	22.1	8.2	1.1	<1	66.2	<10	11.0	37.0
101-1	5-2	37.0	16.0	5.6(H)	18.9(H)	54.7	<10	31.1	<10
101-4	4-25	7.9	23.3	1.5	2.0	28.7	24.4	56.4(H)	<10
101-8	4-24	6.8	<1	<1	<1	<10	<10	<10	<10
101-8(Dup)	4-24	3.9	<1	<1	<1	<10	<10	<10	<10
102-3 Key	4-25	15.4	66.7 (H)	4.2	1.7	<10	<10	<10	<10
102-8	4-24	4.7	1.6	<1	<1	<10	<10	<10	<10
CS-1	4-26	3.0	<1	<1	2.3	62.4	<10	<10	<10
CS-2	4-26	127.2(H)	43.2	3.8	2.4	46.2	<10	47.5	<10
CS-3	4-26	<3.1	16.3	1.2	<1	<10	<10	<10	<10
CS-4	4-26	3.9	<1	<1	<1	17.6	<10	12.3	<10
CS-5 Key	5-2	<3	<1	ND	<1	<10	<10	46.4	<10
CS-6 Key	5-2	<3	<1	ND	1.1	27.9	<10	<10	<10
Number of storm sewer samples above reportability		12/42	19/42	13/42	20/42	22/42	4/42	20/42	7/42

1. Key manhole - GC/MS confirmation to be performed
2. Highest value for indicator compound
3. Duplicate air cartridge

A. Air Samples (cont'd)

Stirring the sediment had no dramatic effect on the release of volatile indicator compounds into the air space except for manhole 97-6, the first manhole south of Colvin Blvd. on 97th Street (Table 3). That was the only location where the samplers could detect a moderate chemical odor at street level after the sediment had been stirred.

B. Sediment Samples

1. Catch Basins

Contamination was detected in every catch basin sampled. In addition to the presence of indicator compounds, polycyclic aromatic hydrocarbons were found. On 97th Street, there is a higher concentration of contaminants in the catch basins on the East side of the street, nearer to the Love Canal landfill site, than on the far side of the street. On 99th Street, there is no such trend (Table 4A).

2. Manholes

All of the sediments from manhole structures, including the controls, contained indicator compounds. The sediment in manhole 97-6, had concentrations of indicator compounds generally 100 times higher than found in the other manhole sediments (Table 4B).

3. Black Creek

Contaminants in the bottom of Black Creek were highest at the 96th Street outfall. The next highest concentrations were downstream half way to Bergholz Creek at sampling location BC-2 (Table 4C).

IV. Discussion

A. Catch Basins

All of the catch basins sampled were contaminated. Almost half of them contained ponded water that had a refractive sheen and sediment that had a slight to moderate chemical odor.

Tal 3 . Eff[illegible] of [illegible]ally [illegible]tir[illegible] th[illegible] [illegible]edim[illegible] in [illegible]hole [illegible]ructures upon any Release of Volatile Indicator Compounds into the Airspace

A. Expressed in micrograms per cubic meter of air ($\mu g/m^3$), or wgt/vol.

Location	Before or After Stirring	Chloro-form	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
96-7	Before	<3	2.9	2.5	3.9	<10	<10	10.0	<10
	After	<3	2.3	1.5	2.4	18.3	<10	<10	<10
97-6	Before	<3	1.0	2.8	3.1	<10	<10	14.3	32.1
	After[1]	<3	1.0	1.2	2.4	178.0	22.9	33.7	181.0
99-2	Before	<3	1.1	<1	1.8	47.6	<10	22.4	<10
	After	<3	1.1	ND[2]	2.1	<10	<10	41.3	<10
99-7	Before	<3	<1	ND	2.2	<10	<10	18.8	<10
	After	<3	1.1	ND	1.4	<10	<10	28.6	<10
CS-5	Before	<3	<1	ND	<1	<10	<10	46.4	<10
	After	<3	1.3	ND	3.3	22.7	<10	<10	<10

B. Expressed in microliters per liter of air ($\mu l/l$), or ppm vol/vol.

Location	Before or After Stirring	Chloro-form	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
96-7	Before	<0.001	0.000	0.000	0.001	<0.003	<0.002	0.002	<0.002
	After	<0.001	0.000	0.000	0.000	0.001	<0.002	<0.002	<0.002
97-6	Before	<0.001	0.000	0.001	0.000	<0.003	<0.002	0.003	0.006
	After[1]	<0.001	0.000	0.000	0.000	0.051	0.006	0.007	0.032
99-2	Before	<0.001	0.000	0.000	0.000	0.014	<0.002	0.005	<0.002
	After	<0.001	0.000	ND	0.000	<0.003	<0.002	0.008	<0.002
99-7	Before	<0.001	0.000	ND	0.000	<0.003	<0.002	0.004	<0.002
	After	<0.001	0.000	ND	0.000	<0.003	<0.002	0.006	<0.002
CS-5	Before	<0.001	0.000	ND	0.000	<0.003	<0.002	0.009	<0.002
	After	<0.001	0.000	ND	0.000	0.007	<0.002	<0.002	<0.002

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[1] After stirring the sediment in this manhole, moderate chemical odor was detected 10' downwind of this location.

[2] ND - Not Detected, as distinct from below levels of reportability. For example, <1 means that an amount below 1 was identified, whereas ND means that none was detected.

Table 4 INDICATOR COMPOUNDS IDENTIFIED IN SEDIMENTS
Expressed in micrograms per gram dry weight[1]
ppm (W/W)[1]
A. Catchbasins

Location	Sample Desc.	Benzene Hexachloride (BHC) α	β	γ	Δ	Trichlorophenol (TCP 2,4,6	2,4,5	Dichlorobenzene 1,4	1,3	1,2
CB READ-3 W	Mud	0.14	0.22	0.11	0.88(H)[2]	ND	<0.01	0.03	0.05	0.04
CB 97-3 NW	Mud	0.05	0.05	0.01	0.02	ND	<0.01	0.1	0.02	<0.01
CB 97-3 SE*	Mud	1.14	1.20(H)	0.49(H)	0.68	ND	ND	0.07	0.03	<0.01
CB 97-4 W	Mud	0.17	0.11	0.02	ND	ND	ND	0.14	0.17	0.02
CB 97-4 E*	Mud	0.91	0.25	0.15	0.18	ND	ND	0.20	0.02	ND
CB 97-5 W	Mud	0.27	0.15	0.05	0.11	ND	ND	0.09	0.01	0.03
CB 97-5 E*	Mud,Leaves	0.75	0.25	0.19	0.31	ND	ND	0.20	0.03	0.02
CB 99-2 E	Mud,Leaves	0.70	0.26	0.11	0.43	ND	ND	0.26(H)	0.16	0.03
CB 99-2 W*	Mud	0.36	0.25	0.08	0.21	ND	0.012	0.22	0.06	0.01
CB 99-3 SE	Mud	0.02	0.03	<0.01	0.04	ND	<0.01	0.09	0.02	ND
CB 99-3 NW*	Mud	0.02	0.01	<0.01	ND	ND	ND	0.13	0.03	ND
CB 99-4 E	Mud	1.15(H)	0.27	0.07	0.11	ND	<0.01	0.11	0.29(H)	0.01
CB 99-4 W*	Gravel	0.10	0.15	0.05	0.05	<0.01	ND	0.02	0.02	ND

[1] Not corrected for percent recoveries
[2] Highest value for indicator compound
[3] side closer to the landfill site

Table 4

INDICATOR COMPOUNDS IDENTIFIED IN SEDIMENTS
Expressed in micrograms per gram dry weight
ppm (W/W)

B. Manhole Structures

Location	Sample Desc.	Benzene Hexachloride (BHC)				Trichlorophenol (TCP)		Dichlorobenzene		
		α	β	γ	Δ	2,4,6	2,4,5	1,4	1,3	1,2
Col - 3	Mud	ND	0.04	ND	0.02	0.02	ND	0.22	0.02	<0.01
96-6 (Key)	Mud	0.26	0.11	0.19	0.18	0.03	0.02	1.06	0.23	0.05
97-1	Gravel	ND	0.29	0.40	ND	0.01	0.02	0.79	0.03	0.06
97-6 (Key)	Mud	12.2	13.3	10.8	3.12	ND	ND	24.7	5.02	11.0
99-2 (Key)	Mud	0.06	0.13	0.05	0.05	ND	ND	0.50	0.06	ND
99-6 (Key)	Mud	ND	ND	ND	ND	0.01	ND	0.61	0.41	0.09
100-7	Mud	0.02	0.05	0.02	0.01	ND	ND	0.02	0.01	ND
102-3 (Key)	Stoney	0.06	1.08	ND	ND	ND	ND	0.41	0.61	ND
CS-5	Gravel-Mud	0.39	ND	0.20	0.04	ND	ND	0.06	0.05	ND
CS-6	Gravel-Mud	ND	0.01	0.01	ND	ND	ND	0.02	0.08	ND

Table 4 INDICATOR COMPOUNDS INDENTIFIED IN SEDIMENTS
Expressed in micrograms per gram dry weight
ppm (W/W)

C. Black Creek Stream Bed [1]

Location	Benzene Hexachloride (BHC)				Trichlorophenol (TCP)		Dichlorobenzene		
	α	β	γ	Δ	2,4,6	2,4,5	1,4	1,3	1,2
BC-1 at confluence with Bergholtz Creek	ND	0.05	ND	0.05	ND	0.21	0.67	0.62	0.18
BC-2 midway between BC-1 and 96th St outfall	1.61	0.61	0.79	0.53	ND	0.09	3.85	1.36	0.11
BC-3 1'downstream of the 96th St. outfall	11.9	2.30	6.81	2.28	ND	0.06	9.09	3.14	0.50
BC-4 at 98th St. stream bed, 1' downstream of twin 48" culverts	ND	0.14	0.06	0.03	ND	0.01	0.25	1.03	ND
BC-5 40 ft. upstream from intake structure at 102nd St.	ND	ND	ND	ND	ND	ND	ND	2.06	ND

1. Each sample was a composite of grab samples taken at five locations across the creek.

V. Discussion (cont'd)

B. Manholes

The highest air reading for hydrocarbons was 0.3 meters beneath the unopened lid of one of the control manholes, located on 98th Street approximately 900 ft North of Cayuga Drive. The street at that location had been repaved and the samplers had to use a pick to remove the tar around the rim of the manhole cover. After the lid was removed, air was allowed to circulate and the resultant hydrocarbon reading was not detectable. Concentrations of at least some volatile indicator compounds were found in most of the manhole air spaces and in all the controls.

Reportable compounds in the airspace were found at all but 2 locations (Table 2). These two locations were on Colvin Boulevard; one was East of 96th Street (Col-3) and the other at the intersection of 97th Street (97-7). At the latter location, it was found that there was insufficient sediment for sampling. The sediment had accumulated upstream on 97th Street in manhole 97-6. The highest amounts of contaminants in sediment were found at manhole 97-6, because of the effect of a trap, or dip in the sewer line.

The highest concentration of a volatile indicator was 0.051 ppm benzene at 97-6, after the sediment had been stirred. This concentration of benzene is 0.5% of the 10 ppm threshold limit value time-weighted average (TLV-TWA) concentration for a normal 8-hour workday as accepted by the Occupational Safety and Health Administration (OSHA). This comparison is presented only to provide reference to the currently acceptable level for workers, and not to imply that 0.051 ppm benzene within the storm sewer airspace would, or would not, pose a health risk to area residents.

Although the sediment at 97-6 contained the highest values for 7 of the indicator compounds, trichlorophenol (TCP) isomers were not detected. Also, trace contamination of polychlorinated biphenyls was found only at this location. These observations demonstrate the variability that can be found in any particular manhole.

B. Manholes (cont'd)

The presence of relatively high values of benzene, toluene, and chlorobenzene at 98-3, south of Black Creek on 98th Street may be due to the fact that the stream had been re-routed from its natural position before the underground conduits were installed. The manhole structure may have been positioned over the former creekbed or contaminated fill from the Love Canal may have been used to backfill the structure in place. It is also possible that contamination may have been transported when water from Black Creek backed up into the structure.

V. Conclusions

1. Though reports from residents indicate an apparent decline in visible Black Creek contamination, and a reduction or disappearance of odors from the creek, this survey presents no scientific basis for such a conclusion. Prior surveys did not establish a base-line for such a comparison. Sediment sample indicator compound levels yielded by this survey cannot be compared to any known prior test program results. Only one known previous sample (no. 2096, by NYS DEC, from 11/79) has common points with one sample from this survey (BC-3). The previous sample showed fifty times more 2,4,5 TCP, about 3½ times more 1,4 Di-chlorobenzene, and nearly four times more 1,3 Di-chlorobenzene. One sample is not a reliable basis for comparison.

2. Data resulting from air sample analyses reported herein cannot be compared with prior storm sewer survey data because no prior comparable air data is available. Prior sampling was of liquids, for total organic halides (TOX).

3. Sediment sample analyses correlate well with air sample analyses, in that locations yielding high air contaminant levels generally yielded high sediment contaminant concentrations.

4. Air sample analyses yielded a very low order concentration, with the highest value being only 0.5% of the TLV-TWA.

5. Though stirring sediments in the manholes did not yield dramatic volumetric vapor releases, stirring does not fully simulate a cleaning operation. Cleaning as planned would involve the use of hot water and pressure spray, and still presents the possibility of localized readings in excess of the accepted thresholds.

V. Conclusions (cont'd)

6. Leachate migration from the Love Canal into the storm sewers has reached all but 2 of the locations sampled. The full extent of this migration is not determinable within the cost constraints of this study.

VI. Recommendations

1. The risk to workers from short term exposure during cleaning operations appears low. Should area residents sensitized to airborne Love Canal contaminants continue in residence at the time of decontamination a full air scrubbing and vapor containment system must be recommended.

2. Construction of the proposed expanded leachate collection system is recommended in order to prevent the contaminants found from flowing to Black Creek.

3. High levels of contaminants found at Control manhole CS-2 suggest another source of chemicals. The source of this contamination should be determined.

4. Decontamination efforts are recommended in the following order of priority: first, the storm sewer system flowing to the 96th Street outfall, second, the system flowing to the 102nd Street outfall, and third, the short system running North along 98th Street.

5. Alternatives outside the scope of this study, and outside the scope of emergency action have come to our attention as a result of the work done.

   a. Some method of evaluating the effectiveness of contamination mitigation is needed. The existing sumps in Ring 1 homes are acceptable and convenient sampling locations. The basements and sumps should be pumped into the expanded leachate collection system, and a program of regular periodic sump liquid sampling instituted in order to evaluate any resulting reduction in ground water contamination.

   b. Conventional systems for dealing with contaminants present in the bottom sediments in Black Creek may be inadequate to meet current need. A search for state-of-the-art technology suited to this problem is recommended.

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Survey of Chemical Contamination in Love Canal Storm Sewers Prior to Decontamination

Prepared For
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1.0 INTRODUCTION

This document is the final report on the analytical work performed by Advanced Environmental Systems, Inc., under subcontract to O.H. Materials Co., for a survey to determine the extent of chemical contamination within the storm sewer system in the northern sector of the Love Canal area. This preliminary study was a survey only, and utilized the indicator compound concept. These compounds were chosen as being typical of the materials disposed in the Canal and were chosen to be compatible with previous analytical work performed in the area by agencies of the state of New York.

Sampling and analytical methodology has been detailed in the project statement submitted April 23, 1980.

Air monitoring, air sampling and sediment sampling were included in this study. These results are detailed in this report.

This report combines and updates previous information to provide an overview of the extent of chemical contamination within the subject storm sewer system.

2.0 SAMPLING METHODOLOGY

Details of the sampling and monitoring protocols were included in proposals submitted April 3, 9, and 22, 1980.

Sampling and monitoring was performed according to the following schedule:

Catchbasins	-	March 25, 1980
Black Creek	-	April 11, 1980
Manhole Structures	-	April 23, 25, 26; May 1-2, 1980

2.1 Catchbasin Sampling

A plastic sheet was placed on the street next to the grate on the catchbasin to be sampled. The grate was pulled onto the plastic sheet. The sampler worked in a prone position on a plastic drop-cloth. A hexane rinsed garden hand shovel was used to obtain scrapings from the bottom of the catchbasin structures. The sample from each location was placed in two separate 16 ounce sample bottles with teflon liners inserted under the caps. The hand shovel, drop cloths, and sample gloves were discarded into a 17H 55 gallon drum after the sampling at each site was completed.

2.2 Black Creek Sampling

Sediment sampling procedures complied with the guidelines described in the draft copy of "Recommended Sediment and Sludge Sample Collection Procedures for Priority Pollutant Analysis," which were provided by U.S. Environmental Protection Agency, Region II.

A 1¼ inch diameter Lucite tube was tested as a core sampler device. After a few attempts, the device was replaced with a hexane rinsed hand shovel. The creek bottom was comprised of 1-2 inches of sediment on top of soft clay.

At each sampling location, sediment was collected at five points across the channel. The sample was composited on site by adding five approximately equal aliquots to the 16 ounce jar and filling the jar to the brim with stream water.

The sampling was performed slowly to minimize the release of any adsorbed volatile components.

The length of the stream that was sampled includes two sites immediately downstream from outfall pipes at 96th Street and approximately 50 feet west of 98th Street.

Sampling began at the farthest point downstream, BC-1 at the confluence with Bergholz Creek, and proceeded upstream to BC-5 which was 40 feet upstream of the inlet pipe at 102nd Street.

Hand shovels, boots and gloves were disposed in the 17H 55 gallon drum.

2.0 SAMPLING METHODOLOGY (cont'd)

2.3 Manhole Structure Monitoring and Sampling

Procedures were detailed in a memorandum from O.H. Materials Co., dated April 16, 1980, (Appendix A). All tasks were performed at street level, i.e., samplers did not go down into the manhole structures.

Two pairs of samplers coordinated the tasks; while one team finished the air sampling and prepared for collection of sediment, the other team proceeded to the next site. At the next site, they monitored the air quality parameters in the ambient air 6-8 feet downwind from the manhole, and one foot below the in situ manhole cover.

Except for two occasions when the samplers waited approximately 15 minutes for the guard to unlock the gates to the Love Canal site, the average sampling was less than three minutes behind schedules that had been distributed to the residents (Appendix B).

2.3.1 Air Monitoring

The following instruments were utilized to monitor air quality parameters:

Photoionization Detector - HNU model PI 101, HNU Systems, Inc., Newton Upper Falls, Massachusetts 02164

Oxygen Indicator - MSA Type E, Mine Safety Appliances Co., Pittsburgh, Pennsylvania 15208

Combustible Gas Indicator - MSA model 2A Explosimeter

Upon arrival at the site, traffic cones were positioned and general weather conditions were recorded while two samplers adjusted the zero settings and calibrated the instruments.

2.3.1.1. Ambient Measurement

The atmosphere approximately three feet above street level and 6-8 feet downwind of the manhole was measured for response on the Photoionization detector.

2.3.1.2 Readings one foot Under the Manhole Covers

The airspace approximately one foot below the manhole cover was measured for PID response, percent oxygen and combustible gases. Each instrument was equipped with a non ferrous probe that was inserted through the ventilation holes in each manhole cover.

2.0 SAMPLING METHODOLOGY (cont'd)

2.3.1.3 Readings Four Feet into the Opened Manhole Structure

After the readings at one foot below the manhole cover were recorded, each manhole cover was removed and placed on a protective plastic film. A four foot long extension of ¼ inch hexane rinsed copper tubing was attached to the PID probe. PID response was measured in each airspace, regardless of the amount of sediment in the bottom of the structure.

2.3.2 Air Sampling

Discrete air samples were collected according to the procedure developed by Dr. R. Narang, N.Y. State Department of Health, (Appendix C). The volumes of air pumped through duplicate Porapak-N cartridges were individually calibrated.

Nineteen air samples were collected from manhole sites adjacent to the Love Canal, and six sites north of Cayuga Creek.

In those manholes that contained adequate amounts of sediment for sampling, air samples were collected before and after disturbing, or stirring, the sediment. The settled material was stirred with an eight foot long aluminum pole. The pole was vigorously moved back and forth ten times, in approximately three foot long strokes, in the direction of the main storm sewer line connections. Within 30 seconds, a second discrete air sample was collected on Porapak-N for laboratory analysis of indicator compounds.

2.3.3 Sediment Sampling

Sampling procedures followed the April 16, 1980 O.H. Materials memorandum. The sample collector device (that was undetermined on April 16) was constructed of a tubular strainer fastened to an aluminum pole.

Two clamps attached on an eight inch length of 1½ inch copper piping to a swivel joint at the end of an aluminum pole. The bottom of the copper cylinder was fitted with aluminum screening that allowed the water to drain out of the sediment sample. The entire collector was thoroughly washed and rinsed with pesticide grade hexane. The collector was discarded into a 17H 55 gallon drum after each manhole was sampled, and the rinsed aluminum pole was fitted with a new collector tube.

It usually required 5-10 scrapings to fill one 16 ounce sample bottle.

All air and sediment samples were labeled, packed in an ice chest, secured with a lock and transported to the laboratory twice daily. Delivery time from the site to the laboratory was less than 10 minutes. The samples were promptly unpacked, inspected and given internal laboratory designations.

3.0 ANALYTICAL METHODOLOGY

3.1 Air Samples

3.1.1 Air Sample Preparation

In summary, Porapak-N cartridges were eluted with 1.5 ml pesticide grade methanol. Elution was allowed to proceed by gravity until complete. The last drops were expelled by attaching a latex bulb at the top of the cartridge and expelling the eluant. The volume of eluant was recorded and the eluate was transferred to 1 ml vials and sealed. The extract was injected into a gas chromatograph for analysis of indicator compounds.

3.1.2 Air Sample Gas Chromatography

Chromatography was performed with two detector systems, electron capture and photoionization.

The conditions for the electron capture system were:

Column - 1% Sp1000 on Carbopack B (60/80 mesh), glass

Carrier Gas - N_2

Oven - 125^{o} Isothermal

Detector - $300^{o}C$

The conditions for the photoionization system were:

Column - 3% OV-1 on supelcoport 80/100 mesh

Carrier Gas - Helium

Oven - $75^{o}C$

Detector - PID, 10.2eV lamp

3.2 Sediment Samples

3.2.1 Sediment Sample Drying and Extraction

Sediment samples were dried overnight at room temperature in a laboratory hood. Three fractions of sediment were separated for the following treatments:

3.2.1.1 Oven Dried

A 10 gram portion was weighed to the nearest hundreth gram, then dried overnight at $104^{o}C$. After reweighing, the percent dry weight was determined.

3.0 ANALYTICAL METHODOLOGY (cont'd)

3.2.1.2 Acid Extraction

A 30 gram portion of sediment was acidified to pH 2 with 6N HCl and soxhlet extracted with 1:1 hexane-acetone for 16 hours.

3.2.1.3 Base/Neutral Extraction

A 30 gram portion of sediment was mixed with just enough 6N NaOH to raise the pH to 11. The sediment was soxhlet extracted with 1:1 hexane-acetone for 16 hours.

3.2.2 Extract Concentration

The extracts were concentrated to 10 ml on a Kuderna-Danish (K-D) Evaporative Concentrator. The concentrated fraction was eluted through 21 grams of florisil packed in a 19 mm x 300 mm Chromaflex column with 15% ethyl ether in hexane. The eluant was concentrated to 10 ml, treated with redistilled mercury to precipitate sulfur, and injected into the gas chromatograph for electron capture detection.

3.2.3 Clean-up Procedure for TCP Extracts

The acidified fraction was concentrated to 10 ml on a K-D Concentrator. In order to reduce interferences, the trichlorophenol extracts were cleaned up using florisil column chromatography. The concentrated extract was eluted through 21 grams of florisil packed in a 19 mm x 300 mm chromaflex column with 200 ml of 15% benzene in methanol. The eluate was concentrated to 10.0 ml, treated with redistilled mercury to precipitate sulfur, then subjected to gas chromatography analysis.

3.2.4 Gas Chromatography

Conditions for the electron capture system were:

Column - 3% OV17 plus 3% OV-225, 6', glass

Carrier Gas - 5%

Oven - 200°C

Detector - EC, 275°C

3.2.5 GC/MS Sample Preparation

One ml aliquots of the acid extractable and base/neutral concentrates prepared according to the methods described in sections 3.2.2 and 3.2.3 were transferred to O.H. Materials laboratory in Cincinnati, Ohio for GC/MS analysis.

3.0 ANALYTICAL METHODOLOGY (cont'd)

3.2.5 GC/MS Sample Preparation (cont'd)

Aliquots were contained in 2 ml serum vials and sealed with teflon lined, aluminum seals. The vials were packaged in an ice filled, styrofoam chest. The chest was locked and transferred to O.H. Materials Co. personnel. Chain of custody procedures were maintained at all times. Transfer of samples occured on the following dates: catchbasin sediments extracts on 4-11-80; manhole sediment extracts on 5-2-80.

3.2.6 TCDD Analysis

Sediment samples for dioxin testing were collected from:

Black Creek	-	1 composited sample
Key Manholes	-	5 locations; 96-6, 97-6, 99-2, 99-6, and 102-3
Control Manholes	-	2 locations; CS-5 and CS-6

These eight sediment samples remain locked in a refrigerator at AES awaiting shipment to a laboratory as designated by EPA, Region II.

4.0 ANALYTICAL RESULTS

4.1 Portable Meter Readings

The portable meter readings (Table 1) taken on-site are generally unremarkable. The highest PID readings for ambient (6-10 feet from closed manhole) and at one foot below the manhole cover were in the controls; CS-1 - 0.7 ppm calibrated against benzene, and CS-4 - 13.6 ppm. The lowest oxygen reading was at control manhole CS-3 at 14.0%. All explosimeter readings were negative.

4.2 Discrete Air Samples

The concentrations of indicator compounds are low as compared to TLV standards.

4.2.1 Effect of Disturbing the Sediment

In general, Ring I values (97th and 99th Streets) are not remarkably higher than other geographical areas (Figure 1).

The discrete air sample data (Table 2) indicates that in four of five manholes the manual stirring of the sediment had little effect on releasing the indicator compounds. In those four manhole structures, with the exception of benzene, the other seven indicator compounds were of the same order of magnitude before and after stirring (AS). At two sites, (96-7 and CS-5), benzene was higher after stirring, whereas at 99-2, it was higher before stirring.

The notable exception is 97-6, where the stirring caused a dramatic release of benzene and chlorotoluene.

4.2.2 Trends in Higher Values

Manhole 97-6 has the highest benzene value (178 $\mu g/m^3$) and the highest chlorotoluene value (181 $\mu g/m^3$). The next manhole to the north, 97-7, has no reportable indicator compounds.

The manhole on 98th Street, just south of Black Creek (98-3) has the highest value for toluene - 48.7 $\mu g/m^3$ and relatively high values for benzene and chlorobenzene.

Manhole 100-7 contained six of eight indicator compounds. Manholes 101-1 and 101-4 have a similar spectrum of indicator compounds. Note that 101-1 has the highest values for trichloroethylene and tetrachloroethylene, and that 101-4 has the highest value for chlorobenzene.

Site number 102-3 has the highest value for carbon tetrachloride - 66.7 $\mu g/m^3$.

All control manholes have reportable levels of some indicator compounds.

Control manhole number CS-2 has higher values than most of the sites closer to the landfill site. These results may necessitate the need for using other control areas.

4.0 ANALYTICAL RESULTS (cont'd)

4.3 Sediment Samples

4.3.1 Catchbasins

Although the concentrations are low, the sediment in catchbasins on the east side of 97th Street (nearest the landfill site) have higher concentrations than the sediments on the west side of the street (Table 3A).

On the 99th Street side, however, that is not the case.

4.3.2 Manhole Structures

Manhole site number 97-6 has more than ten times higher concentrations of indicator compounds than any other site tested (Table 3B). This compares with the air data listed in Table 2 in which 97-6 had the highest concentrations of two of the volatile indicator compounds; benzene and chlorotoluene.

Locations 96-6 and 102-3 have higher values than most of the other sites tested.

4.3.3 Black Creek

The highest concentrations of indicator compounds were at BC-3, except for the 2,4,5 isomer of TCP (Table 3C).

The 1,3 dichlorobenzene isomer was detected in BC-5 at 2.06 ppm.

4.0 ANALYTICAL RESULTS (cont'd)

4.3 Sediment Samples

4.3.4 Deletion of 2-Chloronaphthalene Data

Several problems were encountered in the analysis of 2-chloronaphthalene in sediment samples by GC. Being singly chlorinated, the response of 2-chloronaphthalene is poor using the electron capture detector in comparison to other chlorinated compounds in the sample. Also, the other compounds are present in much larger concentrations than 2-Chloronaphthalene. The net result was that 2-chloronaphthalene gives a very small peak in the chromatogram in the presence of larger, interfering compounds.

In order to obtain the lowest detection limit possible for 2-chloronaphthalene dilutions of sample extracts were kept to a minimum. This resulted in repeated contamination of the EC detector and the need to clean the system. A second clean-up of sample extracts using silica gel was suggested to remove interferences, and will be evaluated for possible use in future analyses, if needed.

Based on the sediments analyzed thus far, 2-chloronaphthalene has not proven to be a true indicator of chemical contamination in the samples. Several major unknown peaks were detected by GC which would serve the purpose of an indicator compound much better. It is suggested that GC/MS data be reviewed and that a substitute compound be selected, or 2-chloro deleted.

4.3.5 Quality Control Data

Table 4 illustrates the result of duplicate analysis of about 10% of the sediment samples. The results demonstrate good precision between sample duplicates.

Table 5 illustrates the results of spike recovery analysis of about 10% of the sediment samples. The calculated recoveries show a negative bias among the samples tested. TCP spikes show particularly low recoveries.

The negative bias of the dichlorobenzenes may be due to the loss of these rather volatile compounds during concentration.

Due to the complex nature of the samples, overlapping of peaks may have occurred causing erroneous retention times and area reports. Dilution of samples in order to resolve highly contaminated samples may also contribute to poor recovery of compounds.

Single column identifications were employed. Confirmation studies of indicator compounds have been made by GC/MS.

5.0 DISCUSSION

5.1 Discrete Air Samples

Levels of indicator compounds in the storm sewer airspace sites are consistent with values in basements peripheral to the landfill site.[1]

In four of five manholes tested, disturbing the sediment had little effect on releasing volatile indicator compounds into the airspace in the manhole structures. However, it is important to note that at 97-6, there was a significant release of benzene, toluene, chlorobenzene and chlorotoluene.

The geographical distribution of volatile indicator compounds appears to be highest at 97-6, 99-6, and 100-7, all along Colvin Boulevard, (Figure 1).

The relatively high values at 101-1 and 102-3 indicate the presence of contamination in that area, to the east of the landfill site.

The presence of four indicator compounds at 98-3, just south of Black Creek, suggests that one route for northward migration of contaminants may have been in the 98th Street storm sewer.

The reason for the relatively high values for the airspace in control manhole CS-2 is unknown at this time. The other five control manholes all show some levels of indicator compounds. There are at least three possible explanations:

1. These indicators may be found at these concentrations in many municipal storm sewers, or,

2. These locations are not outside of the influence of the Love Canal. Bergholz and Cayuga Creeks may not be a sharp boundary that intercepted any migrating leachate, or,

3. Sewer back-ups may have accumulated chemical residues. At 93rd Street, the sanitary sewer flows southward under Cayuga Creek to the 91st Street lift station. Also, the storm sewer on 94th Street flows southward and discharges into Bergholz Creek.

Since BHC's and dichlorobenzenes were found in the control manhole sediments as well, the "control area" should be re-evaluated.

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[1] Love Canal Public Health Time Bomb. A special report to the Governor and Legislature, September, 1978. Report prepared by the N.Y. State Office of Public Health and the Governor's Love Canal Inter-Agency Task Force, and,

EPA Environmental Facts Press Release (not dated); however, the air samples were collected on November 15 and November 28, 1979.

5.0 DISCUSSION (cont'd)

5.2 Sediment Samples

5.2.1 Catchbasins

All the catchbasins sampled were in the Ring I area.

The catchbasins that were sampled contained indicator compounds.

On 97th Street there is a clear trend of higher concentrations of indicator compounds in the catchbasins closer to the Love Canal.

There is no clear trend on 99th Street.

5.2.2 Manhole Structures

These data correspond fairly well with the air sampling data. Manhole 96-6 had a relatively high value for volatile benzene and all the sediment indicators were identified.

Site number 97-6 has the most contaminated sediment and one of the most contaminated airspaces. This was the only location where chemical odor was noted approximately ten feet from the opened structure.

Manhole 100-7 is contaminated with most of the air (6 of 8) and sediment (6 of 9) indicator compounds.

The site on 102nd Street, 102-3, has some contamination in both airspace and sediment.

The two control manholes (CS-5 and CS-6) have relatively low concentrations of indicators in both airspace and sediment.

5.2.3 Black Creek

The data generally indicate that the highest concentrations of indicator compounds are at the 96th Street outfall, and that the concentrations decrease as the stream flows toward Cayuga Creek.

The lower concentrations found immediately downstream from the 98th Street outfall may be due to back flowing of Black Creek or infiltration in the buried section of Black Creek, upstream from the 98th Street outfall. A combination of both of these sources is probable.

The values for 2,4,5 TCP appear to run counter to the other indicator compounds, however, these small differences may not be significant.

The presence of 2.06 ppm 1,3 dichlorobenzene at BC-5 is noted. At several locations, miscellaneous refuse and rubble had been observed.

6.0 CONCLUSIONS

On the basis of the data presented in this report, the following generalities can be formulated:

A. Indicator compounds in the storm sewer system are present in low quantities. The indicator compound with the most stringent OSHA 8 hour threshold limit value (TLV) is Benzene at 10 ppm. The highest benzene concentration found in this survey was 178 $\mu g/m^3$, or 0.1 ppm, one percent of the standard.

B. The distribution of indicator compounds is in Ring I, and to the north and the east as far as 102nd Street.

C. Chemical concentrations north of Colvin Boulevard are higher along 96th Street than at the 98th or 102nd Street outfall areas.

D. The reason for relatively high values for some of the volatile compounds at 98-3 is not known at this time. It may be due to physical transport through the soil, the backing up of Black Creek, the re-routing of Black Creek or backfilling with contaminated soil. (Sediment was not available at 98-3.)

E. There are pockets of leachate containing different compounds:

   i. There is an absence of BHC isomers at 99-6, despite the presence of 2,4,5 TCP and the dichlorobenzene isomers in the sediment as well as five of eight volatile indicators in the airspace.

   ii. Manhole 97-6 has, by far, the highest concentrations of indicator compounds in the sediment, except for TCP which is not detected.

   This may be due to partitioning of the Love Canal landfill into cells as the fill operations progressed northward.

   It is essential to utilize numerous indicator compounds as opposed to using a single indicator compound.

F. The main contamination of Black Creek is at the 96th Street outfall. A secondary point source may be from the 98th Street outfall.

G. There are indicator compounds in the control manhole structures. The source or route of contamination should be investigated. Other control areas should be designated.

Table 1. Meter Readings Adjacent to and within Selected Storm Sewer Manhole Structures

Manhole Number		PID Responses Ambient	1'	4'	One foot under Manhole Cover O_2%	Combust. Gases
96-5		0.2	1.8	ND	17.5	ND
96-6		ND	0.2	ND	19.5	ND
96-7 (K)[1]		0.2	2.5	0.8	20.0	ND
96-11(K)		0.5	0.5	0.6	18.0	ND
97-1		0.2	1.5	1.0	18.5	ND
97-4 (K)	4/23	ND	1.0	1.4	17.0	ND
97-4	5/1	0.4	0.4	0.4	19.0	ND
97-6[2]		ND	ND	0.5	19.5	ND
97-7		0.2	1.2	0.4	19.5	ND
97-11		ND	ND	ND	18.0	ND
98-3		0.3	0.3	0.3	19.0	ND
98-7		0.3	0.3	0.3	19.0	ND
99-2	4/24	0.1	3.8	ND	17.0	ND
99-2(K)	5/1	0.4	0.2	1.0	20.0	ND
99-6		ND	ND	0.2	20.0	ND
99-7	4/24	0.3	2.7	0.5	16.5	ND
99-7(K)	5/1	0.2	0.2	0.2	19.0	ND
100-1		ND	0.2	ND	18.0	ND
100-7		ND	ND	ND	18.0	ND
101-1		ND	ND	1.2	19.0	ND
101-4		0.3	ND	ND	19.0	ND
101-8		ND	ND	ND	17.0	ND
102-3		ND	ND	0.9	19.0	ND
102-8		ND	ND	ND	20.0	ND
CS-1 (K)		0.7	0.5	0.5	18.0	ND
CS-2		0.5	0.2	0.2	18.0	ND
CS-3	4/23	0.2	1.9	0.6	14.0	ND
CS-3(K)		0.2	0.8	0.2	19.0	ND
CS-4[3]		ND	13.6[2]	ND	19.0	ND
CS-5		ND	ND	0.4	19.0	ND
CS-6		ND	ND	ND	20.0	ND

[1] Key manhole; GC/MS analysis will be performed
[2] Moderate chemical odor detected 10' from open manhole
[3] Street had been repaved

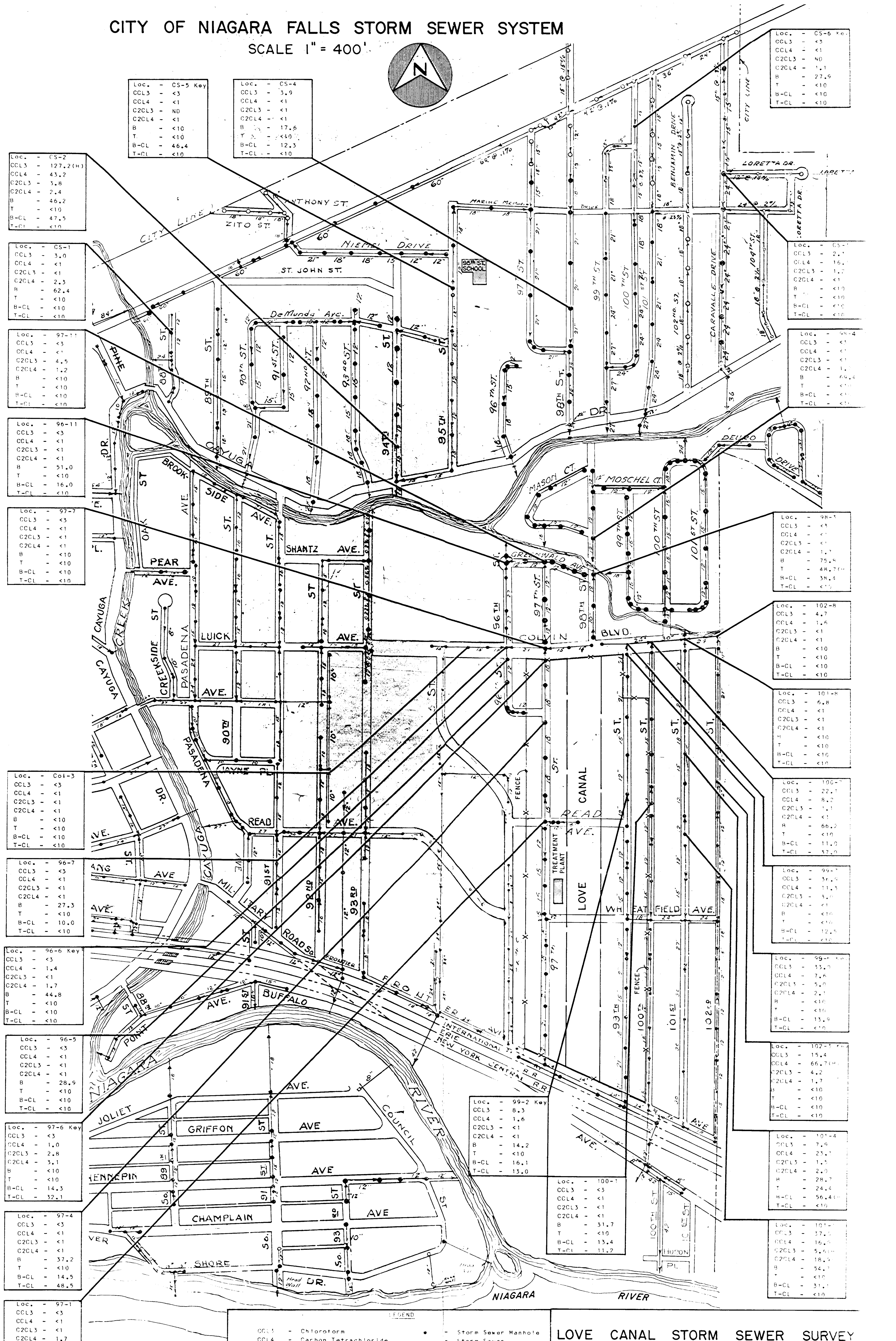
Table 2 Volatile Indicator Compounds in the Airspace in Selected Storm Sewer Manholes
Expressed in micrograms per cubic meter

Location	Date Collected	Chloroform	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
Col-3	4-23	<3	<1	<1	<1	<10	<10	<10	<10
96-5	4-23	<3	<1	<1	<1	28.9	<10	<10	<10
96-6 Key[1]	5-1	<3	1.4	<1	1.7	44.8	<10	<10	<10
96-7	4-23	<3	<1	<1	<1	27.3	<10	10.0	<10
96-7	5-1	<3	2.9	2.5	3.9	<10	<10	10.0	<10
96-7 AS[2]	5-1	<3	2.3	1.5	2.4	18.3	<10	<10	<10
96-11	4-25	<3	<1	<1	<1	51.0	<10	16.0	<10
96-11	5-2	<3	1.3	<1	2.2	45.9	<10	15.7	<10
97-1	4-23	<3	<1	<1	1.7	<10	<10	<10	38.6
97-4	4-23	<3	<1	<1	<1	37.2	<10	14.5	48.5
97-4(Dup)	4-23	<3	<1	<1	1.0	35.0	<10	<10	<10
97-4	5-1	<3	1.4	1.4	1.8	76.5	22.9	19.6	34.7
97-6 Key	5-2	<3	1.0	2.8	3.1	<10	<10	14.3	32.1
97-6 AS	5-2	<3	1.0	1.2	2.4	178.0(H)[3]	22.9	33.7	181.0(H)
97-7	4-23	<3	<1	<1	<1	<10	<10	<10	<10
97-7(Dup)	4-23	<1	<1	<1	<1	<10	<10	<10	<10
97-11	4-25	<3	<1	4.5	1.2	<10	<10	<10	<10
97-11(Dup)	4-25	<3	<1	4.5	1.2	<10	<10	<10	<10
98-3	4-25	<3	<1	<1	1.7	75.8	48.7 (H)	38.4	<10
98-7	4-25	<3	<1	<1	1.2	69.4	<10	<10	<10
99-2 Key	4-24	8.3	1.6	<1	<1	14.2	<10	16.1	13.0
99-2	5-1	<3	1.1	<1	1.8	47.6	<10	22.4	<10
99-2 AS	5-1	<3	1.1	ND	2.1	<10	<10	41.25	<10
99-6 Key	5-1	33.0	7.6	5.0	2.1	<10	<10	13.9	<10
99-7	4-24	36.9	11.3	3.0	<1	<10	<10	12.5	<10
99-7	5-1	<3	<1	ND	2.2	<10	<10	18.8	<10
99-7 AS	5-1	<3	1.1	ND	1.4	<10	<10	28.6	<10

Table 2 (cont'd) Volatile Indicator Compounds in the Airspace in Selected Storm Sewer Manholes Expressed in micrograms per cubic meter

Location	Date Collected	Chloro-form	Carbon Tetra-Chloride	Trichloro-ethylene	Tetrachloro-ethylene	Benzene	Toluene	Chloro-Benzene	Chloro-Toluene
100-1	4-24	<3	<1	<1	<1	31.7	<10	13.4	11.2
100-7	4-24	22.1	8.2	1.1	<1	66.2	<10	11.0	37.0
101-1(San)[5]	4-25	<3	<1	ND	<1	<10	<10	<10	<10
101-1	5-2	37.0	16.0	5.6(H)	18.9(H)	54.7	<10	31.1	<10
101-4	4-25	7.9	23.3	1.5	2.0	28.7	24.4	56.4(H)	<10
101-8	4-24	6.8	<1	<1	<1	<10	<10	<10	<10
101-8 (Dup)	4-24	3.9	<1	<1	<1	<10	<10	<10	<10
102-3 Key	4-25	15.4	66.7 (H)	4.2	1.7	<10	<10	<10	<10
102-8	4-24	4.7	1.6	<1	<1	<10	<10	<10	<10
CS-1	4-26	3.0	<1	<1	2.3	62.4	<10	<10	<10
CS-2	4-26	127.2(H)	43.2	3.8	2.4	46.2	<10	47.5	<10
CS-3	4-26	2.1	16.3	1.2	<1	<10	<10	<10	<10
CS-4	4-26	3.9	<1	<1	<1	17.6	<10	12.3	<10
CS-5 Key	5-2	<3	<1	ND	<1	<10	<10	46.4	<10
CS-5 (AS)	5-2	<3	1.3	ND	3.3	22.7	<10	<10	<10
CS-6 Key	5-2	<3	<1	ND	1.1	27.9	<10	<10	<10
Number of storm sewer sites above reportability		13/43	19/43	13/43	20/43	22/43	4/43	20/43	7/43

[1] Key manhole - GC/MS confirmation to be performed
[2] After stirring sediment
[3] Highest value for indicator compound
[4] Duplicate air cartridge
[5] Sanitary sewer



LEGEND

CCL3	-	Chloroform
CCL4	-	Carbon Tetrachloride
C2CL3	-	Trichloroethylene
C2CL4	-	Tetrachloroethylene
B	-	Benzene
T	-	Toluene
B-CL	-	Chlorobenzene
T-CL	-	Chlorotoluene

● - Storm Sewer Manhole
—•— - Storm Sewer

LOVE CANAL STORM SEWER SURVEY

AIR SPACE VOLATILE INDICATOR COMPOUNDS
(μg/m³)

MAY 29, 1980

Table 3 INDICATOR COMPOUNDS IDENTIFIED IN SEDIMENTS

Expressed in micrograms per gram dry weight[1]
ppm (W/W)

A. Catchbasins

Location	Sample Desc.	Benzene Hexachloride (BHC) α	β	γ	Δ	Trichlorophenol (TCP) 2,4,6	2,4,5	Dichlorobenzene 1,4	1,3	1,2
CB READ-3 W	Mud	0.14	0.22	0.11	0.88(H)[2]	ND	<0.01	0.03	0.05	0.04
CB 97-3 NW	Mud	0.05	0.05	0.01	0.02	ND	<0.01	0.1	0.02	<0.01
CB 97-3 SE*[3]	Mud	1.14	1.20(H)	0.49(H)	0.68	ND	ND	0.07	0.03	<0.01
CB 97-4 W	Mud	0.17	0.11	0.02	ND	ND	ND	0.14	0.17	0.02
CB 97-4 E*	Mud	0.91	0.25	0.15	0.18	ND	ND	0.20	0.02	ND
CB 97-5 W	Mud	0.27	0.15	0.05	0.11	ND	ND	0.09	0.01	0.03
CB 97-5 E*	Mud,Leaves	0.75	0.25	0.19	0.31	ND	ND	0.20	0.03	0.02
CB 99-2 E	Mud,Leaves	0.70	0.26	0.11	0.43	ND	ND	0.26(H)	0.16	0.03
CB 99-2 W*	Mud	0.36	0.25	0.08	0.21	ND	0.012	0.22	0.06	0.01
CB 99-3 SE	Mud	0.02	0.03	<0.01	0.04	ND	<0.01	0.09	0.02	ND
CB 99-3 NW*	Mud	0.02	0.01	<0.01	ND	ND	ND	0.13	0.03	ND
CB 99-4 E	Mud	1.15(H)	0.27	0.07	0.11	ND	<0.01	0.11	0.29(H)	0.01
CB 99-4 W*	Gravel	0.10	0.15	0.05	0.05	<0.01	ND	0.02	0.02	ND

---

1 Not corrected for percent recoveries
2 Highest value for indicator compound
3 Side closer to the landfill site

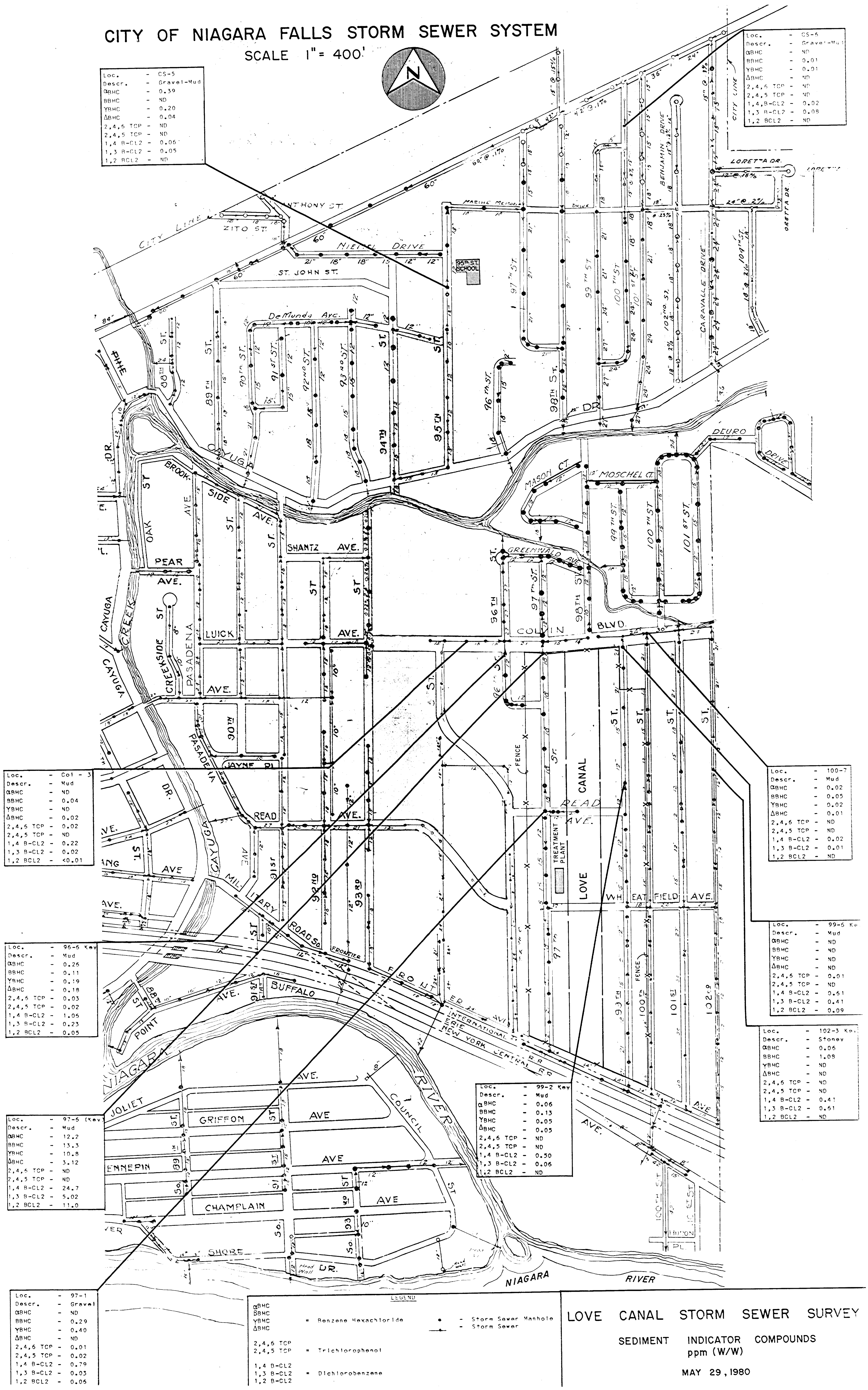
Table 3 INDICATOR COMPOUNDS IDENTIFIED IN SEDIMENTS

Expressed in micrograms per gram dry weight
ppm (W/W)

B. Manhole Structures

Location	Sample Desc.	Benzene Hexachloride (BHC)				Trichlorophenol (TCP)		Dichlorobenzene		
		α	β	γ	Δ	2,4,6	2,4,5	1,4	1,3	1,2
Col - 3	Mud	ND	0.04	ND	0.02	0.02	ND	0.22	0.02	<0.01
96-6 (Key)	Mud	0.26	0.11	0.19	0.18	0.03	0.02	1.06	0.23	0.05
97-1	Gravel	ND	0.29	0.40	ND	0.01	0.02	0.79	0.03	0.06
97-6 (Key)	Mud	12.2	13.3	10.8	3.12	ND	ND	24.7	5.02	11.0
99-2 (Key)	Mud	0.06	0.13	0.05	0.05	ND	ND	0.50	0.06	ND
99-6 (Key)	Mud	ND	ND	ND	ND	0.01	ND	0.61	0.41	0.09
100-7	Mud	0.02	0.05	0.02	0.01	ND	ND	0.02	0.01	ND
102-3 (Key)	Gravel[1]	0.06	1.08	ND	ND	ND	ND	0.41	0.61	ND
CS-5	Gravel-Mud	0.39	ND	0.20	0.04	ND	ND	0.06	0.05	ND
CS-6	Gravel-Mud	ND	0.01	0.01	ND	ND	ND	0.02	0.08	ND

[1] Stones 10-15 mm in diameter as compared to finer (approximately 2 mm) gravel in other samples



LEGEND

αBHC, βBHC, γBHC, ΔBHC = Benzene Hexachloride

2,4,6 TCP, 2,4,5 TCP = Trichlorophenol

1,4 B-CL2, 1,3 B-CL2, 1,2 B-CL2 = Dichlorobenzene

● - Storm Sewer Manhole

—▲— - Storm Sewer

LOVE CANAL STORM SEWER SURVEY

SEDIMENT INDICATOR COMPOUNDS
ppm (W/W)

MAY 29, 1980

Table 3 INDICATOR COMPOUNDS INDENTIFIED IN SEDIMENTS

Expressed in micrograms per gram dry weight
ppm (W/W)

C. Black Creek Stream Bed [1]

	Benzene Hexachloride (BHC)				Trichlorophenol (TCP)		Dichlorobenzene		
Location	α	β	γ	Δ	2,4,6	2,4,5	1,4	1,3	1,2
BC-1 at confluence with Bergholtz Creek	ND	0.05	ND	0.05	ND	0.21	0.67	0.62	0.18
BC-2 midway between BC-1 and 96th St outfall	1.61	0.61	0.79	0.53	ND	0.09	3.85	1.36	0.11
BC-3 1'downstream of the 96th St. outfall	11.9	2.30	6.81	2.28	ND	0.06	9.09	3.14	0.50
BC-4 at 98th St. stream bed, 1' downstream of twin 48" culverts	ND	0.14	0.06	0.03	ND	0.01	0.25	1.03	ND
BC-5 40 ft. upstream from intake structure at 102nd St.	ND	ND	ND	ND	ND	ND	ND	2.06	ND

[1]Each sample was a composite of grab samples taken at five locations across the creek.

Table 4 Duplicate[1] Analysis of Sediments

Site	Lab. No.	Benzene Hexachloride (BHC)				Trichlorophenol (TCP)		Dichlorobenzene		
		α	β	γ	Δ	2,4,6	2,4,5	1,4	1,3	1,2
CB Read 3W	S-00-07	0.14	0.22	0.11	0.88	ND[2]	0.0076	0.03	0.05	0.04
CB Read 3W	S-00-08	0.14	0.17	0.08	1.41	ND	0.0079	0.04	0.05	ND
CB 99 3NW	S-00-05	0.02	0.01	<0.01	ND	ND	ND	0.13	0.03	ND
CB 99 3NW	S-00-06	0.06	0.02	<0.01	0.02	ND	ND	0.10	0.02	ND
99-2	S-00-39	NA[3]	NA	NA	NA	0.003	ND	NA	NA	NA
99-2	S-00-45	NA	NA	NA	NA	ND	ND	NA	NA	NA
102-3	S-00-35	0.06	1.08	ND	ND	NA	NA	0.41	0.61	ND
102-3	S-00-38	ND	1.26	ND	ND	NA	NA	0.49	0.68	ND
BC-4	S-00-28	ND	0.14	0.06	0.03	ND	0.014	0.25	1.03	ND
BC-4R[4]	S-00-29	ND	0.03	0.01	0.04	ND	0.005	0.16	0.52	ND

1 A second aliquot of sediment was separately extracted, concentrated, and injected into the gas chromatograph

2 Not Detected

3 Not Analyzed

4 BC-4 and BC-4R are duplicate grab samples

Table 5 Analysis of Spiked Sediment Samples

	Compound	Known(μg/g)	Observed(μg/g)	% Recovery
Spike 1	2,4,6 Trichlorophenol	0.131	0.053	40.0
	αBHC	0.132	0.113	84.9
	1,4 Dichlorobenzene	0.118	0.086	72.9
Spike 2	2,4,5 Trichlorophenol	0.107	0.084	78.3
	2,4,6 Trichlorophenol	0.105	0.046	43.8
	αBHC	0.090	0.071	78.8
	1,4 Dichlorobenzene	0.089	0.076	85.9
	1,3 Dichlorobenzene	0.100	0.104	104.0
	1,2 Dichlorobenzene	0.103	0.042	40.8
Spike 3	2,4,5 Trichlorophenol	0.105	0.080	76.2
	2,4,6 Trichlorophenol	0.107	0.084	78.3
	αBHC	0.089	0.053	59.7
	1,4 Dichlorobenzene	0.090	0.073	81.1
	1,3 Dichlorobenzene	0.103	0.068	66.0
	1,2 Dichlorobenzene	0.106	0.053	50.1

APPENDIX A

O.H. MATERIALS memorandum,
"Manhole Survey Sampling Procedure"

U. H. Materials Co.

Oil and Hazardous Material Spill Containment and Clean-up

Regional Offices:
Ottawa, Illinois
Atlanta, Georgia
Washington, D.C.

P.O. Box 1022
Findlay, Ohio 45840
Telephone (419) 423-3526
1-800-537-9540

April 16, 1980

Manhole Survey Sampling Procedure

I Sample air with PID prior to opening lid.

II Sample air for explosivity and oxygen content.

III Pop manhole onto plastic spread on street.
IIIA Sample air with discrete sampling method.

IV Sample sediment

1. All samplers will wear sample gloves except pole man who will wear PVC gloves.
2. Sample collector* is dipped into manhole and scraped along bottom, scooping up sediment and ~~water~~.
3. When the collector is raised one sampler will remove the collector from the clamps then pour liquid through a strainer into sample jar. Sediments put into a second jar. Process is repeated until sufficient volumes of samples have been collected. All pouring operations will be performed over the open manhole. After sampling, pole, clamps, collector, all gloves and sample jars will be washed with distilled water from sprayer over open manhole.
4. Sample jars will be placed immediately into coolers, after being properly labelled. Separate collectors will be used for each manhole. Separate containers will be availble for each of the following: used collectors, used sample gloves and plastic cloth, clean sample jars.

V Any boots or gear, contaminated, will be sprayed off over manholes.

VI Close manhole.

Equipment

Raingear	Sample Gloves	Boots
Jars, Lids	Foil	Sample Pole
Coolers	Ice	Distilled Water
Pressure Wash Sprayer	Plastic Dropcloths	Catch Basin Spoon
PID	Air Pump and Discrete Sampling Tubes	Explosion Meter @ Non ferrous Probe
Oxygen Meter	Log Book	Sample Labels
Pick	Sledge	~~PVC~~ Gloves

*undetermined at this time

Appendix B

Sampling Schedule

EPA Environmental Facts

In an effort to keep you informed of the activities which EPA has scheduled in your neighborhood we wish to advise you that our contractor will be checking sewers on your block according to the approximate times listed below.

This activity consists of removing manhole covers for one to two hours while necessary checks are made to insure that a more prolonged opening - needed to inspect sewers by camera - will not cause a health hazard.

We hope to limit traffic and inconvenience to you during these activities designed for the eventual removal of Love Canal sediments from the sewers.

APPROXIMATE SCHEDULE

Date	Location	Time Start	Time Finish
5/1	97th & 96th	08:00	09:50
	Colvin & 96th	09:00	11:05
	96th South of Colvin	10:00	11:55
	99th North of Read	13:30	15:05
	99th & Colvin	14:30	16:40
	99th South of Colvin	15:30	17:25

Date	Location	Time Start	Time Finish
5/2	96th & Greenwald	08:00	09:50
	97th South of Colvin	09:00	11:05
	88th North of Cayuga	10:00	11:55
	103rd (Caravelle) & Lorretta	13:30	15:05
	101st North of Wheatfield	14:30	16:40

Environmental Protection
Region 2
26 Federal Plaza
New York, N.Y. 10007
New York
Puerto Rico
Virgin Islands

EPA Environmental Facts

In an effort to keep you informed of the activities which EPA has scheduled in your neighborhood we wish to advise you that our contractor will be checking sewers on your block according to the approximate times listed below.

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We hope to limit traffic and inconvenience to you during these activities designed for the eventual removal of Love Canal sediments from the sewers.

APPROXIMATE SCHEDULE

Date	Location	Time Start	Time Finish
4/23	97th & Read	8:00	9:50
	97th & 96th	9:00	11:05
	96th South of Colvin	10:00	11:55
	Colvin E. of 95th	13:30	15:05
	Colvin & 96th	14:30	16:40
	Colvin & 97th	15:30	17:25
4/24	99 St. N. Read	8:00	10:10
	99th & Colvin	9:00	11:15

-more-

Date	Location	Time Start	Time Finish
4/24	100 N. of Wheatfield	10:20	12:05
	100 & Colvin	13:30	15:15
	101 & Colvin	14:30	16:15
	102 & Colvin	15:30	17:15
4/25	96th & Greenwald	7:30	9:35
	97th & Greenwald	8:30	10:30
	98th & Greenwald	9:30	11:40
	98th & S. Mason Court	10:30	12:45
	101 & N. Wheatfield	14:00	15:45
	101 N. Wheatfield	15:00	16:45
	102 N. Wheatfield	16:00	17:45
4/26	88 N. Cayuga Drive	7:30	9:40
	94 S. of DeMunda	8:40	10:30
	103 & Loretta	9:40	11:55
	Deuro Drive	10:10	12:40

Appendix C

Volatile Organics in Air

VOLATILE ORGANICS IN AIR

1. Scope and Application

1.1 This method covers the determination of seven volatile organics in air.

1.2 The following compounds may be determined by this method: chloroform, trichloroethylene, tetrachloroethylene, benzene, toluene, chlorobenzene and chlorotoluene.

1.3 Chlorotoluene isomers are partially separated. The o-isomer is resolved but the m- and p- isomers are eluted together.

1.4 Detection limits are 1 ug/M for chlorinated organics (electron capture detection) and 1Ø ug/M for volatile aromatics (photoionization detector).

1.5 The breakthrough volume of the collection system has been shown to be independent of analyte concentration. By series arrangements of filters, trapping efficiency has been shown to be 1ØØ% for all substances tested at sampling volumes up to 25 liters. Breakthrough of chloroform occurs first and thus chloroform retention is the factor mandating a sampling volume of less than 25 liters.

2. Summary of Method

2.1 Volatile organics are trapped by sweeping a known volume of air through a cartridge of Porapak N. Volatiles are eluted from the cartridge with prepurified methanol. Aliquots are injected into a gas chromatography system using electron capture detection (for chloroform, trichloroethylene, and tetrachloroethylene) and photoionization detection (for benzene, toluene, chlorobenzene and chlorotoluene).

3. Interferences

3.1 Solvents, glassware and associated equipment may produce artifacts leading to misinterpretation of gas chromatographic tracings. All reagents and glassware must be demonstrated to be free from interferences under the conditions of analysis. Specific preparation of the eluting solvent (methanol) is required. The Porapak N cartridges are also an occasional source of contamination.

3.2 The gas chromatographic technique may produce peaks from substances that coelute. For absolute identification, mass spectral confirmation is necessary.

4. Apparatus and Materials

4.1 Porapak N - 8Ø/1ØØ mesh, T.M. - Supelco Corp.

4.2 Serum vials - 1Ø ml, with teflon lined caps

4.3 Pasteur capillary pipets

4.4 Glass tubing - pyrex 1/4" X 1Ø"

4.5 Pump - Gast (T.M.) carbon vanes oilless Model # 1531-1Ø7-288 or equivalent

4.6 Gas chromatography columns - 2' X 1/8" packed with 15% SF96 / 6% OV225 on 1ØØ/12Ø mesh Chromosorb W and 9' X 1/8" column packed with the same material

4.7 6-8 tube manifold for collection

4.8 "Ts" and tygon tubing

4.9 Calibrated rotameter

4.1Ø Manifold - for purging cartridges in a conditioning oven

4.11 Polyethylene caps for 1/4" glass tubing

4.12 Glass wool - silanized, methanol washed

5. Reagents, Solvents and Standards

5.1 Methanol - prepurified (see methanol purification - Appendix)

5.2 Standards - reference grade

5.3 Argon/Methane - 95%/5%

5.4 Helium

6. Calibration

6.1 Calibrations are done daily with a minimum of three standards consisting of the seven analytes ranging in quantities from Ø.Ø4 to 4 mg for electron capture detection and from Ø.2 to 2Ø ng for photoionization detection.

6.2 Graduated 5.Ø ml tubes, in which methanol eluant from cartridges is collected, are checked before initial use by weighing before and after filling with water to the 1.Ø and 1.5 ml graduations.

7. Quality Control

7.1 Sample collection will be carried out in triplicate (one for backup) with individually calibrated cartridges.

7.2 Since flow rate can vary considerably from one cartridge to the next, it is important to attempt assurance of uniform packing by visual inspection for loose Porapak. In a further check of proper packing, sample throughput rate will be checked at the beginning and end of sampling. If this differs by more than 10%, the cartridge will be discarded.

7.3 A field blank cartridge will be carried to and from the sampling site.

7.4 One in every eight Porapak N cartridges will be checked for contamination using GC analysis of methanol eluant. If contamination is detected the batch from which the cartridge was drawn will be discarded.

7.5 Methanol will be checked by gas chromatographic analysis for contamination on each day it is used.

7.6 Standards

7.6.1 Every fifth sample will be a standard,

7.6.2 Concentrations of standard mixtures injected will be such that peak areas obtained will bracket peak areas for unknowns.

7.6.3 Standards will be run at least in duplicate. If the range between peak areas for components of duplicate injections exceeds 10% of the mean, the injection will be repeated.

7.7 All components of the standard mixture must be resolved by the chromatographic column. No analyses should proceed until full resolution has been obtained. (Meta and para chlorotoluene isomers are not readily separated.)

8. Procedure

8.1 Sample Cartridge Preparation

8.1.1 Porapak N is added to a chromatographic column and conditioned overnight at 180 C with He or N flowing through it.

8.1.2 A 4" column of Porapak N is sandwiched between methanol-washed, silanized glass wool plugs in a 10" X 1/4" borosilicate glass tube to constitute a cartridge.

8.1.3 Cartridges are attached to a manifold in an oven and heated at 16Ø C for 45 minutes with passage of inert gas at approximately 2Ø ml/min.

8.1.4 Cartridges are capped when just cool enough to handle.

8.2 Sample Collection

8.2.1 Cartridges are attached to the manifold using tygon tubing for connection between the cartridge and the GAST vacuum pump. Polyethylene "X" connectors are used to collect triple parallel samples. Flow rates are measured in the field using a laboratory calibrated rotameter where flow is measured before and after sampling. Flows of Ø.3 to Ø.5 liters per minute are observed where about 2Ø liters of sample are collected. No critical orifice is necessary, since the resistance of the cartridge itself determines the flow rate.

8.2.2 Cartridges are kept sealed until sample collection. After sampling the caps are replaced on the cartridges and placed in a screw capped test tube with teflon liner. The test tubes must be refrigerated at 4 C immediately following sample collection. The samples are transported promptly to the lab.

8.3 The methanol elution of a cartridge is performed by clipping the cartridge in a vertical position with the lower end at about the 2 ml graduation of the collection tube. 1.5 ml of methanol is added dropwise to the top of the cartridge and elution allowed to proceed by gravity until complete. The last drop is expelled by application of a latex bulb at the top of the column to bring the volume of eluant to 1.Ø ml. The volume is recorded.

8.4 Gas chromatography is carried out using electron capture and photoionization detection.

8.4.1 Recommended conditions for the electron capture system are:

Column - 12' X 1/8" packed with 15% SF-96/6% OV-225 on Chromosorb W

Carrier gas - Argon/Methane, 3Ø-4Ø ml/min

Oven - 6Ø C

Detector - 3ØØ C

AGE

Injector - 2ØØ C

8.4.2 Recommended conditions for the photoionization system are:

Column - 9' X 1/8" packed with 15% SF-96/6% OV-225 on Chromosorb W

Carrier gas - He, 3Ø ml/min

Oven - 7Ø C

Detector - 22Ø C

Injector - 18Ø C

9. Calculations

9.1 Calculations involve interpolation of peak areas for unknowns on the linear regression line connecting bracketing peak areas for the standard curve.

9.2 Concentration per cubic meter of sample includes the following factors:

Sampling time

Flow rate - average of initial and final

Volume of methanol eluted

Volume injected into gas chromatograph

Amount indicated by interpolation of standard curve

1Ø. References

Narang, R. Manuscript in preparation.

SECTION III

Analytic Results/GC/MS Data

O. H. Materials Co.
Oil and Hazardous Material Spill Containment and Clean-up

Regional Offices:
Ottawa, Illinois
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1-800-537-9540

SUMMARY REPORT
NO. 1
Project 871
GC/MS Data

Project: Preliminary Survey
Love Canal
Niagara Falls, New York

Date: June 3, 1980

For: USEPA, Region II
Mr. George Zachos

by: George Vander Velde   date: 5/30/80

All technical correspondence should be directed to:

George Vander Velde
O.H. Materials Co.
P.O. Box 46452
Cincinnati, Ohio 45246
(513)772-8113

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TABLE OF CONTENTS (contd)

I. INTRODUCTION

This report covers the GC/MS analysis performed on air monitoring and sediment analysis samples which have been performed as a preliminary survey of the materials found within the Love Canal northern sector storm sewer system. These GC/MS analyses were performed on a very limited subset of the samples which were collected during this phase of the study. These analyses were performed on samples which were prepared according to the proposals submitted for the preliminary survey; preliminary to the storm sewer decontamination.

The purpose of these analyses was twofold:

1. To survey the nature of the contamination contained within the storm sewer system.

2. To serve as a quality control procedure to the quantitative analyses as performed on the indicator compound analyses by Advanced Environmental Systems, Inc., Niagara Falls, New York.

The indicator compound concept was employed in this study, the indicator compounds to be indicative of the contamination found within the Love Canal storm sewer system. The indicator compounds used were those as suggested by the New York State Agencies.

Since total organic profile data from the storm sewer system are not generally available, these GC/MS studies were deemed important to indicate if additional compounds should be used as indicator compounds.

II. SCOPE OF WORK

This portion of the project is intended to provide a qualitative survey of the nature of the organic contaminants as found in the Love Canal area storm sewer system under study. Only a very few selected sampling sites were chosen for GC/MS survey analysis.

A second purpose of this portion of the study was to provide a quality control check on the GC results obtained by AES in the quantitative portion of the determinations.

Three sample types were received from the AES laboratory.

1. Tenax air sample cartridges
2. Solvent extracts of sediment
3. An individual water sample

The analytical procedures and results are discussed below.

It was anticipated that the sample matrices would be extremely complex. For this reason glass capillary columns were employed for most of the sample analyses.

All samples were received directly by O.H. Materials personnel in the laboratory. Chain of custody was employed for all samples. All samples were received in coolers placed in locked boxes. All samples were transported packed with ice.

III. ANALYTICAL PROCEDURES

A. General Procedures

All samples were utilized directly as provided by the AES laboratory. Where applicable all samples were coinjected with 20 ng of D_{10}anthracene used as a marker compound.

All samples were analyzed on either a Finnigan Model 3323 GC/MS/DS (air and water) or a Finnigan Model 4023 GC/MS/DS (solvent extracts). The instruments are calibrated daily and decafluorotriphenylphosphine (DFTPP) mass and abundance ratios are determined. Additionally a quality control mixture is injected with each set of the solvent extracts to determine operational characteristics of the system. This mixture is used to determine the overall operational characteristics including the chromatography, transfer and mass spectral characteristics.

All data reported are generally produced by the following procedures. After the acquisition has been completed an automated data reduction routine is employed which determines the presence of compounds within the chromatogram by a peak detection algorithm. Each peak identified by this algorithm

A. General Procedures (contd)

is written into a scan list that is generated. (An example of these lists is included with the data.) A background corrected spectrum is automatically produced for each item which has been placed into the scan list and the resultant spectrum is automatically searched through the NBS/EPA 31,000 compound library contained within the GC/MS/DS. A second list of these identifications is produced which corresponds to the original list. (These procedures are considered proprietary by O.H. Materials).

This list is used by a skilled mass spectroscopist as a basis of which to begin to make identifications. Identifications are only made by a mass spectroscopist. Each spectrum is individually examined and identified by the mass spectroscopist. Judgements are made as to the purity of the mass spectrum normally by the use of mass chromatograms. Selected and random mass spectra are also individually verified by a second mass spectroscopist. In several instances where the particular compound is deemed not important for reporting on this project a complete identification will not be made, but it will be classified generally (e.g. hydrocarbon, pthalicacidester, etc.). Particular attention has been given to chlorinated species in these analyses as being indicative of the compounds of the Love Canal.

B. Specific Analytical Procedures

1. Water sample

Two water samples were received with specific instructions to be analyzed by purge and trap techniques. The analytical procedure is as follows:

The water samples were analyzed by purge and trap method using a Tekmar LSC2 device connected to a Finnigan 3323 GC/MS system. The following purge conditions were set:

Purge flow rate (He)	:	40 ml/min.
Pugre time	:	8 min.
Desorb time (150°C)	:	4 min.
Bake out (210°C)	:	7 min.

B. <u>Specific Analytical Procedures</u> (contd)

1. Water sample (contd)

The following gas chromatographic conditions were set:

Initial temp	:	50°C
Initial hold	:	3 min.
Program rate	:	8°C/min.
Final temp	:	150°C
Final hold	:	until all compounds eluted

The column consisted of 0.2% carbowax 1500 on Carbopak C.

The mass spectrometer was scanned from 35-350 amu in two seconds.

2. Tenax air cartridges

The tenax traps were thermally desorbed using a Nutech model 320 desorbtion apparatus. The samples were desorbed for ten (10) minutes. After the ten minute time period, the sample was "injected", the trap heated and data acquisition started. The system was left in the inject mode for five (5) minutes then returned to the desorb mode, vented and allowed to purge for approximately 15 minutes.

The samples were chromatographed on a 6' 0.2% Carbowax 1500 on Carbopak C under the following conditions:

Initial temp	:	50°C
Initial hold	:	5 min.
Program rate	:	8°C/min.
Final temp	:	150°C
Final hold	:	10 min. (or until all components eluted)

The mass spectrometer was scanned from 35-350 amu in two seconds. Data was collected for 1½ hours.

The samples were received with labels attached to them. Before the samples could be run, these labels were removed and the outside of the cartridge washed with hexane to remove any residual adhesive. This procedure invalidated the results due to the addition of additional contamination from the hexane.

3. Solvent extracted samples

The samples were analyzed by injecting 1 µl onto a GC/MS system equipped with a 30 meter SP2100 capillary column. The following gas chromatographic conditions were set:

Initial temp	:	50°C
Initial hold	:	5 min.
Initial rate	:	2°C/min.
Intermediate temp	:	150°C
Final rate	:	4°C/min.
Final temp	:	250°C
Final hold	:	10 min.

Linear flow rate	:	~20 cm/sec.
Split	:	Grob injection returning to 1:20 split after 0.3 min.
Sweep	:	1:10

The mass spectrometer scan function was 35-500 amu in two (2.0) seconds. Data was collected for 1½ hours.

C. Data Storage

All data have been archived on magnetic tape.

D. Quantitation

No quantitation has been performed on the data collected nor is it recommended that quantitative interpretation of the GC/MS data be attempted. The sediment samples were prepared for GC analysis and in several instances this required further purification of the samples to remove interferences. This involved additional solvent exchanges, etc. Recoveries would be extremely difficult to calculate unless internal standard methods were used and the internal standards were incorporated at the point of sampling.

IV. RESULTS

The analytical results are given below for the individual samples. In several instances the chromatograms are given for reference purposes.

A. Water Sample

1. Samples

Two samples were received on April 15 from George Vander Velde which were labeled:

#1	W-00-03	Purge and trap control
#2	W-00-04	House water sample

2. Analysis

As mentioned above. Standards used were Suppelco purge and trap standards.

3. Data results

The sample from the house (labeled W-00-04) was found to contain both dimethyldisulfide and tetrachloroethane at very low levels, but above control. The estimated concentration is $<$ 500ppt.

The control (W-00-03) showed contamination of methylene chloride, chloroform, tetrachloroethane and tetrachloroethene. These were all at very low levels.

4. Notes

The collection of this sample cannot be verified and it is doubtful that it was properly taken for a purge and trap analysis (headspace free with teflon liner).

The original sample was reported to have a black deposit which probably should be extracted and determined.

B. Air Samples

1. Samples

The samples labelled #21 through #29 were received from George Vander Velde on the 5th of May 1980. The samples were 9 tenax traps to be analyzed for volatiles.

2. Analysis

As noted above.

B. <u>Air Samples</u> (contd)

3. Data

Chromatograms are enclosed for reference. Table I shows the analytical results. The numbers listed indicate the scan number at which the compound occured. A plus sign (+) indicates that the compound was positively identified.

4. Notes

As previously mentioned there were problems with the attachment of labels directly to the sample tubes which necessitated removal with solvent.

Table 1

GC/MS SURVEY OF VOLATILE ORGANIC COMPOUNDS IN DISCRETE AIR SAMPLES

compound	#21 Blank	#22 96-11	#23 97-4	#24 96-6	#25 96-7	#26 CS-5	#27 97-7	#28 99-2	#29 CS-6	Nutech Blank
dichloromethane					tent 181	+ 176	+ 161	Extremely high water content	Extremely high water content	None detected
methylpropane		+				+				
2 propanone	+ 208	+ 186	+ 208	+ 190	+ 205	+ 194	+ 176			
trichlorofluoromethane			+ 221	+ 202	+ 219	+ 206	+ 181			
cyclopentane	+ 249		+ 257	+ 239		+ 235	+ 199			
methylbutane	+ 303	+ 283				+ 288				
1,1' oxybisethane			+ 327	+ 301	+ 310		+ 244			
trichlorotrifluoroethane				tent 318	tent 326	tent 305				
trichloromethane					tent 326	tent 305	+ 252			
pentane	+ 350	+ 333	+ 373	+ 350	+ 359	+ 335				
cyclohexane	+ 373	+ 357					+ 362			

Table 1 (contd)

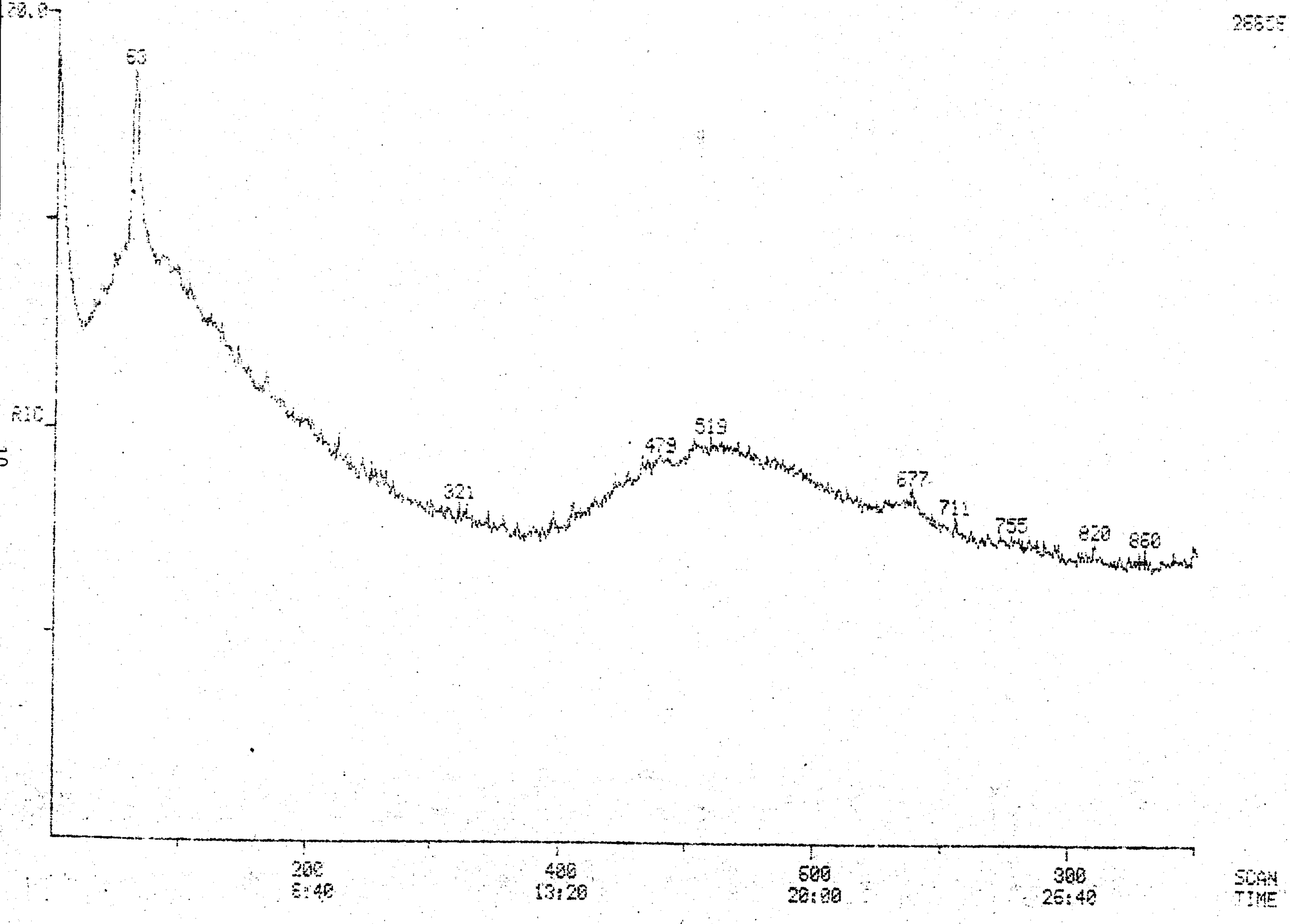
GC/MS SURVEY OF VOLATILE ORGANIC COMPOUNDS IN DISCRETE AIR SAMPLES

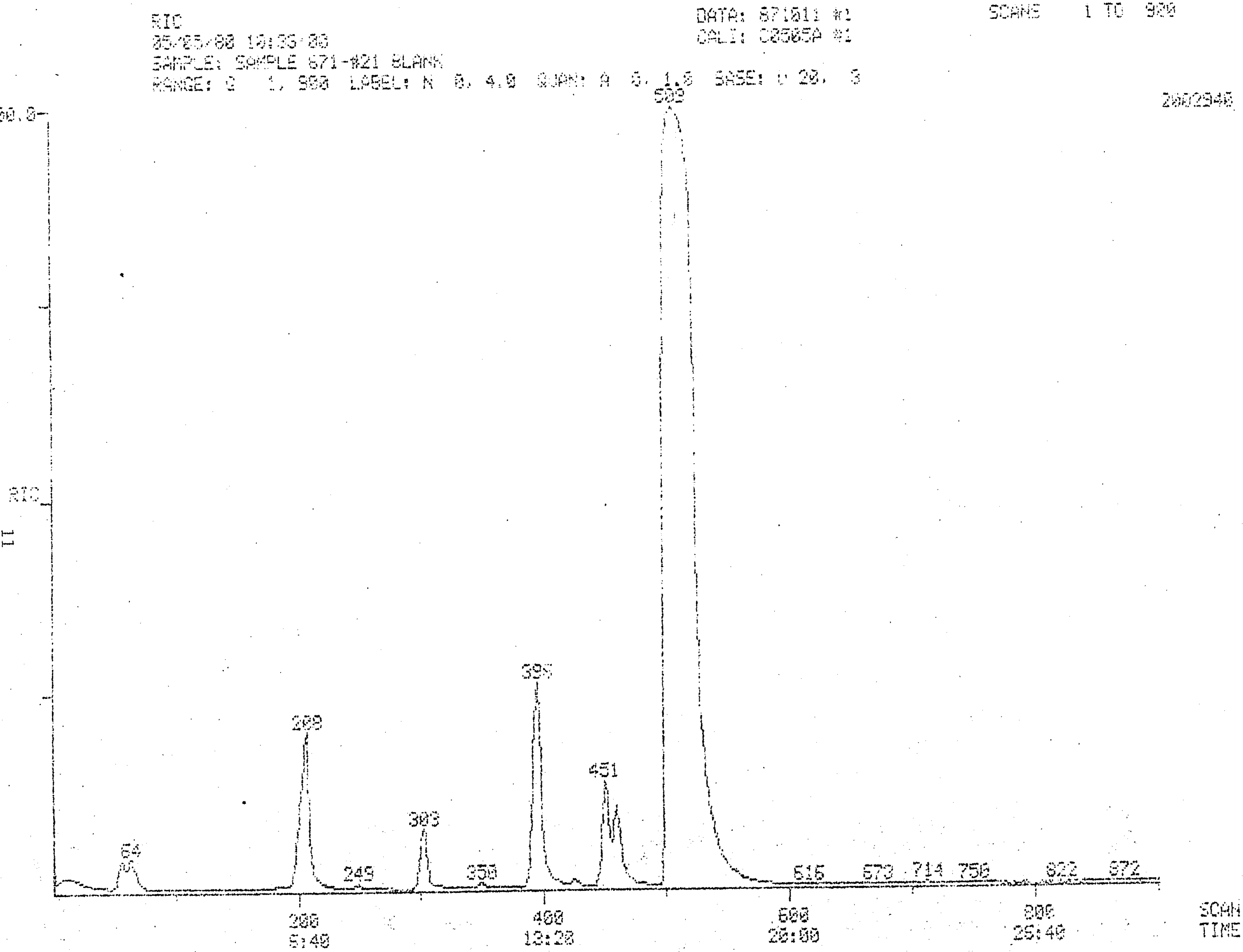
compound	#21 Blank	#22 96-11	#23 97-4	#24 96-6	#25 96-7	#26 CS-5	#27 97-7	#28 99-2	#29 CS-6	Nutech Blank
trichloroethane					+ 375	tent 355				None detected
methylcyclopentane	+ 396	+ 381	+ 436	+ 400	+ 404	+ 384		+ 411	+	
methylpentane	+ 457	+ 438	+ 484	+ 458	+ 474	+ 439		+ 457		
trichloroethene					+ 474					
benzene	+ 463	+ 454	+ 500	+ 475	+ 474		+ 374	+ 420		
trichloro product			tent 500							
hexane	+ 509	+ 501	+ 547	+ 521	+ 529	+ 502	+ 387	+ 513	+	
methylhexane			+ 649	+ 623	+ 629	+ 605	+ 601			
tetrachloroethene	+ 662	+ 645	+ 692	+ 667	+ 676		+ 644			
toluene	+ 712	+ 698	+ 745	+ 720	+ 730	+ 699	+ 695			
chlorobenzene			+ 846							

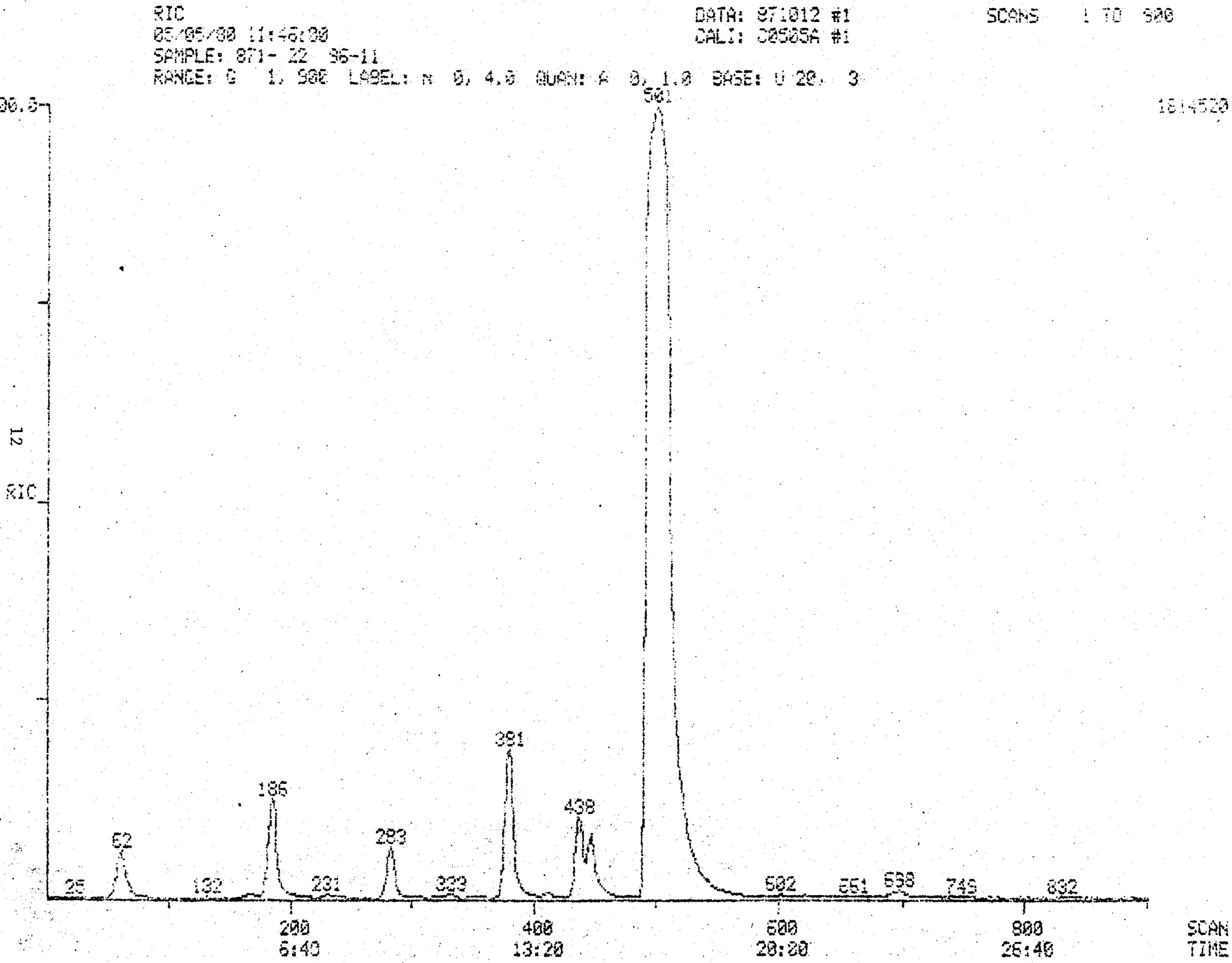
RIC
05/05/90 9:42:00
SAMPLE: NUTECH DEVICE WITH NO SAMPLE
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: S71010 #1
CALI: C0505A #1

SCANS 1 TO 900

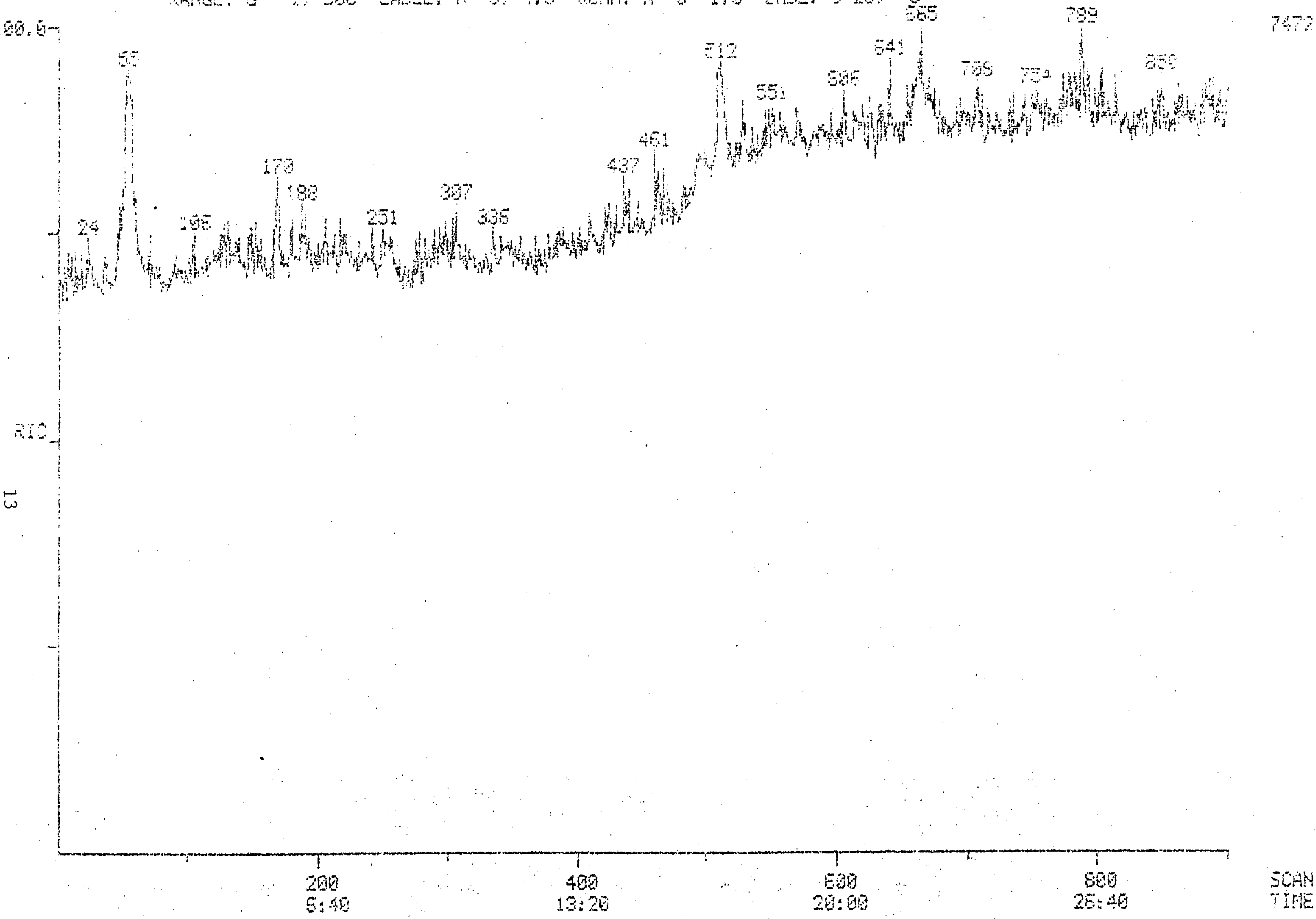


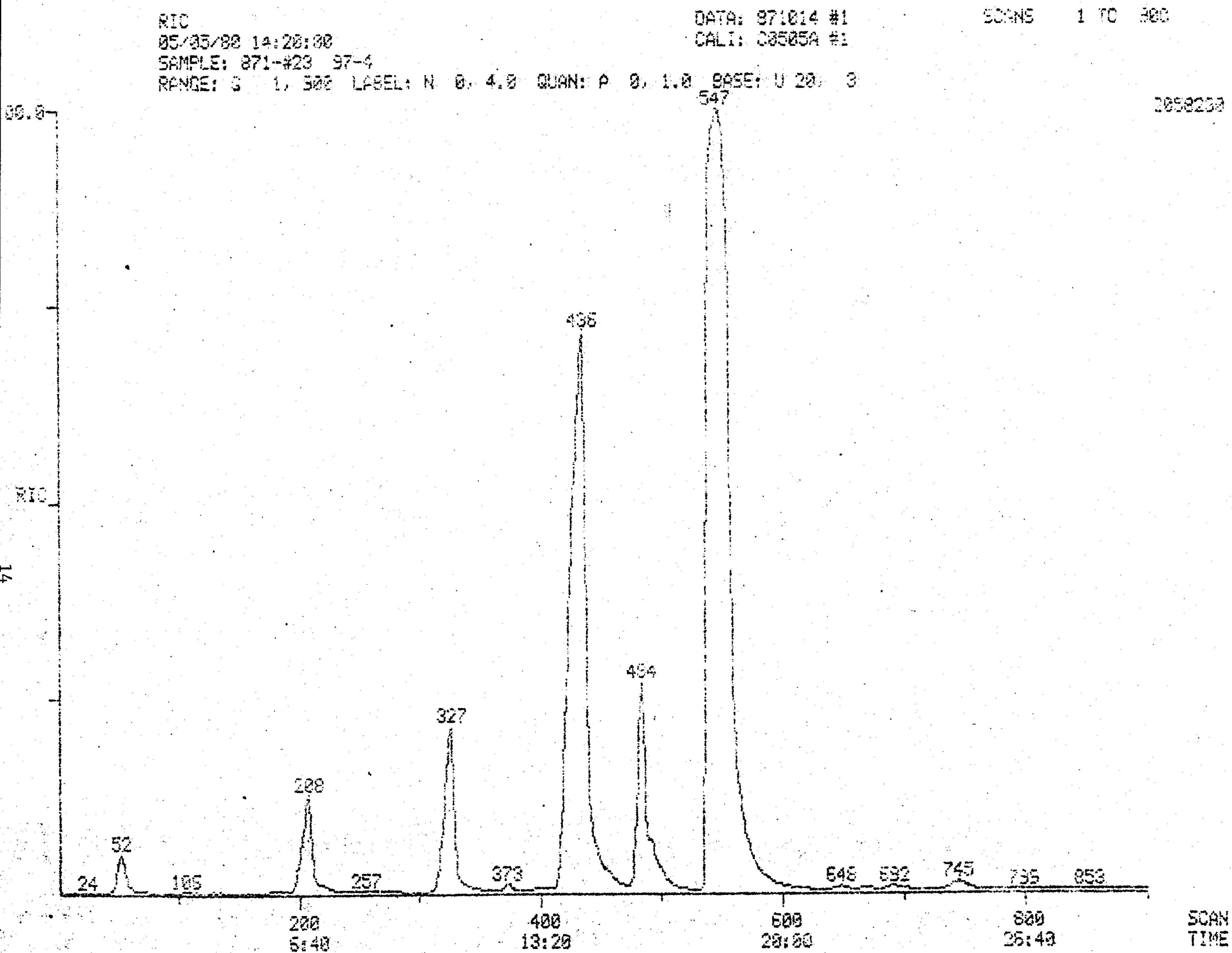

RIC
05/25/80 10:35:00
SAMPLE: SAMPLE 671-#21 BLANK
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871011 #1
CALI: C0505A #1
SCANS 1 TO 900
2002940
00.0
RIC
64
200
249
303
350
395
451
509
516
573
714
750
822
872
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME

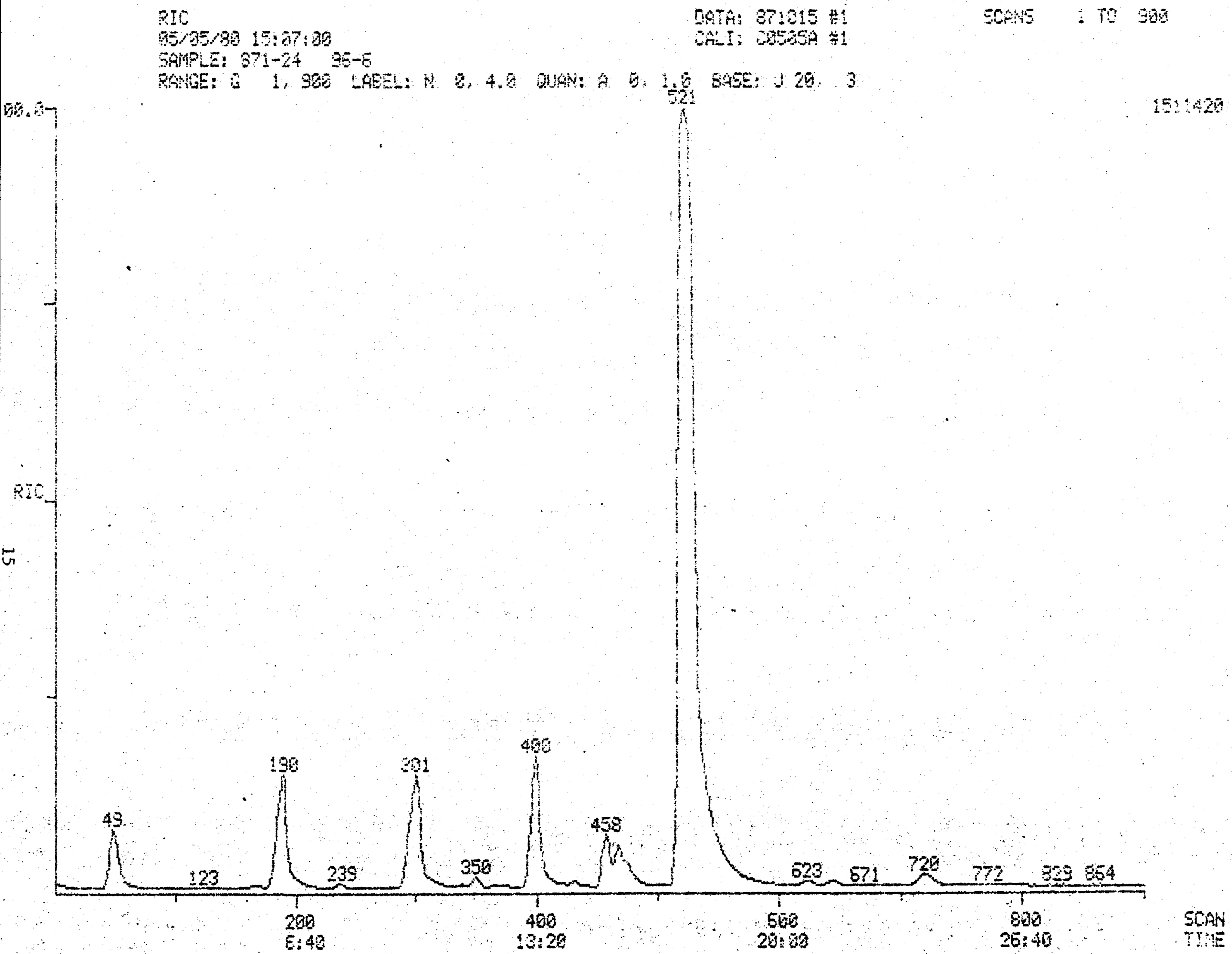

RIC
05/05/80 11:46:00
SAMPLE: 871- 22 96-11
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871012 #1
CALI: C0505A #1
SCANS 1 TO 900
100.0
1814520
RIC
25
52
132
186
231
283
333
381
438
501
602
651
698
749
832
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME

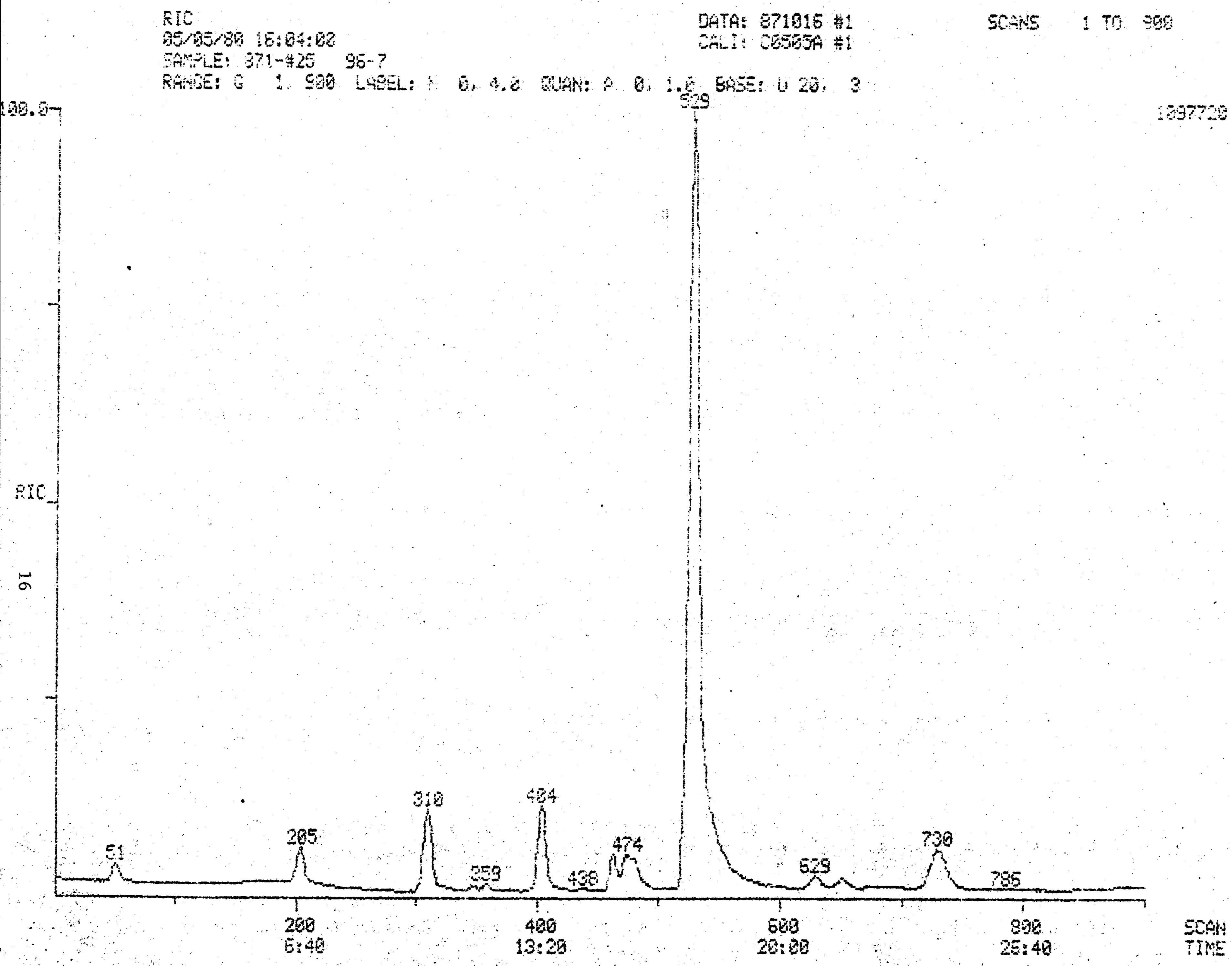
RIC
05/05/80 13:34:00
SAMPLE: NUTECH DEVICE WITH NO SAMPLE
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

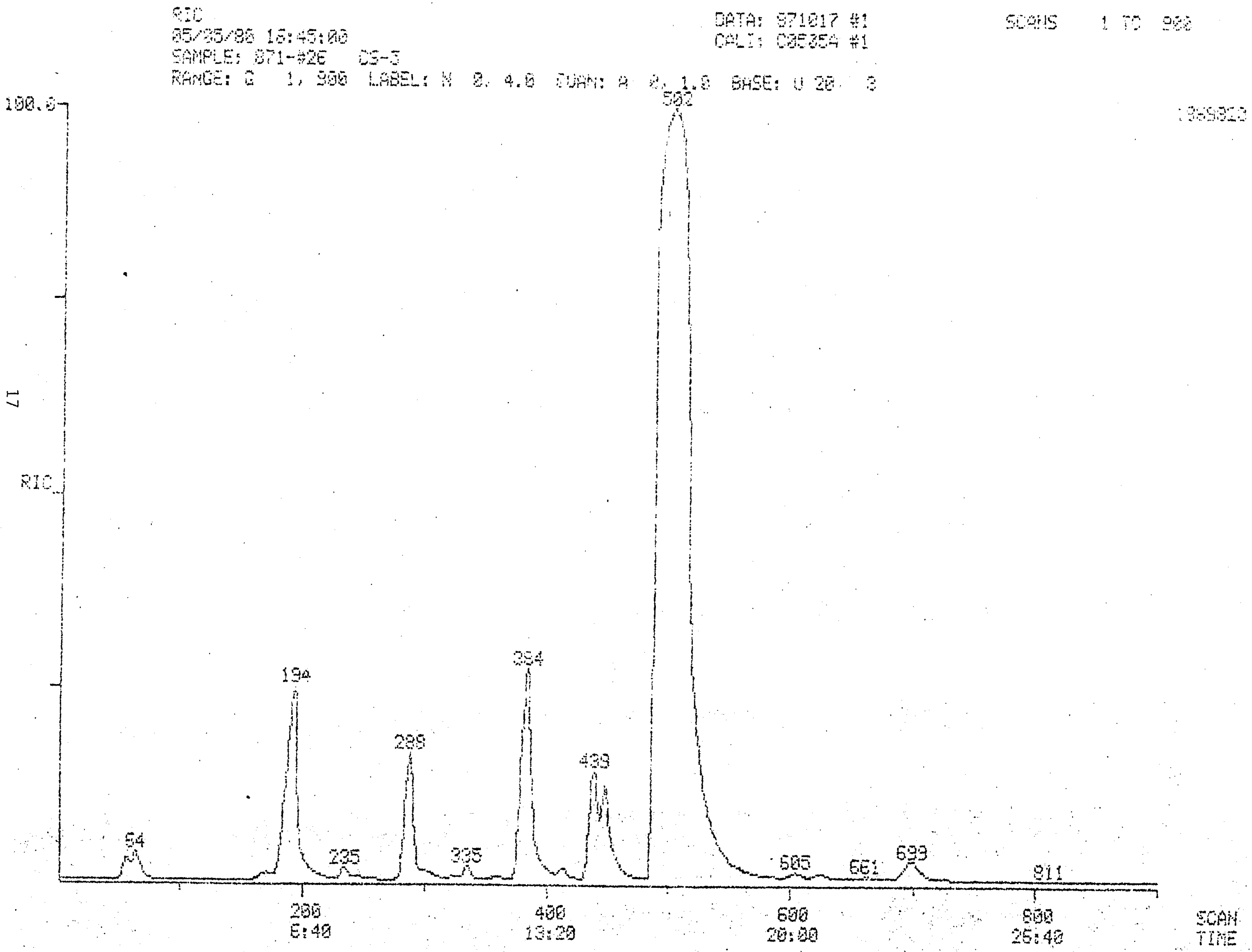
DATA: 871313 #1 SCANS 1 TO 900
CALI: C0505A #1

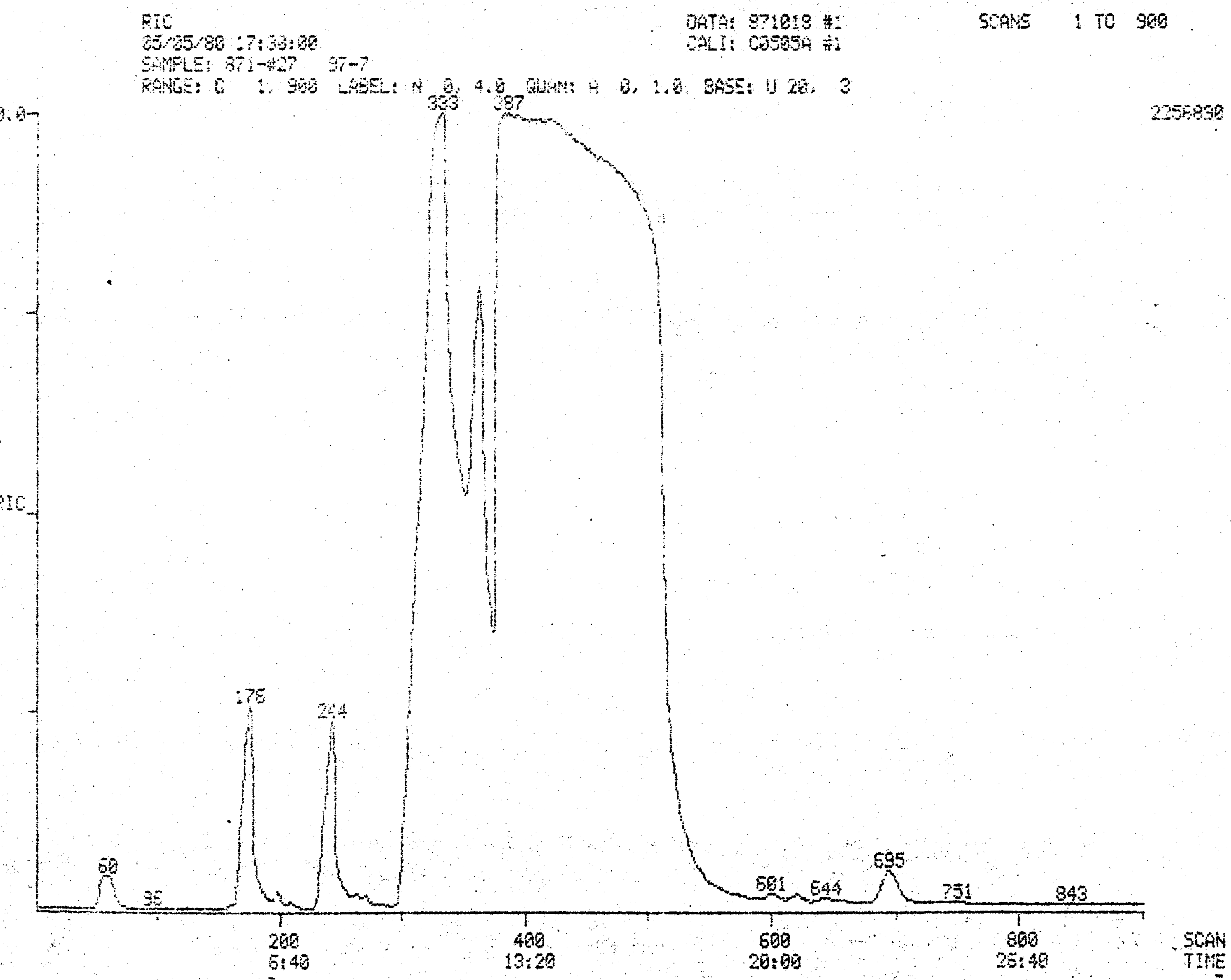


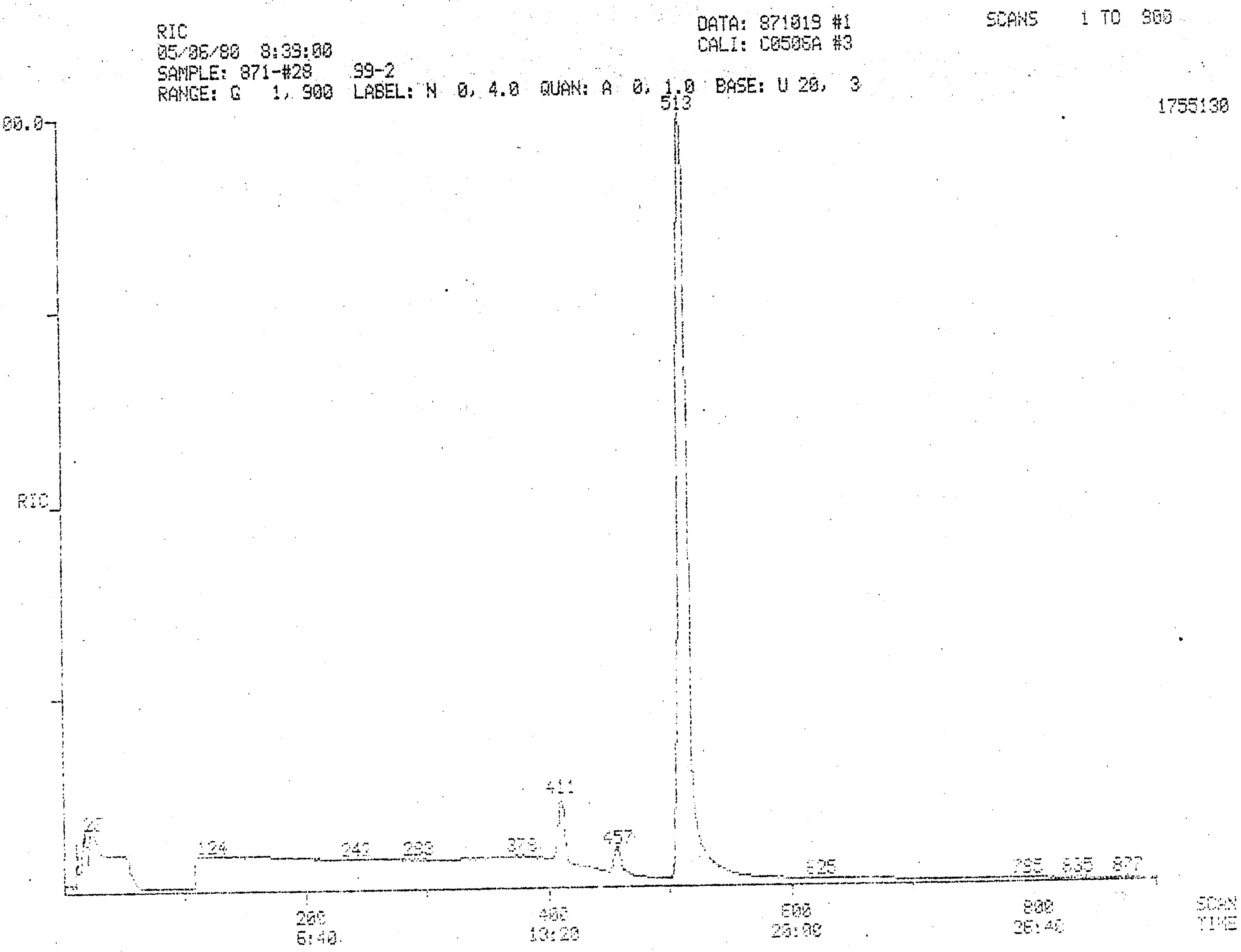

RIC
05/05/80 14:20:00
SAMPLE: 871-#23 97-4
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871014 #1
CALI: C0505A #1
SCANS 1 TO 900
2058238
80.0
RIC
24
52
105
208
257
327
373
436
484
547
646
692
745
795
853
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME


RIC
05/05/80 15:07:00
SAMPLE: 871-24 96-6
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871015 #1
CALI: C0505A #1
SCANS 1 TO 900
151420
RIC
49
123
190
239
201
350
400
458
521
623
671
720
772
829
864
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME

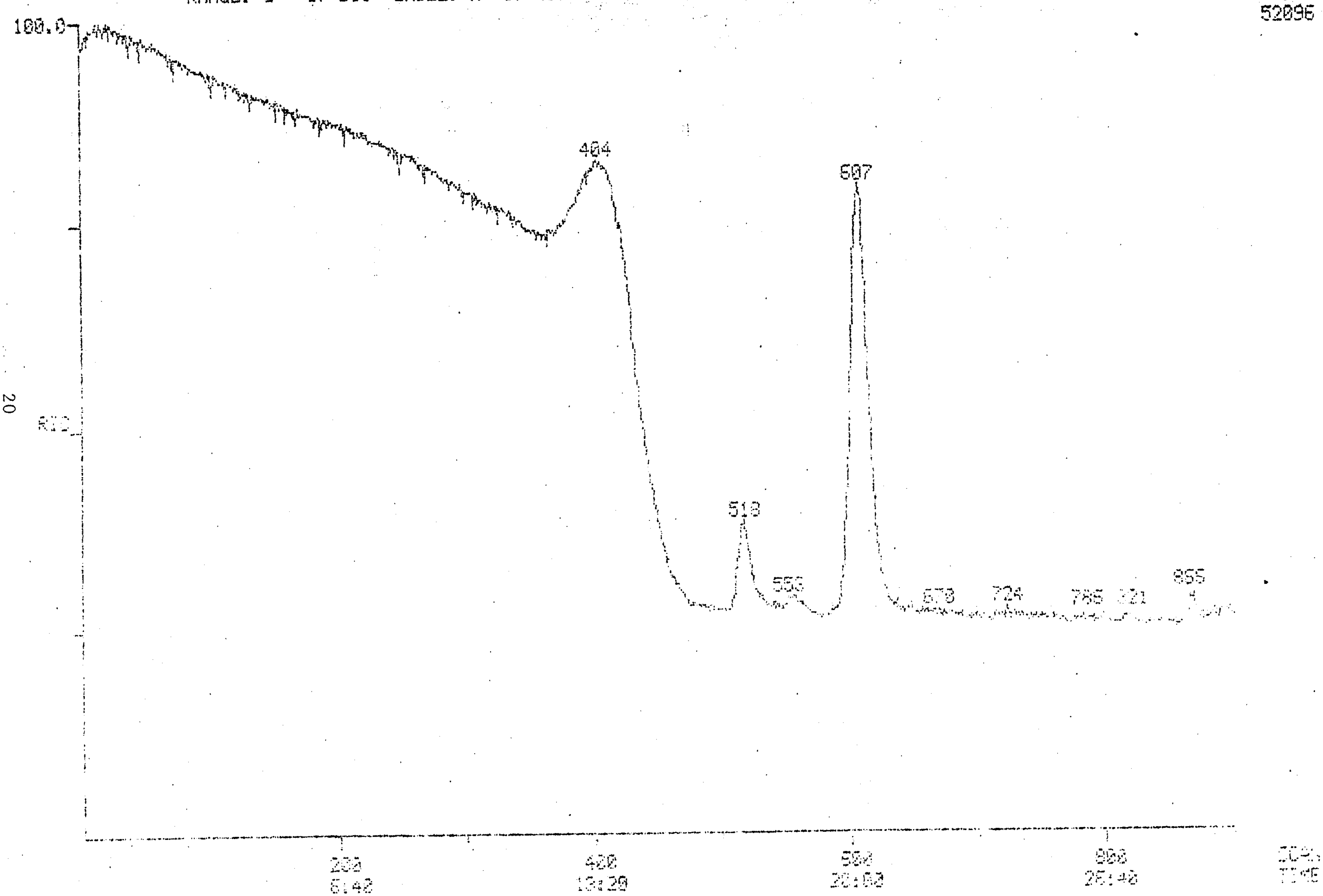

RIC
05/05/80 16:04:00
SAMPLE: 371-#25 96-7
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871016 #1
CALI: C0505A #1
SCANS 1 TO 900
100.0
1097720
RIC
51
205
310
359
404
438
474
529
629
730
786
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME


RIC
05/35/88 16:45:00
SAMPLE: 871-026 CS-3
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871017 #1
CALI: C0535A #1
SCANS 1 TO 900
100.0
RIC
54
194
235
288
335
384
433
502
605
661
699
911
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME


RIC
05/05/80 17:38:00
SAMPLE: 871-#27 97-7
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871018 #1
CALI: C0505A #1
SCANS 1 TO 900
2256890
20.0
RIC
60
95
178
244
323
387
601
644
695
751
843
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME


RIC
05/06/80 8:33:00
SAMPLE: 871-#28 99-2
RANGE: G 1, 900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871019 #1
CALI: C0505A #3
SCANS 1 TO 900
1755130
100.0
RIC
124
411
457
513
200
6:40
400
13:20
600
20:00
800
26:40
SCAN
TIME

RIC   DATA: 871020 #1   SCANS   1 TO 900
05/06/80 9:24:00   CALI: C0505A #1
SAMPLE: 871-#29   CS-6
RANGE: G   1, 900   LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3



C. Solvent Extracted Samples

1. Samples

a. Catchbasin samples

Received on the 11th of April 1980 from George Vander Velde which were labelled:

#1	S-00-01	sediment extract	CB-97, 4W
#10	S-00-10	sediment extract	CB-99, 2E
#12	S-00-12	sediment extract	CB-97, 4E
#13	S-00-13	sediment extract	CB-99, 4E
#16	S-00-16	sediment extract	Blank

b. Storm sewer and Black Creek sediment samples

Samples #30, 31, 37, 46, 36, 43, 32 and 44. Samples #30 and 31 were received on the 5th of May, 1980 by James R. Dahlgran and correspond to acid and base/neutral extracts of 99-2 respectively.

Received on 9th of May, 1980 at 1900 from George Vander Velde which were labelled:

871-34 - S0062	Acid	CS-6
871-35 - S0046	Acid	102-3
871-36 - S0066	Base	97-6
871-37 - S0055	Acid	99-6
871-38 - S0063	Acid	97-6
871-39 - S0061	Acid	CS-5
871-40 - S0019	Base	BC-3
871-41 - S0020	Base	BC-4
871-42 - S0028	Acid	BC-4
871-43 - S0038	Base	102-3
871-44 - S0065	Base	CS-6
871-45 - S0052	Acid	96-6
871-46 - S0050	Base	99-6
871-47 - S0047	Base	96-6
871-48 - S0027	Acid	BC-3
871-49 - S0064	Base	CS-5

2. Analysis

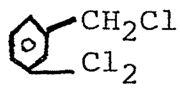
As noted above

3. Data

a. Catchbasin sediments

The following is a list of compounds detected in the samples:

Sample #01
S-00-01
CB97, 4W

Scan #	Compound
158	$C_6H_{10}O$ ketone
202	4-hydroxy-4-methyl-2-pentanone
407	C_9H_{12}
439	$C_{10}H_{20}$ substituted cyclohexane
452	C_9H_{12}
470	dichlorobenzene
693	dichlorotoluene (tent.)
721	trichlorobenzene (tent; low level)
710	$C_{10}H_{14}$ subst. benzene
806	trichlorobenzene
817	naphthalene
923	hydrocarbon
1050	low level chlorinated product (possibly dichloro methylchloro benzene)
1070	low level chlorinated product (possibly 
1116	tetrachlorobenzene
1201	tetrachlorobenzene
1245	dimethylnaphthalene (1266,1292,1298,1329,1352)
1397	$C_{12}H_{10}$ 1,2 dihydroacenaphthalene
1445	hydrocarbon
1462	tent. dibenzofuran
1487	tent. BHT
1493	trimethylnaphthalene (1502,1528,1535,1559)
1510	hydrocarbon
1530	tent. dichloronaphthalene (1536 also tent.)
1577	$C_{13}H_{10}$ tent. 9H Fluorene
1609	$C_{13}H_{12}$ tent. methyl-1,1'-biphenyl
1623	$C_{13}H_{12}$ tent. methyl-1,1'-biphenyl
1652	$C_{14}H_{14}$ tent. dimethyl-1,1'-biphenyl
1673	$C_{13}H_{10}O$ tent. methyldibenzofuran
1685	$C_{11}H_{24}$
1742	$C_6H_6Cl_6$ (I. 1 , 2 , 3 II. 1 , 2 , 3)

Sample #01 (contd)
S-00-01
CB97 4W

Scan #	Compound
1764	tent. methyl 9H Fluorene
1809	low level $C_6H_6Cl_6$
1821	subst. heterocyclic ring
1835	hydrocarbon
1855	$C_{14}H_{10}$ Phenanthrene (tent.)
1867	Anthracene + D_{10}anthracene
1942	(tent.) 9H-carbazole $C_9H_{12}N$
1957	$C_{13}H_{10}S$ 4methyldibenzothiophene
1981	methylphenanthrene
1985	methylphenanthrene
1997	tent. subst. phenanthrene
(2002) 2007	methylphenanthrene
2037	9,10-anthracenedione
2049	$C_{16}H_{12}$ tent. 2-phenylnaphthalene
2044	phthalateester
2106	$C_{16}H_{14}$ dimethylphenanthrene ⊕
2115	hydrocarbon
2124	tent. fluoranthene $C_{16}H_{10}$
2164	tent. pyrene $C_{16}H_{10}$
2222,2239	methyl pyrene or 11H-benzo [a] fluorene
2279,2253	methyl pyrene
2308	phthalate
2402	benzo(2)anthracene (tent.)
2408	triphenylene (tent.)
2438	hydrocarbon
2476	phthalate ester
2667	$C_{20}H_{12}$ tent. benzo (∂) fluoranthene

Sample #10
S-00-10
CB99, 4W

Scan #	Compound
201	4-hydroxy-4-methyl-2-pentanone
489	hydrocarbon
538	hydrocarbon
688	subst. benzene
695	hydrocarbon
720	subst. benzene
836	hydrocarbon
905	hydrocarbon
928	hydrocarbon
1051	hydrocarbon
1109	hydrocarbon
1177	hydrocarbon
1264	hydrocarbon
1225,1246,1248,1272, 1278,1309,1332	dimethylnaphthalene
1305	hydrocarbon
1426	hydrocarbon
1434,1443,1452,1463, 1474,1482,1508,1515, 1538,1652,1574	trimethylnaphthalene
1725	low level $C_6H_6Cl_6$
1746	hydrocarbon
1808	hydrocarbon
1821	hydrocarbon
1839	anthracene
1848	D_{10}anthracene
1851	phenanthrene
1921	hydrocarbon
1928	9H carbazole $C_{12}H_9N$ (tent.)
1934	hydrocarbon
2017	hydrocarbon
2102	hydrocarbon
2110	(tent.) fluoranthene
2149	pyrene
2157	hexadecamethylheptasiloxane
2180	hydrocarbon
2225	$C_{17}H_{12}$ (tent. 11H-benzo(a)fluorene)
2239	$C_{17}H_{12}$ (tent. 11H-benzo(a)fluorene)
2253	hydrocarbon
2322	hydrocarbon
2343	siloxane
2348	$C_{18}H_{12}$ tent. benzo(c)phenanthrene
2387	$C_{18}H_{12}$ tent. crysene

Sample #10 (contd)
S-00-10
CB99, 4W

Scan #	Compound
2393	$C_{18}H_{12}$ benz(a)anthracene (tent.)
2406	$C_{18}H_{12}$
2420	hydrocarbon
2443	siloxane
2462	phthalate ester
2485	siloxane
2566	siloxane
2643	$C_{20}H_{12}$ benzo(a)fluorene

Sample #12
S-00-12
CB97, 4E

Scan #	Compound		
228	heptane		
239	hydrocarbon		
292	toluene		
329	4-methyl-2-penten-2-one		
339	hexanol		
415	4-hydroxy-4-methyl-2-pentanone		
478	ethylbenzene		
		substituted benzenes	
503	xylene	C_9H_{12} (m/z120)	$C_{10}H_{14}$ (m/z134)
561	xylene	735,908	1129,1196,1403
		791,974	1139,1245,1415
		819,1006	1153,1272
		850	1169,1349
855	benzenamine		
1045	C_9H_{10} dihydro-1H-indene		
1071	C_9H_8 1H-indene		
1416	$C_{11}H_{24}$		
1432	2-chlorobenzenamine		
1467	$C_{11}H_{20}$+ methylphenol		
1476,1514,1549	$C_{10}H_{12}$ subst. benzene		
1534	hydrocarbon		
1629	naphthalene		
1670	hydrocarbon		
1689	hydrocarbon		
1699	tent. $C_{12}H_{22}$ decahydrodimethylnaphthalene		
1714	hydrocarbon		
1838	hydrocarbon		
1930	hydrocarbon		
1963	subst. cyclohexane group		
1985	$C_{11}H_{14}$ tent. dihydro-dimethyl-1H-indene		
2058	$C_{11}H_{14}$ tent. dihydro-dimethyl-1H-indene		
2086	methylnaphthalene		
2104	hydrocarbon		
2129	hydrocarbon		
2132	$C_{12}H_{16}$ tent.		
2144	methylnaphthalene		
2148	hydrocarbon		
2182	tent. subst. cyclohexane		
2216	tent. 1H-indole		
2222	low level chlorinated product, possibly Cl_4 ($C_6H_2Cl_4$)		

Sample #12 (contd)
S-00-12
CB97, 4E

Scan #	Compound
2249	$C_{12}H_{18}$ subst. benzene
2304	tent. $C_{13}H_{18}$ tetrahydrotrimethylnaphthalene
2324	hydrocarbon +
2340	hydrocarbon
2385	$C_{12}H_{24}$ subst. cyclohexane
2389	tetrachlorobenzene
2416	1,1'-biphenyl
2453	hydrocarbon + PAH ?? $C_{10}H_{10}S$
2480	dimethylnaphthalene
2503	hydrocarbon
2510	tent. $C_{10}H_{10}S$ dimethylbenzo(B)thiophene
2524,2529	dimethylnaphthalene
2559	hydrocarbon
2570	tent. $C_{10}H_{10}S$
2577	dimethylnaphthalene
2589	dimethylnaphthalene
2642	hydrocarbon
2649	dimethylnaphthalene
2696	dimethylnaphthalene
2723	methyl-ethylnaphthalene
2788	dihydroacenaphthalene
2822	methylbiphenyl
2842	hydrocarbon +
2852	methyl-1,1'-biphenyl
2862	hydrocarbon
2884	hydrocarbon
2899	methyl-1,1'-biphenyl
2904	$C_{13}H_{14}$ methylethyl-naphthalene
2917	methylbiphenyl + $C_{13}H_{14}$
2935	$C_{13}H_{14}$
2949	hydrocarbon + ?PAH $C_{12}H_{14}S$
2958	$C_{13}H_{14}$
2980	$C_{13}H_{14}$
2997	$C_{13}H_{14}$
3015	hydrocarbon
3050	trimethylnaphthalene
3063	trimethylnaphthalene
3111	trimethylnaphthalene
3149	9H-Fluorene
3158	tent. trimethylnaphthalene
3178	$C_{13}H_{12}$ methyl-1,1'-biphenyl (tent.)
3182	$C_{13}H_{14}$ trimethylnaphthalene
3200	methyl-1,1'-biphenyl

Sample #12 (contd)
S-00-12
CB97, 4E

Scan #	Compound
3212	$C_{13}H_{12}$ propenylnaphthalene
3240	methyl-1,1'-biphenyl
3256	hydrocarbon
3296	$C_{13}H_{10}O$
3340	$C_{13}H_{10}O$ 9H-Xanthene
3365	hydrocarbon C_{17}
3408	$C_{14}H_{16}$ subst. naphthalene
3416	hydrocarbon
3448	$C_{14}H_{12}$ possibly dihydrophenanthrene
3471	$C_{14}H_{16}$ subst. naphthalene
3478	$C_6H_6Cl_6$ tent. lindane
3511	$C_{14}H_{16}$ subst. naphthalene
3518	hydrocarbon
3521	methyl-9H-fluorene $C_{14}H_{12}$
3535	methyl-9H-fluorene $C_{14}H_{12}$
3539	X low level
3550	hydrocarbon
3563	$C_{14}H_{12}$ methyl-9H-fluorene (tent.)
3570	hydrocarbon
3586	tent. subst. naphthalene $\geq C_{14}H_{16}$
3642	hydrocarbon
3666	hydrocarbon
3733	anthracene
3725	D_{10}anthracene
3712	phenanthrene
3802	$C_{15}H_{14}$ tent. subst. benzene
3864	hydrocarbon
3878	$C_{12}H_9N$ tent. 9H-carbazole
3879	$C_{16}H_{12}$ tent. phenylnaphthalene
3890	hydrocarbon
3910	C H S tent. methyl-dibenzothiophene
3920	hydrocarbon
3957	methylphenanthrene
3966	methylphenanthrene
3985	methylphenanthrene
4000	methylphenanthrene
4008	methylphenanthrene
4054	hydrocarbon
4069	$C_{14}H_{12}S$ tent. dimethylnaphtho(2,3-B)thiophen
4094	$C_{16}H_{12}$ phenylnaphthalene
4106	$C_{14}H_{12}S$ (tent.) ⊕
4131,4179,4159, 4166,4209,4219, 4225,4245	$C_{16}H_{14}$ (dimethylphenanthrene) tent.

Sample #12 (contd)
S-00-12
CB97, 4E

Scan #	Compound
4225	hydrocarbon + dimethylphenanthrene
4249	fluoranthene
4327	pyrene
4336	possibly $C_{15}H_{11}N$ (phenylisoquinoline)
4344,4392,4369, 4425	$C_{15}H_{10}N_2$ (tent.)
4381	hydrocarbon
4440	$C_{17}H_{12}$methylpyrene
4476	$C_{17}H_{12}$ tent. 11H-benzo(A)fluorene
4493	siloxane
4503	$C_{17}H_{12}$ tent. 11H-benzo(A)fluorene (methylpyrene)
4513	$C_{17}H_{12}$
4526	hydrocarbon
4536	$C_{18}H_{16}$ (tent.)
4546	$C_{17}H_{12}$ (methylpyrene)
4555	$C_{18}H_{16}$ + $C_{17}H_{12}$
4619	1,1':2',1"-terphenyl $C_{18}H_{14}$
4664	hydrocarbon
4705	siloxane
4721	$C_{18}H_{12}$ tent. benzo(c)phenanthrene
4734	$C_{14}H_{15}O_2N$ tent.
4759	hydrocarbon
4802	$C_{18}H_{12}$ tent. benzo(A)anthracene
4814	$C_{18}H_{12}$ tent. triphenylene
4841	$C_{18}H_{12}$ tent. benzo(d)phenanthrene
4890	$C_{19}H_{14}$ tent. methylbenzo(a)anthracene
4908	siloxane
4936	hydrocarbon
4949	phthalateester
4990	methyltriphenylene $C_{19}H_{14}$
5102	hydrocarbon
5163	siloxane
5303	hydrocarbon
5331	$C_{20}H_{12}$ perylene
5390	$C_{20}H_{12}$ tent. benzo(a)pyrene

Sample #13
S-00-13
CB99, 4E

Scan #	Compound
64	dichloromethane
95	benzene
97	C_6H_{12} (tent. methylcyclopentane)
141	toluene
158	$C_6H_{10}O$ 4methyl-3-penten-2-one
201	4-hydroxy-4-methyl-2-pentanone
234	xylene
248	xylene
282	xylene
457	C_9H_{12} subst. benzene
504	hydrocarbon
507	C_9H_{12} subst. benzene
519	$C_{11}H_{14}$ subst. benze
537	$C_{10}H_{16}$ subst. cyclohexene
552	hydrocarbon
572	$C_{10}H_{14}$ subst. benzene
587	$C_{10}H_{14}$ subst. benzene
626	$C_{10}H_{14}$ subst. benzene
638	$C_{10}H_{14}$ subst. benzene
703	$C_{11}H_{20}$ (decahydro-2-methylnaphthalene) + $C_{10}H_{14}$ subst. benzene
709	hydrocarbon
736	$C_{11}H_{20}$ (decahydro-2-methylnaphthalene)
748	hydrocarbon
762	$C_{11}H_{16}$ substituted benzene
767	pentylcyclohexane
770	$C_{10}H_{14}$ substituted benzene
781	$C_{11}H_{16}$ (tent.) subst. benzene
788,798	tent. subst. cyclohexane
809	$C_{11}H_{16}$ subst. benzene
814	naphthalene
825	hydrocarbon
845	hydrocarbon
858	hydrocarbon
874	$C_{11}H_{16}$ subst. benzene +
894	$C_{11}H_{16}$ subst. benzene
908	$C_{11}H_{16}$ subst. benzene
920	dodecane
930	$C_{12}H_{18}$ subst. benzene
940	$C_{11}H_{16}$ subst. benzene
952	hydrocarbon
957	(tent.) subst. cyclohydrocarbon $C_{11}H_{14}O$
969	$C_{11}H_{14}$ tetrahydromethylnaphthalene
993	$C_{11}H_{14}$ tetrahydromethylnaphthalene

Sample #13 (contd)
S-00-13
CB99, 4E

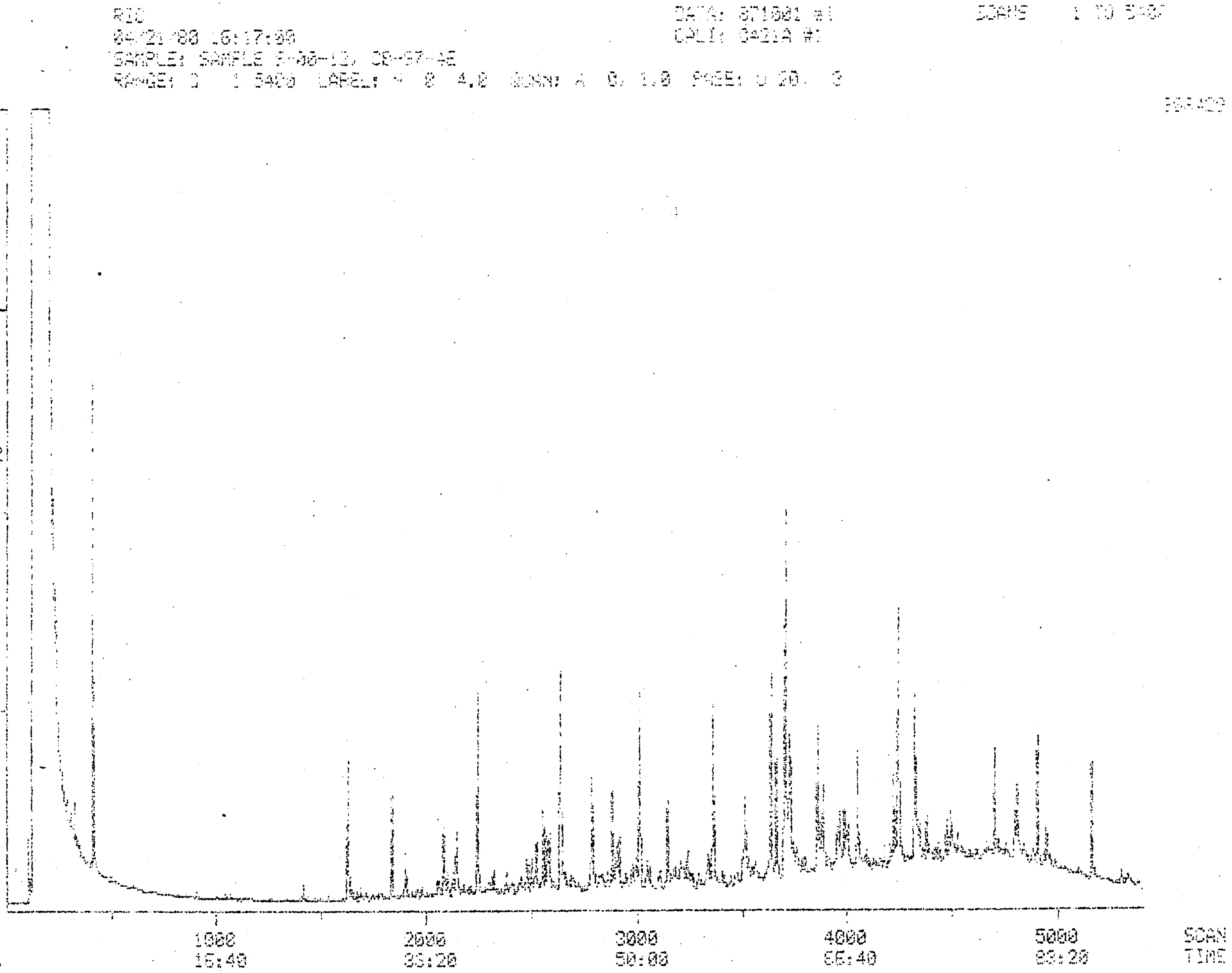
Scan #	Compound
1015	$C_{12}H_{18}$ subst. benzene
1035	$C_{12}H_{18}$ subst. benzene
1043	dimethylnaphthalene
1045	$C_{12}H_{18}$ subst. benzene
1063	hydrocarbon
1071	dimethylnaphthalene
1073	hydrocarbon
1089	tent. subst. cyclohexane
1111	tetrachlorobenzene
1125	hydrocarbon
1161	hydrocarbon
1189	tent. subst. benzene
1191	tent. subst. benzene + hydrocarbon
1195	tetrachlorobenzene
1209	tent. $C_{13}H_{20}$ subst. benzene
1219	tent. $C_{13}H_{20}$ subst. benzene
1225	hydrocarbon
1239	dimethylnaphthalene
1242	hydrocarbon +
1251	hydrocarbon
1262	dimethylnaphthalene
1275	subst. benzene
1278	hydrocarbon
1289,1293	dimethylnaphthalene
1320	hydrocarbon
1324	dimethylnaphthalene
1347	dimethylnaphthalene
1372	hydrocarbon
1391	subst. cyclohexane C_{11} or C_{12} (tent.)
1397	hydrocarbon
1409	methyl-1,1'-biphenyl
1418	tent. subst. 1,1'-biphenyl +
1440	hydrocarbon
1449,1456,1466, 1478,1488,1497	dimethylnaphthalene
1507	hydrocarbon
1523,1530,1553, 1578,1589	trimethylnaphthalene
1619	subst. naphthalene
1626	hydrocarbon
1630	hydrocarbon
1681	hydrocarbon
1702	$C_{14}H_{16}$ subst. naphthalene

Sample #13 (contd)
S-00-13
CB99, 4E

Scan #	Compound
1733	tent. 2-methoxy-1,1'-biphenyl
1736	$C_6H_6CL_6$ Lindane
1753	tent. $C_{14}H_{16}$ subst. naphthalene
1756	hydrocarbon
1764,1781,1795	$C_{14}H_{14}$ subst. 1,1'-biphenyl
1818	hydrocarbon
1828	dimethyl-1,1'-biphenyl
1829	hydrocarbon
1849	tent. $C_{14}H_{10}$ phenanthrene
1857	D_{10}anthracene
1868	hydrocarbon
1877	hydrocarbon
1890	hydrocarbon
1898	tent. dimethyl-9H-fluorene
1905	dimethyl-9H-fluorene
1929	hydrocarbon
1942	hydrocarbon
1950	tent. methyldibenzothiophene $C_{13}H_{10}S$
1974	methylphenanthrene
1979	methylphenanthrene
1990	hydrocarbon
2024	hydrocarbon
2086	dimethylphenanthrene (tent.)
2100	dimethylphenanthrene (tent.)
2110	hydrocarbon
2118	fluoranthene
2157	pyrene
2173	hydrocarbon
2188	hydrocarbon
2193	trimethylphenanthrene
2400	hydrocarbon
2473	phthalateester
2517	hydrocarbon

Sample #16
Control

Scan #	Compound
206	4-hydroxy-4-methyl-2-pentanone
424	hydrocarbon C_9-C_{11}
1856	D_{10}anthracene
1953	phthalateester
2038	phthalateester
2117	fluoranthene
2157	pyrene
2302	phthalateester
2470	phthalateester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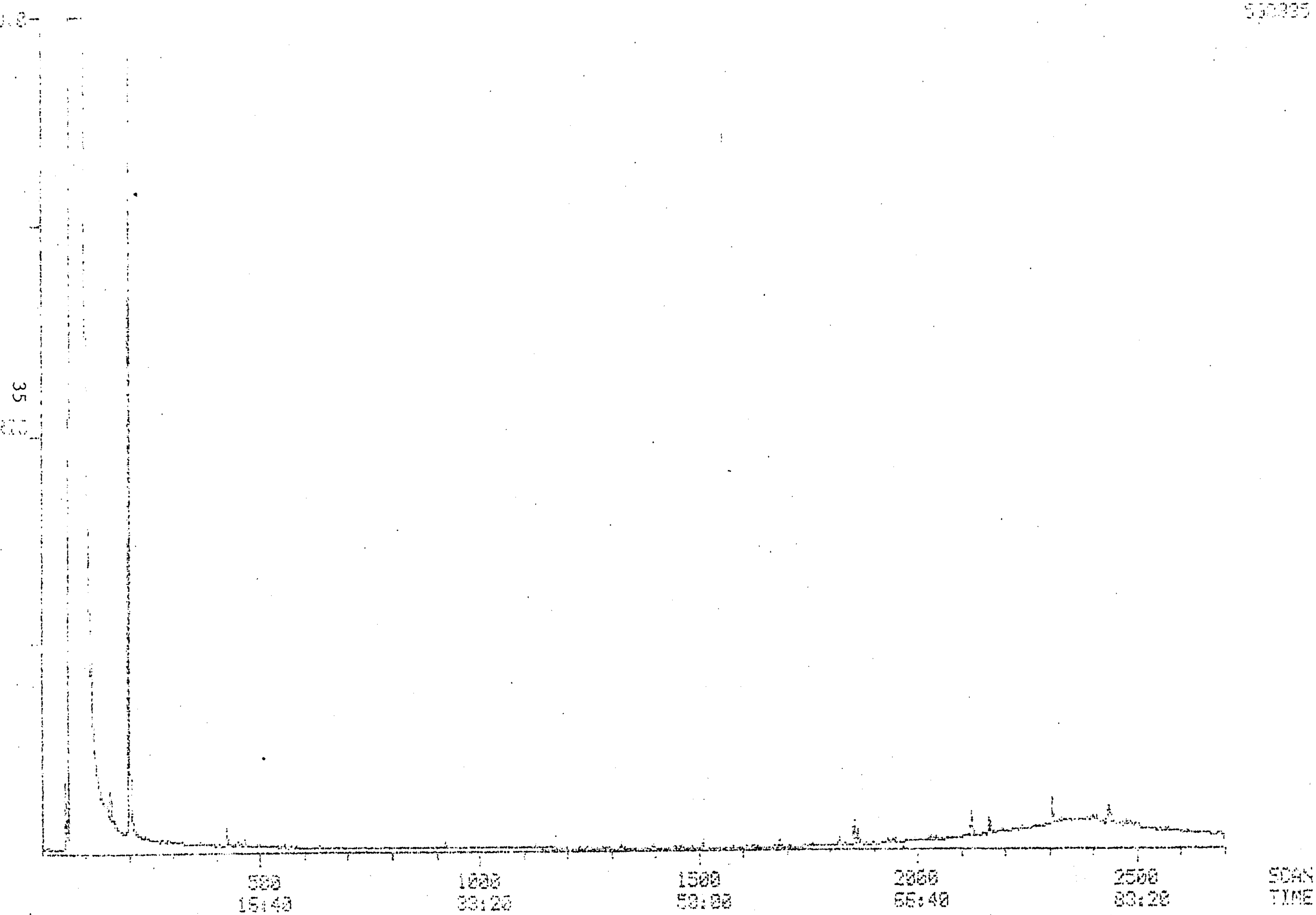
04/21/88 16:17:00
SAMPLE: SAMPLE F-00-12, C8-97-4E
RANGE: G 1,5400 LABEL: N 0 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871001 #1
CALI: 0421A #1
SCANS 1 TO 5400
588429
1000
15:40
2000
33:20
3000
50:00
4000
66:40
5000
83:20
SCAN
TIME

RIC
04/22/80 14:22:00
SAMPLE: S-80-81, DB-87-4W
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871004 #1
CALI: B-22A 45

SCANS 1 TO 2700

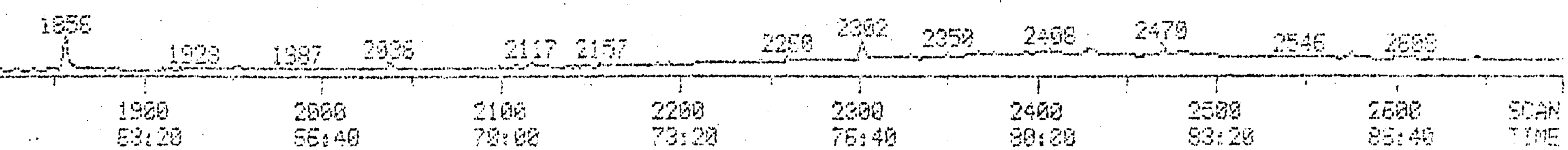
530335



RIC
04/23/80 8:31:00
SAMPLE: CONTROL (5-30-15) FOR SAMPLES 5-09-01 THROUGH 5-30-15
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 371005 #1
CALI: 0423A #3

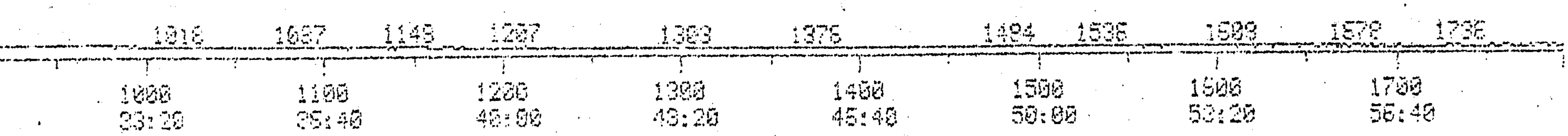
SCANS 1801 TO 2700
OUT OF 1 TO 2734



RIC
04/23/80 8:31:00
SAMPLE: CONTROL (S-80-16) FOR SAMPLES S-80-01 THROUGH S-80-15
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871205 #1
CALI: 0423A #3

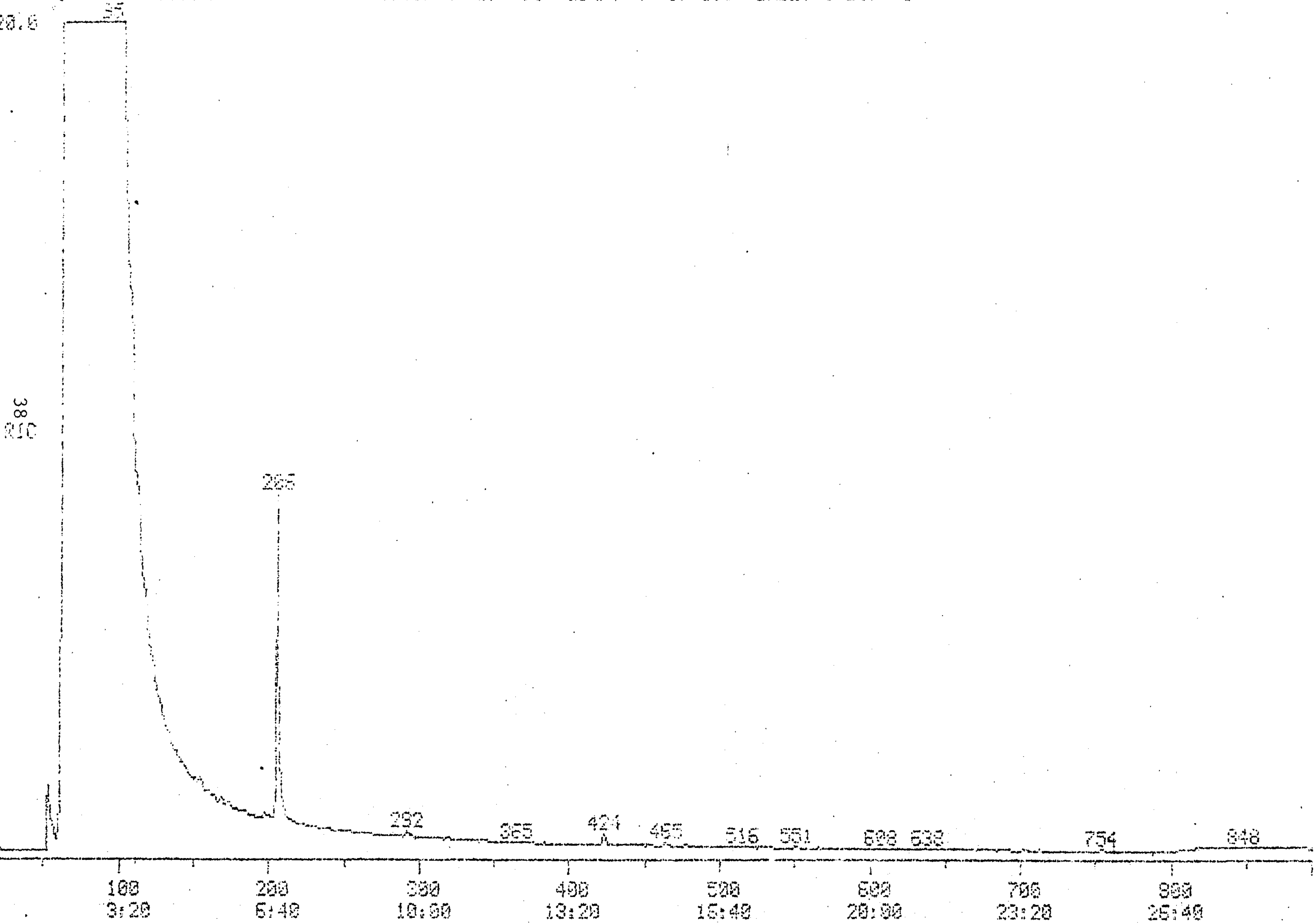
SCANS 921 TO 1801
OUT OF 1 TO 2700



RIC
04/23/80 8:31:00
SAMPLE: CONTROL (S-80-16) FOR SAMPLES S-80-01 THROUGH S-80-15
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 971085 #1
CALI: 0423A #3

SCANS 1 TO 901
OUT OF 1 TO 2700



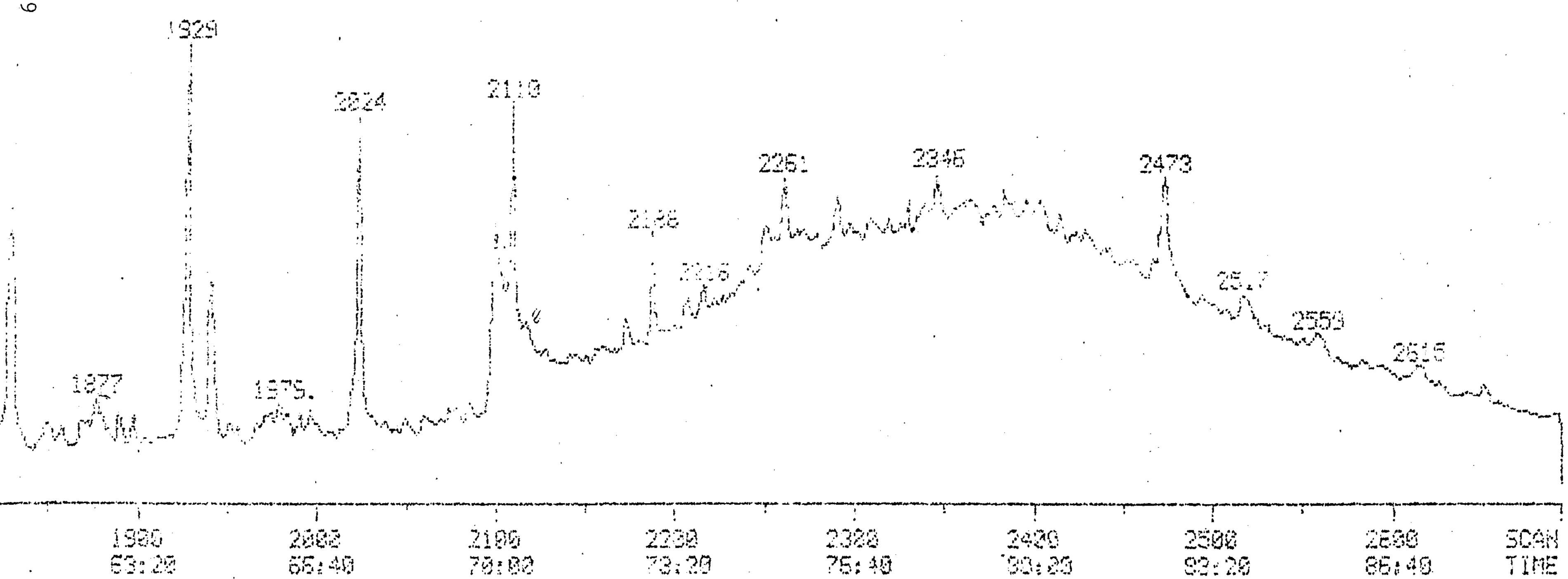
38

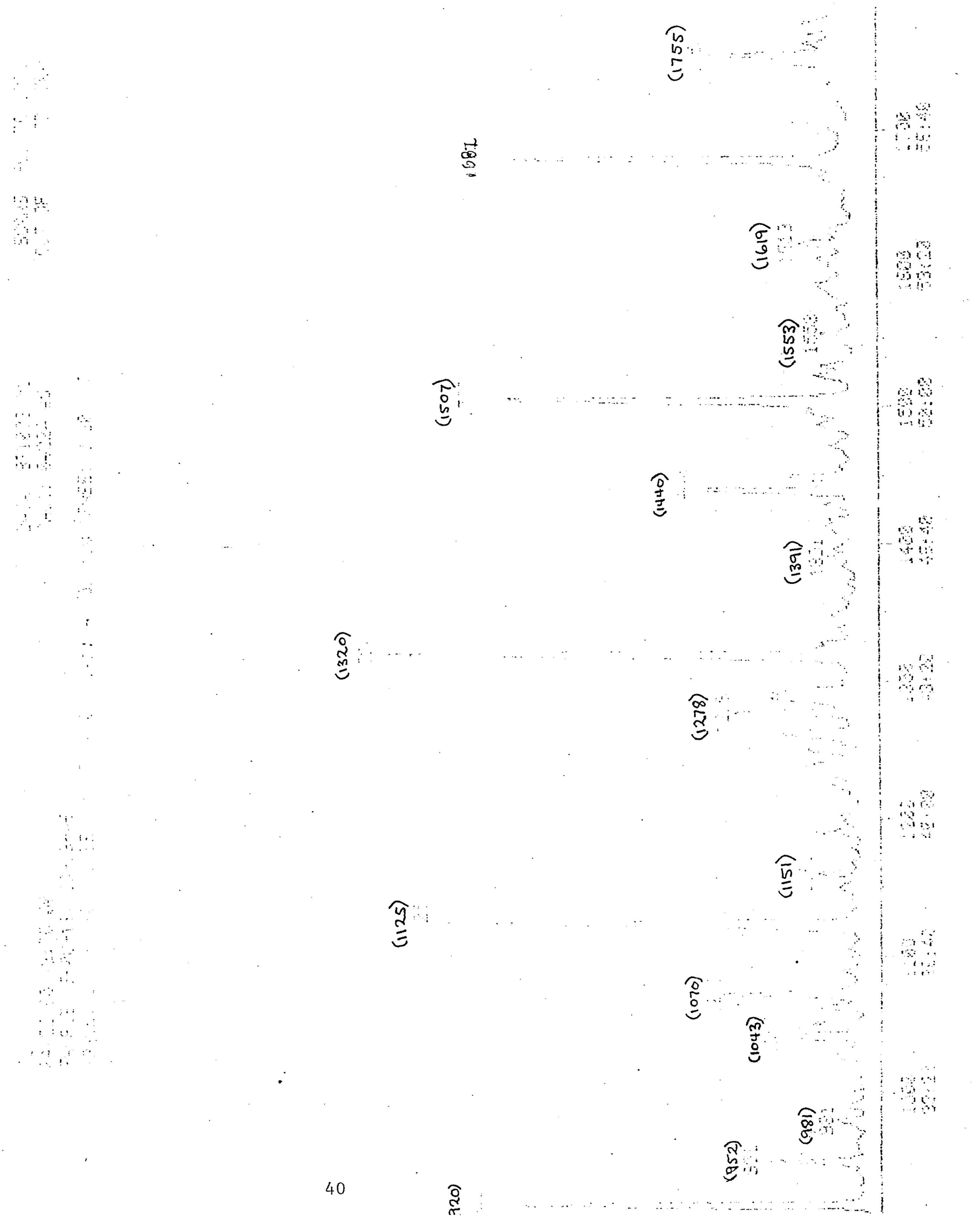
RIC
04/22/80 12:30:00
SAMPLE: S-80-19, C2-S?-4E
RANGE: G 1,2720 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: S71009 #1
CALI: 0422A #5

SCANS 1801 TO 2700
OUT OF 1 TO 2700

586547




(1755)
1601
(1619)
(1553)
(1507)
(1440)
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(1320)
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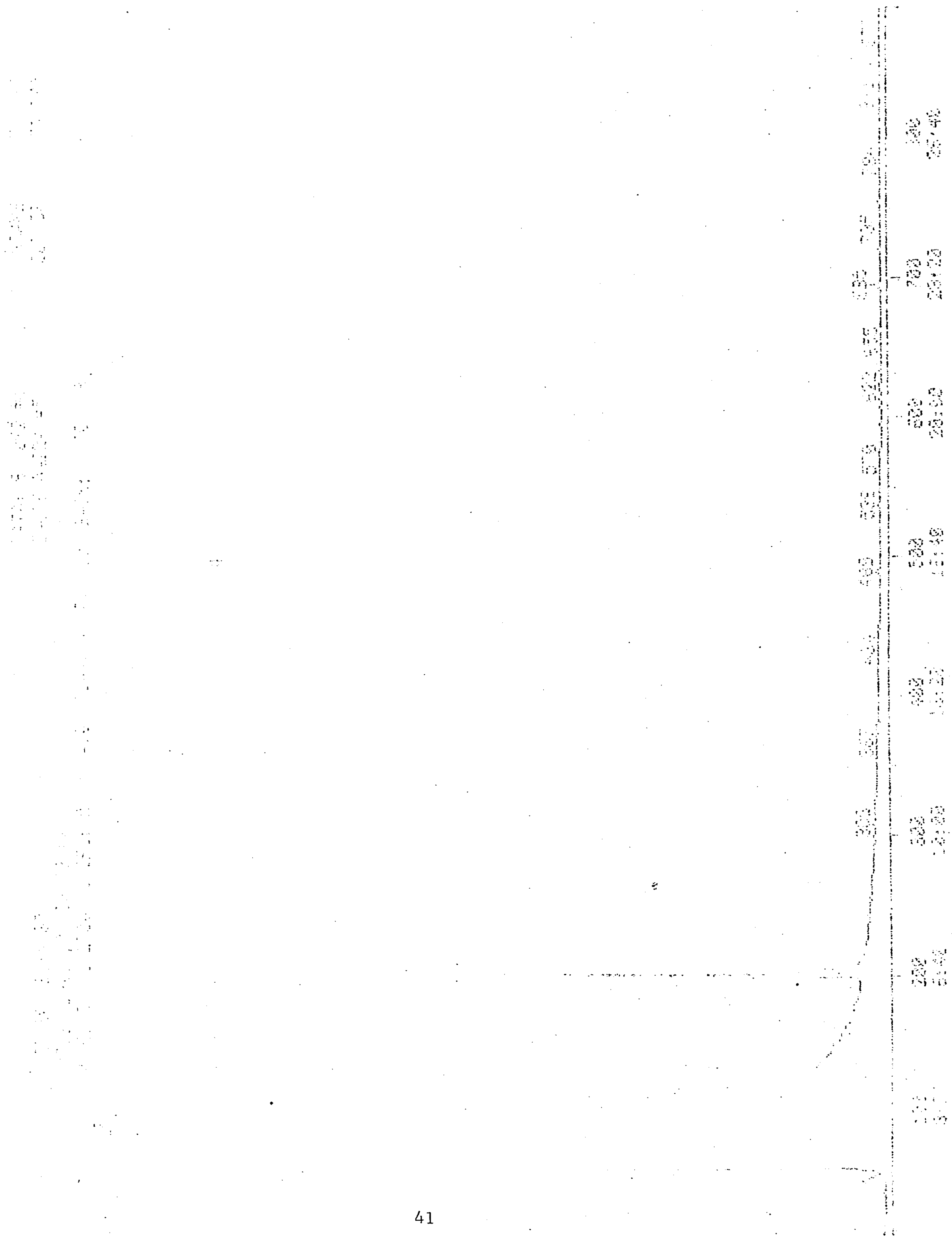
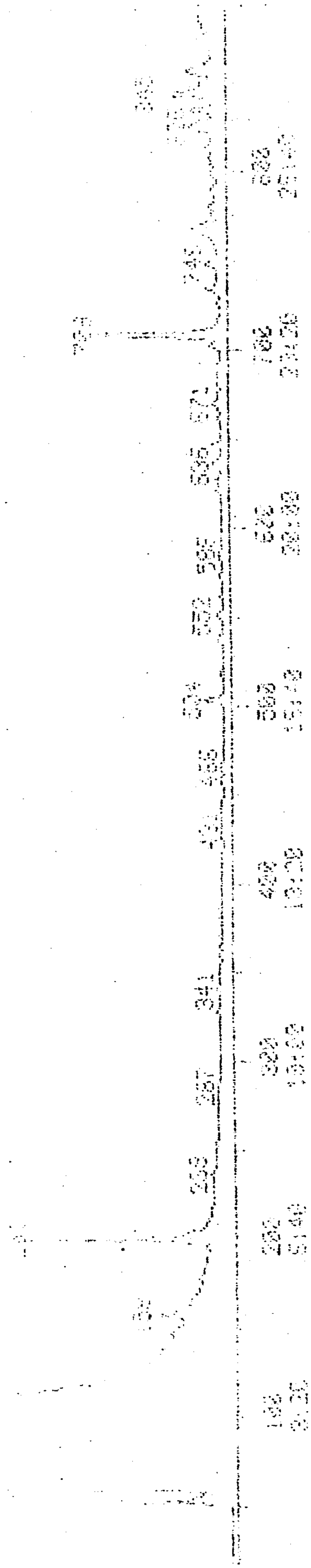
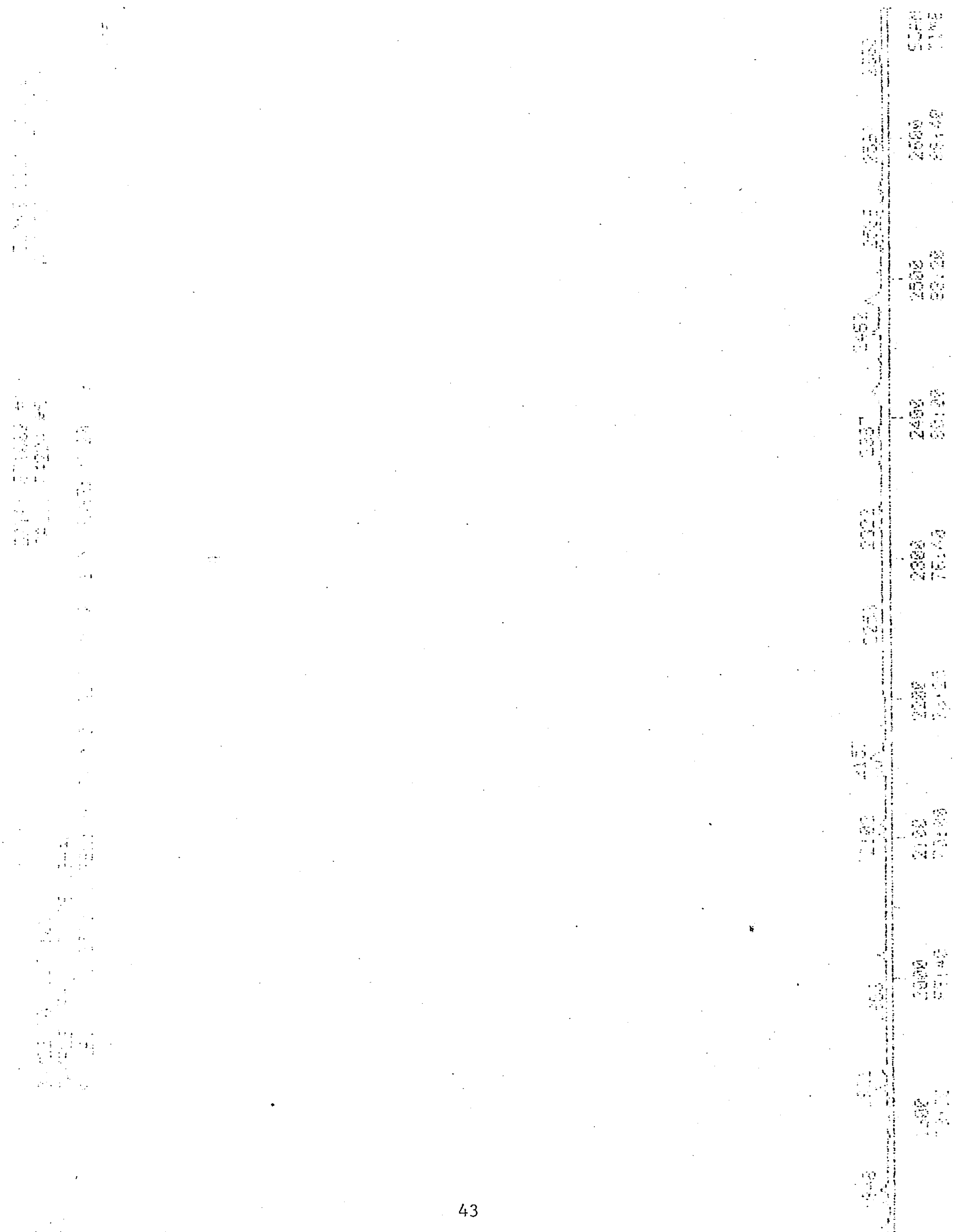
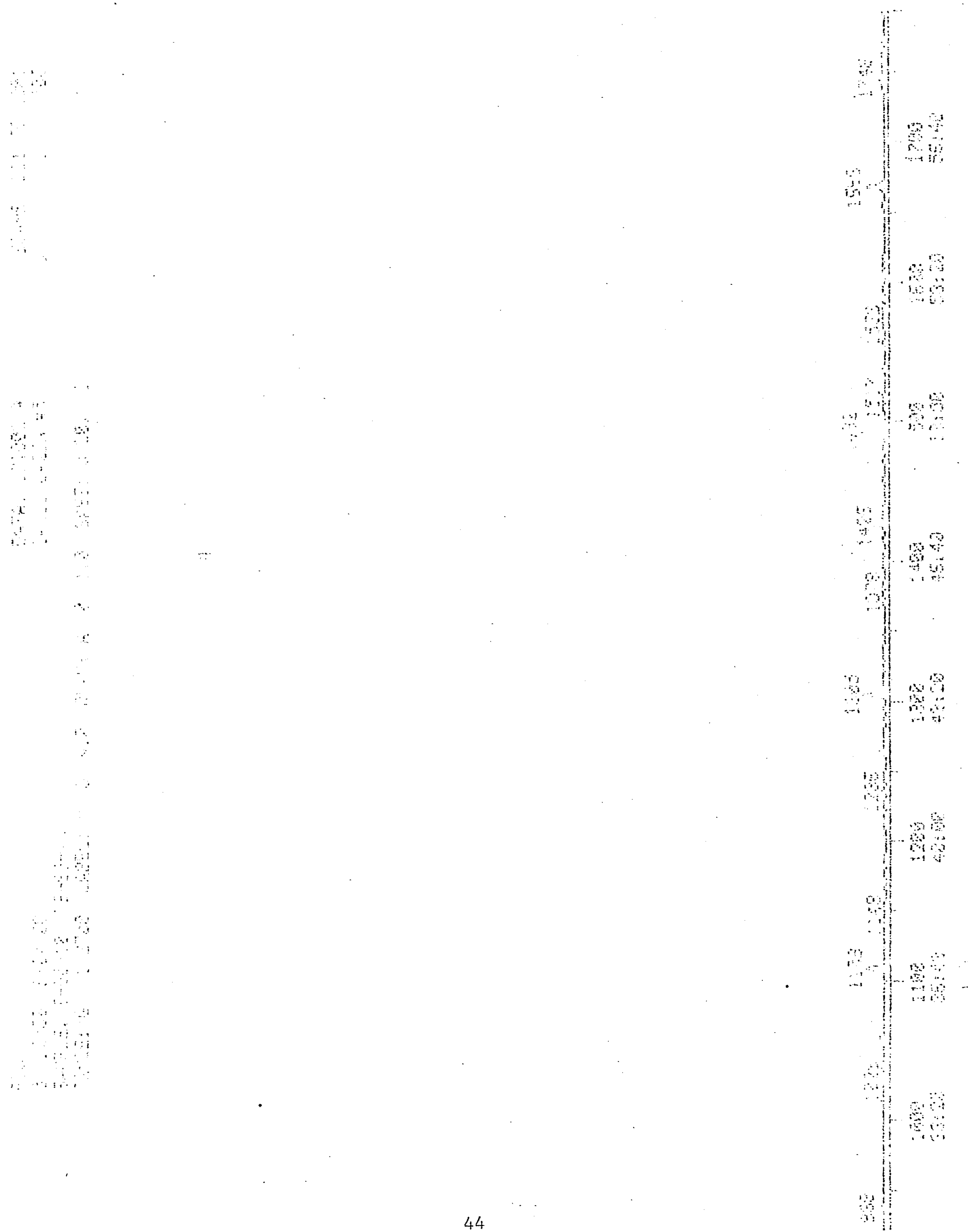
(1151)
(1125)
(1070)
(1043)
(981)
(952)
(920)









C. <u>Solvent Extracted Samples</u> (contd)

3. Data (contd)

b. Storm sewer sediments

The following is a list of compounds detected in the samples:

<u>Sample #31</u>
S-00-32
99-2 B/N

Scan #	Compound
69-87	dichloromethane
153	benzene
157	cyclohexane
164	2-methyl-hexane
168	ethenylcyclobutane
182	heptane
219	methylbenzene
259	tetrachloroethene
312	ethylbenzene
323	1,2-dimethylbenzene
348	1,2-dimethylbenzene
498	1,2,3 trimethylbenzene
556	octamethyl-cyclotetrasiloxane
594,599,605,611	diethylbenzene
658	2-ethyl-1,3-dimethylbenzene
718	2-ethyl-1,4-dimethylbenzene
722	undecane
724	1-ethyl-2,4-dimethylbenzene
812	trichlorobenzene
823	naphthalene
1041	2-methylnaphthalene
1069	2-methylnaphthalene
1279,1232,1256,1285	1,2-dimethylnaphthalene
1382	1,2-dihydroacenaphthalene
1431	2-(1-methylethyl)-naphthalene
1477	1,3,6 trimethyl-naphthalene
1485	1,3,6 trimethyl-naphthalene
1496	dichlorodiphenylamine (tent.)
1700	4-methyl-phenanthrene (tent.)
1839	phenanthrene
1852	D_{10}anthracene
1854	anthracene
1927	9-H-carbazole
1969,1965,1979,1986, 1990	1-methyl-phenanthrene

Sample #31 (contd)
S-00-32
99-2 B/N

Scan #	Compound
2034	phenylnaphthalene
2076	3,6-dimethyl-phenanthrene
2091	2,3-dimethyl-phenanthrene
2108	fluoranthene
2147	pyrene
2223,2237,2242, 2259	11H-benzo(A)fluorene
2346	benzo(GHI)fluorene (tent.)
2386	benzo(C)phenanthrene
2391	triphenylene
2648	hexadecamethyl-heptasiloxane

Sample #36
S-00-66
97-6 B/N

Scan #	Compound
61	dichloromethane
92	benzene
103	tent. trichloroethane
235	toluene
210	chlorobenzene
368	1chloro2methylbenzene
377	chloromethylbenzene
379	ethylbenzene
455	dichlorobenzene
466	dichlorobenzene
507	dichlorobenzene
424,527	tent. dichlorothiophene
574	tent. subst. chlorobenzene m/z 162 with one chlorine
682	dichlorotoluene
707	trichlorobenzene
736	dichlorotoluene
797	trichlorobenzene
857	trichlorobenzene
903	hydrocarbon
968	tent. bromochloromethylphenol
973	dichloro-1-(chloromethyl)benzene
1032	dichloro-1-(chloromethyl)benzene
1052	dichloro-1-(chloromethyl)benzene
1099	tetrachlorobenzene
1104	dichloro-1-(chloromethyl)benzene
1108	hydrocarbon
1190	tetrachlorobenzene
1235	hydrocarbon
1305	hydrocarbon
1318	hydrocarbon
1366	dichloro-1-(dichloromethyl)benzene
1394	tent. methyl-1,1'-biphenyl
1418	dichloro-1-(dichloromethyl)benzene
1461	pentachlorobenzene
1474	trimethylnaphthalene
1483	trimethylnaphthalene
1493	hydrocarbon
1511	dichloronaphthalene
1516	dichloronaphthalene
1533	dichloronaphthalene
1539	trimethylnaphthalene
1548	dichloronaphthalene

Sample #36 (contd)
S-00-66
97-6 B/N

Scan #	Compound
1688	tetramethylnaphthalene
1720	tetramethylnaphthalene
1723	hexachlorocyclohexane tent. Lindane
1740	tetramethylnaphthalene
1745	hydrocarbon
1764	C_6Cl_{16} tent. hexachlorobenzene
1772	trichloronaphthalene (tent.)
1778	trichloronaphthalene
1809	hydrocarbon
1821	hydrocarbon
1838	anthracene
1847	D_{10}anthracene
1867	trichloro product (230,248) possibly sub.
1888	hydrocarbon
1943	trichlorobiphenyl
1963	trichlorobiphenyl (tent.)
1967	$C_{14}H_{11}Cl_2$ tent.
1975	trichlorobiphenyl (tent.)
1986	methylphenanthrene (tent.)
1991	$C_{14}H_{11}Cl_2$ tent.
2016	hydrocarbon
2023	$C_{14}H_{11}Cl_2$ tent.
2033	tent. 1,1'-thiobis(4-chlorobenzene)
2041	$C_{14}H_{12}S$ tent. dimethylnaphtho(2,3-B) thiophene
2050	trichlorobiphenyl
2091	dimethylphenanthrene
2101	hydrocarbon
2108	substituted benzene
2114	$C_{14}H_9Cl_3$ (tent.)
2115	$C_{14}H_{11}Cl_3$ tent.
2140	$C_{14}H_{11}Cl_3$ tent.
2143	tetrachlorobiphenyl
2151	$C_{14}H_{11}Cl_3$ tent.
2170	$C_{12}H_7Cl_3$
2190	$C_{14}H_9Cl_3$ 1,1'-(chloroethenylidene)bis (4-chlorobenzene) (tent.)
2219	$C_{14}H_9Cl_3$ 1,1'-(chloroethenylidene)bis (4-chlorobenzene) (tent.)
2229	possibly PAH
2251	hydrocarbon
2281	$C_{12}H_6SCl_4$ (tent.)
2288	$C_{14}H_8Cl_4$

Sample #36 (contd)
S-00-66
97-6 B/N

Scan #	Compound
2289	$C_{14}H_8Cl_4$
2325	trichloro product possibly similar to $C_{14}H_9Cl_3$
2340	siloxane
2440	siloxane
2562	siloxane
2623	hydrocarbon

Sample #43
S-00-38
102-3 B/N

Scan #	Compound
63	dichloromethane
95	benzene
106	tent. trichloroethane
138	toluene
469	dichlorobenzene (low level)
690	$C_{11}H_{20}$
696	hydrocarbon
722	$C_{11}H_{20}$ decahydromethylnaphthalene
802	trichlorobenzene
868	hydrocarbon
841	hydrocarbon
1057	$C_{12}H_{16}$ subst. benzene
1115	hydrocarbon
1144	tent. subst. benzene
1161	hydrocarbon
1199	1,1'-biphenyl
1255	dimethylnaphthalene
1279	dimethylnaphthalene
1306	hydrocarbon
1310	hydrocarbon
1326	$C_{15}H_{28}$ subst. -1H-indene
1384	$C_{12}H_{10}$ tent. dihydroacenaphthalene
1392	hydrocarbon
1405	tent. acidester
1441	trimethylnaphthalene
1456	pentachlorobenzene
1479	trimethylnaphthalene
1487	trimethylnaphthalene
1496	hydrocarbon
1514	trimethylnaphthalene + trichloro product mw $\geq$196 (trichlorotoluene)
1543	trimethylnaphthalene
1579	trimethylnaphthalene
1636	9H-Xanthene
1642	subst. benzene
1658	tent. methyldibenzofuran
1671	hydrocarbon
1724	dimethyl 1,1'-biphenyl
1731	possibly subst. PAH
1748	hydrocarbon
1764	tent. hexachlorobenzene (low level)
1775	trichloroproduct m/z 230
1788	9H-fluoren-9-one + trichloro product m/z 230

Sample #43 (contd)
S-00-38
102-3 B/N

Scan #	Compound
1810	hydrocarbon
1829	hydrocarbon
1833	hydrocarbon
1846	phenanthrene
1870	hydrocarbon
1910	hydrocarbon
1921	hydrocarbon
1928	9Hcarbazole + $C_{16}H_{12}$
1984	tent. $C_{15}H_{10}$ 4H-cyclopenta(DEF)phenanthrene
2026	$C_{14}H_8O_2$ tent. 9,10anthracenedione
2037	phenylnaphthalene
2115	fluoranthene
2154	pyrene
2211	11Hbenzo(a)fluorene $C_{17}H_{12}$
2228	2methylpyrene $C_{17}H_{12}$
2241	methylpyrene $C_{17}H_{12}$
2351	$C_{18}H_{10}$ tent. benzo(GHI)fluoranthene
2389	tent. triphenylene $C_{18}H_{12}$
2397	tent. crysene $C_{18}H_{12}$
2410	benzo(c)phenanthrene $C_{18}H_{12}$
2413	$C_{20}H_{20}$ tent. dihydro-15H-cyclopenta(a) phenanthrene
2434	methylbenz(a)anthracene $C_{19}H_{14}$
2482	methylbenz(a)anthracene $C_{19}H_{14}$
2508	substituted PAH

Sample #44
S-00-65
CS-6 B/N

Scan #	Compound
62	dichloromethane
141	toluene
162	methy-3-pentenone
178	tetrachloroethene
253	xylene
337	ethyl-benzenediol
371	ethyl-benzenediol
638	dimethyl-3-cylcoheren-l-one
751	3-hexen-2-one
859	4hydroxy-4-methyl-2pentanone
906	hydrocarbon
1110	hydrocarbon
1183	tetrachlorobenzene
1265	hydrocarbon
1310	hydrocarbon
1322	tent. oclahydrohexamethyl-lH-indene
1475	trimethylnaphthalene
1492	hydrocarbon
1509	trimethylnaphthalene
1516	trimethylnaphthalene
1746	hydrocarbon
1809	hydrocarbon
1821	hydrocarbon
1849	D_{10}anthracene
1921	hydrocarbon
1934	hydrocarbon
2017	hydrocarbon
2103	hydrocarbon
2182	hydrocarbon
2225	hydrocarbon
2323	hydrocarbon
2389	hydrocarbon
2466	phthalicacidester
2628	phthalicacidester

Sample #46
S-00-50
99-6 B/N

Scan #	Compound
63	dichloromethane
91	methylpentane
98	benzene
155	tent. methylpentanone
136	toluene
233	xylene
247	xylene
281	xylene
335	4-ethyl-1,3-benzenediol (tent.)
516	tent. C_6-C_8 ketone
575	tent. $C_7H_{12}O$ ketone
622	tent. $C_9H_{14}O$ ketone
642	methylcyclohexenone
773	subst. benzene
802	3-hexen-2-one
825	tent. $C_7H_{16}O$ alcohol
844	trichlorobenzene
901	trichlorobenzene
915	tent. 4hydroxy-4-methyl-2pentanone
928	subst. cyclohexane
985	$C_{12}H_{18}O$ possibly subst. phenol
1024	hydrocarbon
1028	$C_{10}H_{18}$ subst. cyclopentane or pentene
1054	tent. 1,2dichloro-4-(chloromethyl)benzene
1074	tent. 2,4dichloro-1-(chloromethyl)benzene
1115	tetrachlorobenzene
1150	hydrocarbon (tent.)
1167	hydrocarbon (tent.)
1196	tetrachlorobenzene
1255	hydrocarbon
1284	hydrocarbon
1297	hydrocarbon
1433	hydrocarbon
1437	hydrocarbon
1459	pentachlorobenzene
1482	hydrocarbon
1498	hydrocarbon
1504	hydrocarbon
1516	hydrocarbon
1528	hydrocarbon
1546	hydrocarbon
1565	hydrocarbon
1673	hydrocarbon
1727	1-(1,1 dimethylethyl)naphthalene

Sample #46 (contd)
S-00-50
99-6 B/N

Scan #	Compound
1734	hydrocarbon
1745	hydrocarbon
1750	hydrocarbon
1812	hydrocarbon
1824	hydrocarbon
1845	anthracene
1853	D_{10}anthracene
1924	hydrocarbon
1937	hydrocarbon
2005	DFTPP
2020	hydrocarbon
2114	tent. fluoranthene
2154	tent. pyrene
2170	hydrocarbon
2184	hydrocarbon
2322	siloxane
2467	phthalicacidester
2642	hydrocarbon

C. Solvent Extracted Samples (contd)

3. Data (contd)

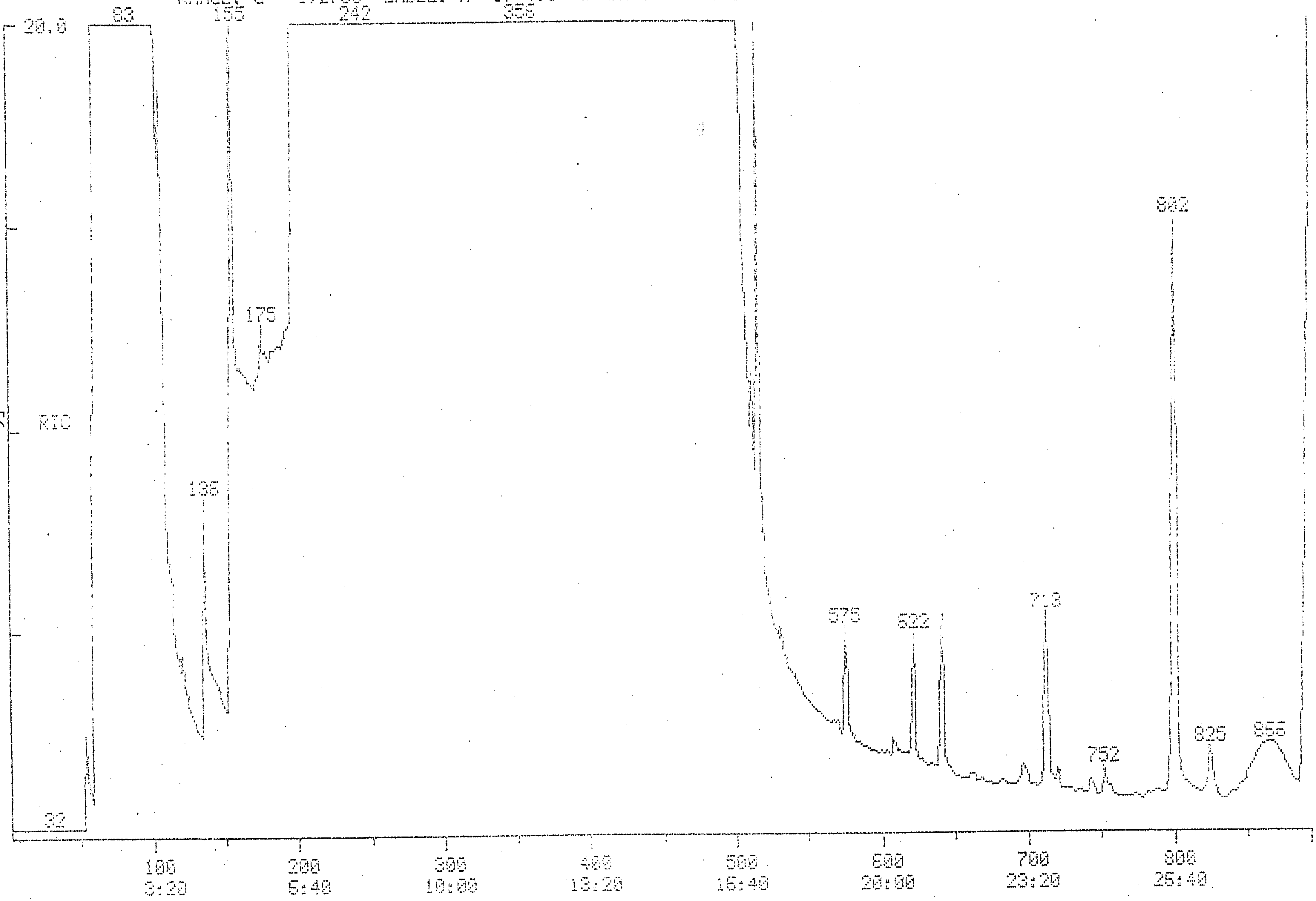
Attached are specific chromatograms for illustrative purposes only. The first example shows the chromatogram for one of the samples (99-6 B/N), followed by the scan list generated followed by the best library match. These are not identifications.

Identification is only made by visual and interpretive judgement of the mass spectroscopist.

RIC
05/12/80 16:10:00
SAMPLE: #46 -- S-00-50 -- 99-6 B/N
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871024 #2642
CALI: 0512A #1

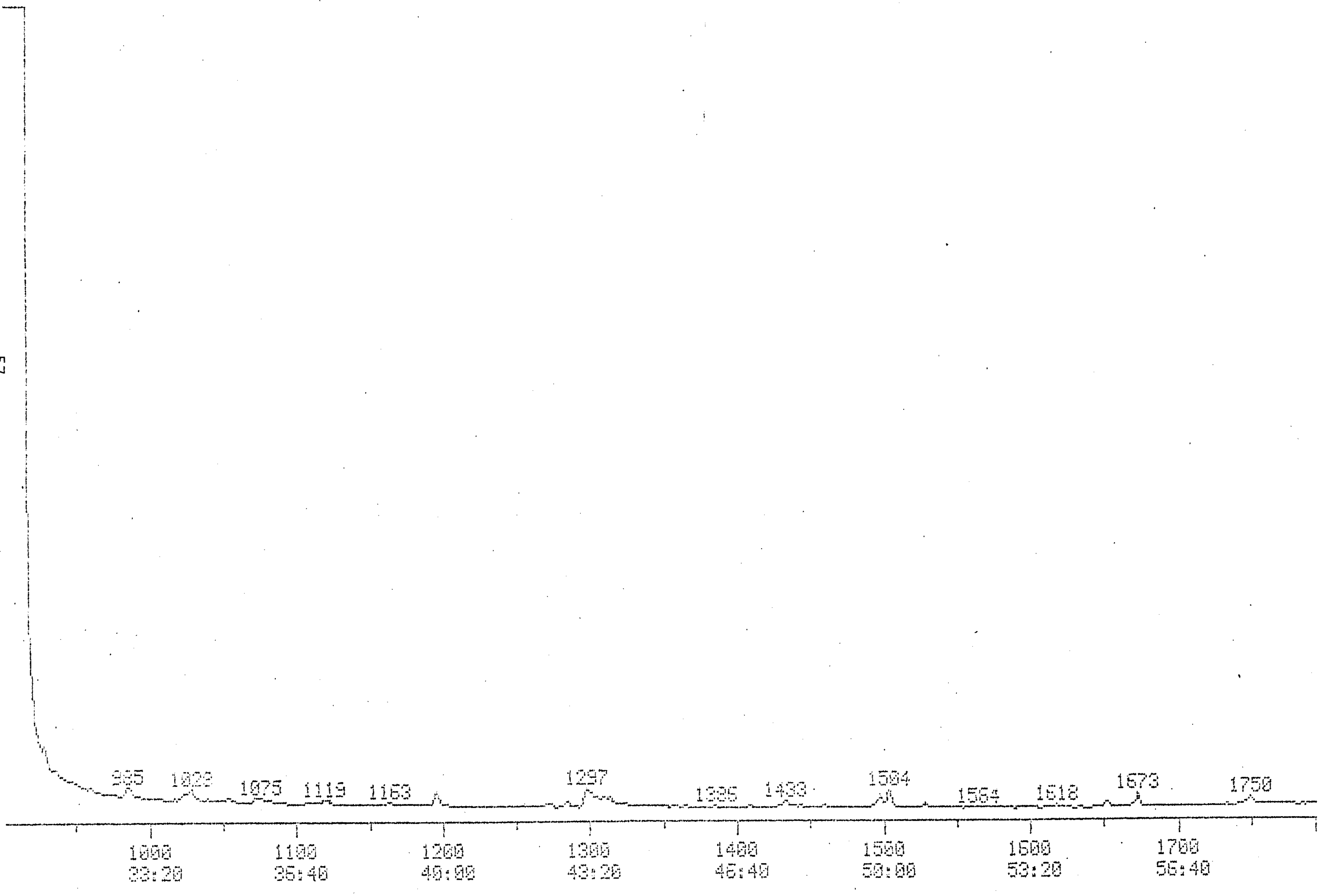
SCANS 1 TO 901
OUT OF 1 TO 2700



RIC
05/12/80 16:10:00
SAMPLE: #46 -- 5-00-50 -- 99-6 B/N
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871024 #2642
CALI: 0512A #1

SCANS 901 TO 1801
OUT OF 1 TO 2700

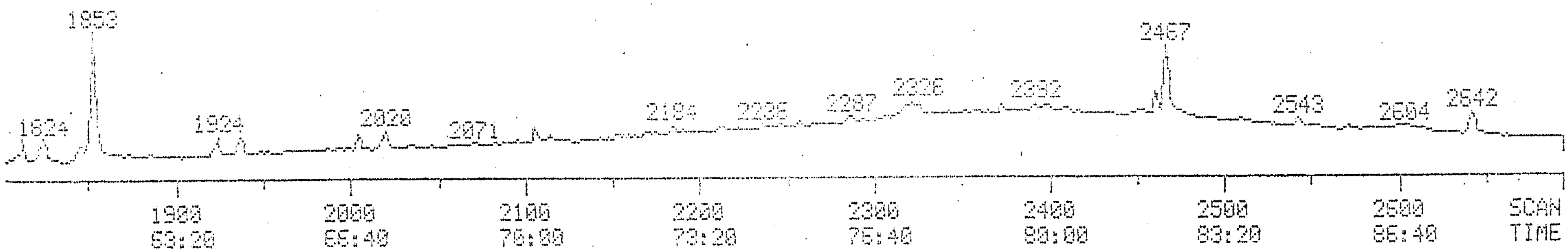


RIC
05/12/80 16:10:00
SAMPLE: #46 -- S-00-50 -- 99-6 B/N
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871024 #2642
CALI: 0512A #1

SCANS 1801 TO 2700
OUT OF 1 TO 2700

630784



	NAM	NUM:	WT	FORMULA	NAME
6	70	379:	84	C. H2. CL2	METHANE, DICHLORO-
83	70	408:	84	C5. H8. O	FURAN, 2, 3-DIHYDRO-3-METHYL-
92	70	291:	78	C6. H6	BENZENE
	70	2379:	118	C6. H14. O2	BUTANE, 1, 4-DIMETHOXY-
155	70	879:	98	C6. H10. O	3-PENTEN-2-ONE, 4-METHYL-
233	70	1436:	106	C8. H10	BENZENE, ETHYL-
33	70	4432:	138	C8. H10. O2	1, 3-BENZENEDIOL, 4-ETHYL-
	70	8831:	169	C7. H11. O2. N3	L-HISTIDINE, 1-METHYL-
	70	4449:	138	C9. H14. O	2, 5-HEPTADIEN-4-ONE, 2, 6-DIMETHYL-
	70	7272:	158	C8. H14. O3	2-HEXANONE, 6-(ACETYLOXY)-
	70	1794:	112	C7. H12. O	5-HEPTEN-2-ONE
608	70	1040:	100	C5. H8. O2	1-PROPEN-2-OL, ACETATE
	70	4454:	138	C9. H14. O	2-PROPANONE, 1-CYCLOHEXYLIDENE-
61	70	1607:	110	C7. H10. O	2-CYCLOHEXEN-1-ONE, 3-METHYL-
	70	4369:	138	C10. H18	CYCLOPENTENE, 1, 3-DIMETHYL-2-(1-METHYLETH
	70	1954:	114	C6. H10. O2	3-PENTENOICACID, 4-METHYL-
	70	2265:	116	C7. H16. O	1-PENTANOL, 2, 2-DIMETHYL-
	70	3098:	127	C7. H13. O. N	2-AZETIDINONE, 3, 3, 4, 4-TETRAMETHYL-
	70	6555:	154	C10. H18. O	2-CYCLOHEXEN-1-OL, 3-METHYL-6-(1-METHYLET
71	70	2755:	124	C8. H12. O	2-CYCLOHEXEN-1-ONE, 3, 5-DIMETHYL-
	70	1853:	112	C8. H16	2-HEXENE, 2, 3-DIMETHYL-
220	70	6226:	152	C10. H16. O	CYCLOHEXANONE, 5-METHYL-2-(1-METHYLETHYLI
242	70	4449:	138	C9. H14. O	2, 5-HEPTADIEN-4-ONE, 2, 6-DIMETHYL-
74	70	4394:	138	C6. H10. N4	5H-TETRAZOLO[1, 5-A]AZEPINE, 6, 7, 8, 9-TETRA
	70	2769:	124	C8. H12. O	3, 5-HEPTADIEN-2-ONE, 6-METHYL-, (E)-
	70	780:	96	C6. H8. O	2-CYCLOPENTEN-1-ONE, 3-METHYL-
	70	3845:	134	C10. H14	BENZENE, (1, 1-DIMETHYLETHYL)-
80	70	868:	98	C6. H10. O	3-HEXEN-2-ONE
	70	2265:	116	C7. H16. O	1-PENTANOL, 2, 2-DIMETHYL-
84	70	10350:	180	C6. H3. CL3 +	BENZENE, 1, 3, 5-TRICHLORO-
870	70	10351:	180	C6. H3. CL3	BENZENE, 1, 2, 4-TRICHLORO-
901	70	10351:	180	C6. H3. CL3	BENZENE, 1, 2, 4-TRICHLORO-
	70	3561:	130	C8. H18. O	3-OCTANOL
	70	3756:	132	C7. H16. O2	1, 3-PROPANEDIOL, 2, 2-DIETHYL-
	70	21285:	290	C10. H11. O2. I	2, 6-ADAMANTANEDIONE, 4-IODO-, (1R)-
959	70	5686:	148	C10. H12. O	ETHANONE, 1-(2, 4-DIMETHYLPHENYL)-
97	70	5686:	148	C10. H12. O	ETHANONE, 1-(2, 4-DIMETHYLPHENYL)-
	70	15578:	224	C15. H28. O	2-PENTADECYN-1-OL
	70	4383:	138	C4. H10. O3. S	METHANESULFONICACID, 1-METHYLETHYLESTER
	70	10908:	184	C13. H28	NONANE, 4-METHYL-5-PROPYL-
	70	4369:	138	C10. H18	CYCLOPENTENE, 1, 3-DIMETHYL-2-(1-METHYLETH
	70	4231:	136	C9. H12. O	2-CYCLOPENTEN-1-ONE, 2, 3, 5-TRIMETHYL-4-ME
	70	12133:	194	C7. H5. CL3	BENZENE, 1, 2-DICHLORO-4-(CHLOROMETHYL)-
	70	12131:	194	C7. H5. CL3	BENZENE, 2, 4-DICHLORO-1-(CHLOROMETHYL)-
	70	6917:	156	C11. H24	UNDECANE
	70	4903:	142	C6. H6. O2. S	2-THIOPHENECARBOXYLICACID, 5-METHYL-
	70	4976:	142	C8. H14. O2	2H-PYRAN-2-ONE, TETRAHYDRO-4, 6, 6-TRIMETHY
111	70	14548:	214	C6. H2. CL4 +	BENZENE, 1, 2, 3, 5-TETRACHLORO-
	70	3182:	128	C7. H12. O2	2-BUTENOICACID, 3-METHYL-, ETHYLESTER
112	70	8977:	170	C12. H26	UNDECANE, 2-METHYL-
116	70	2769:	124	C8. H12. O	3, 5-HEPTADIEN-2-ONE, 6-METHYL-, (E)-
	70	12071:	194	C13. H22. O	6, 8-NONADIEN-2-ONE, 8-METHYL-5-(1-METHYLE
1194	70	14548:	214	C6. H2. CL4	BENZENE, 1, 2, 3, 5-TETRACHLORO-
	70	5984:	150	C11. H18	CYCLOHEXENE, 3-(3-METHYL-1-BUTENYL)-, (E)-
	70	8138:	164	C6. H13. BR	PENTANE, 1-BROMO-4-METHYL-
	70	16331:	232	C10. H16. O4. S	BICYCLO[2. 2. 1]HEPTANE-1-METHANESULFONICA
	70	895:	98	C6. H10. O	CYCLOPENTANONE, 2-METHYL-
	70	13849:	208	C15. H28	1H-INDENE, OCTAHYDRO-2, 2, 4, 4, 7, 7-HEXAMETH
	70	13817:	208	C13. H20. O2	3-CYCLOHEXEN-1-ONE, 4, 6, 6-TRIMETHYL-5-(1-
	70	16767:	236	C17. H32	CYCLOHEXANE, 1, 1'-(1, 5-PENTANEDIYL)BIS-
	70	13849:	208	C15. H28	1H-INDENE, OCTAHYDRO-2, 2, 4, 4, 7, 7-HEXAMETH
	70	13811:	208	C13. H20. O2	3-BUTEN-2-ONE, 4-(2, 2, 6-TRIMETHYL-7-OXABI
1433	70	6920:	156	C11. H24	DECANE, 2-METHYL-

1457	70[illegible]:	[illegible]	[illegible]	[illegible]
	70 9727:	176	C12. H16. O	ETHANONE, 1-[4-(1, 1-DIMETHYLETHYL)PHENYL]
49	7010915:	184	C13. H28	DECANE, 2, 3, 5-TRIMETHYL-
	7018383:	254	C15. H26. O3	1-BUTANOL, 1-[(2, 6, 6-TRIMETHYL-1-CYCLOHEX
	7010833:	184	C12. H24. O	FURAN, TETRAHYDRO-2-ISOPENTYL-5-PROPYL-
	7013849:	208	C15. H28	1H-INDENE, OCTAHYDRO-2, 2, 4, 4, 7, 7-HEXAMETH
	7025767:	362	C26. H50	PENTALENE, OCTAHYDRO-1-(2-OCTYLDECYL)-
	7010986:	184	C9. H12. O4	3-FURANCARBOXYLICACID, 5-(ETHOXYMETHYL)-2
	7010986:	184	C9. H12. O4	3-FURANCARBOXYLICACID, 5-(ETHOXYMETHYL)-2
16	7017150:	240	C17. H36	HEPTADECANE
	70 4454:	138	C9. H14. O	2-PROPANONE, 1-CYCLOHEXYLIDENE-
	7012396:	196	C14. H28	CYCLOHEXANE, OCTYL-
17	70 6934:	156	C11. H24	OCTANE, 2, 4, 6-TRIMETHYL-
	7010610:	182	C14. H14	1, 1'-BIPHENYL, 2-ETHYL-
	7016773:	236	C18. H20	BENZENE, 1, 1'-(3, 3-DIMETHYL-1-BUTENYLIDEN
	7012283:	196	C10. H12. O4	2H-PYRAN-2-CARBOXYLICACID, 5-ETHYLIDENE-5
	7022380:	308	C11. H28. O4. SI3	ACETICACID, BIS[(TRIMETHYLSILYL)OXY]-, TR
1812	7017150:	240	C17. H36	HEPTADECANE
1824	7021796:	296	C21. H44	HEPTADECANE, 2, 6, 10, 14-TETRAMETHYL-
	7014991:	219	C16. H13. N	1H-PYRROLE, 2, 4-DIPHENYL-
	7031332:	188	C14. D10	D10 ANTHRACENE
	70 6641:	154	C11. H22	1-DECENE, 8-METHYL-
181	7031332:	188	C14. D10	D10 ANTHRACENE
	70 3311:	128	C8. H16. O	HEXANAL, 5, 5-DIMETHYL-
	7027059:	394	C28. H58	OCTACOSANE
	7010909:	184	C13. H28	DECANE, 2, 2, 5-TRIMETHYL-
	7010102:	179	C10. H13. O2. N	CARBAMICACID, PHENYL-, PROPYLESTER
	7013864:	208	C16. H16	BENZENE, 1, 1'-(3-METHYL-1-PROPENE-1, 3-DIY
	7023292:	318	C15. H11. O3. BR	ETHANONE, 2-(BENZOYLOXY)-1-(4-BROMOPHENYL
191	7017150:	240	C17. H36	HEPTADECANE
192	7017150:	240	C17. H36	HEPTADECANE
1949	7020371:	278	C16. H22. O4	1, 2-BENZENEDICARBOXYLICACID, BUTYL2-METHY
	7010562:	182	C12. H22. O	11-DODECEN-2-ONE
19	7012396:	196	C14. H28	CYCLOHEXANE, OCTYL-
	7020856:	284	C17. H32. O3	HEXADECANOICACID, 2-OXO-, METHYLESTER
	7028601:	442	C18. H5. F10. P	PHOSPHINE, BIS(PENTAFLUOROPHENYL)PHENYL-
20	7028601:	442	C18. H5. F10. P	PHOSPHINE, BIS(PENTAFLUOROPHENYL)PHENYL-
2020	7021792:	296	C21. H44	HENEICOSANE
	7014308:	212	C14. H12. S	NAPHTHO[2, 3-B]THIOPHENE, 4, 9-DIMETHYL-
	7010255:	180	C11. H21. O. B	1, 2-OXABOROLE, 2, 3, 4-TRIETHYL-2, 5-DIHYDRO
	7023753:	326	C12. H24. BR2	DODECANE, 1, 2-DIBROMO-
	70 3308:	128	C8. H16. O	OXIRANE, (3, 3-DIMETHYLBUTYL)-
	70 6205:	152	C10. H16. O	BICYCLO[2. 2. 1]HEPTAN-2-ONE, 5, 5, 6-TRIMETH
	70 6926:	156	C11. H24	NONANE, 3, 7-DIMETHYL-
	7024920:	346	C22. H18. O4	4H-1-BENZOPYRAN-4-ONE, 2, 3-DIHYDRO-3-HYDR
	70 8983:	170	C12. H26	DECANE, 3, 6-DIMETHYL-
210	7021792:	296	C21. H44	HENEICOSANE
2114	7013123:	202	C16. H10	PYRENE
	7014269:	212	C13. H24. O2	6-OCTEN-1-OL, 3, 7-DIMETHYL-, PROPANOATE
	70 9076:	170	C9. H14. O3	1, 2-BUTANEDIOL, 1-(2-FURYL)-3-METHYL-
215	7013123:	202	C16. H10	PYRENE
	70 372:	83	C5. H9. N	1-AZABICYCLO[3. 1. 0]HEXANE
	7019827:	271	C13. H6. N. F5	BENZENAMINE, N-[(PENTAFLUOROPHENYL)METHYL
217	7010868:	184	C13. H28	UNDECANE, 4, 7-DIMETHYL-
2184	7017150:	240	C17. H36	HEPTADECANE
	7017037:	242	C16. H34. O	OCTANE, 1, 1'-OXYBIS-
	70 9785:	176	C7. H13. BR	CYCLOHEXANE, 1-BROMO-4-METHYL-
	7028601:	442	C18. H5. F10. P	PHOSPHINE, BIS(PENTAFLUOROPHENYL)PHENYL-
2213	7015826:	226	C16. H34	TRIDECANE, 5-PROPYL-
	7014816:	218	C10. H6. O4. N2	NAPHTHALENE, 1, 3-DINITRO-
	7010858:	184	C13. H28	UNDECANE, 2, 5-DIMETHYL-
	70 5468:	146	C5. H7. O. N2. CL	ACETAMIDE, 2-CHLORO-N-(2-CYANOETHYL)-
	7014726:	216	C17. H12	PYRENE, 1-METHYL-
	70 3555:	130	C8. H18. O	1-HEXANOL, 2-ETHYL-
	7028992:	458	C14. H42. O5. SI6	HEXASILOXANE, TETRADECAMETHYL-
[illegible]	70[illegible]:	184	C13. H28	UNDECANE, 4, 6-DIMETHYL-

	7021792:	296	C21.H44	HENEICOSANE
	7012636:	198	C13.H26.O	ETHER,1-DODECENYLMETHYL
	7023208:	352	C16.H33.I	HEXADECANE,1-IODO-
	70 8984:	170	C12.H26	DECANE,3,8-DIMETHYL-
2287	7021796:	296	C21.H44	HEPTADECANE,2,6,10,14-TETRAMETHYL-
	70 8975:	170	C12.H26	DECANE,2,4-DIMETHYL-
	7030082:	532	C16.H48.O6.SI7	HEPTASILOXANE,HEXADECAMETHYL-
2326	7010868:	184	C13.H28	UNDECANE,4,7-DIMETHYL-
2342	7021796:	296	C21.H44	HEPTADECANE,2,6,10,14-TETRAMETHYL-
234	7030082:	532	C16.H48.O6.SI7	HEPTASILOXANE,HEXADECAMETHYL-
	7018244:	252	C18.H36	DODECANE6-CYCLOHEXYL-,6-CYCLOHEXYL-
	7020131:	274	C20.H34	ANTHRACENE,9-CYCLOHEXYLTETRADECAHYDRO-
	7022416:	304	C22.H40	CYCLOPENTANE,1,1'-[3-(2-CYCLOPENTYLETHYL
	7016260:	230	C9.H5.O2.N2.F3	SYDNONE,3-(.ALPHA.,.ALPHA.,.ALPHA.-TRIFL
	70 9356:	173	C10.H23.O.N	HYDROXYLAMINE,O-DECYL-
	7018079:	250	C18.H34	HEXANE,1,6-DICYCLOHEXYL-
	7023265:	352	C25.H52	PENTACOSANE
	7019606:	268	C19.H40	PENTADECANE,2,6,10,14-TETRAMETHYL-
2410	7010895:	184	C13.H28	NONANE,3-METHYL-5-PROPYL-
	7010904:	184	C13.H28	HEPTANE,4-ETHYL-2,2,6,6-TETRAMETHYL-
	7026918:	390	C24.H38.O4	1,2-BENZENEDICARBOXYLICACID,DIISOOCTYLES
	7019017:	261	C14.H19.N3.S	1,2-ETHANEDIAMINE,N,N-DIMETHYL-N'-2-PYRI
	7030082:	532	C16.H48.O6.SI7	HEPTASILOXANE,HEXADECAMETHYL-
	7021954:	298	C20.H42.O	1-EICOSANOL
2461	7021792:	296	C21.H44	HENEICOSANE
246	7026918:	390	C24.H38.O4	1,2-BENZENEDICARBOXYLICACID,DIISOOCTYLES
	7011716:	191	C9.H6.O.N3.F	2H-1,2,3-TRIAZOLE-4-CARBOXALDEHYDE,2-(2-
2510	7012669:	198	C14.H30	DODECANE,4,6-DIMETHYL-
	7013174:	203	C10.H21.O3.N	NITRICACID,DECYLESTER
254	7021792:	296	C21.H44	HENEICOSANE
2556	7010888:	184	C13.H28	UNDECANE,3,5-DIMETHYL-
	7028992:	458	C14.H42.O5.SI6	HEXASILOXANE,TETRADECAMETHYL-
	70 6253:	152	C10.H16.O	3-CYCLOHEXENE-1-CARBOXALDEHYDE,1,3,4-TRI
	70 6852:	155	C9.H17.O.N	2-OCTEN-4-ONE,2-(METHYLAMINO)-
	7010571:	182	C12.H22.O	1-PROPANONE,1-[2-(1,1-DIMETHYLETHYL)CYCL
2617	7021792:	296	C21.H44	HENEICOSANE

#46

SCAN	FIT	PURITY	LIB	ENTRY
63	877	843	70	379
83	855	764	70	408
98	844	739	70	291
100	703	636	70	2377
155	993	967	70	879
233	847	812	70	1436
335	903	733	70	4432
431	147	144	70	8831
502	701	490	70	4449
516	823	665	70	7272
575	921	632	70	1794
608	861	707	70	1040
622	833	590	70	4454
642	979	960	70	1607
647	725	460	70	4369
661	894	681	70	1954
682	868	767	70	2265
694	819	727	70	3098
699	742	537	70	6555
711	864	828	70	2705
713	850	585	70	1853
720	811	712	70	6226
742	817	701	70	4449
744	931	850	70	4394
752	828	673	70	2769
756	895	578	70	786
773	877	646	70	3045
802	967	772	70	888
825	930	626	70	2268
844	969	948	70	10350
901	859	820	70	10351
901	858	820	70	10351
914	779	662	70	3561
928	773	642	70	3756
947	910	685	70	21285
959	965	736	70	5686
976	918	806	70	5686
985	594	419	70	15578
987	853	654	70	4383
1023	874	602	70	10708
1029	851	642	70	4369
1043	876	699	70	4231
1054	736	302	70	12133
1074	772	436	70	12131
1076	862	585	70	6717
1081	670	389	70	4703
1108	767	658	70	4976
1115	939	883	70	14548
1119	760	630	70	3182
1122	913	812	70	8977
1163	827	733	70	2769
1190	656	472	70	12071
1196	974	930	70	14548
1203	891	660	70	5984
1256	609	473	70	8138
1285	812	614	70	16331
1298	830	744	70	895
1331	732	558	70	13849
1358	585	498	70	13817
1386	755	554	70	16767
1394	667	584	70	13849

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1433	983	718	70	6720
1459	896	862	70	17903
1483	841	660	70	9727
1498	973	801	70	10915
1504	769	423	70	18383
1528	750	433	70	10833
1548	662	363	70	13849
1565	761	582	70	25767
1618	693	524	70	10786
1652	805	657	70	10786
1673	967	890	70	17150
1734	744	414	70	4454
1743	816	708	70	12396
1750	970	890	70	6934
1758	573	327	70	10610
1789	562	372	70	16773
1808	683	506	70	12285
1810	540	311	70	22580
1812	982	875	70	17150
1824	966	891	70	21796
1841	655	389	70	14991
1845	880	692	70	31332
1847	835	505	70	6641
1853	940	911	70	31332
1855	844	391	70	3311
1885	745	512	70	27059
1893	735	428	70	10909
1899	565	295	70	10102
1906	479	203	70	13864
1914	650	221	70	23292
1924	977	769	70	17150
1937	976	859	70	17150
1949	905	825	70	20371
1952	824	592	70	10562
1980	813	702	70	12396
1987	799	478	70	20856
1999	733	609	70	28601
2005	947	774	70	28601
2020	968	866	70	21792
2028	675	296	70	14308
2033	621	424	70	10255
2035	515	415	70	23753
2059	839	485	70	3308
2071	817	498	70	6205
2082	849	329	70	6926
2093	561	149	70	24920
2096	894	464	70	8983
2106	976	821	70	21792
2114	974	867	70	13123
2116	773	356	70	14269
2124	441	272	70	9076
2154	983	907	70	13123
2159	658	403	70	372
2163	553	272	70	19827
2170	932	796	70	10863
2184	960	843	70	17150
2190	611	344	70	17337
2205	760	580	70	9785
2211	866	668	70	28601
2213	911	778	70	15826
2216	578	137	70	14816
2219	564	405	70	10858
2224	609	330	70	5468
2230	760	549	70	14726
2234	741	521	70	3555

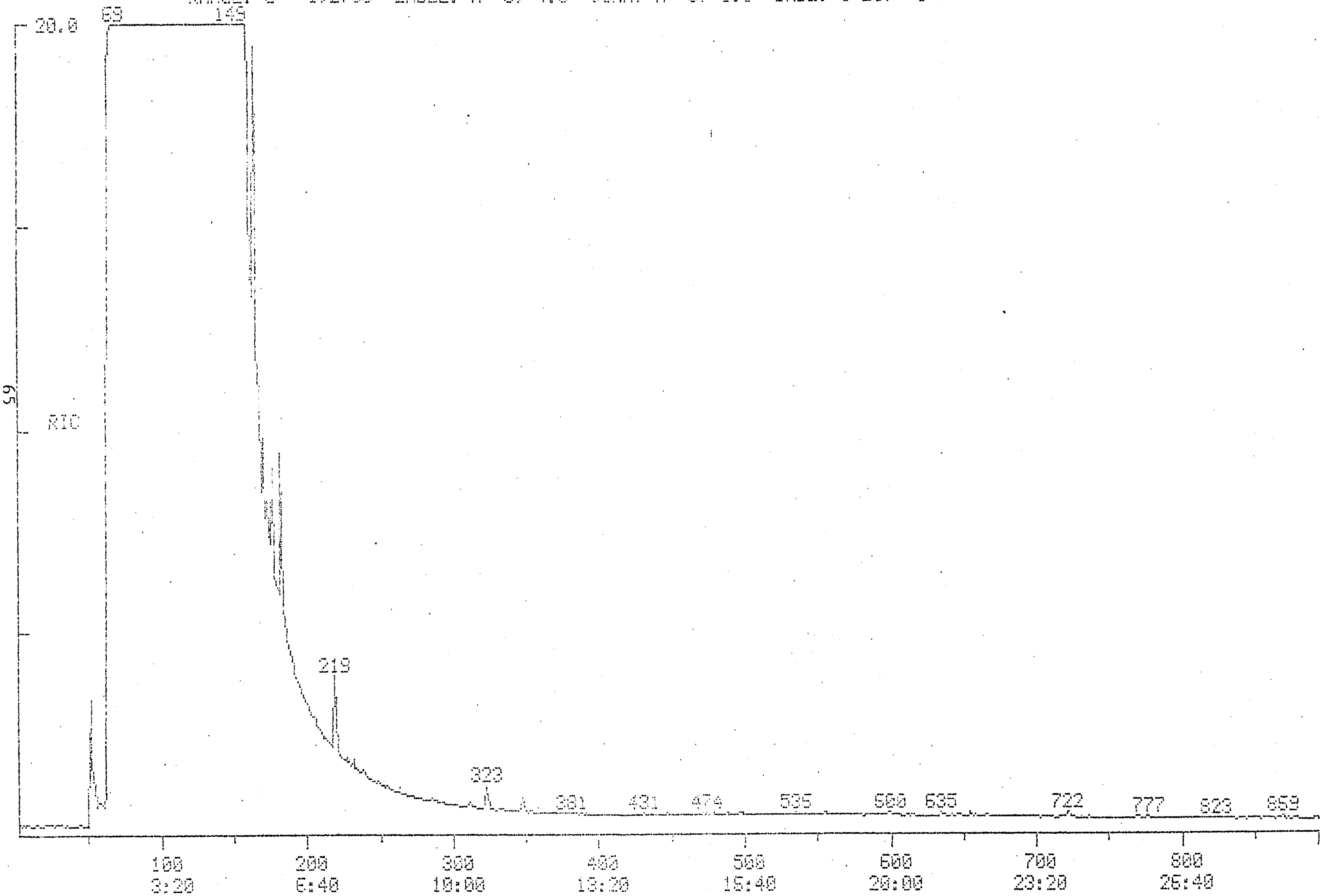
[illegible]	[illegible]	[illegible]	70	[illegible]
2246	885	738	70	10889
2257	892	658	70	21792
2264	523	188	70	12636
2276	427	303	70	25208
2285	920	594	70	8984
2287	921	787	70	21796
2306	873	558	70	8975
2321	723	589	70	30082
2326	940	782	70	10868
2342	899	779	70	21796
2347	812	715	70	30082
2352	618	476	70	18244
2359	632	480	70	20131
2361	645	496	70	22416
2369	515	279	70	16260
2373	890	543	70	9356
2379	446	310	70	18079
2392	871	766	70	25265
2399	746	361	70	19606
2410	933	697	70	10895
2424	752	546	70	10904
2433	423	198	70	26918
2436	409	212	70	19017
2447	734	702	70	30082
2452	929	755	70	21954
2461	979	888	70	21792
2467	930	824	70	26918
2486	755	376	70	11716
2510	862	775	70	12669
2523	588	341	70	13174
2543	963	880	70	21792
2552	871	707	70	10888
2571	755	647	70	28992
2583	689	392	70	6253
2597	591	300	70	6852
2612	699	542	70	10571
2642	976	874	70	21792

ANALYSIS OF 871024 COMPLETED ON 5/13/80 10:41:40

RIC
05/07/80 10:53:00
SAMPLE: 871-#31 (S:00:32 -- 99-2 -BASE)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871022 #2548
CALI: 0507A #1

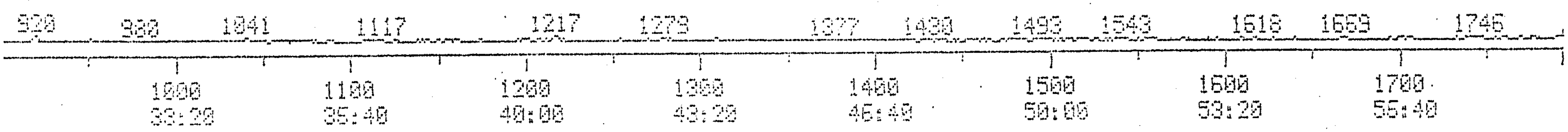
SCANS 1 TO 901
OUT OF 1 TO 2700

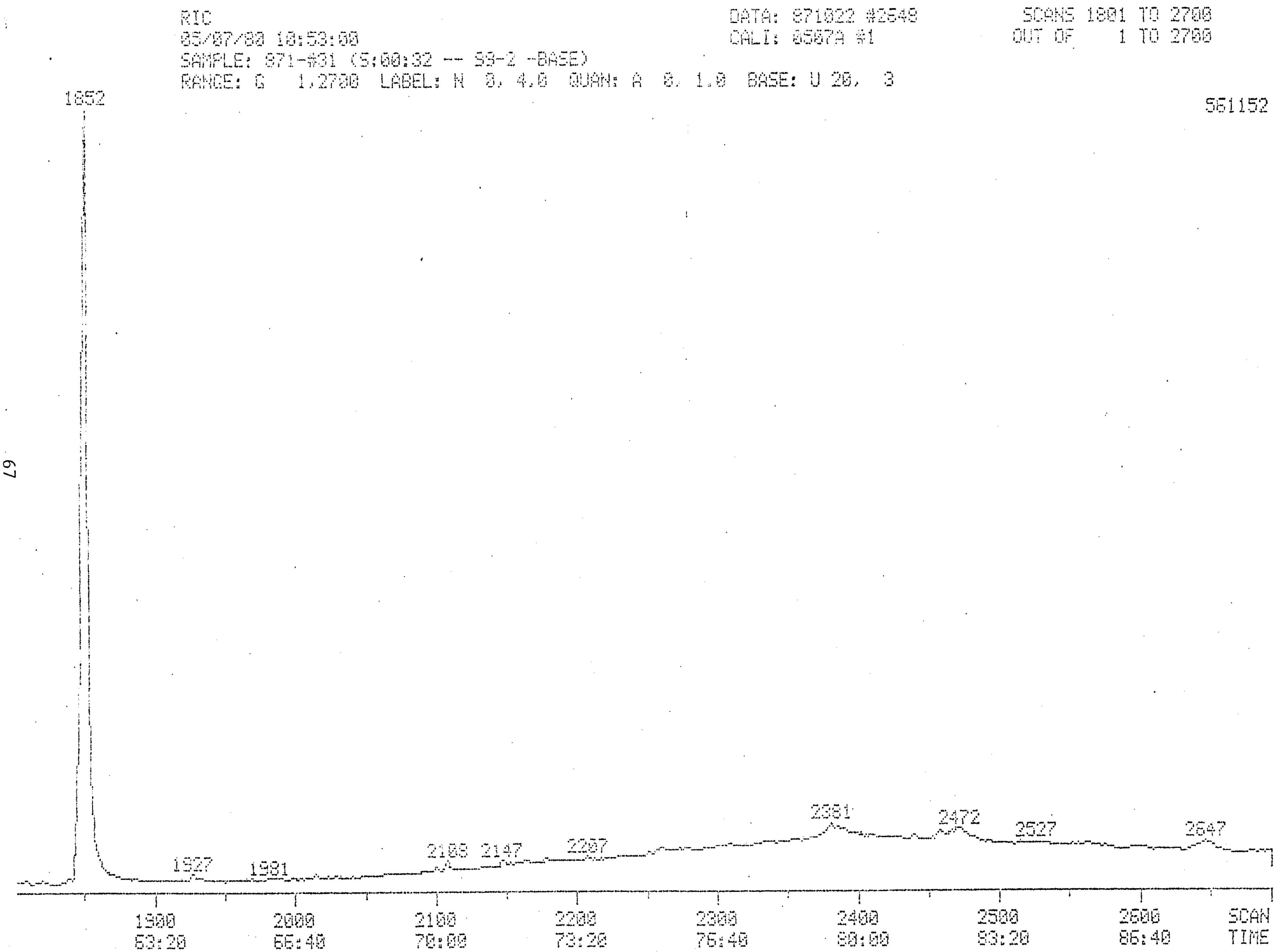


RIC
05/07/80 10:53:00
SAMPLE: 871-#31 (5:00:32 -- 99-2 -BASE)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871022 #2648
CALI: 0507A #1

SCANS 901 TO 1801
OUT OF 1 TO 2700

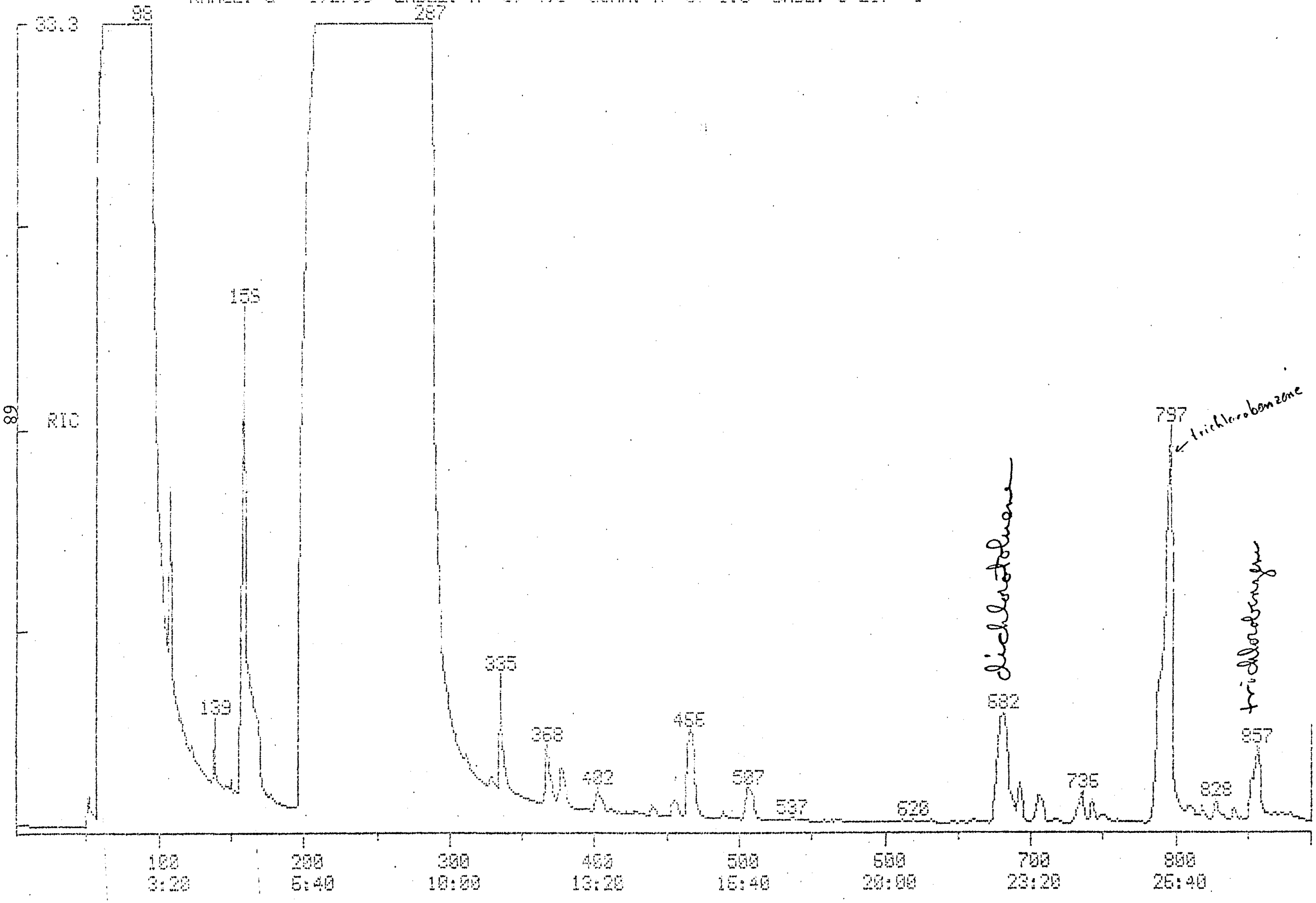



RIC
05/07/88 10:53:00
SAMPLE: 871-#31 (5;00:32 -- SS-2 -BASE)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871022 #2648
CALI: 0507A #1
SCANS 1801 TO 2700
OUT OF 1 TO 2700
561152
1852
1927
1981
2108
2147
2207
2381
2472
2527
2647
1900
63:20
2000
66:40
2100
70:00
2200
73:20
2300
76:40
2400
80:00
2500
83:20
2600
86:40
SCAN
TIME

RIC
05/13/80 8:39:00
SAMPLE: #35 -- 5:00:66 -- 97-6 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871025 #1
CALI: 0513A #1

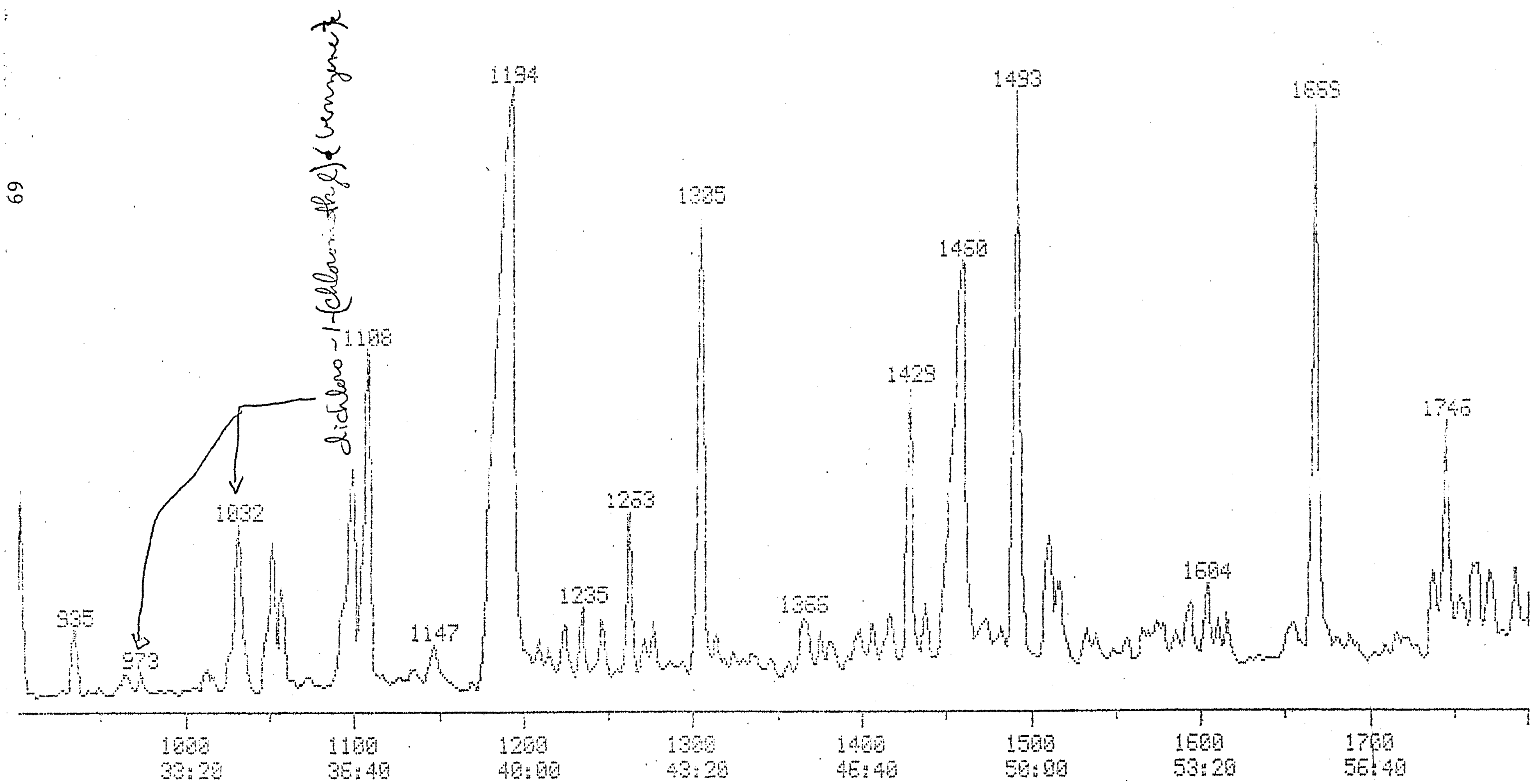
SCANS 1 TO 901
OUT OF 1 TO 2700



RIC
05/13/88 8:38:00
SAMPLE: #06 -- 5:00:65 -- 97-6 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871025 #1
CALI: 0513A #1

SCANS 901 TO 1801
OUT OF 1 TO 2700

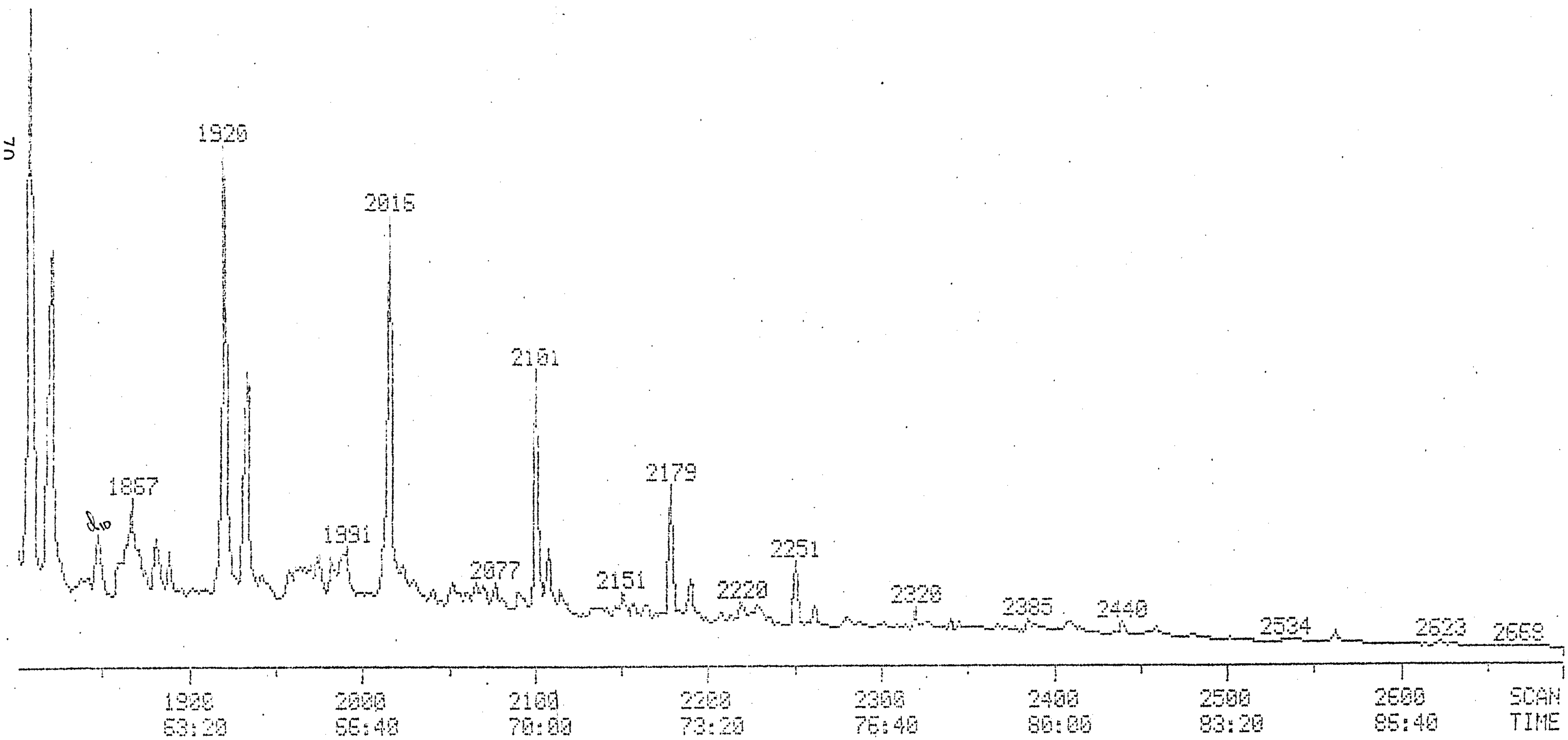


RIC
05/13/80 8:39:00
SAMPLE: #36 -- 5:00:66 -- 97-6 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871025 #1
CALI: 0513A #1

SCANS 1801 TO 2700
OUT OF 1 TO 2700

1073150

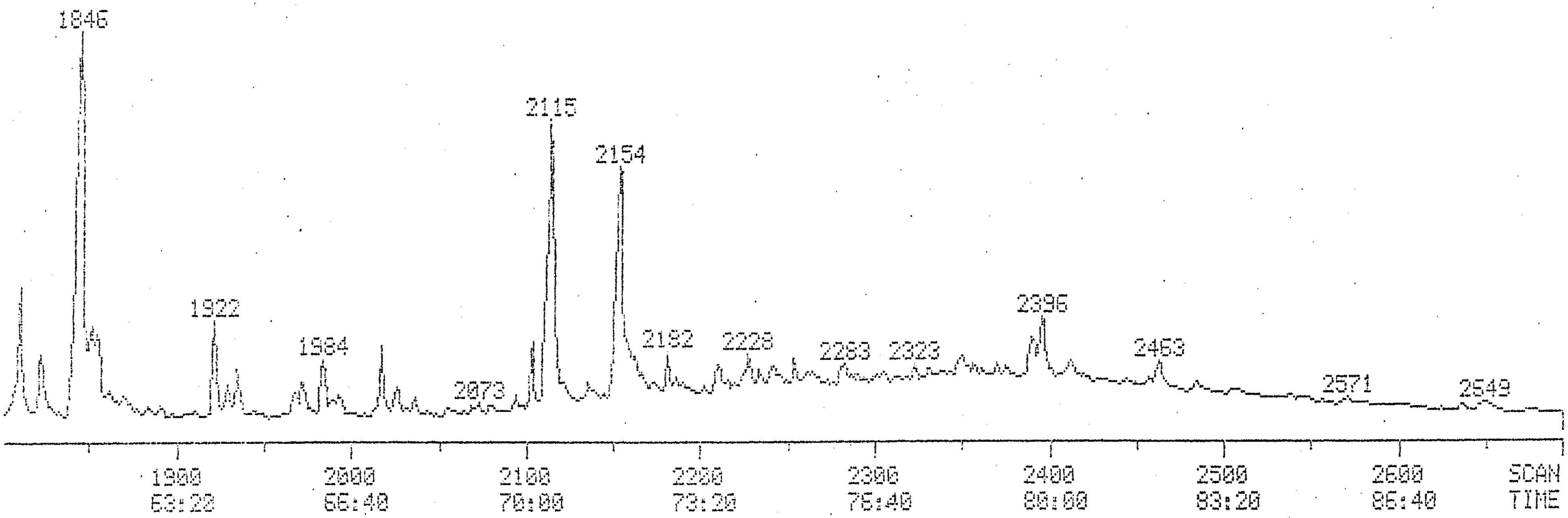


RIC
05/13/88 10:28:00
SAMPLE: #43 -- 5:00:38 -- 182-3 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871025 #2508
CALI: 0513A #1

SCANS 1801 TO 2700
OUT OF 1 TO 2700

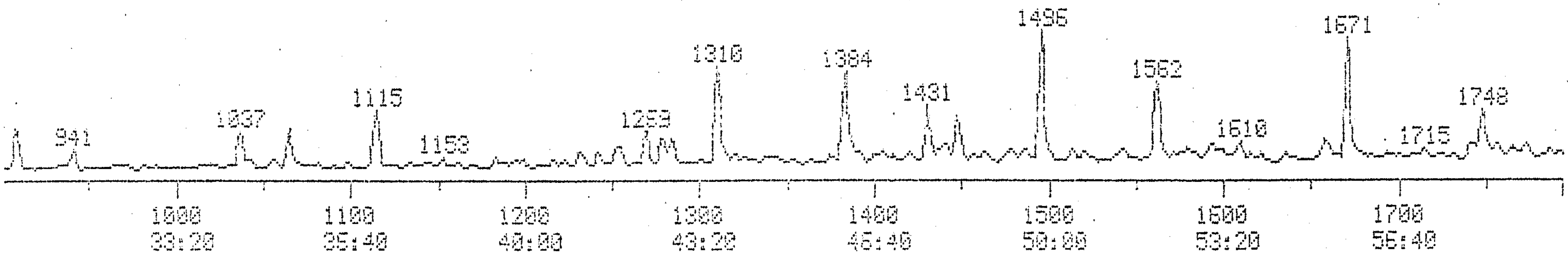
1051300



RIC
05/13/88 13:20:00
SAMPLE: #43 -- 5:00:38 -- 102-3 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871026 #2508
CALI: 0513A #1

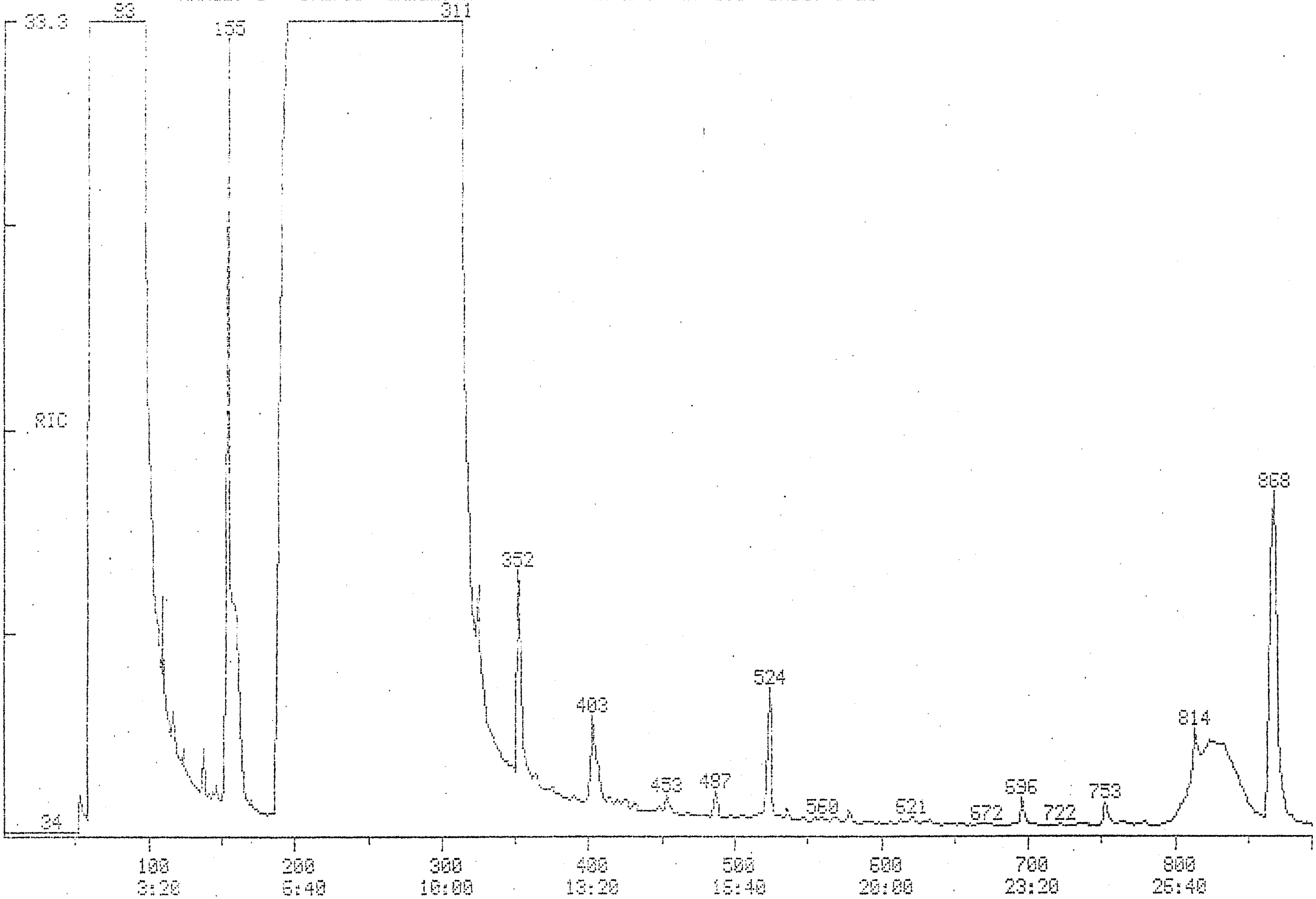
SCANS 901 TO 1801
OUT OF 1 TO 2700



RIC
05/13/88 10:20:00
SAMPLE: #43 -- 5:00:38 -- 102-3 BASE
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871025 #2508
CALI: 0513A #1

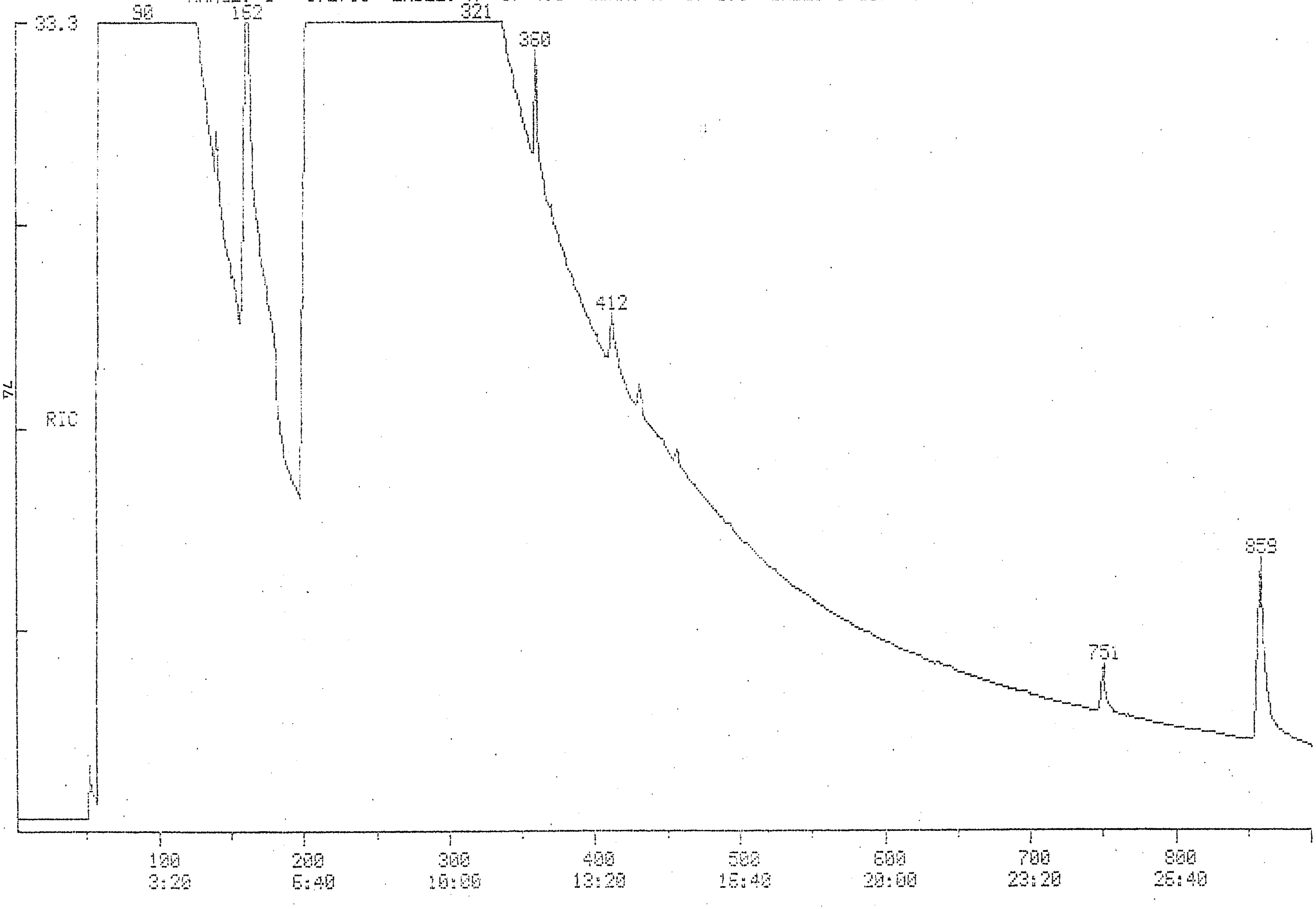
SCANS 1 TO 901
OUT OF 1 TO 2700



RIC
05/23/80 9:28:00
SAMPLE: 871-#44 (-- 5:00:65 -- CS-6 B/N)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871028 #1
CALI: 8523A #1

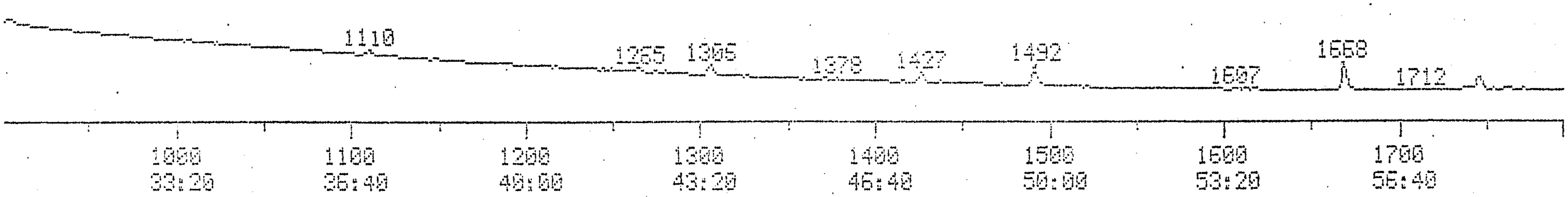
SCANS 1 TO 901
OUT OF 1 TO 2700



RIC
05/23/80 9:28:00
SAMPLE: 871-#44 (-- 5:00:65 -- CS-6 B/N)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871028 #1
CALI: 0523A #1

SCANS 901 TO 1801
OUT OF 1 TO 2700

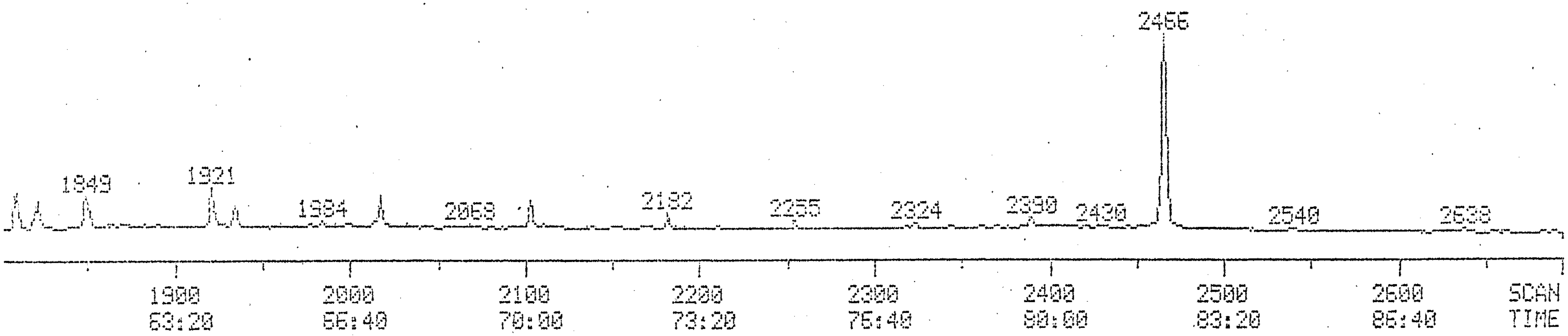


RIC
05/23/80 9:28:00
SAMPLE: 871-#44 (-- 5:00:65 -- CS-6 B/N)
RANGE: G 1,2700 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871028 #1
CALI: 0523A #1

SCANS 1801 TO 2700
OUT OF 1 TO 2700

1137320



C. <u>Solvent Extracted Samples</u> (contd)

3. Data (contd)

c. Black Creek

Attached are the list of compounds found in the Black Creek samples as indicated. The 96th Street outfall sample holds the highest concentration of contaminants.

4. Notes

Not all samples received have been analyzed due to time constraints. Most of the base material samples have been determined because they show the highest number of compounds to be present. Discussions will be held with the OSC to determine if additional analyses should be performed beyond those reported here.

SAMPLE #40

S0019

BC 3

Scan #	Compound
491	4-hydroxy-4-methyl-2-pentanone
507	chlorobenzene
800	chlorotoluene
819	chlorotoluene
973	dichlorobenzene
998	dichlorobenzene
1072	dichlorobenzene
1424	dichlorotoluene
1434	dichlorotoluene
1475	trichlorobenzene
1526	dichlorotoluene
1650	trichlorobenzene
1770	trichlorobenzene
1993	tent. 2-bromo-4chloro-6methylphenol
2002	dichloro(chloromethyl)benzene
2125	dichloro(chloromethyl)benzene
2166	dichloro(chloromethyl)benzene
2263	tetrachlorobenzene
2271	dichloro(chloromethyl)benzene
2460	tetrachlorobenzene
2578,2660	hydrocarbon
2792	dichloro(dichloromethyl)benzene
2870	tent. chlorodecane or chlorononane
2887	tent. (1,1'-bicyclohexyl)-one
2898	dichloro(dichloromethyl)benzene
2990	pentachlorobenzene
3004	$C_{14}H_{14}$
3040	$C_{14}H_{14}$ 1methyl-(phenylmethyl)benzene
3080	dichloronaphthalene
3092	dichloronaphthalene
3123	dichloronaphthalene
3152	
3180	1,1'thiobisbenzene
3292	dichloro-1,1'-biphenyl
3381	hydrocarbon
3452	dichloro-1,1'-biphenyl
3483	$C_7H_3Cl_5$ possibly pentachlorotoluene
3497	$C_6H_6Cl_6$ (lindane)
3506	dichloro-1,1'-biphenyl
3536	dichloro-1,1'-biphenyl

SAMPLE #40

S0019

BC 3

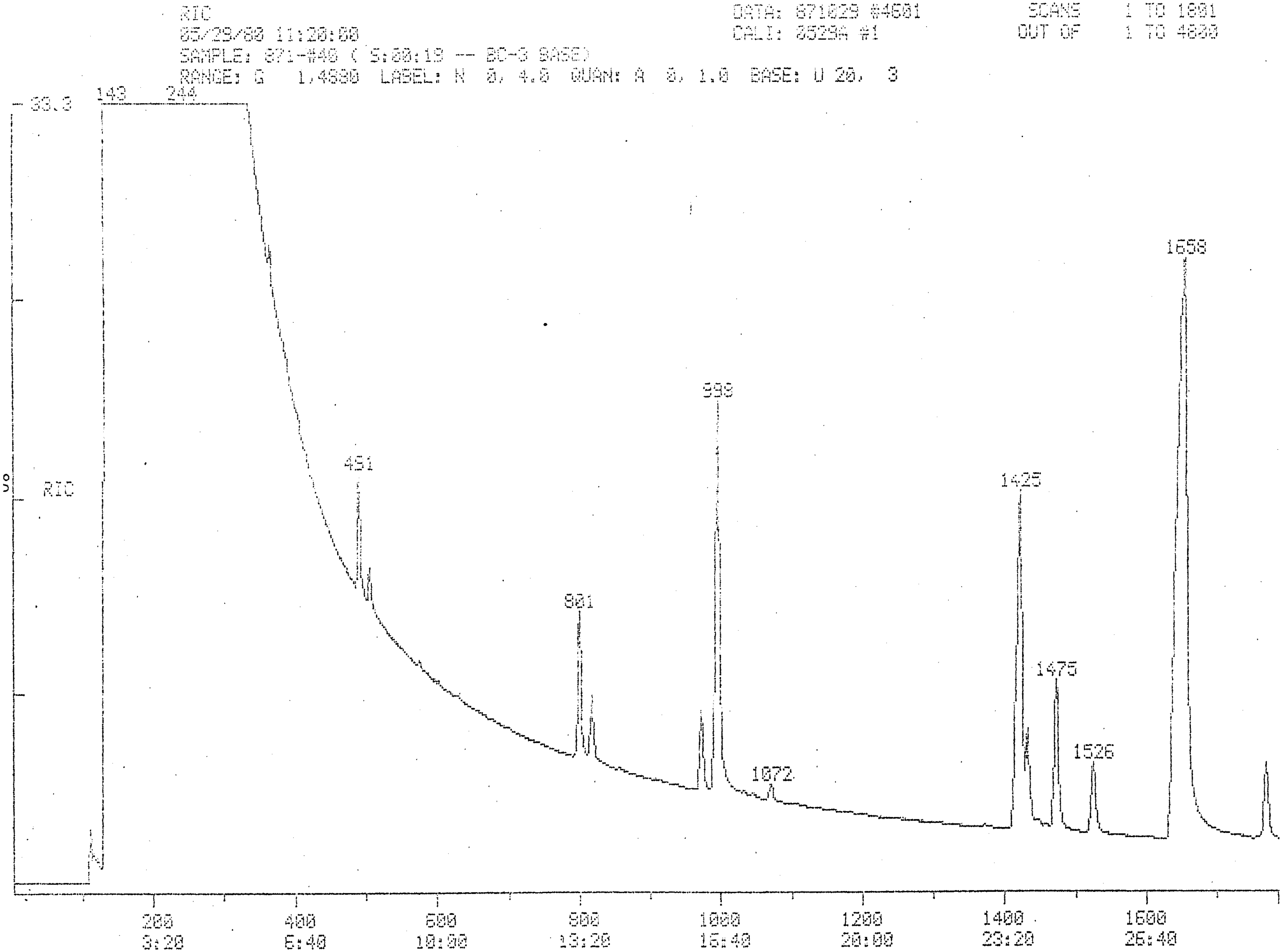
Scan #	Compound
3576	C_6Cl_6 tent. hexachlorobenzene
3589,3615	trichloroproduct mw ≥230 possibly trichloronaphthalene
3655	$C_6H_6Cl_6$ hexachlorocyclohexane
3723	dichloro-1,1'-biphenyl + phenanthrene
3739	D_{10}anthracene
3776	ethenylidene bis(chlorobenzene)
3930,3975,3991,4015 4023,4047,4087	tent. $C_{14}H_{10}Cl_2$ possibly dichloroethenediyl bis(benzene)
4106	1,1'-thiobis(chlorobenzene)
4140	tent. trichloro-1,1'-biphenyl
4256	fluoranthene
4269	trichloro compound mw ≥ 286
4341	trichloro compound mw ≥ 286
4394,4420,4479,4496	possibly bromoiodobenzene
4604	tetrachloro derivative 1,1'thiobisbenzene

SAMPLE #41

S0020

BC 4

Scan #	Compound
2418	tetrachlorobenzene
2961	pentachlorobenzene
3500	$C_6H_6Cl_6$ lindane
3658	$C_6H_6Cl_6$ (tent.)
3574	C_6Cl_6 tent.
3742	D_{10}anthracene
4261	fluoranthene
4340	pyrene
4968	phthalatic acid ester

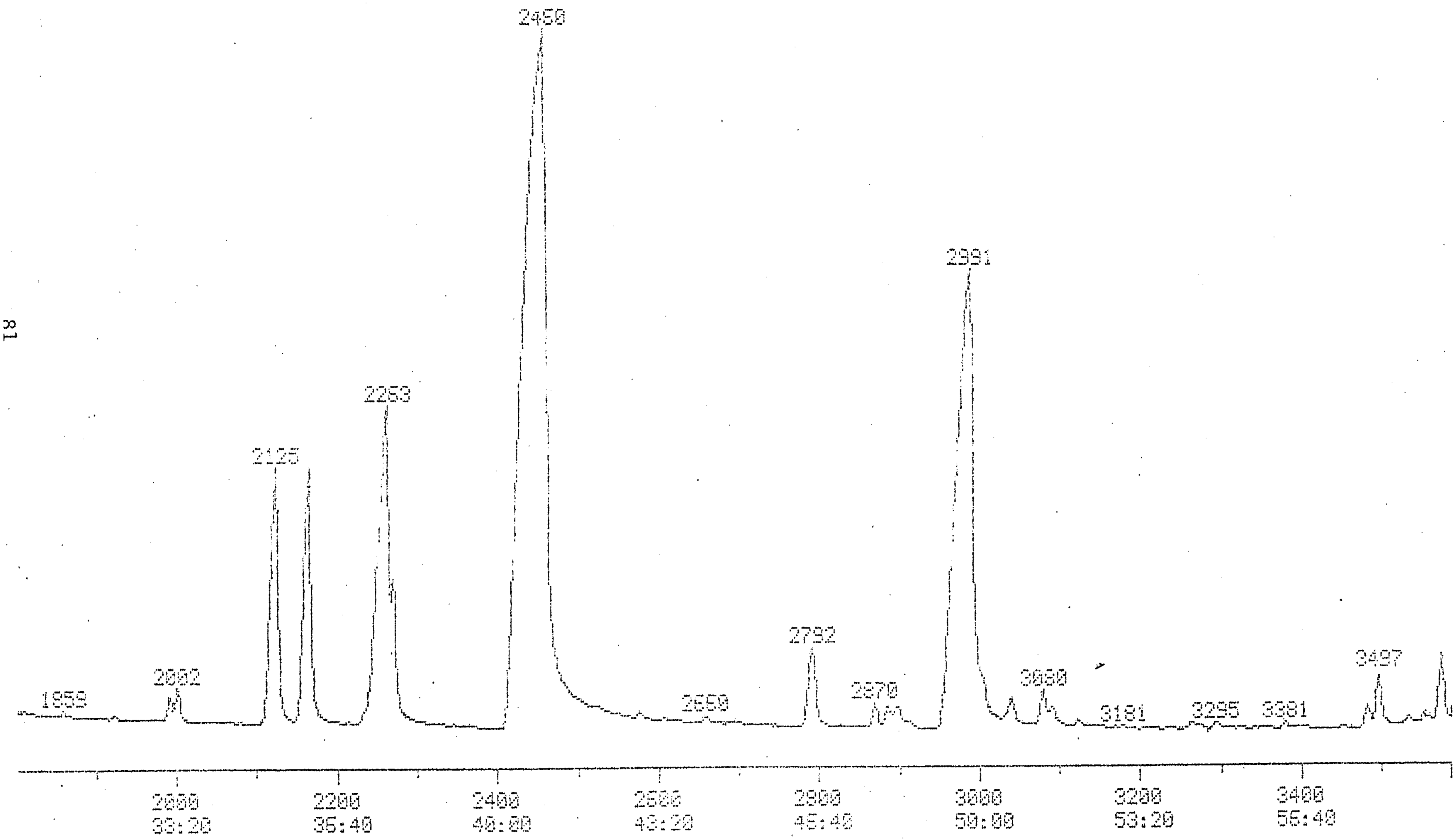


RIC
05/29/80 11:20:00
SAMPLE: 871-#40 (5:00:19 -- BC-3 BASE)
RANGE: G 1,4800 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 871029 #4601
CALI: 0529A #1
SCANS 1 TO 1801
OUT OF 1 TO 4800
33.3
RIC
143
244
451
801
998
1072
1425
1475
1526
1658
200 3:20
400 6:40
600 10:00
800 13:20
1000 16:40
1200 20:00
1400 23:20
1600 26:40

RIC
05/23/80 11:20:00
SAMPLE: 871-#40 (5:00:15 -- BC-3 BASE)
RANGE: G 1,4880 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871029 #4501
CALI: 0529A #1

SCANS 1801 TO 3601
OUT OF 1 TO 4800

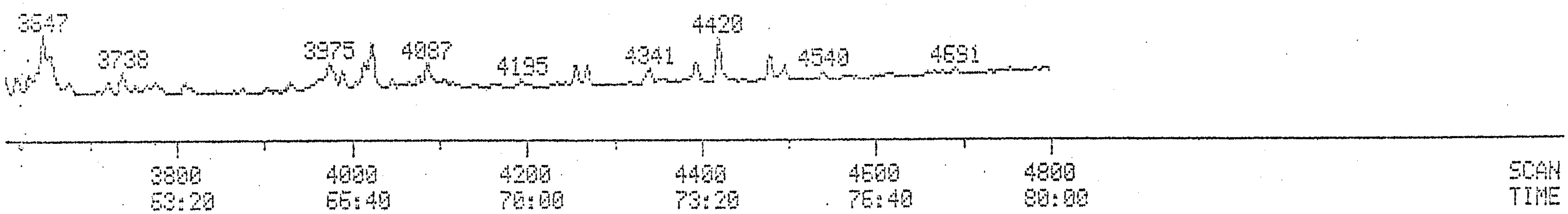


RIC
05/29/80 11:20:00
SAMPLE: 871-#40 (5:00:19 -- BD-3 BASE)
RANGE: G 1,4800 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871029 #4501
CALI: 0529A #1

SCANS 3501 TO 4800
OUT OF 1 TO 4800

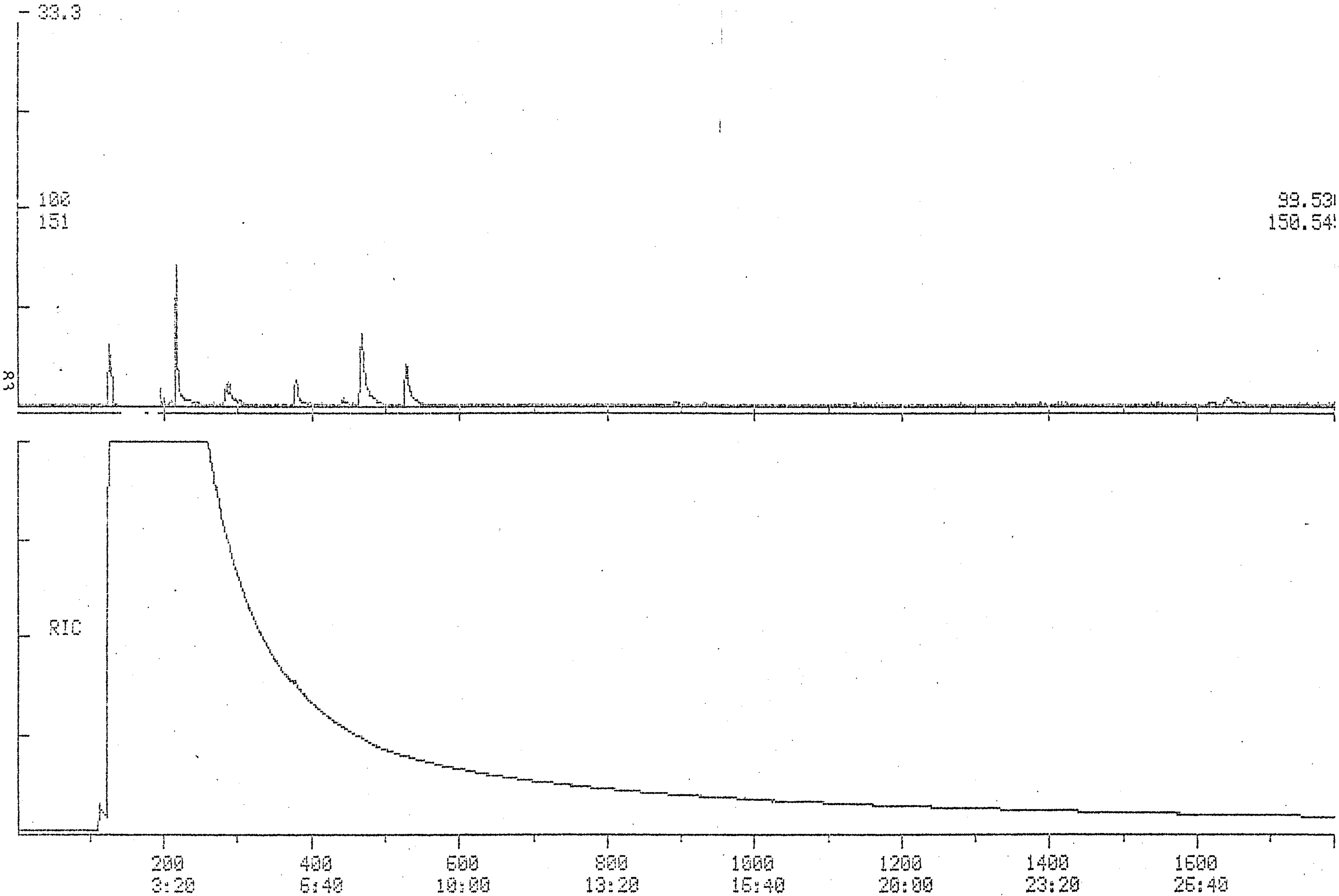
343381



RIC + MASS CHROMATOGRAM
05/29/80 12:52:00
SAMPLE: 871-#41 (5:00:20 -- BC-4 BASE)
RANGE: G 1,5400 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871030 #4568
CALI: 0529A #1

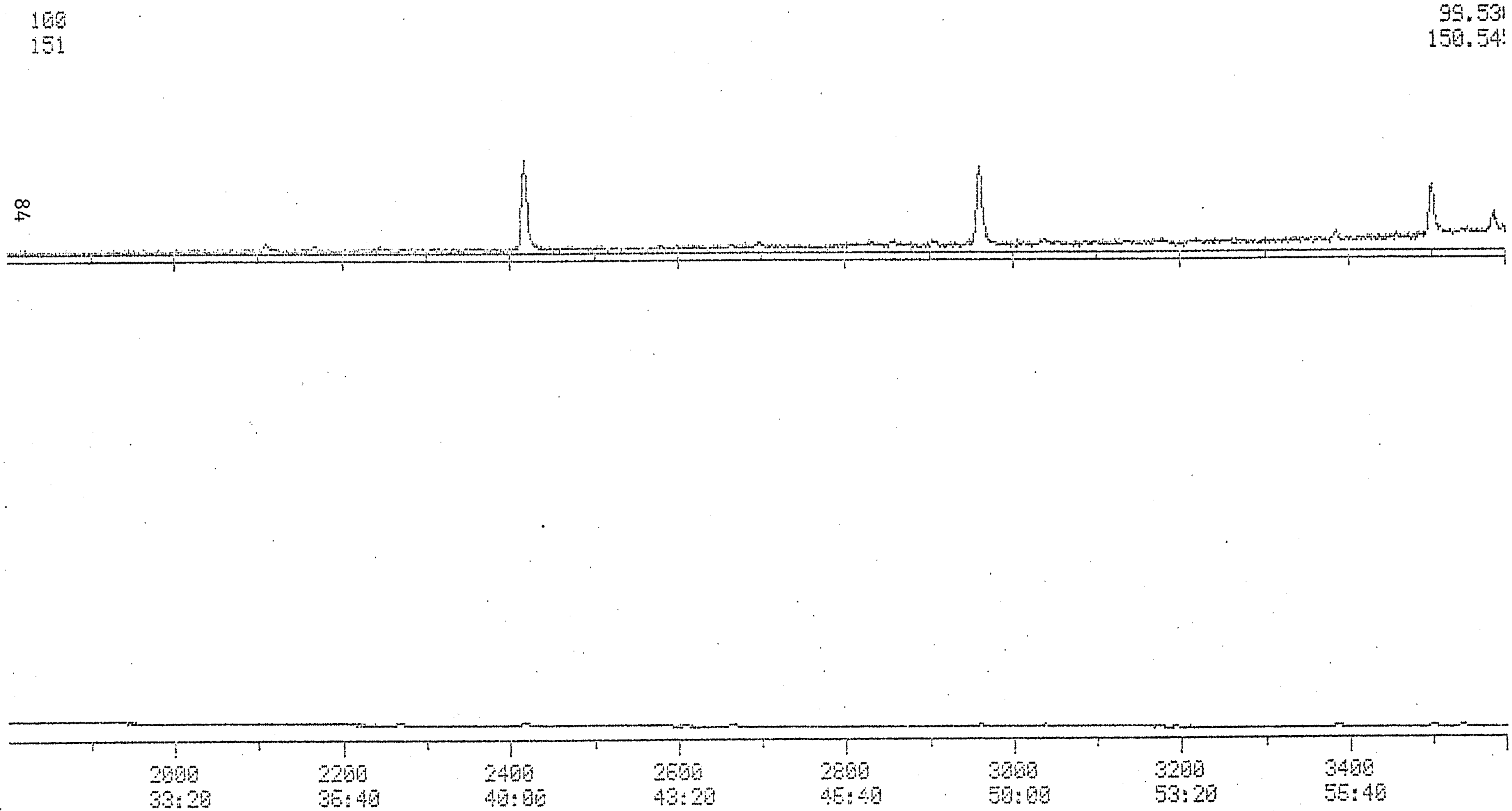
SCANS 1 TO 1801
OUT OF 1 TO 5400



RIC + MASS CHROMATOGRAM
05/29/80 12:52:00
SAMPLE: 871-#41 (5:00:20 -- BC-4 BASE)
RANGE: G 1,5400 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871030 #4968
CALI: 0529A #1

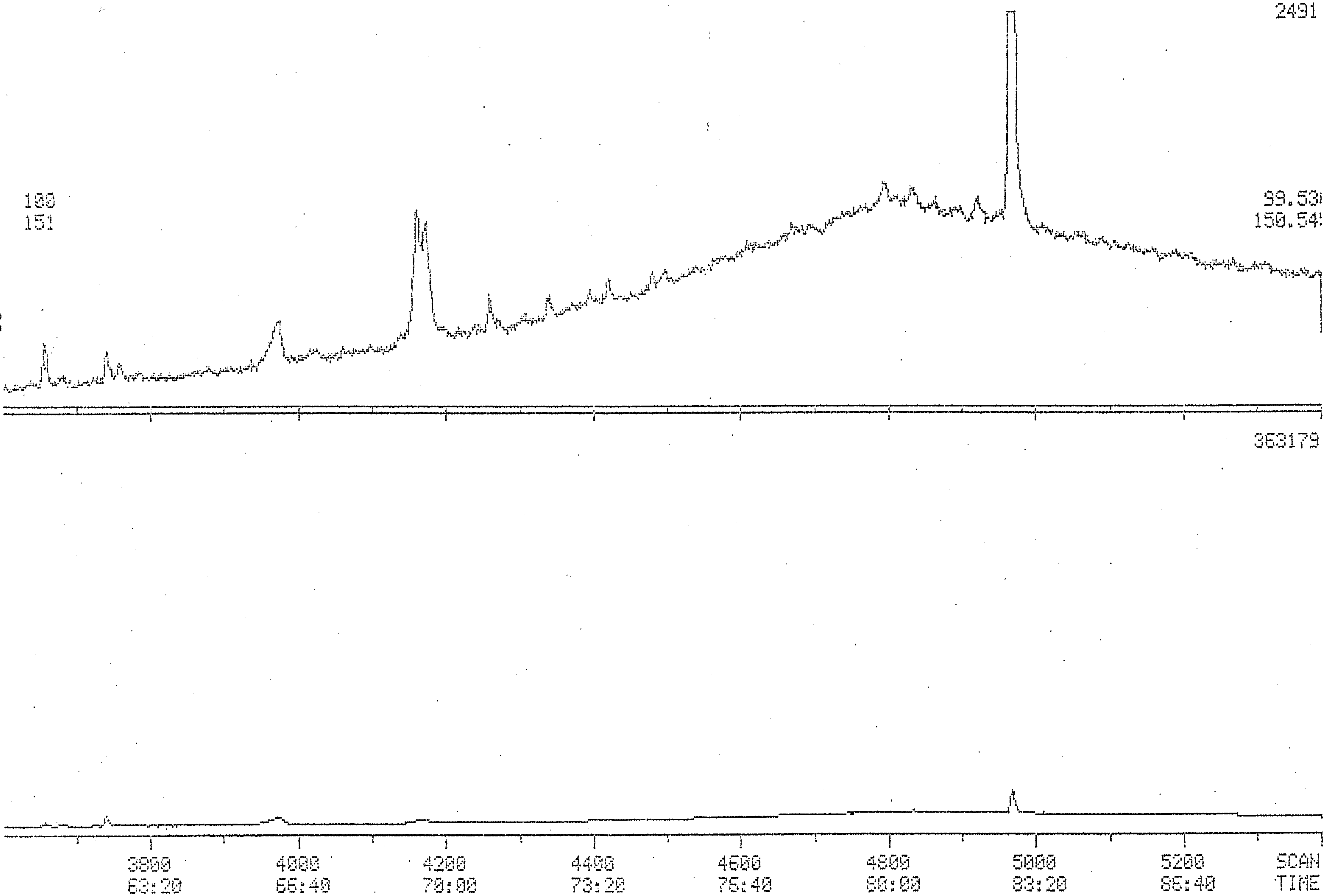
SCANS 1801 TO 3601
OUT OF 1 TO 5400



RIC + MASS CHROMATOGRAM
05/29/80 12:52:00
SAMPLE: 871-#41 (S:00:20 -- BC-4 BASE)
RANGE: G 1,5400 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: 871030 #4959
CALI: 0529A #1

SCANS 3601 TO 5400
OUT OF 1 TO 5400



V. DISCUSSION

A. Water Sample

The water sample results are largely negative. This may possibly be due to sampling technique and sample transfer.

B. Air Cartridges

The air results are ambiguous due to the attachment of labels to the cartridges. Some of the chlorinated products listed are from the intended sample. No real determination can be made as to which components are from the sample and which come from the "working" process. Since this error was introduced due to a mistake on the part of an O.H. Materials subcontractor, if it is decided to repeat these analyses it will be performed at no cost to the government.

C. Solvent Extracted Samples

1. Catchbasin samples

These samples contained most of the compounds previously identified as being Love Canal contamination. These include chlorinated benzenes, chlorinated naphthalenes and BHCs. Additionally, several polycycloaromatic hydrocarbons were determined to be present.

There appears to be a distribution of more compounds and at higher concentrations for the catchbasin closest to the canal (99-W and 97-E). This might be expected.

The source of the polyccycloaromatic hydrocarbons is not known. It is possible that these may come from street runoff, automobile exhaust or oil. Only catchbasins in the Ring I area have been sampled to date. Control catchbasins have not been analyzed, but would be valuable for this study.

2. Storm sewer sediments

The storm sewer sediment samples contain most of the components previously identified within the Love Canal. These include all of the chlorinated aromatics.

C. Solvent Extracted Samples (contd)

2. Storm sewer sediments (contd)

The largest distribution of compounds in sediment was found to be within the sediment from the Ring I area. These were concentrated at the key manhole sediment from 99-6 and 97-6. The compound distributions were difficult at these two locations.

It must be additionally noted that certain polychlorinated biphenyl compounds have been determined to be present in the sediment removed at manhole 97-6. This is the first time that PCB's have been identified as being within the Love Canal area. They are present at low concentrations and their origin is not determined. Speculation should not be made on the basis of one sample.

The GC/MS data reported here bear out the conclusions reached by the GC data. Sample 99-6 was determined not to have lindane as being present. This was confirmed by the GC/MS data. However, at this location several other chlorinated species are present. This suggests that disposal into the canal was not uniform, but there exist pockets of specific contamination within the canal.

3. Black Creek sediments

The Black Creek sediment samples show significant contamination. The sample taken at the 96th Street outfall shows gross contamination of virtually all the chlorinated aromatic hydrocarbons which have been identified with the Love Canal. Traces of PCB's have also been determined.

The 98th Street outfall contains some of the same compounds, but not at as significantly high levels.

O.H. Materials Co.
EMERGENCY SERVICE
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