Results of Ground Water Sampling
March and June 1995
Former Unocal Service Station 5353
Seattle, Washington

September 1, 1995

For

Unocal CERT - Northern Region

GeoEngineers

File No. 9161-013-R04

GeoEngineers

September 1, 1995

Geotechnical, Geoenvironmental and Geologic Services

Unocal CERT - Northern Region
P.O. Box 76
Seattle, Washington 98111

Attention: Dr. Mark Brearley, R.G.

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INTRODUCTION

This report summarizes the results of GeoEngineers' ground water monitoring activities conducted at and in the vicinity of Unocal Service Station 5353 during March and June 1995. Unocal Service Station 5353 is located northeast of the intersection of Westlake Avenue North and Mercer Street in Seattle, Washington. The Unocal site is shown relative to surrounding physical features in Figure 1. The site layout is shown in Figure 2. Approximately 80,000 gallons of leaded premium gasoline was released from a product line at the Unocal site in or before early 1980.

BACKGROUND

AREA HISTORY

The site is located about 500 feet south of the present shoreline of Lake Union. The original shoreline of Lake Union extended south of the present alignment of Mercer Street. In the late 1800s, the south end of Lake Union was developed predominantly with lumber mills and related facilities. The accumulated deposits of sawdust and wood waste from the sawmills and other fill materials eventually extended the shoreline of Lake Union north to its present location.

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The land use in the area of the site between the late 1800s and the present included commercial, light industrial and heavy industrial, based on our historical research. Land uses on approximately 20 different properties in close proximity to the Unocal site were identified as potential sources of contamination, based on former or current facilities at those locations. These facilities include service stations, an asphalt plant and a fuel storage yard.

UNOCAL SITE HISTORY

The Unocal site was covered by Lake Union before the south shore of the lake was extended northward in the late 1800s. In 1893, the site was occupied by Brace and Hergert Mill Company. Century Brewing Company and Horluck Creameries Inc. occupied the site beginning sometime between 1917 and 1935, and extending to 1965. Unocal leased the site from 1964 to 1967 and has owned the site since 1967. The western half of the Unocal site has been occupied by and operated as a service station since 1965. The service station facility is currently active. The eastern half of the Unocal site has been occupied by a Denny's restaurant since 1968.

ASSESSMENT AND CLEANUP HISTORY

Unocal employees detected a gasoline leak in a product line at the Unocal site in May 1980. The leak location was in the southwestern portion of the site, near the western service island. Unocal estimated that as much as 80,000 gallons of leaded premium gasoline had been released during the 4-month period prior to detection of the leak. The USTs (underground storage tanks) and the product lines were immediately replaced.

Twenty-five monitoring wells were installed in 1980 to assess the extent of free product floating on the ground water. An extensive free product plume was encountered beneath the Unocal site, north to Valley Street, west beneath Westlake Avenue North and south beneath Mercer Street.

A free product recovery system was installed at the site in June 1980. The recovery system operated from June 1980 until October 1982. A total of approximately 41,900 gallons of gasoline was recovered during this period. A subsurface VES (vapor extraction system) was installed at the site in June 1988. The VES has operated from June 1988 to the present.

Eighteen additional monitoring wells were drilled and installed in 1991 and 1992 to assess the extent of contaminated soil and ground water in the vicinity of the Unocal site. An area of contaminated soil was encountered extending beneath the Unocal site, north to Valley Street, west beneath Westlake Avenue and south beneath Mercer Street. Contaminated ground water was encountered beneath the site and beneath Westlake Avenue North, Mercer Street, Terry Avenue North and possibly Valley Street.

The locations of the monitoring wells installed in 1991 and 1992, and the locations of the monitoring wells installed in 1980 are shown in Figure 3.

SUBSURFACE SOIL CONDITIONS

Our interpretation of subsurface soil conditions is based on monitoring well borings completed in the vicinity of the Unocal site and on review of city of Seattle logs of borings drilled in the vicinity. Mixed fill materials consisting of sand, sand with silt, silty sand, silty gravel, silt, and sawdust were encountered in the borings. The fill materials extend to a depth of approximately 35 feet. Little horizontal continuity was observed in the nonsawdust fill units. Fill zones consisting of sawdust and wood chips were encountered beneath and in the vicinity of the Unocal site. The sawdust and wood chip zones ranged from several feet to greater than 10 feet in thickness. Native sand with varying amounts of gravel was encountered beginning at a depth of approximately 35 feet in borings that extended to this depth.

GROUND WATER CONDITIONS

Ground water is present at depths of about 7 to 14 feet beneath the Unocal site. The general direction of ground water flow in the area is toward the northeast, although considerable variation in ground water flow direction occurs in localized areas.

SCOPE

The purpose of our ground water monitoring services at the site was to evaluate ground water conditions beneath and in the vicinity of the site. The specific scope of our services during this reporting period was as follows.

1. Measure the depths to ground water in selected monitoring wells during the March 8 and June 6, 1995 sampling visits, and calculate water table elevations relative to an assumed site datum. Our field procedures are described in Attachment A.
2. Obtain ground water samples from monitoring wells MW-32A, MW-34 through MW-37, MW-40 through MW-47, SMW-3 and SMW-4 on March 8 and June 6, 1995. Submit the samples for laboratory analysis of BETX (benzene, ethylbenzene, toluene and xylenes) by EPA Method 8020, gasoline-range hydrocarbons by Ecology Method WTPH-G, and diesel- and heavy oil-range hydrocarbons by Ecology Method WTPH-D extended.

GROUND WATER SAMPLING

GROUND WATER ELEVATIONS

Ground water levels were measured in the well casings of monitoring wells MW-32A, MW-34 through MW-37, and MW-40 through MW-47 on March 8 and/or June 6, 1995 using an electric water level indicator. Ground water depths and elevations are summarized in Table 2. The depths to water measured in the monitoring wells ranged from about 8.2 to 12.4 feet on March 8, 1995. The depths to water measured in the monitoring wells ranged from about 7.3 to 15.0 feet on June 6, 1995. Approximately 0.01 feet of free product was measured in MW-37 on June 6, 1995. Free product was not observed in this well on March 8, 1995. Free product

was not encountered in other monitoring wells that were measured during this reporting period. Ground water elevations and inferred ground water contours and flow direction based on the March 1995 measurements are shown in Figure 3.

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in the monitoring well casings on March 8 and June 6, 1995 and are presented in Table 1.

Combustible vapor concentrations were generally consistent with concentrations measured during previous monitoring events.

GROUND WATER SAMPLING AND ANALYSIS

GeoEngineers obtained ground water samples from monitoring wells MW-32A, MW-33, MW-34 through MW-37, MW-40 through MW-47, SMW-3 and SMW-4 on March 8, 1995. We obtained ground water samples from monitoring wells MW-34 through MW-37, MW-40 through MW-47, SMW-3 and SMW-4 on June 6, 1995. Monitoring well locations are shown in Figure 3. Each sample was submitted for laboratory analysis of BETX, and gasoline-, diesel- and heavy oil-range hydrocarbons. Sampling procedures are described in Attachment A. Chemical analytical results are summarized in Table 2 and in Figure 4. The laboratory reports and our review of the laboratory QA/QC program are included in Attachment B.

Dissolved-phase BETX constituents (benzene, ethylbenzene, toluene and xylenes) were detected at concentrations exceeding the MTCA Method A ground water cleanup levels in the samples obtained from monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-37, MW-45 and SMW-4 during this reporting period. Benzene was detected at a concentration greater than the MTCA Method A ground water cleanup level in the March and June 1995 samples from MW-40, MW-42, MW-43 and MW-47. The sum of dissolved-phase gasoline-, diesel- and/or heavy oil-range hydrocarbons exceeded the Method A ground water cleanup level in the samples obtained from monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-36, MW-37, MW-40, MW-42, MW-43, MW-45, MW-46, MW-47, SMW-3 and SMW-4 during one or both sampling events of this reporting period. However, the March 1995 results for the SMW-3 sample are not consistent with previous results from this well and are not representative of actual conditions, in our opinion.

DISCUSSION

Free product was present in MW-37 (located beneath Mercer Street south of the site) during this reporting period, which is consistent with observed conditions during past reporting periods. Free product was not observed in any other wells at the site, which is also consistent with observed conditions during past reporting periods. Petroleum-related ground water contamination, primarily consisting of gasoline, is present beneath the site at concentrations

exceeding the MTCA Method A cleanup levels. The chemical analytical results obtained during this reporting period are generally consistent with results obtained during previous reporting periods, except for the March 1995 sample from SMW-3. It is our opinion the chemical analytical results provided for the March 8, 1995 SMW-3 ground water sample event do not represent actual conditions in the well. This opinion is based on visual inspection of the chromatogram provided with the WTPH-D extended analysis of SMW-3 and comparison to previous and subsequent ground water analytical results for SMW-3 and SMW-4. The results of water level and combustible vapor concentration measurements in March and June 1995 were similar to those obtained in previous monitoring events.

FUTURE MONITORING

We will continue monitoring and sampling the on- and off-site wells on a quarterly basis. The next sampling event is scheduled for September 1995.

We appreciate the opportunity to be of service on this project. Please call if you have any questions regarding this report.

Respectfully submitted,
GeoEngineers, Inc.

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Principal

DEW:DLC:JAM:cms
Document ID: 9161013.PR1
Attachments
Two copies submitted
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TABLE 1
GROUND WATER ELEVATIONS AND COMBUSTIBLE VAPOR CONCENTRATIONS

Monitoring Well[1]	Date Measured	Water Depth From Ground Surface (feet)	Corrected Ground Water Elevation[2] (feet)	Combustible Vapor Concentration[3] (ppm)
MW-32A	03/08/95	11.29	9.69	>10,000
	06/06/95	--	--	--
MW-33	03/08/95	11.16	9.73	<400
	06/06/95	--	--	--
MW-34	03/08/95	11.62	10.08	<400
	06/06/95	11.73	9.97	<400
MW-35	03/08/95	10.67	9.60	800
	06/06/95	10.67	9.60	700
MW-36	03/08/95	9.07	8.97	<400
	06/06/95	7.92	10.12	<400
MW-37	03/08/95	11.94	9.24	>10,000
	06/06/95	11.76[4]	9.43[4]	>10,000
MW-40	03/08/95	10.98	10.14	--
	06/06/95	11.18	9.94	>10,000
MW-41	03/08/95	14.72	12.48	--
	06/06/95	15.02	12.18	6,000
MW-42	03/08/95	9.45	10.91	--
	06/06/95	9.37	10.99	>10,000
MW-43	03/08/95	11.35	9.94	--
	06/06/95	11.45	9.84	4,200
MW-44	03/08/95	9.44	10.46	--
	06/06/95	8.28	10.62	<400
MW-45	03/08/95	7.92	9.23	--
	06/06/95	8.55	9.86	>10,000
MW-46	03/08/95	8.00	8.91	>10,000
	06/06/95	7.30	10.01	>10,000
MW-47	03/08/95	10.88	9.16	>10,000
	06/06/95	10.91	9.13	600
SMW-3	03/08/95	10.24	--	800
	06/06/95	10.23	--	300
SMW-4	03/08/95	8.14	--	>10,000
	06/06/95	8.90	--	>10,000

Notes:

[1]Approximate locations of monitoring wells are shown in Figure 3.

[2]Elevations are measured relative to the city of Seattle datum.

[3]Measured with a Bacharach TLV Sniffer calibrated to hexane equipped with a 2-inch-diameter clip cap.

[4]0.01 foot of product was measured in MW-37 on 06/06/95.

ppm = parts per million

Field procedures are described in Attachment A.

Document ID: 161013M1.WK1

TABLE 2 (Page 1 of 2)
SUMMARY OF MONITORING WELL GROUND WATER CHEMICAL ANALYTICAL DATA

Sample Number	Date Sampled	BETX[1] (µg/l)				Gasoline-range Hydrocarbons[2] (mg/l)	Diesel-range Hydrocarbons[3] (mg/l)	Heavy Oil-range Hydrocarbons[3] (mg/l)
		B	E	T	X			
MW-32A	03/08/95	5,800	990	1,700	2,900	21	2.3	2.3
MW-33	03/08/95	650	320	<25	420	4.9	1.4	2.0
MW-34	03/08/95	2,400	250	1,500	1,300	8.2	1.1	0.48
	06/06/95	4,200	330	1,000	1,200	9.1	2.3	<0.75
MW-35	03/08/95	400	120	<25	93	2.6	1.2	1.3
	06/06/95	62	27	1.4	36	0.81	1.0	0.93
MW-36	03/08/95	2.6	<0.5	<0.5	<1.0	<0.05	0.56	1.2
	06/06/95	1.0	<0.5	<0.5	<1.0	<0.5	<0.25	<0.75
MW-37	03/08/95	3,100	1,200	2,400	6,700	34	3.2	1.4
	06/06/95[6]	3,700	1,300	2,400	7,900	45	4.6	2.5
Laboratory Duplicate	06/06/95[6]	5,100	2,400	6,000	14,000	90	--	--
MW-40	03/08/95	11	11	<0.5	<1.0	0.97	2.6	2.6
	06/06/95	6.8	4.1	4.3	21	1.5	2.3	1.6
MW-41	03/08/95	1.6	<0.5	<0.5	<1.0	<0.05	<0.25	<0.75
	06/06/95	<0.5	<0.5	<0.5	<1.0	<0.05	<0.25[7]	<0.75[7]
MW-42	03/08/95	790	<25	<25	<50	0.13	0.67	1.2
	06/06/95	500	<0.5	<0.59	<1.0	0.12	0.92	1.5
MW-43	03/08/95	25	<0.5	<0.5	<1.0	<0.05	0.65	2.4
	06/06/95	8.2	<0.5	<0.5	<1.0	<0.05	0.69	1.5
MW-44	03/08/95	<0.5	<0.5	<0.5	<1.0	<0.05	0.29	0.94
	06/06/95	<0.5	<0.5	<0.5	1.6	<0.05	<0.25	0.82
MW-45	03/08/95	3,000	790	95	3,300	16	1.5	1.1
	06/06/95	1,700	500	10	1,500	8.1	1.0[7]	0.98[7]
MW-46	03/08/95	<0.5	<0.5	<0.5	<1.0	<0.05	0.72	3.6
	06/06/95	<0.5	<0.5	<0.5	<1.0	<0.05	<0.25	1.4
MW-47	03/08/95	5.3	<0.5	<0.5	<1.0	<0.05	0.33	1.6
	06/06/95	15	<0.5	0.59	2.3	0.07	0.38	0.78
MTCA Method A Ground Water Cleanup Levels		5	30	40	20	1.0[5]		

Notes appear on page 2 of 2.

TABLE 2 (Page 2 of 2)

Sample Number	Date Sampled	BETX[1] (µg/l)				Gasoline-range Hydrocarbons[2] (mg/l)	Diesel-range Hydrocarbons[3] (mg/l)	Heavy Oil-range Hydrocarbons[3] (mg/l)
		B	E	T	X			
SMW-3	03/08/95	<0.5	<0.5	<0.5	<1.0	<0.05	0.40[8]	2.5[8]
	06/06/95	<0.5	<0.5	<0.5	<1.0	<0.05	<0.25	<0.75
SMW-4	03/08/95	13,000	2,400	<250[4]	6,200	39	4.1	5.1
	06/06/95	9,400	2,700	44	4,900	41	5.5	<0.75
MTCA Method A Ground Water Cleanup Levels		5	30	40	20	1.0[5]		

Notes:

[1]Analyzed by EPA Method 8020. B = benzene, E = ethylbenzene, T = toluene, X = xylenes.

[2]Analyzed by Ecology Method WTPH-G.

[3]Analyzed by Ecology Method WTPH-D (extended range, through N-C_{34}).

[4]Laboraotry detection level exceeds the MTCA Method A cleanup level.

[5]The MTCA Method A ground water cleanup level for the sum of gasoline-, diesel- and heavy oil-range hydrocarbons is 1.0 mg/l if the carbon ranges are distinctly quantified using gas chromatography methods.

[6]Results shoudl be considered estimated based on high variability of sample and laboratory duplicate.

[7]Results should be considered estimated because of surrogate recovery exceptions.

[8]It is our opinion these chemical analytical results are not representative of ground water quality in SMW-3, as discussed in the text of this report.

µg/l = micrograms per liter

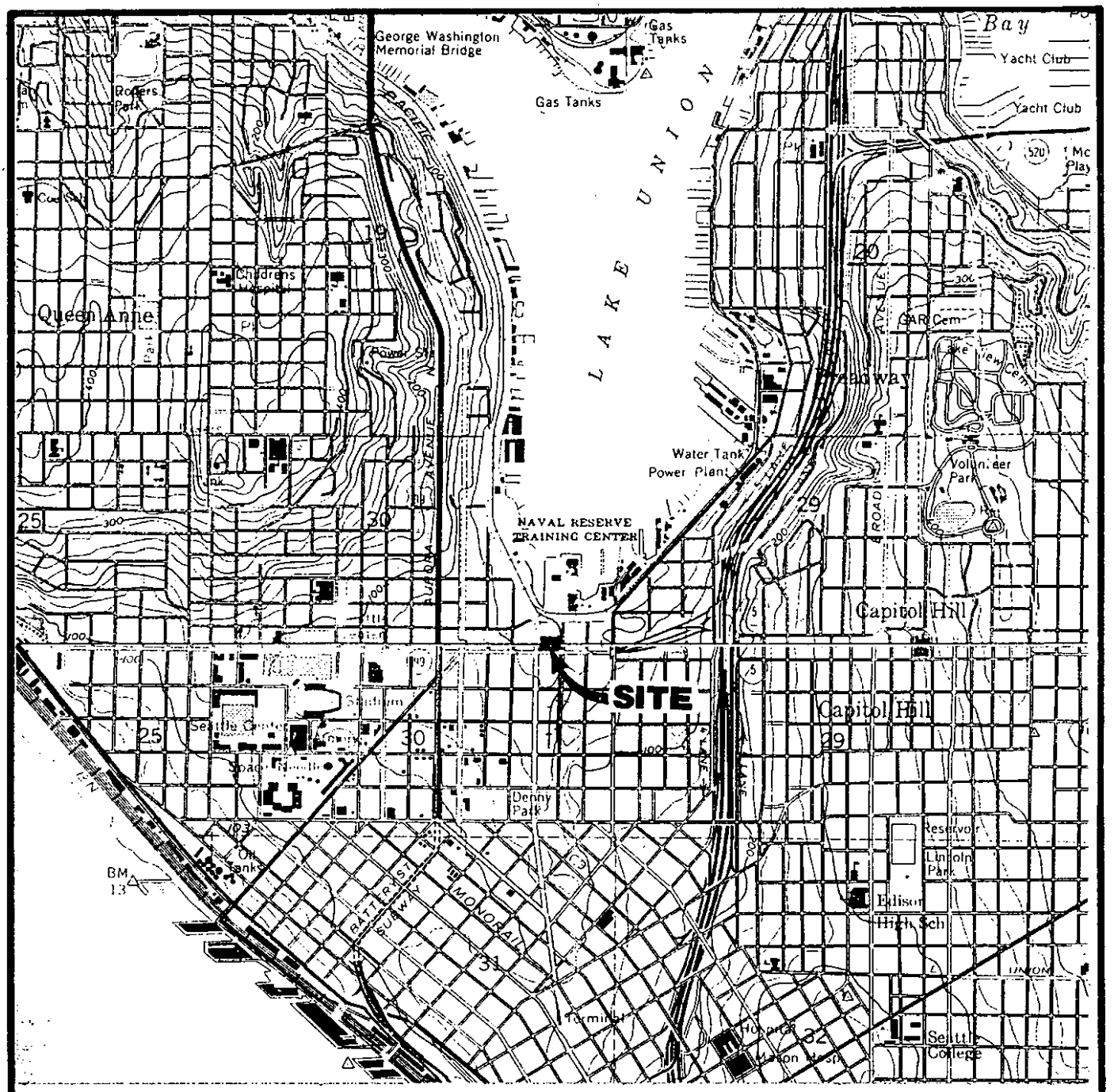
mg/l = milligrams per liter

"–" = not tested

Shading indicates that the concentrations are equal to or exceeding the MTCA Method A cleanup levels.

Chemical analyses by North Creek Analytical. Laboratory reports are in Attachment B.

Document ID: 161013M2.WK1



REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS "SEATTLE NORTH, WASH.," PHOTOREVISED 1968 AND "SEATTLE SOUTH, WASH.," PHOTOREVISED 1973.

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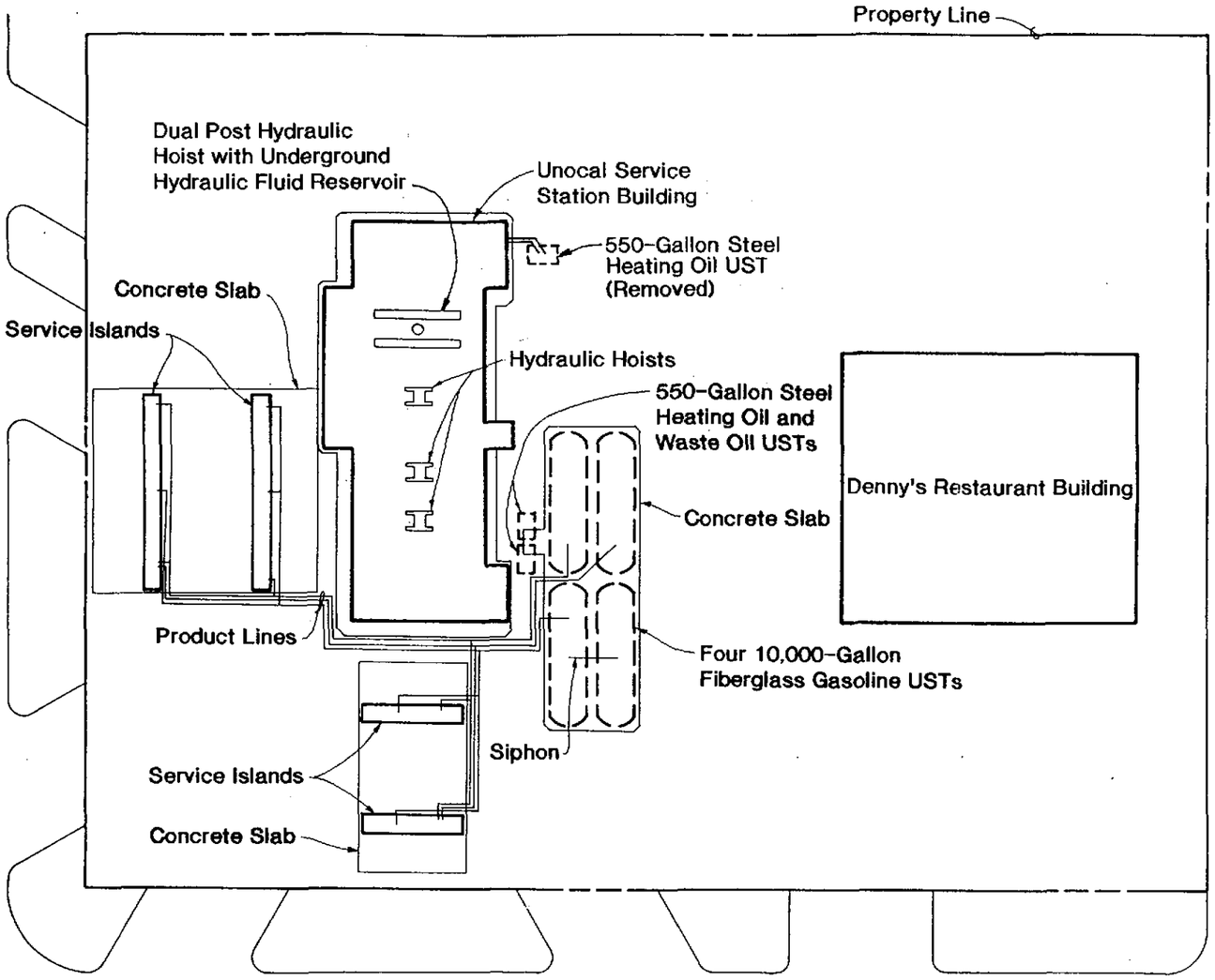
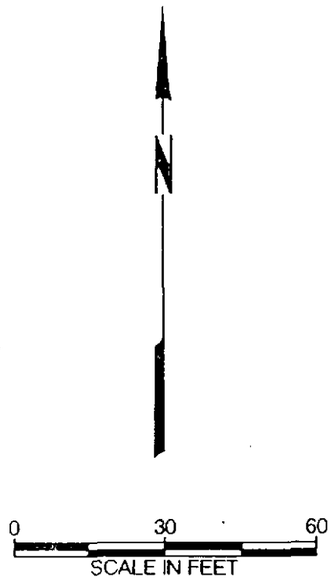
VICINITY MAP

FIGURE 1

0161-013-R04 AMA:KKT 2/13/92





EXPLANATION:

UST UNDERGROUND STORAGE TANK

REFERENCE: DRAWINGS ENTITLED "GENERAL ARRANGEMENT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE WASHINGTON," DATED 03/05/65; AND "TANK & PIPELINE REPLACEMENT PROJECT, SERVICE STATION 5353, WESTLAKE AVE. & MERCER ST., SEATTLE, WASHINGTON," DATED 06/18/80, BOTH BY UNION OIL COMPANY OF CALIFORNIA.

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SITE PLAN

FIGURE 2

0161-013-R69 NLP:BDH 12.9.91(B)

EXPLANATION:

- **MW-2** ● MONITORING WELL INSTALLED IN 1980
- **MW-33** ◑ MONITORING WELL INSTALLED IN 1991 OR 1992
- **SMW-2S** ⊗ MONITORING WELL INSTALLED BY SCS
- 8.97 GROUND WATER ELEVATION (FEET) ON 03/08/95
- 10.5 GROUND WATER ELEVATION CONTOUR (FEET) ON 03/08/95
- GENERAL DIRECTION OF GROUND WATER FLOW ON 03/08/95

N

0 80 160
SCALE IN FEET

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

Unocal Property Line

MW-38

MW-46 8.91

MW-36 8.97

9.0

MW-47 9.16

MW-48

MW-29

Denny's Restaurant

MW-40 10.14

City of Seattle Property

MW-45 9.23

MW-32

MW-49

MW-3

MW-33 9.73

MW-19

MW-35 9.60

Unocal SS-5353

MW-37 9.24

MW-2

SMW-1S

SMW-5

MW-32A 9.69

MW-18

MW-24

SMW-3

SMW-4

SMW-2S

MW-1

MW-34 10.08

City Park

MW-42 10.91

MW-17

MW-11

MW-27

MW-41 12.48

WESTLAKE AVENUE NORTH

MW-13

MW-15

MW-14

MW-16

MW-43 9.94

MW-44 10.46

WESTLAKE AVENUE NORTH

BROAD STREET

MW-39

SMW-2

10.5

11.0

11.5

12.0

Notes:
1. The locations of all features shown are approximate.
2. Ground water elevations are referenced to City of Seattle datum.

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0161013E.DWG

DEW:BDH

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GROUND WATER ELEVATIONS ON 03/08/95

FIGURE 3

MW-46	B	G	D	O
03/08/95	<0.5	<0.05	0.72	3.6
06/06/95	<0.5	<0.05	<0.25	1.4
MTCA	5.0	1.0		

MW-45	B	G	D	O
03/08/95	3,000	16	1.5	1.1
06/06/95	1,700	8.1	1.0	0.98
MTCA	5.0	1.0		

MW-47	B	G	D	O
03/08/95	5.3	<0.05	0.33	1.6
06/06/95	15	0.73	0.38	0.78
MTCA	5.0	1.0		

MW-38	B	G	D	O
03/08/95	2.0	<0.05	0.56	1.2
06/06/95	1.0	<0.05	<0.25	<0.75
MTCA	5.0	1.0		

MW-33	B	G	D	O
03/08/95	650	5.9	1.4	2.0
MTCA	5.0	1.0		

MW-40	B	G	D	O
03/08/95	11	0.97	2.6	2.6
06/06/95	6.8	1.5	2.3	1.6
MTCA	5.0	1.0		

MW-35	B	G	D	O
03/08/95	400	2.6	1.2	1.3
06/06/95	62	0.51	1.0	0.93
MTCA	5.0	1.0		

MW-32A	B	G	D	O
03/08/95	5,800	21	2.3	2.3
MTCA	5.0	1.0		

MW-37	B	G	D	O
03/08/95	3,100	34	3.2	1.4
06/06/95	5,100	90	4.8	2.5
MTCA	5.0	1.0		

SMW-3	B	G	D	O
03/08/95	<0.5	<0.05	0.40	2.5
06/06/95	<0.5	<0.05	<0.25	<0.75
MTCA	5.0	1.0		

MW-34	B	G	D	O
03/08/95	2,400	8.2	1.1	0.48
06/06/95	4,200	9.1	2.3	<0.75
MTCA	5.0	1.0		

MW-41	B	G	D	O
03/08/95	1.6	<0.05	<0.25	<0.75
06/06/95	<0.5	<0.05	<0.25	<0.75
MTCA	5.0	1.0		

SMW-4	B	G	D	O
03/08/95	13,000	39	4.1	5.1
06/06/95	9,400	41	5.5	<0.75
MTCA	5.0	1.0		

MW-43	B	G	D	O
03/08/95	25	<0.05	0.65	2.4
06/06/95	8.2	<0.05	0.69	1.5
MTCA	5.0	1.0		

MW-42	B	G	D	O
03/08/95	790	0.13	0.67	1.2
06/06/95	500	0.12	0.92	1.5
MTCA	5.0	1.0		

MW-44	B	G	D	O
03/08/95	<0.5	<0.05	0.29	0.94
06/06/95	<0.5	<0.05	<0.25	0.82
MTCA	5.0	1.0		

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

WESTLAKE AVENUE NORTH

WESTLAKE AVENUE NORTH

BROAD STREET

MW-38 ◑

MW-48 ◑

MW-29 ●

MW-49 ◑

MW-32 ◑

MW-3 ●

⊗SMW-1S

⊗SMW-5

⊗SMW-2S

MW-1 ●

MW-19 ●

MW-18 ●●

MW-24 ◑

MW-11 ●

MW-27 ●

MW-17 ●

MW-13 ●

MW-15 ●

MW-14 ●

MW-16 ●◑

MW-39 ◑

⊗SMW-2

N

0 80 160

SCALE IN FEET

EXPLANATION:

- MW-2 ● MONITORING WELL INSTALLED IN 1980
- MW-33 ◑ MONITORING WELL INSTALLED IN 1991 OR 1992
- SMW-2S ⊗ MONITORING WELL INSTALLED BY SCS

- B BENZENE (µg/l) BY EPA METHOD 8020
- G GASOLINE-RANGE HYDROCARBONS (mg/l) BY ECOLOGY METHOD WTPH-G
- D DIESEL-RANGE HYDROCARBONS (mg/l) BY ECOLOGY METHOD WTPH-D EXTENDED
- O HEAVY OIL-RANGE HYDROCARBONS (mg/l) BY ECOLOGY METHOD WTPH-D EXTENDED
- MTCA MODEL TOXICS CONTROL ACT METHOD A GROUND WATER CLEANUP LEVEL

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SUMMARY OF GROUND WATER ANALYTICAL DATA

FIGURE 4

0161013R04:072095

0161013D.DWG

DEW:BDH

ATTACHMENT A

ATTACHMENT A

MONITORING WELL MEASUREMENTS AND SAMPLING

GROUND WATER ELEVATIONS

Depths to the ground water table relative to the monitoring well casing rims and thicknesses of free product, where present, were measured on the dates indicated in Table 2. The water level measurements were made using an electric water level indicator. Product thickness was measured with a transparent disposable bailer. The electric water level indicator was cleaned with a Liquinox (phosphate-free detergent) solution wash and a distilled water rinse prior to use in each well. Ground water elevations were calculated by subtracting the water table depths from the casing rim elevations.

GROUND WATER SAMPLING

Ground water samples were obtained from monitoring wells MW-32A, MW-33, MW-34 through MW-37, MW-40 through MW-47, SMW-3 and SMW-4 on March 8, 1995. We obtained ground water samples from monitoring wells MW-34 through MW-37, MW-40 through MW-47, SMW-3 and SMW-4 on June 6, 1995. The samples were obtained with a new disposable bailer and clean bailing rope after at least three well volumes of water were removed from each well casing. The samples were transferred in the field to laboratory-prepared sample containers and were kept cold during transport to the testing laboratory. Chain-of-custody procedures were followed during transport of the samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in attachment B.

COMBUSTIBLE VAPOR CONCENTRATIONS

We measured the combustible vapor concentrations in the monitoring wells on May 30, 1995 using a Bacharach TLV Sniffer calibrated to hexane. The measurements were obtained from the wells casing using a 2-inch-diameter slip cap connected to the TLV Sniffer by rubber tubing. The lower threshold of significance for the TLV Sniffer in this application is 400 ppm (parts per million), or 3.6 percent of the lower explosive limit of hexane. The combustible vapor concentrations measured on March 8 and June 6, 1995 are presented in Table 1.

ATTACHMENT B

ATTACHMENT B

CHEMICAL ANALYTICAL PROGRAM

ANALYTICAL METHODS

Chain-of-custody procedures were followed during the transport of the field samples to the analytical laboratory. The samples were held in cold storage pending extraction and/or analysis. The analytical results, analytical methods reference and laboratory QA/QC (quality assurance/quality control) records are included in this appendix. The analytical results are also summarized in the text and tables of this report.

ANALYTICAL DATA REVIEW

The laboratory maintains an internal quality assurance program as documented in its laboratory quality assurance manual. The laboratory uses a combination of blanks, surrogate recoveries, duplicates, matrix spike recoveries, matrix spike duplicate recoveries, blank spike recoveries and blank spike duplicate recoveries to evaluate the validity of the analytical results. The laboratory also uses data quality goals for individual chemicals or groups of chemicals based on the long-term performance of the test methods. The data quality goals were included in the laboratory reports. The laboratory compared each group of samples with the existing data quality goals and noted any exceptions in the laboratory report. The laboratory QA/QC and data quality exceptions documented by the laboratory were reviewed by GeoEngineers using the applicable data validation guidelines from the following documents: "National Functional Guidelines for Organic Data Review" draft dated 1991 and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" dated 1988.

ANALYTICAL DATA REVIEW SUMMARY

Based on our data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use except for the following:

WTPH-G/EPA Method 8020:	Gasoline-range hydrocarbon and BETX results for sample MW-37 (June 1995) should be considered estimated based on the high variability evidenced by the results of the laboratory duplicate.
WTPH-D: (Extended Range)	Diesel- and heavy oil-range hydrocarbon results for samples MW-41 and MW-45 (June 1995) should be considered estimated because of surrogate recovery exceptions. It is our opinion that the diesel- and heavy oil-range hydrocarbon results for sample SMW-3 (March 1995) do not represent actual conditions in the well.

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Project Name:	UNOCAL Seattle, #5353	
8410 154th Avenue N.E.	Client Project #:	#9161-013-R69	
Redmond, WA 98052			Received: Mar 9, 1995
Attention: Norm Puri	NCA Project #:	B503152	Reported: Mar 22, 1995

PROJECT SUMMARY PAGE

Laboratory Sample Number	Sample Description	Sample Matrix	Date Sampled
B503152-01	MW-32A	Water	3/8/95
B503152-02	MW-33	Water	3/8/95
B503152-03	MW-34	Water	3/8/95
B503152-04	MW-35	Water	3/8/95
B503152-05	MW-36	Water	3/8/95
B503152-06	MW-37	Water	3/8/95
B503152-07	MW-40	Water	3/8/95
B503152-08	MW-41	Water	3/8/95
B503152-09	MW-42	Water	3/8/95
B503152-10	MW-43	Water	3/8/95
B503152-11	MW-44	Water	3/8/95

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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Laura Dutton

Laura Dutton
Project Manager

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GeoEngineers, Inc.	Project Name:	UNOCAL Seattle, #5353	
8410 154th Avenue N.E.	Client Project #:	#9161-013-R69	
Redmond, WA 98052			Received: Mar 9, 1995
Attention: Norm Puri	NCA Project #:	B503152	Reported: Mar 22, 1995

PROJECT SUMMARY PAGE

Laboratory Sample Number	Sample Description	Sample Matrix	Date Sampled
B503152-12	MW-45	Water	3/8/95
B503152-13	MW-46	Water	3/8/95
B503152-14	MW-47	Water	3/8/95
B503152-15	SMW-3	Water	3/8/95
B503152-16	SMW-4	Water	3/8/95

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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Mar 9, 1995
Redmond, WA 98052	Analysis Method:	WTPH-G	Analyzed:	Mar 13-14, 1995
Attention: Norm Puri	First Sample #:	B503152-01	Reported:	Mar 22, 1995

TOTAL PETROLEUM HYDROCARBONS-GASOLINE RANGE

Sample Number	Sample Description	Sample Result µg/L (ppb)	Surrogate Recovery %
B503152-01	MW-32A	21,000	122
B503152-02	MW-33	5,900	130
B503152-03	MW-34	8,200	107
B503152-04	MW-35	2,600	109
B503152-05	MW-36	N.D.	101
B503152-06	MW-37	34,000	112
B503152-07	MW-40	970	S-2
B503152-08	MW-41	N.D.	97
B503152-09	MW-42	130	96
B503152-10	MW-43	N.D.	103

Reporting Limit:	50

4-Bromofluorobenzene surrogate recovery control limits are 50 - 150 %.
Volatile Total Petroleum Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Laura Dutton

Laura Dutton
Project Manager

Please Note:
S-2 = The Surrogate Recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample.

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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Mar 9, 1995
Redmond, WA 98052	Analysis Method:	WTPH-G	Analyzed:	Mar 13-15, 1995
Attention: Norm Puri	First Sample #:	B503152-11	Reported:	Mar 22, 1995

TOTAL PETROLEUM HYDROCARBONS-GASOLINE RANGE

Sample Number	Sample Description	Sample Result µg/L (ppb)	Surrogate Recovery %
B503152-11	MW-44	N.D.	98
B503152-12	MW-45	16,000	108
B503152-13	MW-46	N.D.	97
B503152-14	MW-47	N.D.	103
B503152-15	SMW-3	N.D.	92
B503152-16	SMW-4	39,000	127
BLK031495	Method Blank	N.D.	94

Reporting Limit:	50

4-Bromofluorobenzene surrogate recovery control limits are 50 - 150 %.
Volatile Total Petroleum Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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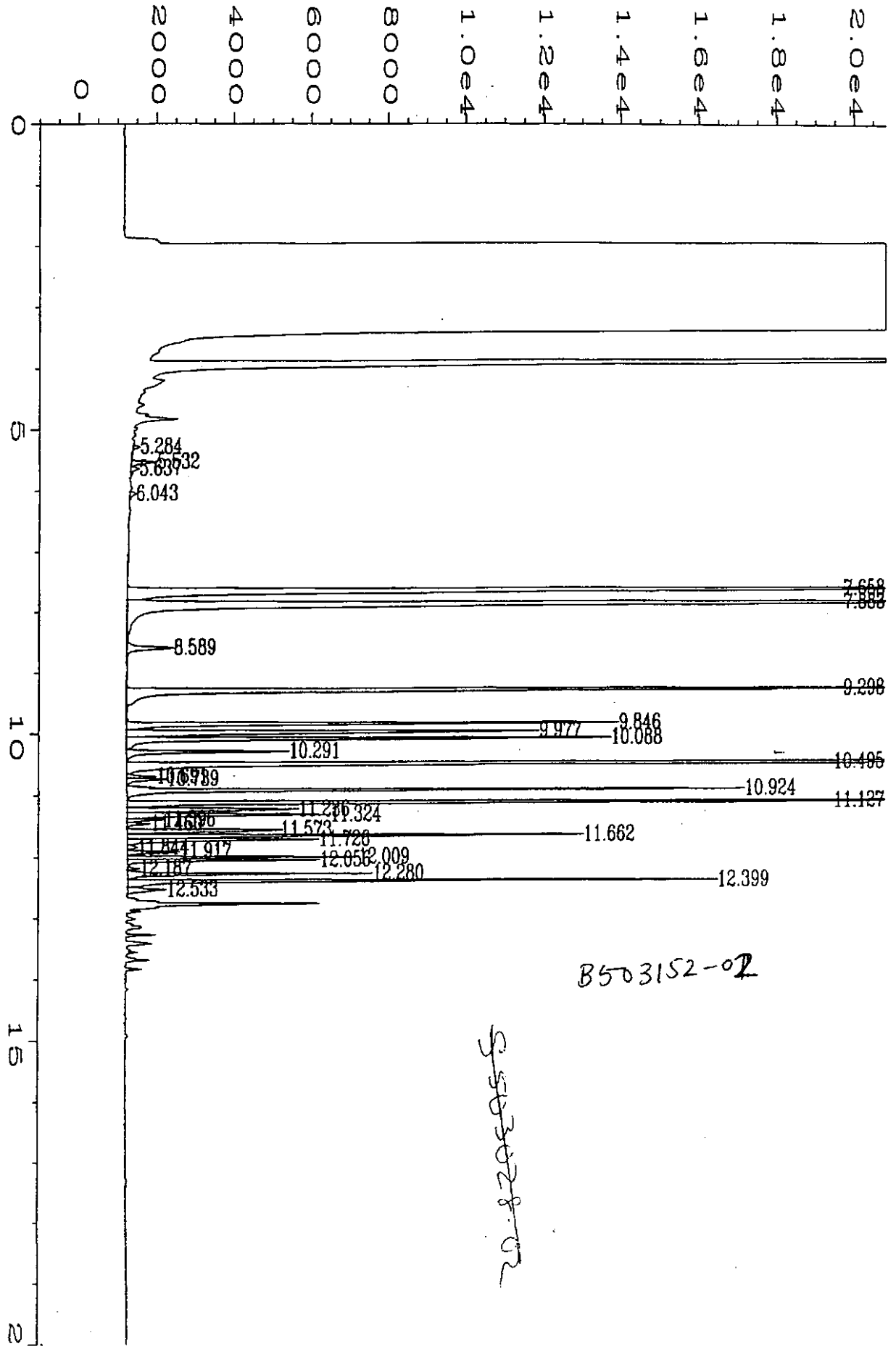
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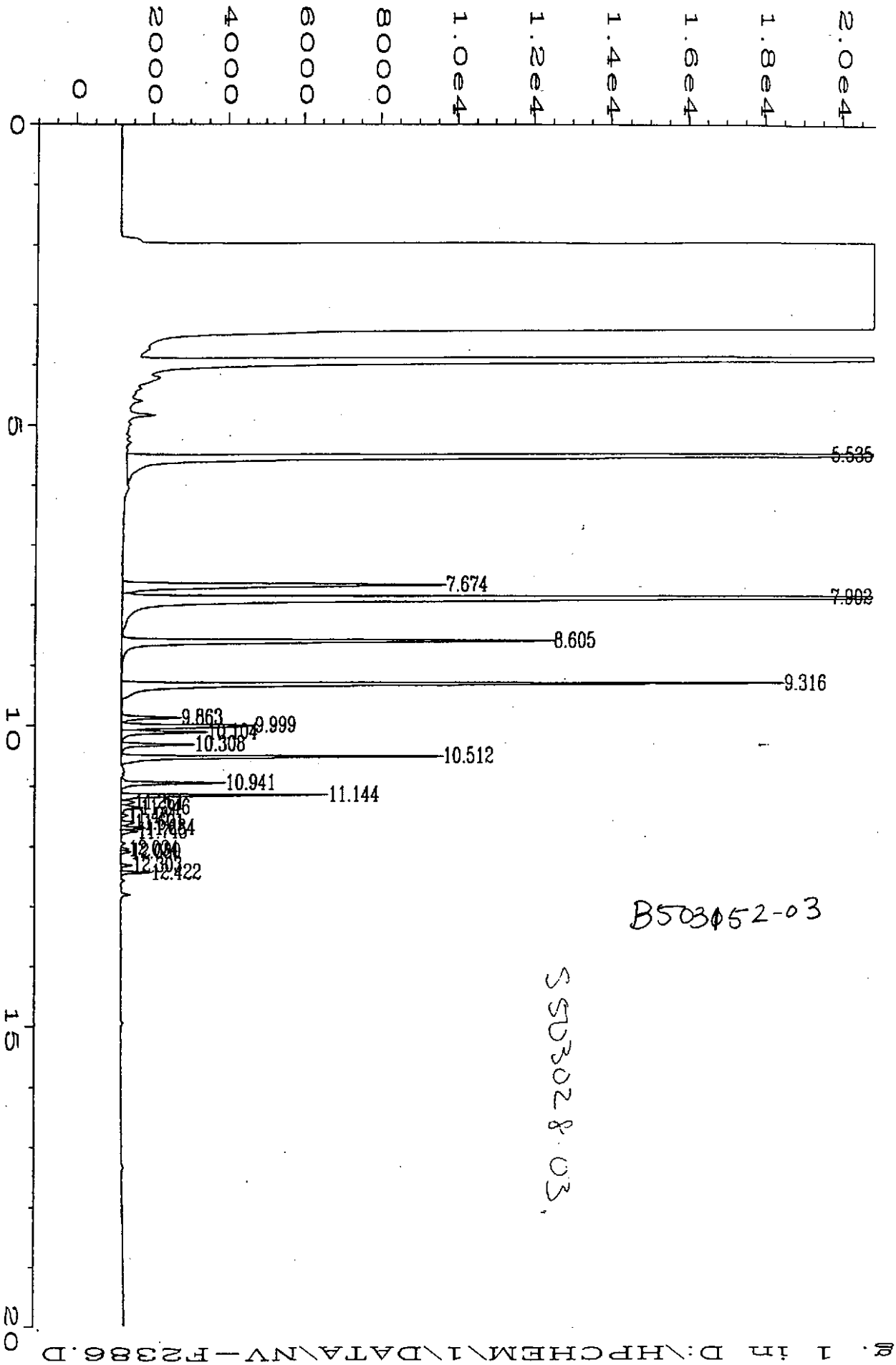

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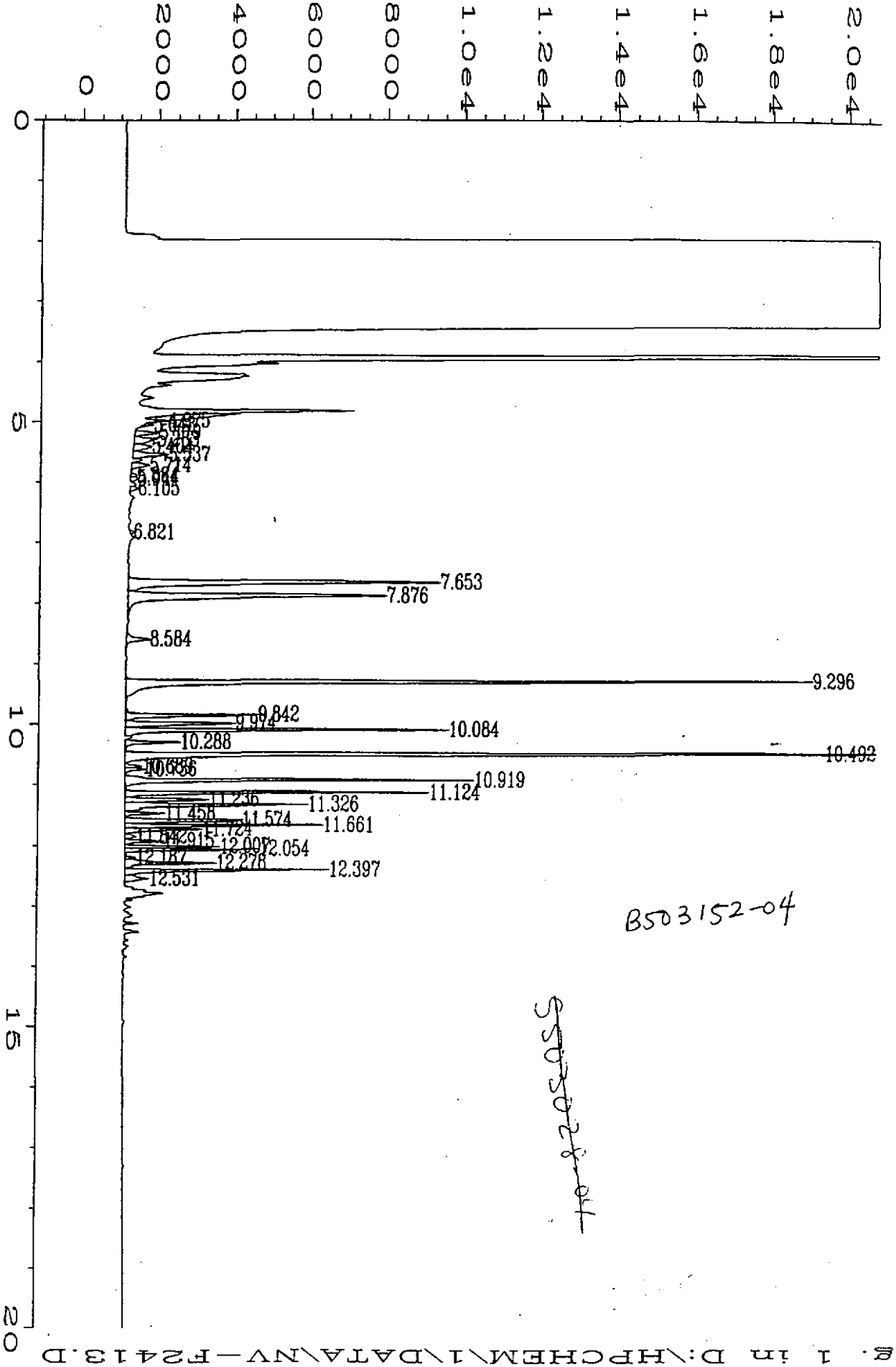

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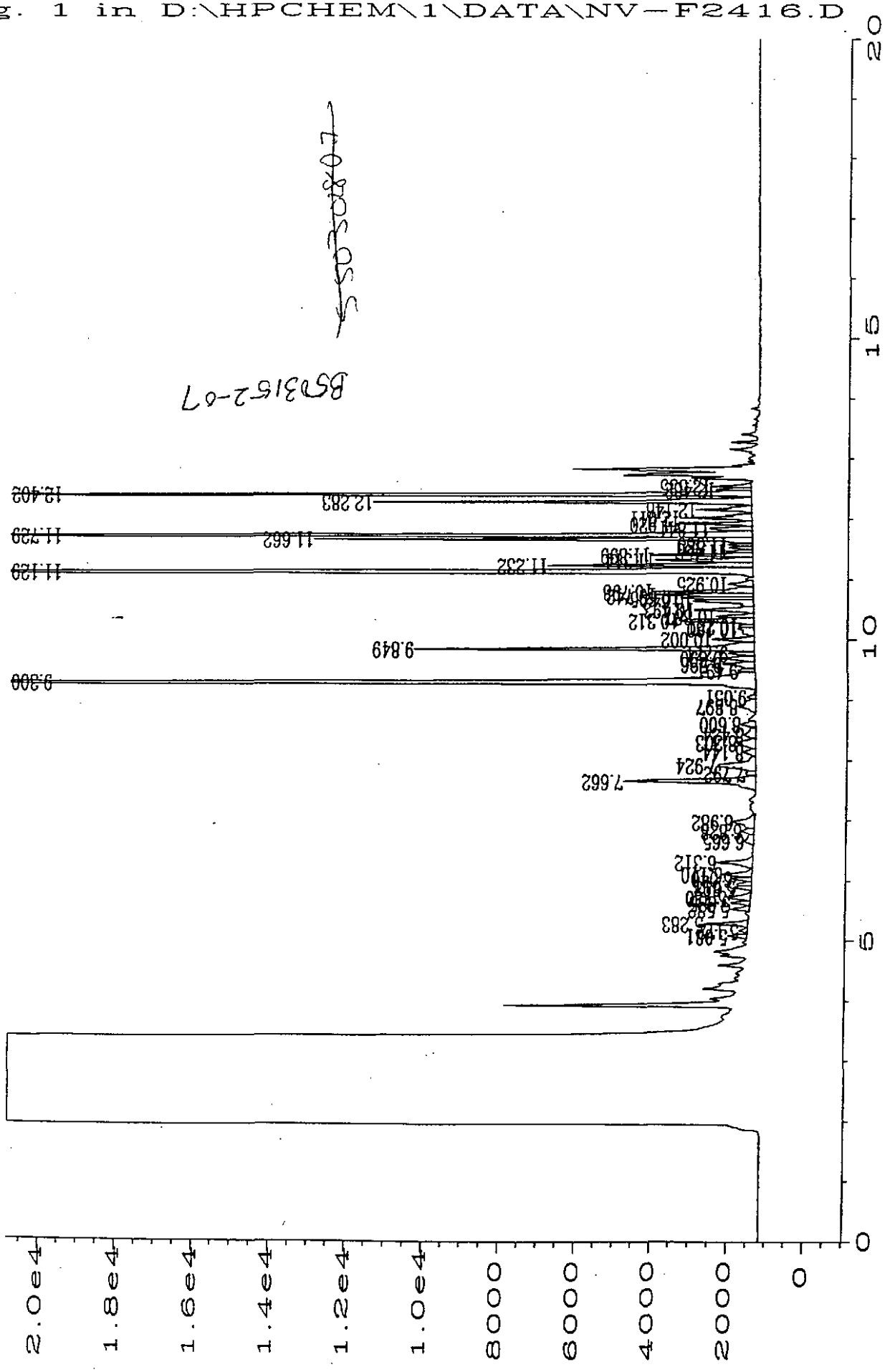
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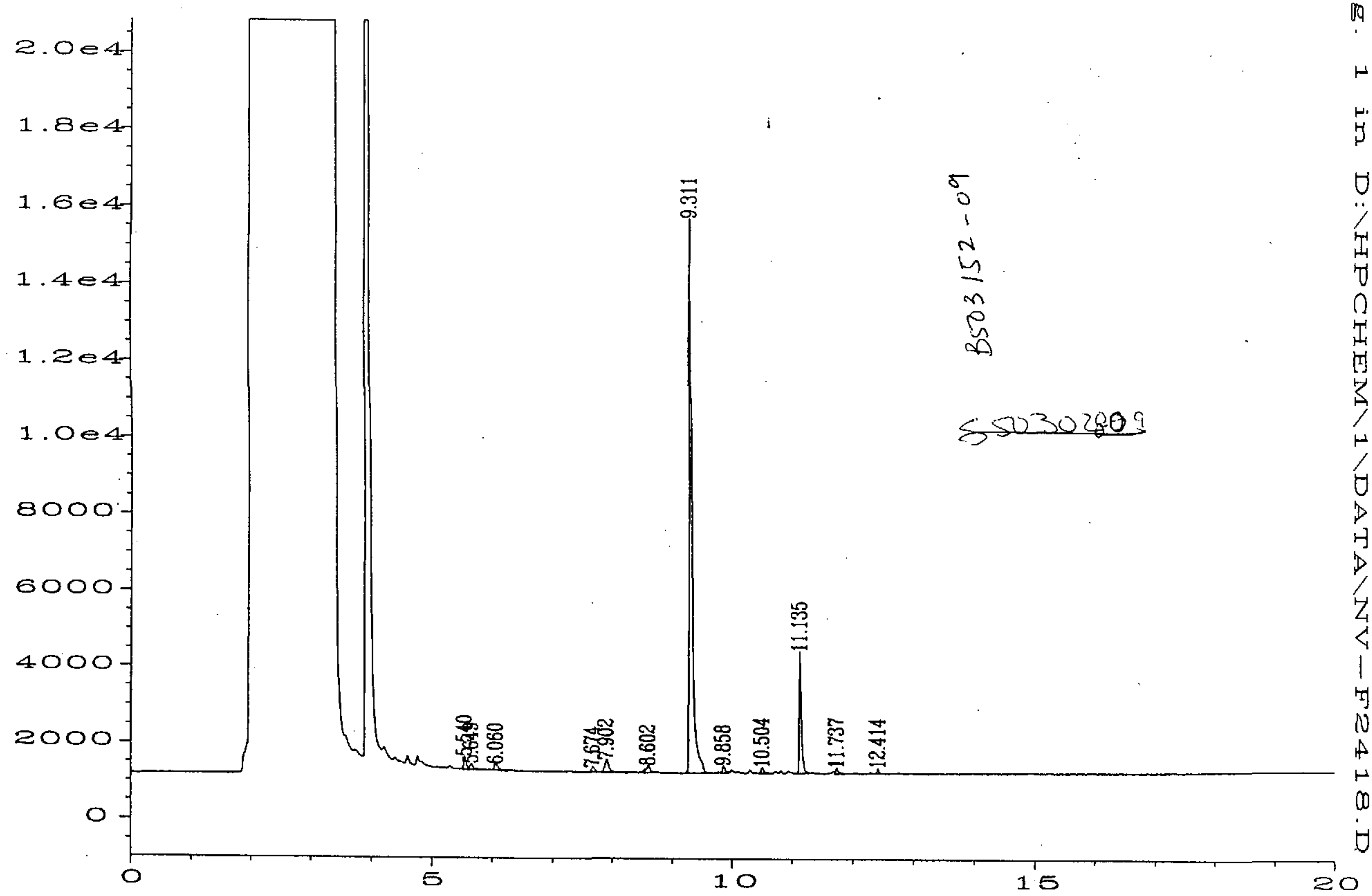

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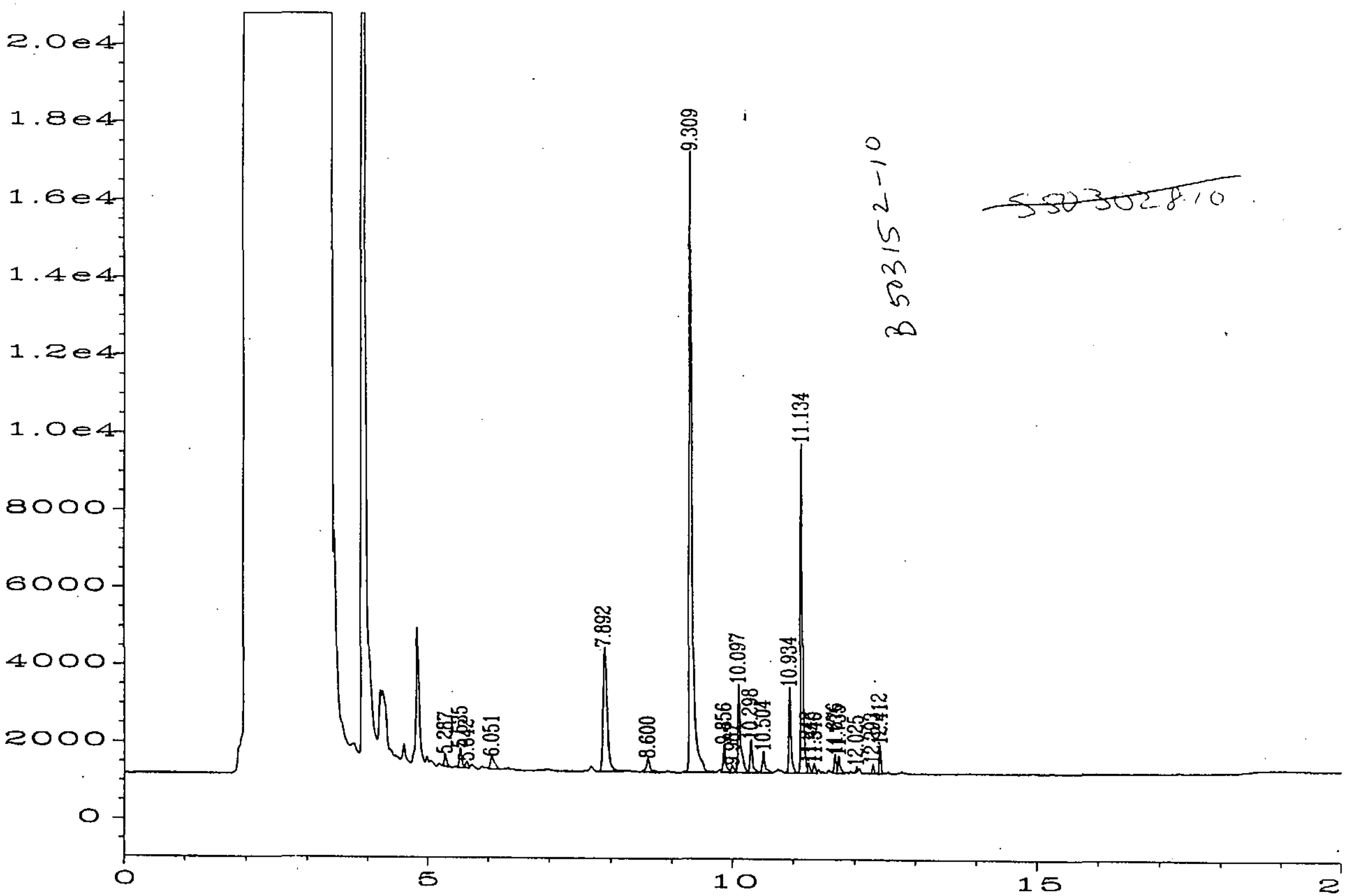

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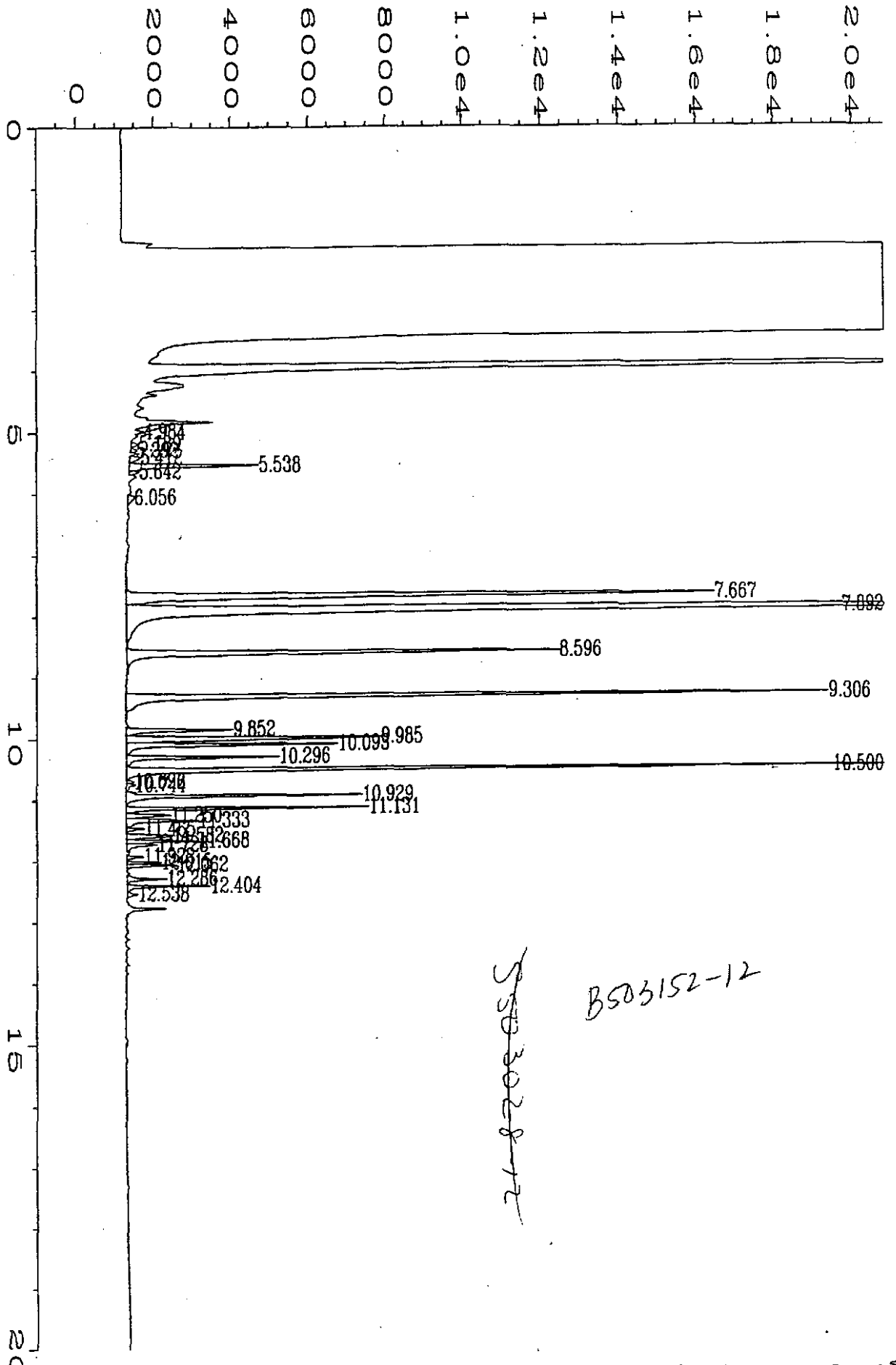
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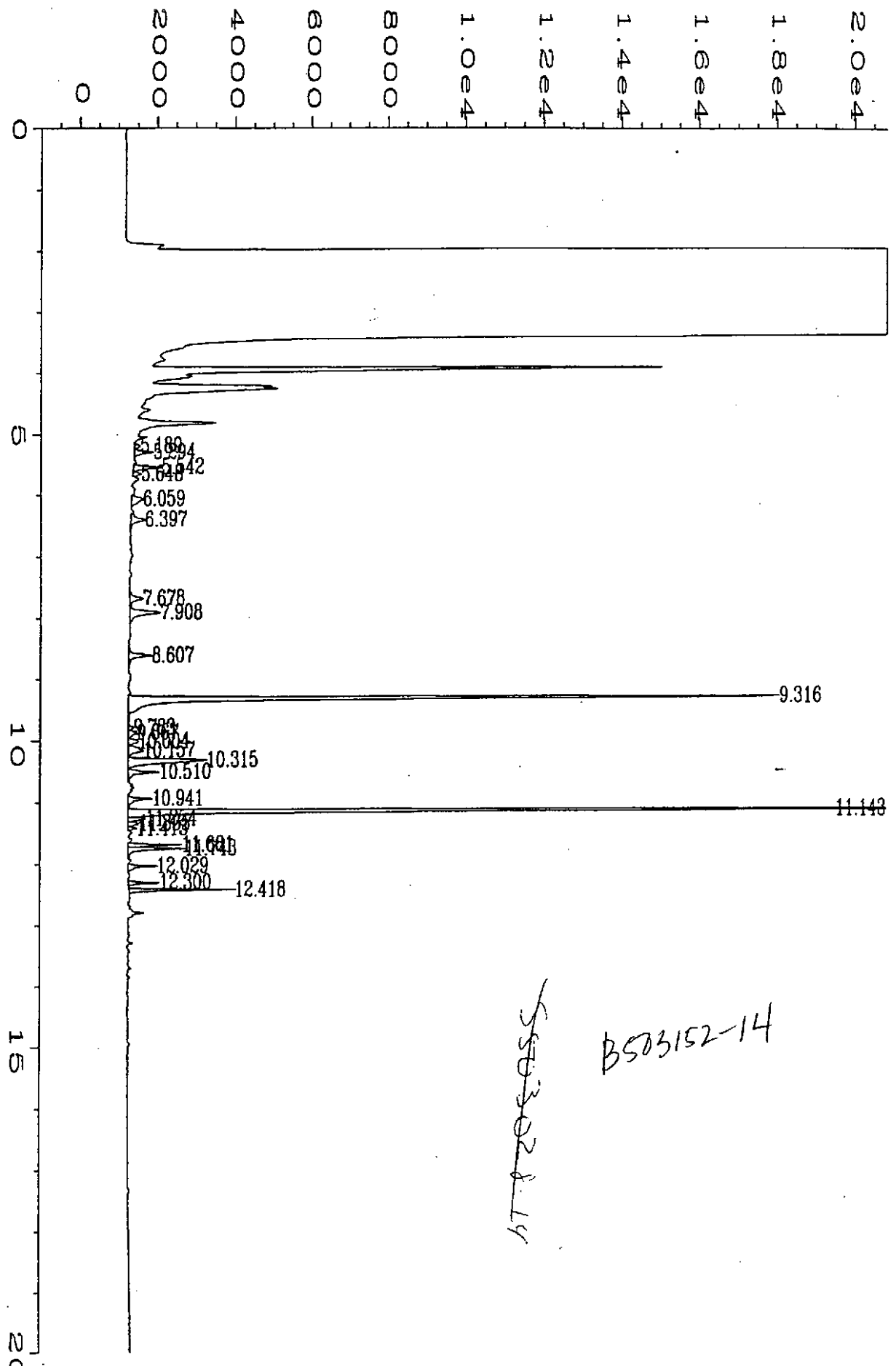

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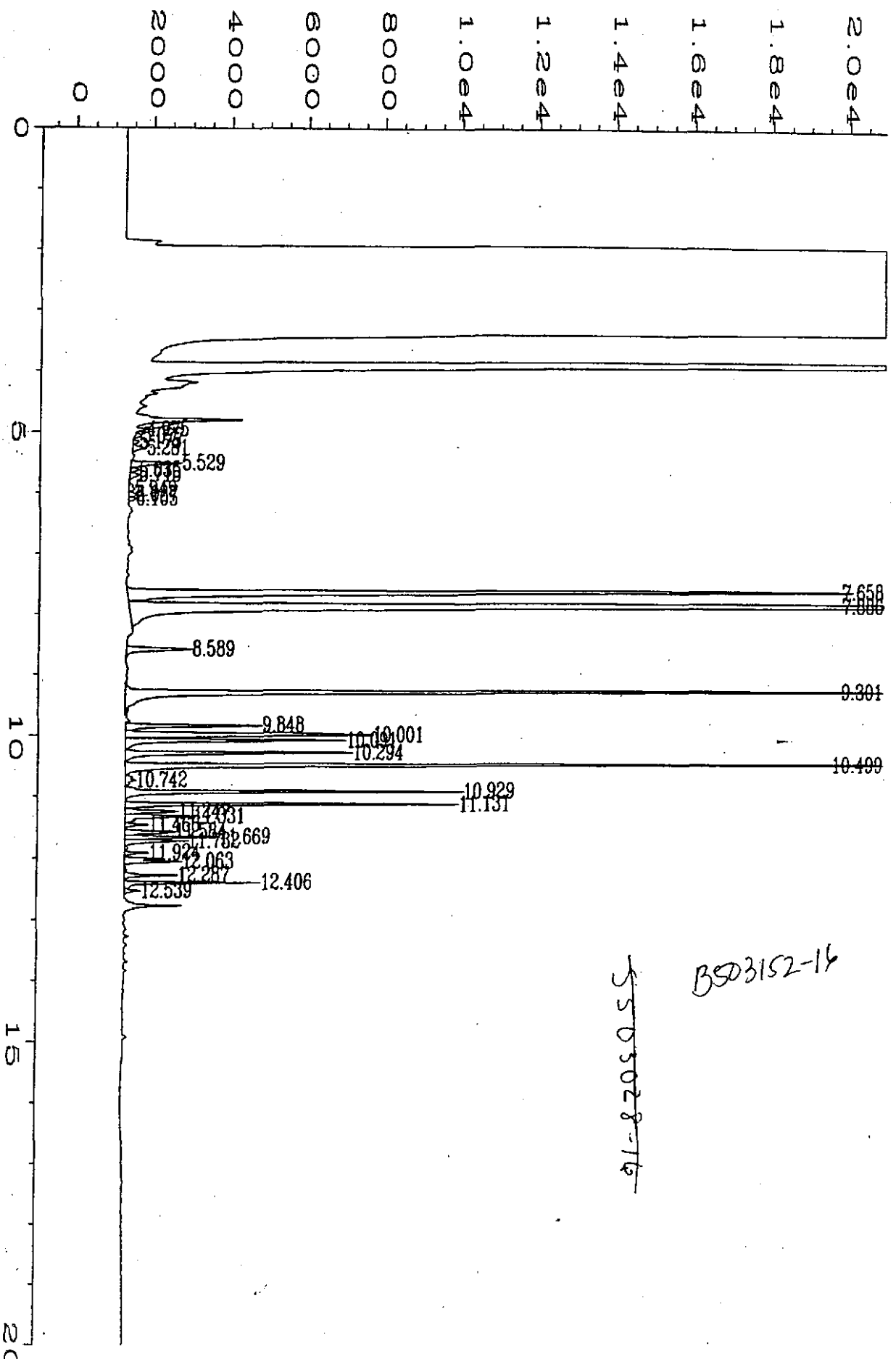
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GeoEngineers, Inc.	Client Project ID: UNOCAL Seattle, #5353	Analyst:	R. Hager
8410 154th Avenue N.E.	Sample Matrix: Water		F. Shino
Redmond, WA 98052	Analysis Method: WTPH-G		
Attention: Norm Puri	Units: µg/L (ppb)	Analyzed:	Mar 13, 1995
		Reported:	Mar 22, 1995

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

Gasoline

Spike Conc. Added:	2,000
Spike Result:	2,150
% Recovery:	108
Upper Control Limit %:	114
Lower Control Limit %:	55

PRECISION ASSESSMENT
Sample Duplicate

Gasoline Range Organics

Sample Number:	S503028-14
Original Result:	N.D.
Duplicate Result:	N.D.
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.
Maximum RPD:	38

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Laura Dutton

Laura Dutton
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled: Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received: Mar 9, 1995
Redmond, WA 98052	Analysis Method:	EPA 8020	Analyzed: Mar 13-14, 1995
Attention: Norm Puri	First Sample #:	B503152-01	Reported: Mar 22, 1995

BTEX DISTINCTION

Sample Number	Sample Description	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)	Surrogate Recovery %
B503152-01	MW-32A	5,800	1,700	990	2,900	121
B503152-02	MW-33	650	N.D. (R.L. = 25)	320	420	117
B503152-03	MW-34	2,400	1,500	250	1,300	109
B503152-04	MW-35	400	N.D. (R.L. = 25)	120	93	109
B503152-05	MW-36	2.6	N.D.	N.D.	N.D.	106
B503152-06	MW-37	3,100	2,400	1,200	6,700	113
B503152-07	MW-40	11	N.D.	11	N.D.	S-2
B503152-08	MW-41	1.6	N.D.	N.D.	N.D.	95
B503152-09	MW-42	790	N.D. (R.L. = 25)	N.D. (R.L. = 25)	N.D. (R.L. = 50)	94
B503152-10	MW-43	25	N.D.	N.D.	N.D.	99
Reporting Limits:		**0.50**	**0.50**	**0.50**	**1.0**	

4-Bromofluorobenzene surrogate recovery control limits are 55 - 144 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

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Project Manager

Please Note:
S-2 = The Surrogate Recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample.

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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Mar 9, 1995
Redmond, WA 98052	Analysis Method:	EPA 8020	Analyzed:	Mar 13, 1995
Attention: Norm Puri	First Sample #:	B503152-11	Reported:	Mar 22, 1995

BTEX DISTINCTION

Sample Number	Sample Description	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)	Surrogate Recovery %
B503152-11	MW-44	N.D.	N.D.	N.D.	N.D.	93
B503152-12	MW-45	3,000	95	890	3,300	111
B503152-13	MW-46	N.D.	N.D.	N.D.	N.D.	88
B503152-14	MW-47	5.3	N.D.	N.D.	N.D.	103
B503152-15	SMW-3	N.D.	N.D.	N.D.	N.D.	86
B503152-16	SMW-4	13,000	N.D. (R.L. = 250)	2,400	6,200	109
BLK031395	Method Blank	N.D.	N.D.	N.D.	N.D.	89
Reporting Limits:		**0.50**	**0.50**	**0.50**	**1.0**	

4-Bromofluorobenzene surrogate recovery control limits are 55 - 144 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

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GeoEngineers, Inc.	Client Project ID: UNOCAL Seattle, #5353	Analyst:	R. Hager
8410 154th Avenue N.E.	Sample Matrix: Water		F. Shino
Redmond, WA 98052	Analysis Method: EPA 8020		
Attention: Norm Puri	Units: µg/L (ppb)	Analyzed:	Mar 13, 1995
	QC Sample #: S503028-14	Reported:	Mar 22, 1995

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	5.3	N.D.	N.D.	N.D.
Spike Conc. Added:	10.0	10.0	10.0	30.0
Spike Result:	17.6	11.2	11.3	34.9
Spike % Recovery:	123%	112%	113%	116%
Spike Dup. Result:	16.6	11.2	11.5	35.4
Spike Duplicate % Recovery:	113%	112%	115%	118%
Upper Control Limit %:	138	121	126	130
Lower Control Limit %:	57	78	83	77
Relative % Difference:	5.8%	0.0%	1.8%	1.4%
Maximum RPD:	9.0	9.0	13	20

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Project Manager

$$\text{\% Recovery:} \quad \frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$$

$$\text{Relative \% Difference:} \quad \frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$$

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Mar 9, 1995
Redmond, WA 98052	Analysis Method:	WTPH-D Extended	Extracted:	Mar 13, 1995
Attention: Norm Puri	First Sample #:	B503152-01	Analyzed:	Mar 15, 1995
			Reported:	Mar 22, 1995

TOTAL PETROLEUM HYDROCARBONS - DIESEL RANGE EXTENDED

Sample Number	Sample Description	Diesel Result mg/L (ppm)	Heavy Oil Result mg/L (ppm)	Surrogate Recovery %
B503152-01	MW-32A	2.3 D-1	2.3	93
B503152-02	MW-33	1.4 D-1	2.0	70
B503152-03	MW-34	1.1 D-1	0.48	87
B503152-04	MW-35	1.2 D-1	1.3	75
B503152-05	MW-36	0.56 D-1	1.2	74
B503152-06	MW-37	3.2 D-1	1.4	82
B503152-07	MW-40	2.6 D-1	2.6	79
B503152-08	MW-41	N.D.	N.D.	48, S-4
B503152-09	MW-42	0.67 D-1	1.2	70
B503152-10	MW-43	0.65 D-1	2.4	75
Reporting Limit:		**0.25**	**0.75**	

2-Fluorobiphenyl surrogate recovery control limits are 50 - 150%.
Extractable Hydrocarbons are quantitated as Diesel Range Organics (C12 - C24) and Heavy Oil Range Organics (>C24).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

Please Note:
S-4 = The Surrogate Recovery for Sample #B503152-08 is outside of method established control limits.

NORTH CREEK ANALYTICAL

18939 120th Avenue N.E., Suite 101 • Bothell, WA 98011-9508 (206) 481-9200 • FAX 485-2992
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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Mar 8, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Mar 9, 1995
Redmond, WA 98052	Analysis Method:	WTPH-D Extended	Extracted:	Mar 13, 1995
Attention: Norm Puri	First Sample #:	B503152-11	Analyzed:	Mar 15, 1995
			Reported:	Mar 22, 1995

TOTAL PETROLEUM HYDROCARBONS - DIESEL RANGE EXTENDED

Sample Number	Sample Description	Diesel Result mg/L (ppm)	Heavy Oil Result mg/L (ppm)	Surrogate Recovery %
B503152-11	MW-44	0.29	0.94	55
B503152-12	MW-45	1.5 D-1	1.1	42, S-4
B503152-13	MW-46	0.72	3.6	79
B503152-14	MW-47	0.33 D-1	1.6	70
B503152-15	SMW-3	0.40	2.5	76
B503152-16	SMW-4	4.1 D-1	5.1	69
BLK031395	Method Blank	N.D.	N.D.	83
Reporting Limit:		**0.25**	**0.75**	

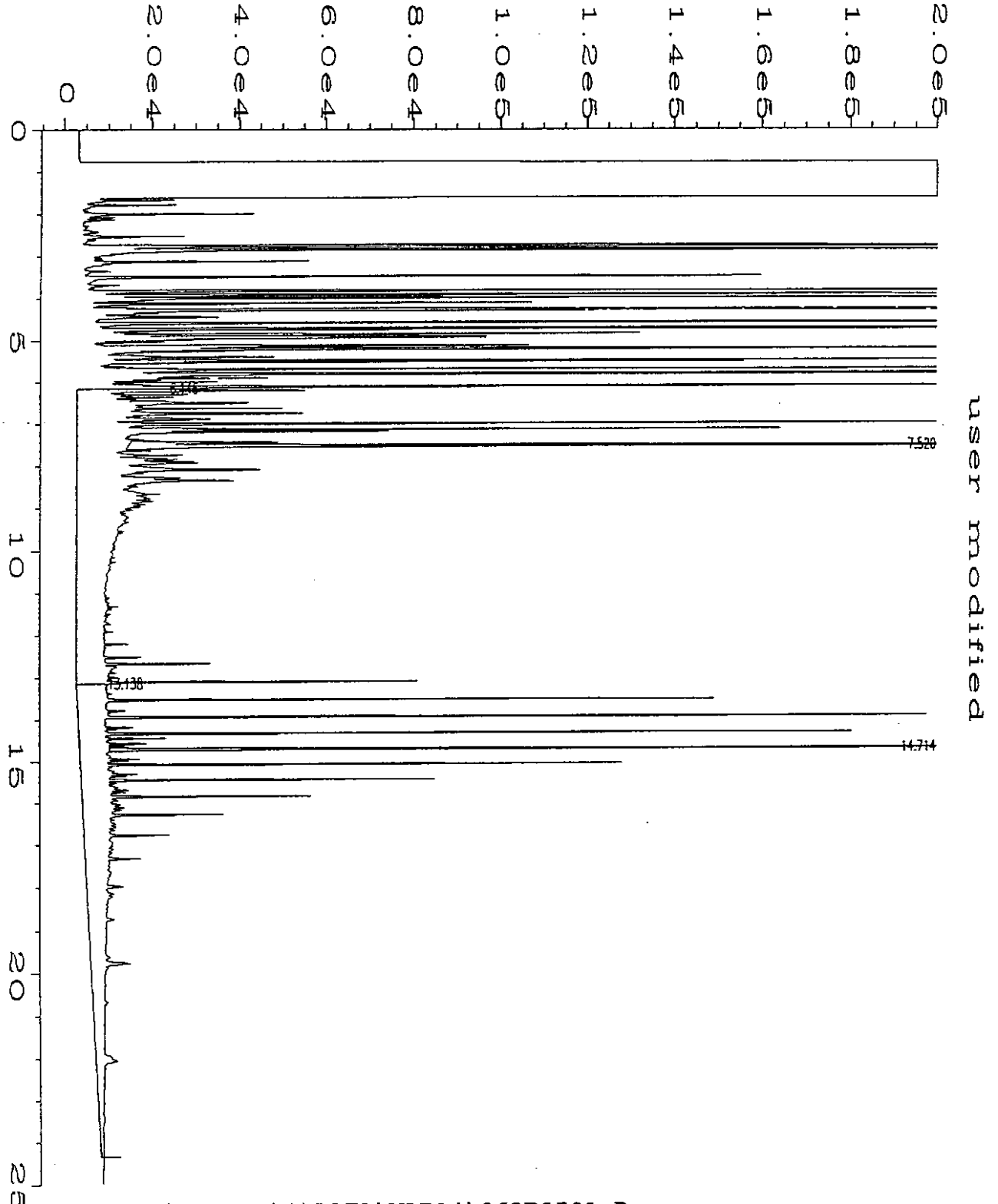
2-Fluorobiphenyl surrogate recovery control limits are 50 - 150%.
Extractable Hydrocarbons are quantitated as Diesel Range Organics (C12 - C24) and Heavy Oil Range Organics (>C24).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

Please Note:
S-4 = The Surrogate Recovery for Sample #B503152-12 is outside of method established control limits.

Sig. 2 in C:\HPCHEM\2\DATA\MAR14\060RO301.D
0
1.0e5
2.0e5
3.0e5
4.0e5
0
5
10
15
20
25
7.520
13.141
14.710
user modified
B503152-01



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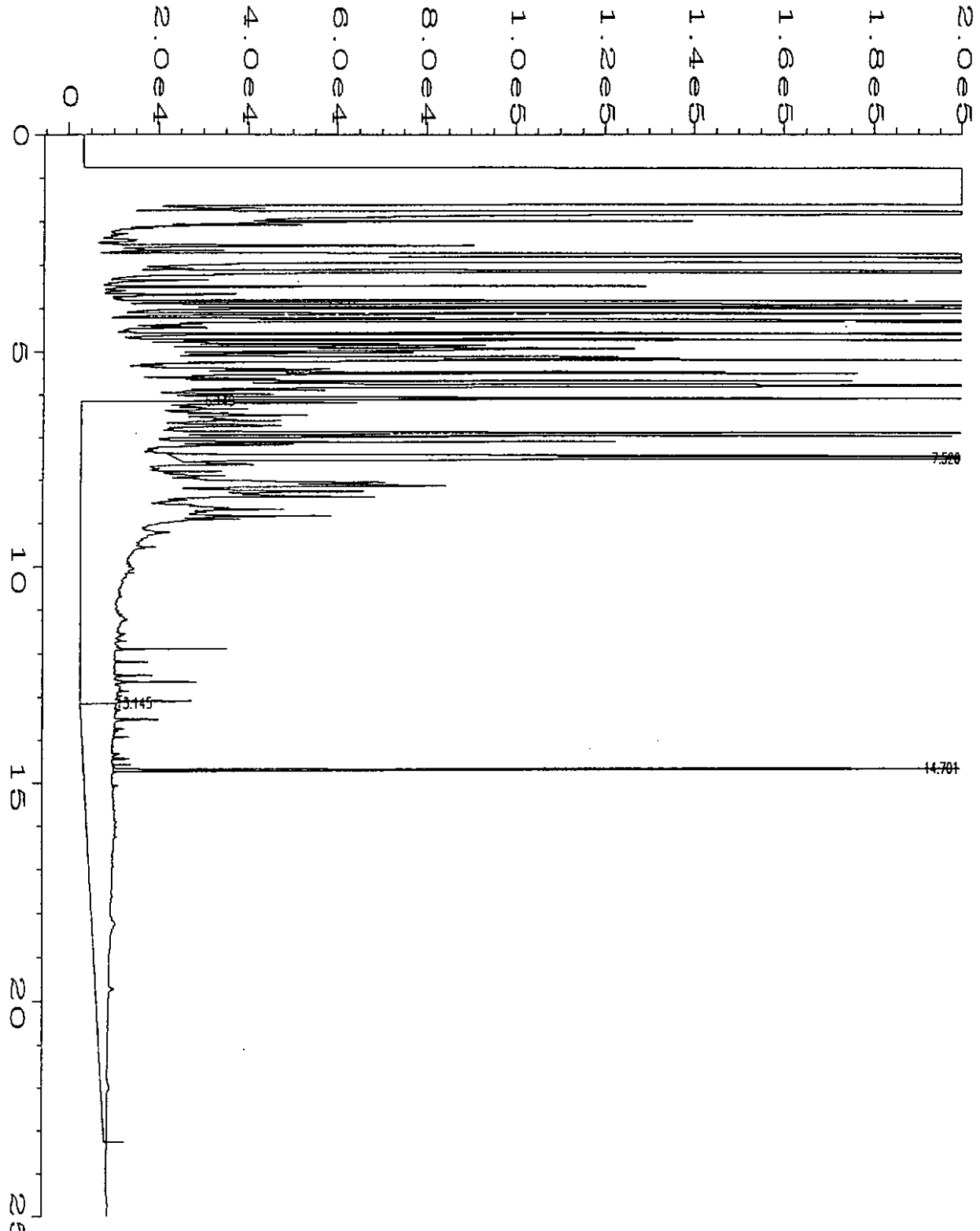
perator : TF
strument : BOB
ample Name : 503152-02
un Time Bar Code:
quired on : 15 Mar 95 08:15 AM
eport Created on: 16 Mar 95 02:51 PM

Page Number : 1
Vial Number : 62
Injection Number : 1
Sequence Line : 5
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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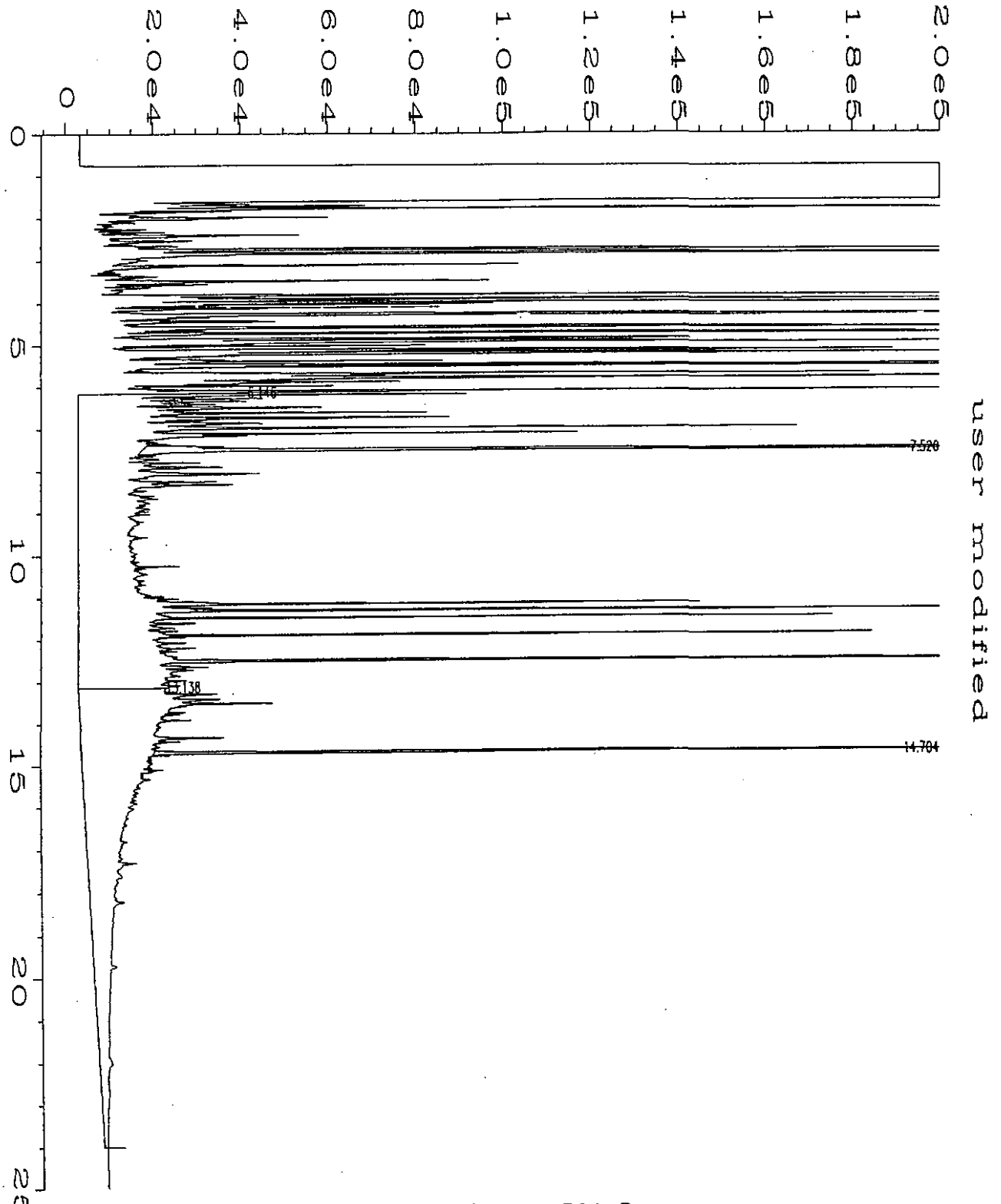
Operator : TF
Instrument : BOB
Sample Name : 503152-03
Run Time Bar Code:
Acquired on : 15 Mar 95 08:43 AM
Report Created on: 16 Mar 95 02:53 PM

Page Number : 1
Vial Number : 63
Injection Number : 1
Sequence Line : 5
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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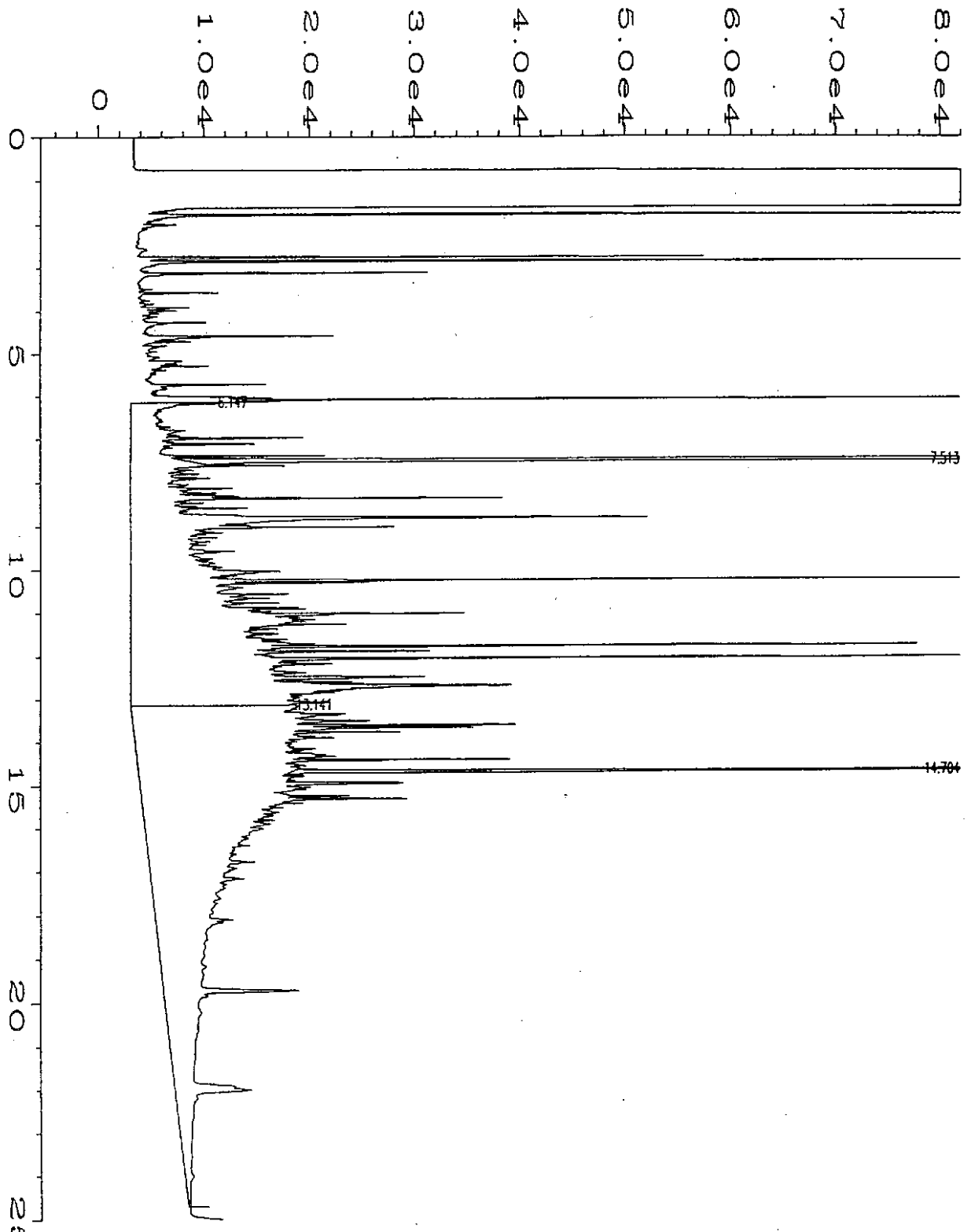
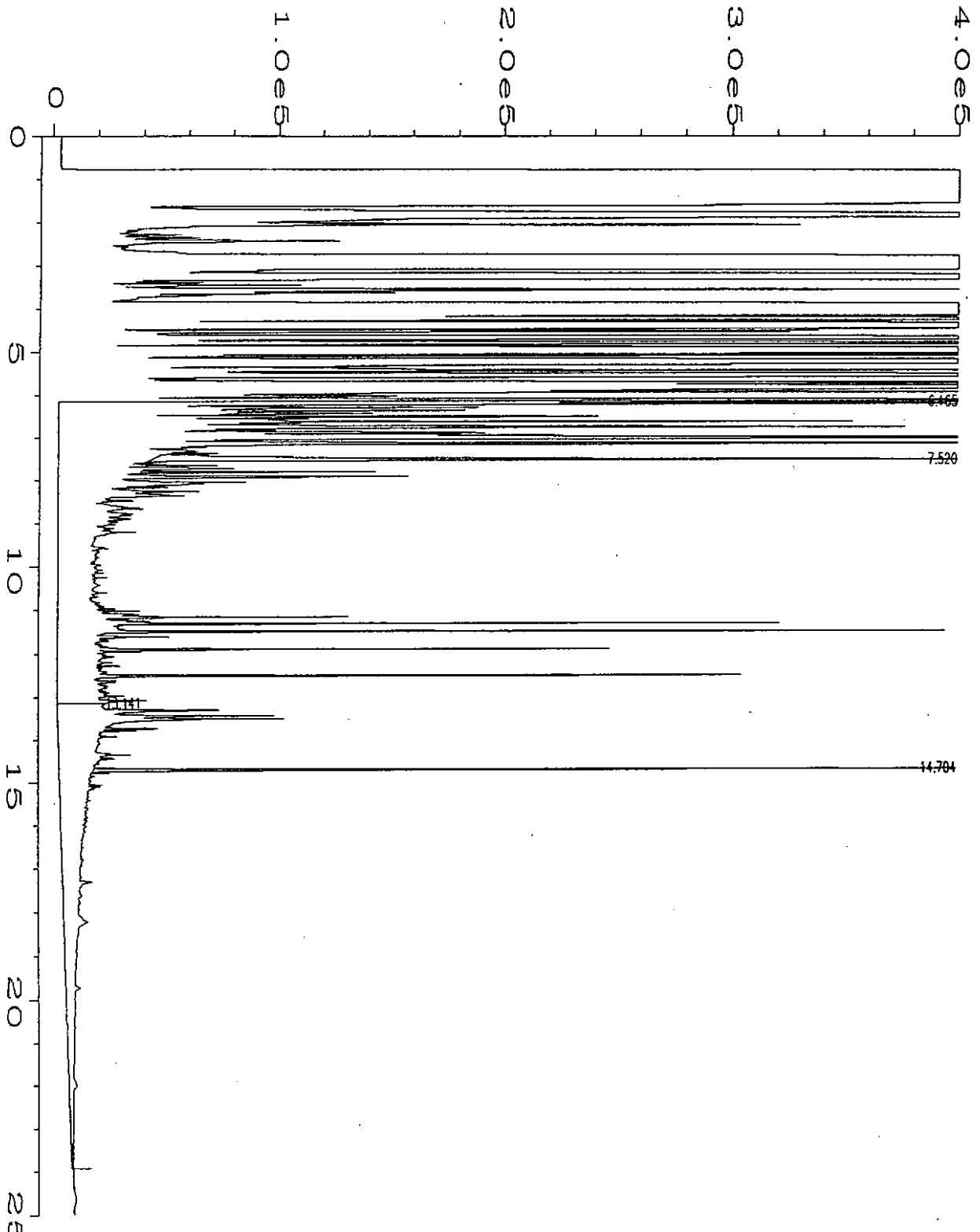
Report Created on: 16 Mar 95 02:55 PM

Page Number : 1
Vial Number : 64
Injection Number : 1
Sequence Line : 5
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



ata File Name : C:\HPCHEM\2\DATA\MAR14\065R0801.D
perator : TF
nstrument : BOB
ample Name : 503152-05
un Time Bar Code:
cquired on : 15 Mar 95 11:21 AM
eport Created on: 16 Mar 95 02:56 PM

Page Number : 1
Vial Number : 65
Injection Number : 1
Sequence Line : 8
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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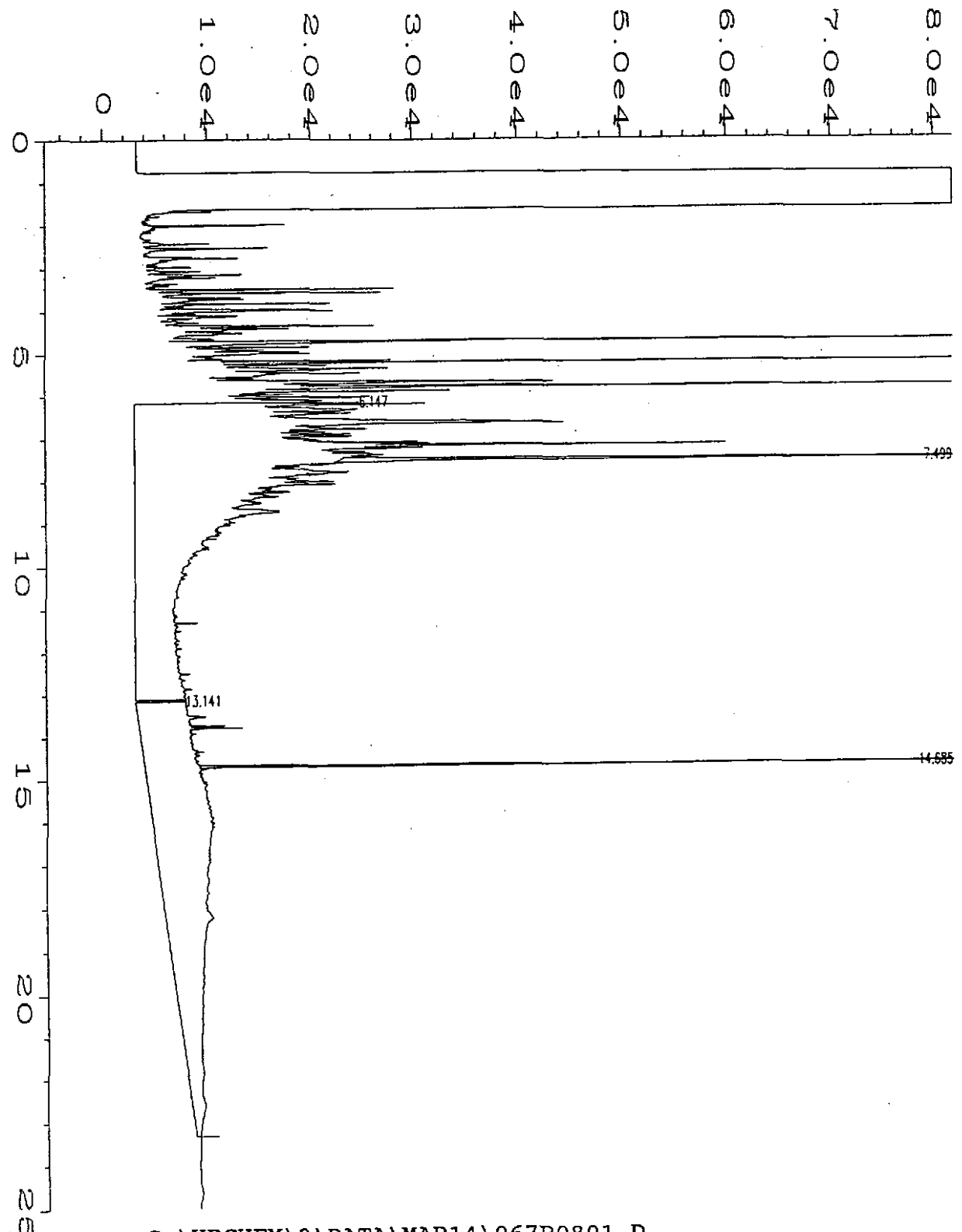
Operator : TF
Instrument : BOB
Sample Name : 503152-06
Run Time Bar Code:
Acquired on : 15 Mar 95 11:53 AM
Report Created on: 16 Mar 95 02:58 PM

Page Number : 1
Vial Number : 66
Injection Number : 1
Sequence Line : 8
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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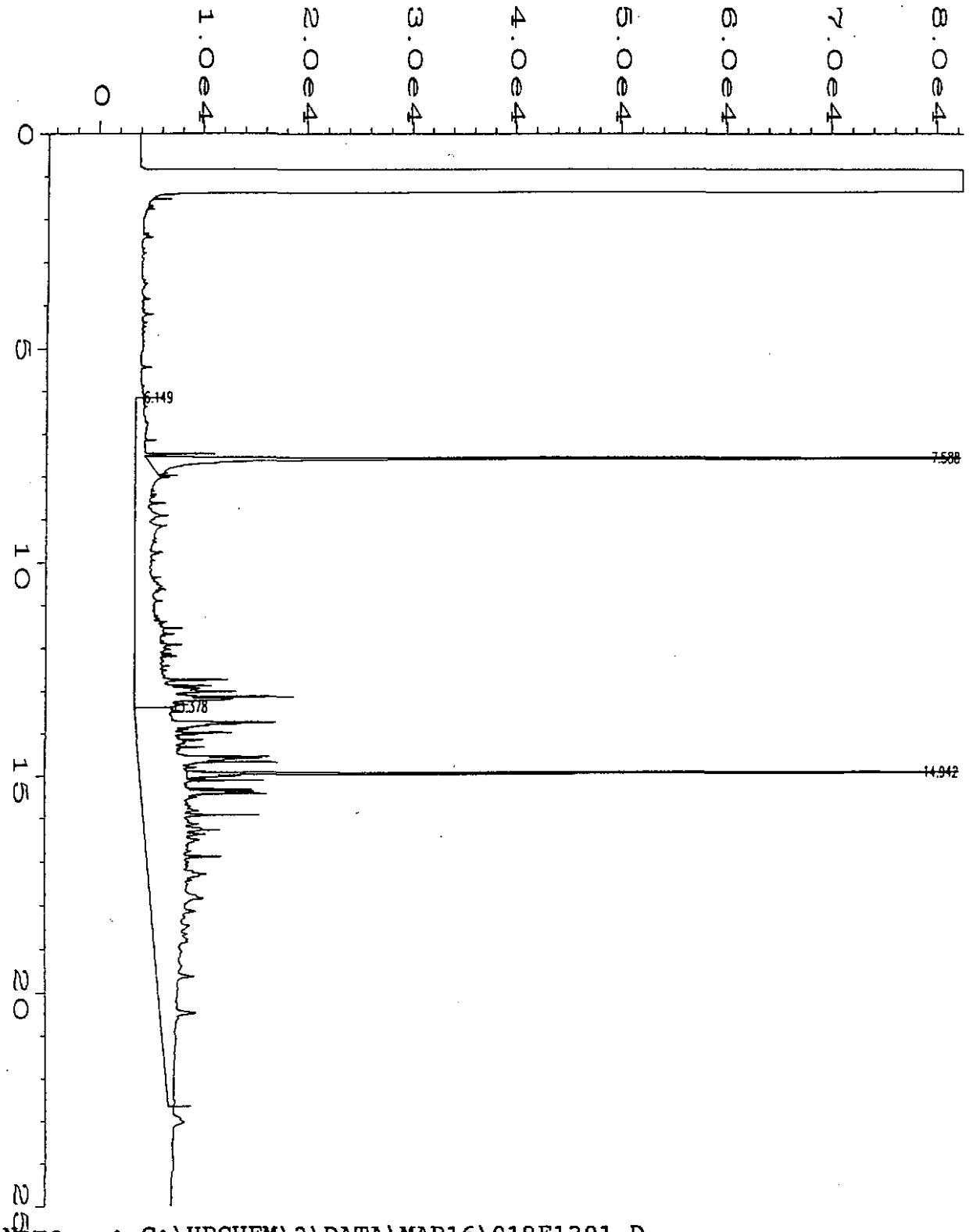
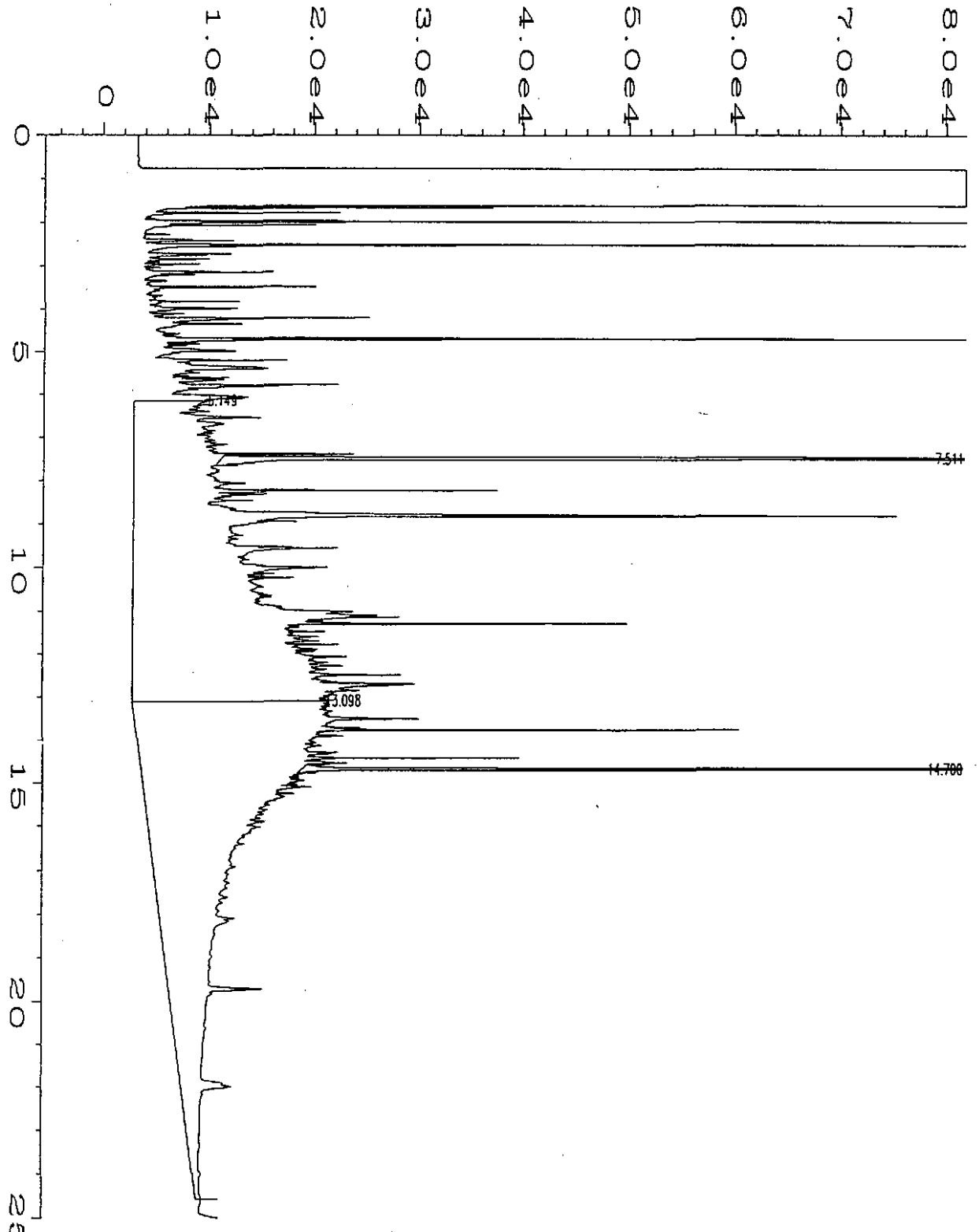
Operator : TF
Instrument : BOB
Sample Name : 503152-07 5Y
Run Time Bar Code:
Acquired on : 15 Mar 95 12:25 PM
Report Created on: 16 Mar 95 03:00 PM

Page Number : 1
Vial Number : 67
Injection Number : 1
Sequence Line : 8
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



Data File Name : C:\HPCHEM\2\DATA\MAR16\019F1201.D
Operator : TF
Instrument : BOB
Sample Name : 503152-08
Run Time Bar Code:
Acquired on : 17 Mar 95 04:53 AM
Report Created on: 17 Mar 95 03:17 PM

Page Number : 1
Vial Number : 19
Injection Number : 1
Sequence Line : 12
Instrument Method: NEW3F.MTH
Analysis Method : NEW1F.MTH



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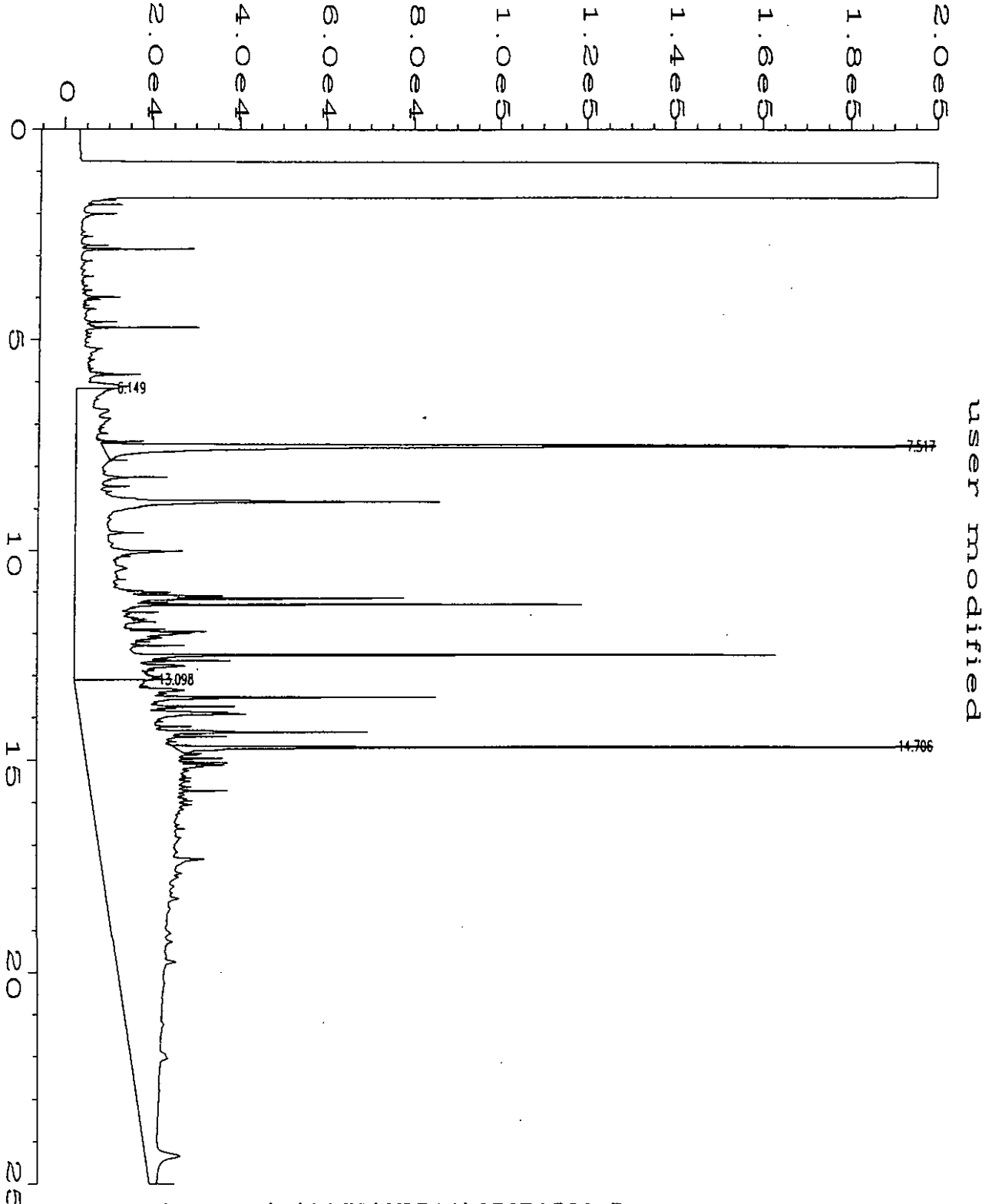
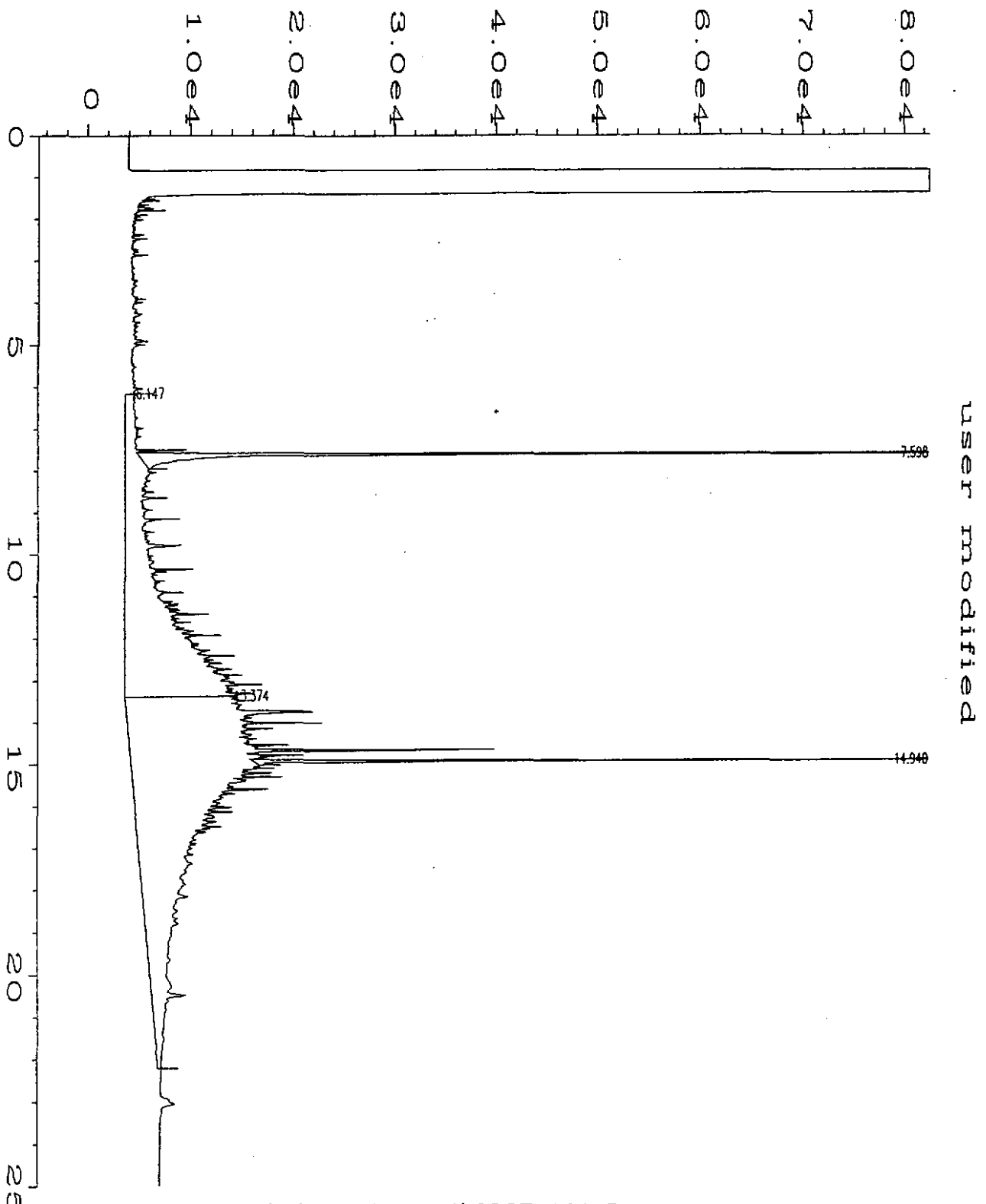
Operator : TF
Instrument : BOB
Sample Name : 503152-09
Run Time Bar Code:
Acquired on : 15 Mar 95 01:28 PM
Report Created on: 16 Mar 95 03:03 PM

Page Number : 1
Vial Number : 69
Injection Number : 1
Sequence Line : 8
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



Data File Name : C:\HPCHEM\2\DATA\MAR14\070R1501.D
Operator : TF
Instrument : BOB
Sample Name : 503152-10
Run Time Bar Code:
Acquired on : 15 Mar 95 06:48 PM
Report Created on: 16 Mar 95 03:04 PM

Page Number : 1
Vial Number : 70
Injection Number : 1
Sequence Line : 15
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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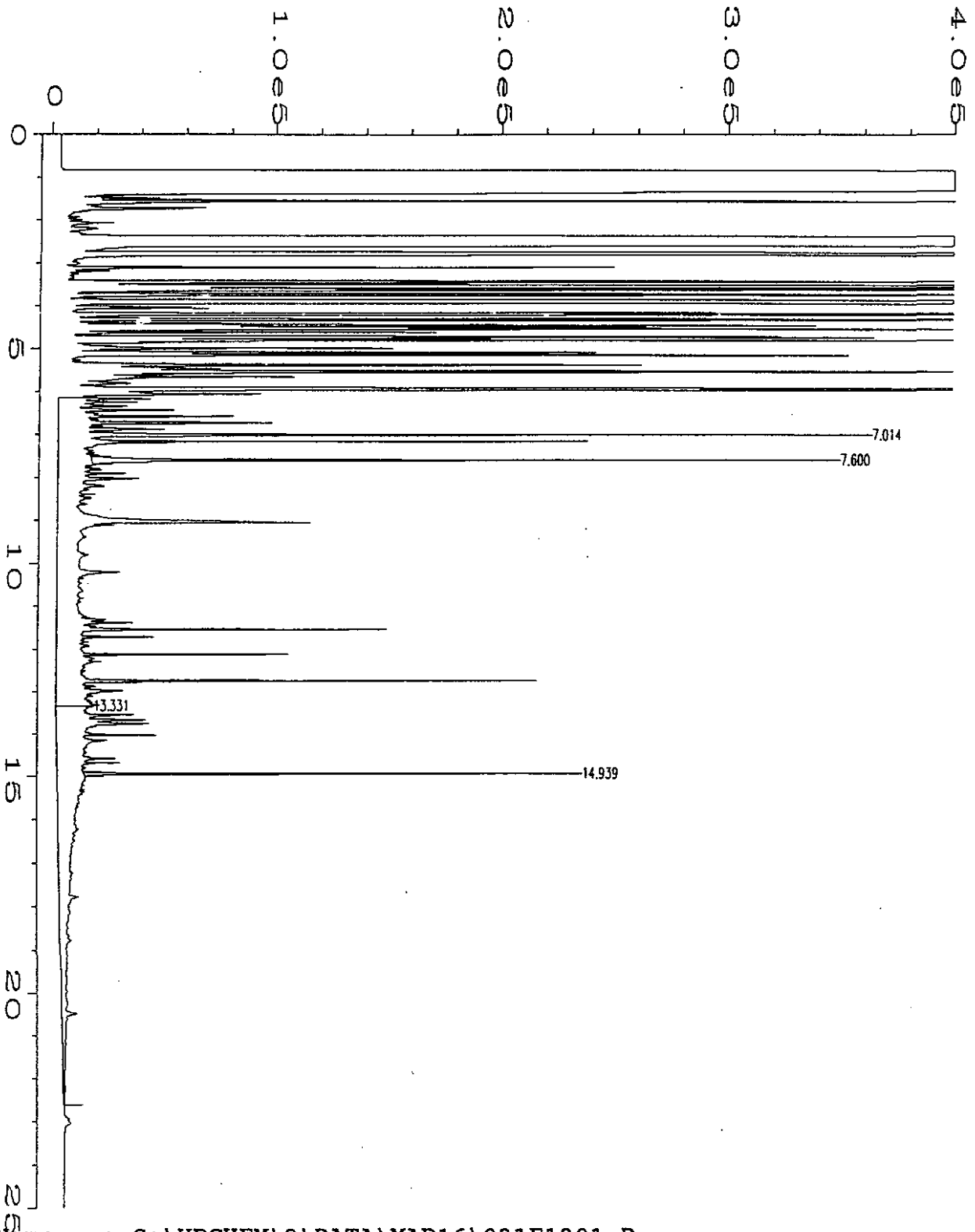
Operator : TF
Instrument : BOB
Sample Name : 503152-11
Run Time Bar Code:
Acquired on : 17 Mar 95 05:25 AM
Report Created on: 17 Mar 95 03:18 PM

Page Number : 1
Vial Number : 20
Injection Number : 1
Sequence Line : 12
Instrument Method: NEW3F.MTH
Analysis Method : NEW1F.MTH



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un Time Bar Code:		Sequence Line	: 12
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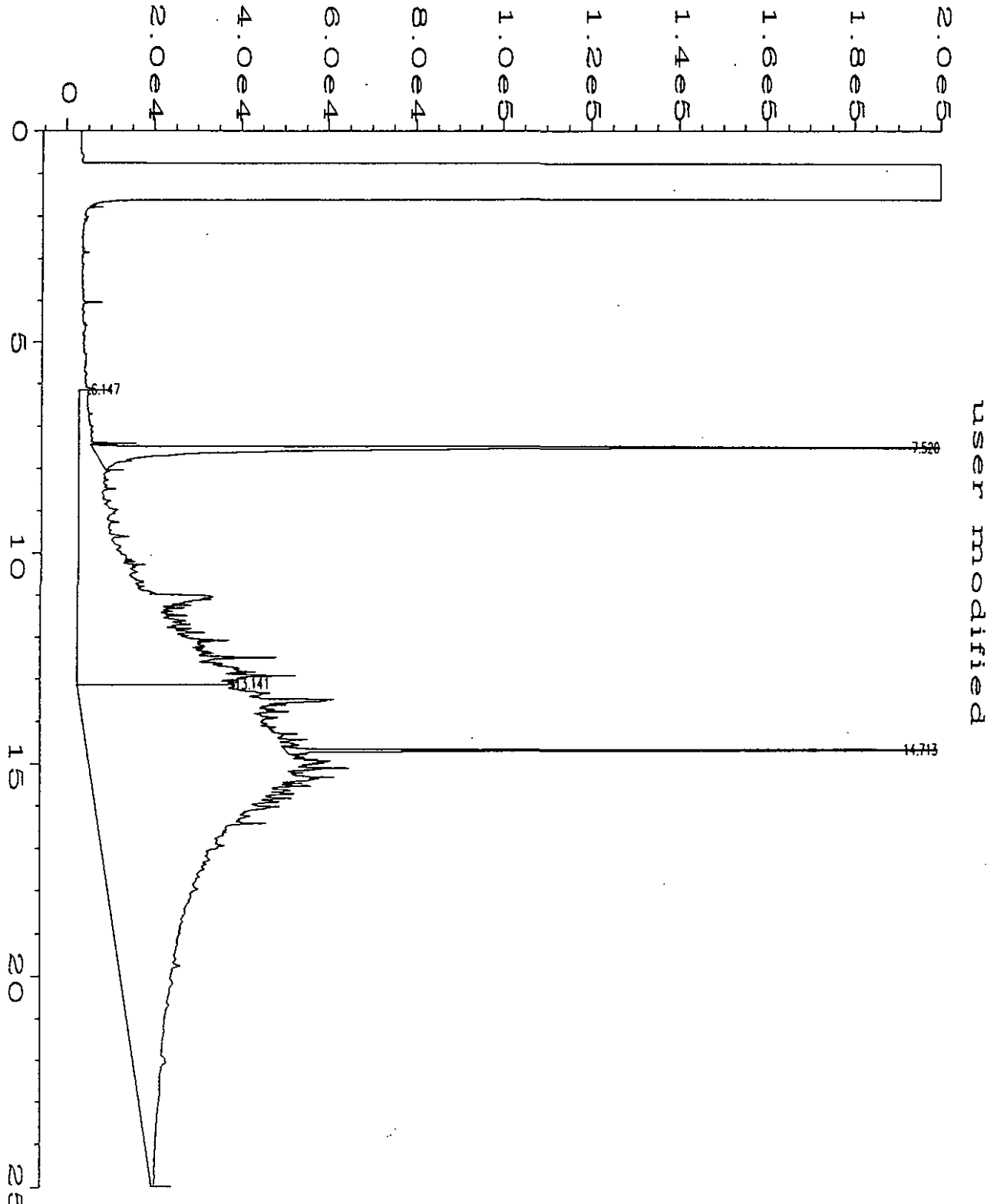

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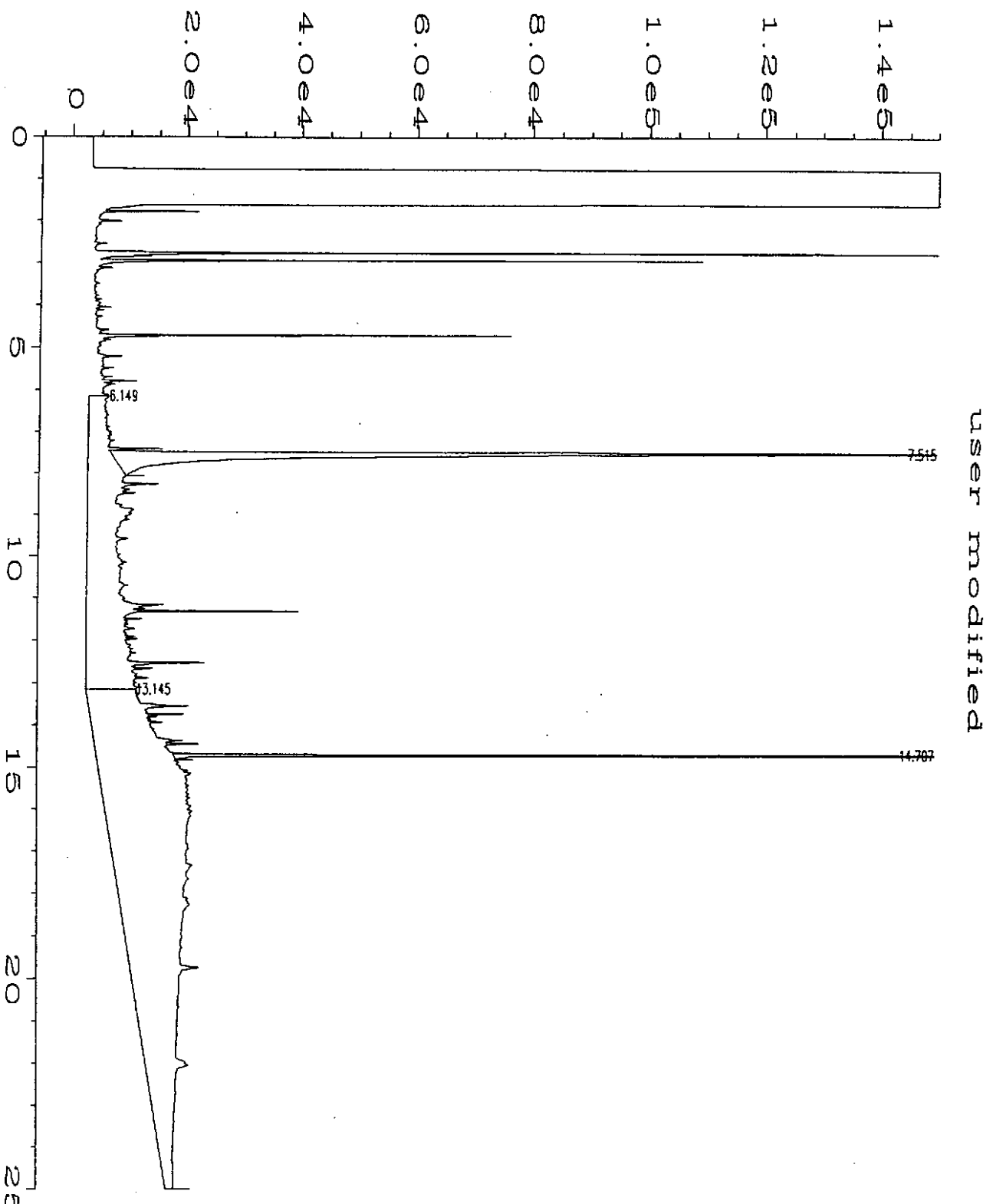
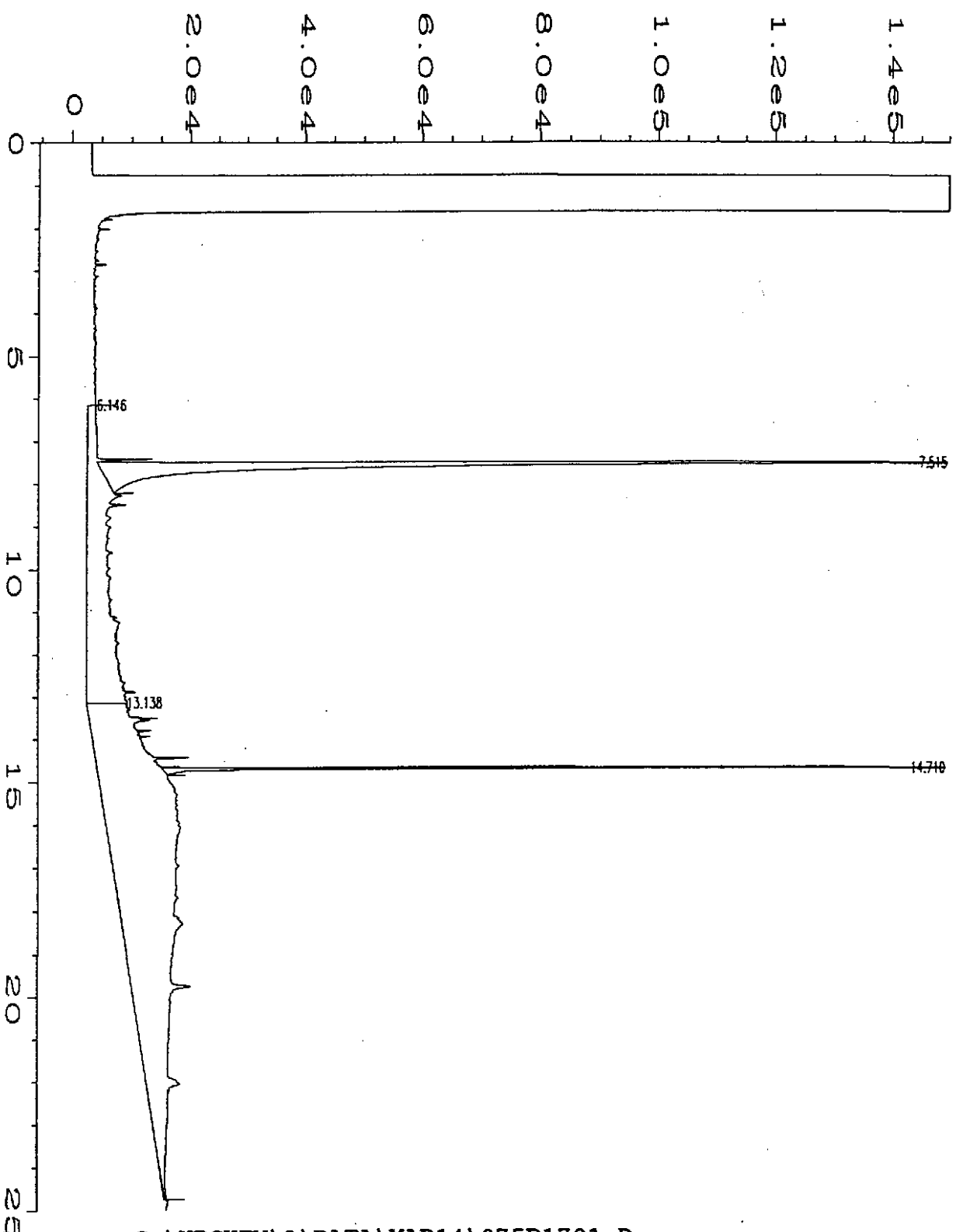
Operator : TF
Instrument : BOB
Sample Name : 503152-13
Run Time Bar Code:
Acquired on : 15 Mar 95 08:56 PM
Report Created on: 16 Mar 95 03:19 PM

Page Number : 1
Vial Number : 73
Injection Number : 1
Sequence Line : 17
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



Data File Name : C:\HPCHEM\2\DATA\MAR14\074R1701.D
Operator : TF
Instrument : BOB
Sample Name : 503152-14
Run Time Bar Code:
Acquired on : 15 Mar 95 09:28 PM
Report Created on: 16 Mar 95 03:20 PM

Page Number : 1
Vial Number : 74
Injection Number : 1
Sequence Line : 17
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



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Operator : TF
Instrument : BOB
Sample Name : 503152-15
Run Time Bar Code:
Acquired on : 15 Mar 95 09:59 PM
Report Created on: 16 Mar 95 03:21 PM

Page Number : 1
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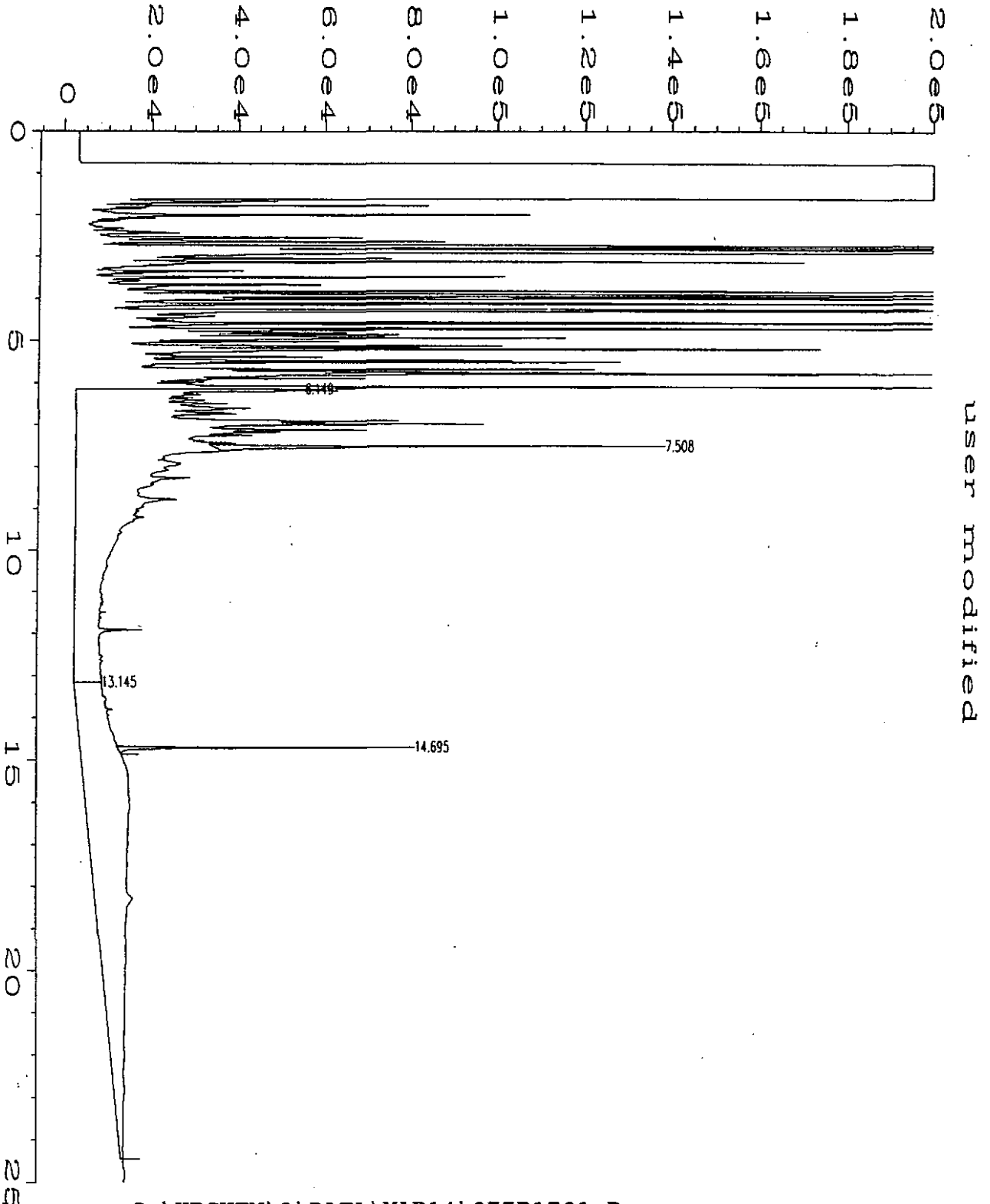
Injection Number : 1
Sequence Line : 17
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH



Data File Name : C:\HPCHEM\2\DATA\MAR14\077R1701.D
Operator : TF
Instrument : BOB
Sample Name : 503152-16 5X
Run Time Bar Code:
Acquired on : 15 Mar 95 11:03 PM
Report Created on: 16 Mar 95 03:24 PM

Page Number : 1
Vial Number : 77
Injection Number : 1
Sequence Line : 17
Instrument Method: NEW3F.MTH
Analysis Method : NEW1R.MTH

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HYDROCARBON ANALYSIS FOOTNOTES

2/94, Rev. 3

VOLATILE HYDROCARBONS - GASOLINE RANGE ORGANICS

G 1 This sample appears to contain extractable diesel range organics.

G 2 The chromatogram for this sample does not resemble a typical gasoline pattern. Please refer to the sample chromatogram.

G 3 The total hydrocarbon result in this sample is primarily due to an individual compound(s) eluting in the volatile hydrocarbon range. Identification and quantitation by EPA 8010, 8021 or 8240 is recommended.

G 4 This sample contains compound(s) not identified as Benzene, Toluene, Ethyl benzene or Xylene.

G 5 This sample appears to contain or be saturated with gasoline product.

EXTRACTABLE HYDROCARBONS - DIESEL RANGE ORGANICS

D 1 This sample appears to contain volatile gasoline range organics.

D 2 The hydrocarbons present in this sample resemble heavy, non-resolvable oil range organics. Quantitation by TPH-Diesel Extended or TPH 418.1 is recommended.

D 3 The hydrocarbon concentration result in this sample is partially due to an individual peak(s) eluting in the diesel / motor oil carbon range.

D 4 The hydrocarbons present in this sample are a complex mixture of diesel range and heavy oil range organics.

D 5 The hydrocarbon result shown is an estimated (greater than) value due to the high concentration. Reanalysis is being performed to yield a quantitative result. An amended report will follow.

D 6 The sample chromatographic pattern does not resemble the fuel standard used for quantitation. A fuel fingerprint is advised.

D 7 This sample appears to contain or be saturated with diesel product.

Oils and Lubricants

[----------]

TRPH 418.1

Diesel & Fuel Oils

[----------]

Extractable Hydrocarbons (TPH-D)

Gasoline

[----------]

Volatile Hydrocarbons (TPH-G)

HYDROCARBON BOILING POINT RANGE

LOW LOW TO MEDIUM MEDIUM MEDIUM TO HIGH VERY HIGH

CARBON RANGE:

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31+

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GeoEngineers, Inc.	Client Project ID: UNOCAL Seattle, #5353	Analyst: T. Fitzgibbon
8410 154th Avenue N.E.	Sample Matrix: Water	
Redmond, WA 98052	Analysis Method: WTPH-D	Extracted: Mar 13, 1995
Attention: Norm Puri	Units: mg/L (ppm)	Analyzed: Mar 15, 1995
		Reported: Mar 22, 1995

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Diesel
Spike Conc. Added:	2.1
Spike Result:	2.1
% Recovery:	100
Upper Control Limit %:	119
Lower Control Limit %:	74

PRECISION ASSESSMENT
Sample Duplicate

	Diesel Range Organics	Diesel Range Organics
Sample Number:	B503152-01	B503152-15
Original Result:	2.3	0.40
Duplicate Result:	2.0	0.38
Relative % Difference	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Detection Limit.	
Maximum RPD:	44	44

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

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East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 (509) 924-9200 FAX 924-9290
9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 643-9200 FAX 644-2202

UNOCAL CHAIN OF CUSTODY REPORT

Chain of Custody Record #:

UNOCAL INFORMATION

Facility Number: 5353
Site Address: 600 Westlake & Mercer
City, State, ZIP: Seattle, WA 981
Site Release Number: [redacted]
Unocal Manager: Dr Mark Brearley

CONSULTANT INFORMATION

Firm: GE1 Project Number: 9161-013-R89
Address: 8410 154th Ave NE
Redmond, WA 98052
Phone: 861-6000 Fax: 861-6050
CERT CRRS Code: 3[redacted]-600
Project Manager: Norm Puri
Sample Collection by: TMK / DEW

Quality Assurance Data Level: [X] A [ ] B
A: Standard Summary
B: Standard + Chromatograms

Laboratory Turnaround Days: [X] 10 [ ] 5 [ ] 3 [ ] 2 [ ] 1

O Oregon O Washington Hydrocarbon Methods

	SAMPLE IDENTIFICATION	SAMPLING DATE / TIME	MATRIX (W,S,O)	# OF CON-TAINERS	TPH-HCID	TPH-Gas	BTEX (EPA 8020 Mod.)	TPH-Gas + BTEX	TPH-Diesel Extended	TPH-Diesel Extended	TPH-418.1	Halogen. Volatiles (EPA 8010)	Aromatic Volatiles (EPA 8020)	Pesticides/PCBs or PCBs Only	GC/MS Volatiles (EPA 8240/8260)	GC/MS SemiVols. (EPA 8270)	PAHs by HPLC (EPA 8310)	Lead: Total or Dissolved	TCLP Metals (8)	NCA SAMPLE NUMBER
1.	MW-32A	03/08/95	Water	3				X	X											9503152-01
2.	MW-33																			02
3.	MW-34																			03
4.	MW-35																			04
5.	MW-36																			05
6.	MW-37																			06
7.	MW-40																			07
8.	MW-41																			08
9.	MW-42																			09
10.	MW-43																			10

Relinquished by:	Firm:	Date & Time	Received by:	Firm:	Date & Time
1. Tina King	GE1	3/9/95 0830	[redacted]	NCA	3/9/95
2.					
3.					

Final Report Approval

Were all requested results provided? yes no Define
Were results within requested turnaround? yes no "No" on back
Final Approval Signature:
Firm: Date:

Page 1 of 2

Rev. 2.1, 9/94

Comments:

Distribution: White - Laboratory Yellow - Consultant Pink - Unocal Final

CREEK ANALYTICAL
[redacted] 120[redacted] Avenue N.E., Suite 101, Bothell, WA 98011-9508 (206) 481-9200 FAX 485-2992
East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 (509) 924-9200 FAX 924-9290
9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 643-9200 FAX 644-2202

UNOCAL CHAIN OF CUSTODY REPORT

Chain of Custody Record #:

UNOCAL INFORMATION

Facility Number: 5353
Site Address: 600 Westlake & Mercer
City, State, ZIP: Seattle, WA 981
Site Release Number:
Unocal Manager: Dr Mark Brunely

CONSULTANT INFORMATION

Firm: GEI Project Number: 9161-013-R69
Address: 8410 154th Ave NE Redmond, WA 98052
Phone: 861-6000 Fax: 861-6050
CERT CRRS Code: 3[redacted]-600
Project Manager: Norm Rux
Sample Collection by: TMK/DEW

Quality Assurance Data Level: [X] A [ ] B
A: Standard Summary
B: Standard + Chromatograms

Laboratory Turnaround Days: [X] 10 [ ] 5 [ ] 3 [ ] 2 [ ] 1

O Oregon O Washington Hydrocarbon Methods

SAMPLE IDENTIFICATION	SAMPLING DATE / TIME	MATRIX (W,S,O)	# OF CONTAINERS	TPH-HCID	TPH-Gas	BTEX (EPA 8020 Mod.)	TPH-Gas + BTEX	TPH-Diesel Extended	TPH-Diesel Extended	TPH-418.1	Halogen. Volatiles (EPA 8010)	Aromatic Volatiles (EPA 8020)	Pesticides/PCBs or PCBs Only	GC/MS Volatiles (EPA 8240/8260)	GC/MS SemiVols. (EPA 8270)	PAHs by HPLC (EPA 8310)	Lead: Total or Dissolved	TCLP Metals (8)	NCA SAMPLE NUMBER
1. MW-44	03/05/95	W	3				X	X											B503152-11
2. MW-45																			12
3. MW-46																			13
4. MW-47																			14
5. SMW-3																			15
6. SMW-4																			16
7.																			
8.																			
9.																			
10.																			

Relinquished by:	Firm:	Date & Time	Received by:	Firm:	Date & Time
1. Tina King	GEI	3/9/95 0830			
2.					
3.					

Final Report Approval

Were all requested results provided? yes no Define
Were results within requested turnaround? yes no "No" on back
Final Approval Signature:
Firm: Date:

Page 2 of 2
Rev. 2.1, 9/94

Comments:

Distribution: White - Laboratory Yellow - Consultant Photocopy - Unocal

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GeoEngineers, Inc.	Project Name:	UNOCAL Seattle, #5353	
8410 154th Avenue N.E.	Client Project :	#9161-013-R04	
Redmond, WA 98052			Received: Jun 7, 1995
Attention: Norm Puri	NCA Project #:	B506122	Reported: Jun 20, 1995

PROJECT SUMMARY PAGE

Laboratory Sample Number	Sample Description	Sample Matrix	Date Sampled
B506122-01	SMW-3	Water	6/6/95
B506122-02	SMW-4	Water	6/6/95
B506122-03	MW-34	Water	6/6/95
B506122-04	MW-35	Water	6/6/95
B506122-05	MW-36	Water	6/6/95
B506122-06	MW-37	Water	6/6/95
B506122-07	MW-40	Water	6/6/95
B506122-08	MW-41	Water	6/6/95
B506122-09	MW-42	Water	6/6/95
B506122-10	MW-43	Water	6/6/95
B506122-11	MW-44	Water	6/6/95

GeoEngineers
JUN 23 1995
Routing: NLP
File

The results in this report apply to the samples analyzed in accordance with the chain of custody document.
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NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

NORTH CREEK ANALYTICAL

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East 11115 Montgomery, Suite B • Spokane, WA 99206-4776 (509) 924-9200 • FAX 924-9290
9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Project Name:	UNOCAL Seattle, #5353	
8410 154th Avenue N.E.	Client Project :	#9161-013-R04	
Redmond, WA 98052			Received: Jun 7, 1995
Attention: Norm Puri	NCA Project #:	B506122	Reported: Jun 20, 1995

PROJECT SUMMARY PAGE

Laboratory Sample Number	Sample Description	Sample Matrix	Date Sampled
B506122-12	MW-45	Water	6/6/95
B506122-13	MW-46	Water	6/6/95
B506122-14	MW-47	Water	6/6/95

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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Jun 7, 1995
Redmond, WA 98052	Analysis Method:	WTPH-G	Analyzed:	Jun 9-12, 1995
Attention: Norm Puri	First Sample #:	B506122-01	Reported:	Jun 20, 1995

TOTAL PETROLEUM HYDROCARBONS-GASOLINE RANGE

Sample Number	Sample Description	Sample Result µg/L (ppb)	Surrogate Recovery %
B506122-01	SMW-3	N.D.	89
B506122-02	SMW-4	41,000	106
B506122-03	MW-34	9,100	89
B506122-04	MW-35	810	148
B506122-05	MW-36	N.D.	90
B506122-06	MW-37, VOA A	45,000	96
B506122-06	MW-37, VOA B	90,000	111
B506122-07	MW-40	1,500	150
B506122-08	MW-41	N.D.	77
B506122-09	MW-42	120	125

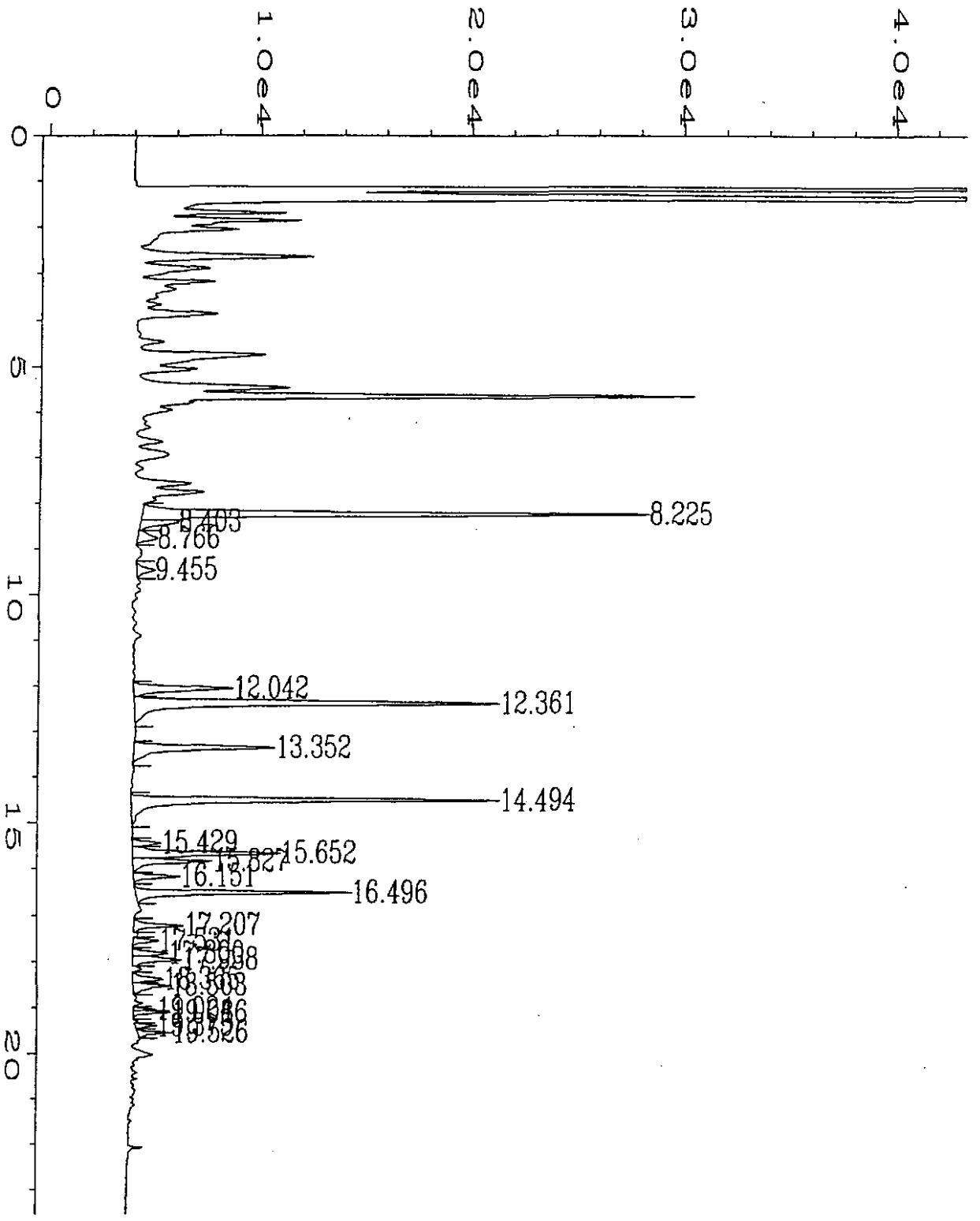
Reporting Limit:	**50**

4-Bromofluorobenzene surrogate recovery control limits are 50 - 150 %.
Volatile Total Petroleum Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager



Data File Name : C:\HPCHEM\2\DATA\060995\002F0101.D
Operator :
Instrument : GC#6
Sample Name : gas std
Run Time Bar Code:
Acquired on : 09 Jun 95 11:49 AM
Report Created on: 09 Jun 95 12:13 PM
Sample Info : 500 ng V-5ab

Page Number : 1
Vial Number : 2
Injection Number : 1
Sequence Line : 1
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH

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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Jun 7, 1995
Redmond, WA 98052	Analysis Method:	WTPH-G	Analyzed:	Jun 9-12, 1995
Attention: Norm Puri	First Sample #:	B506122-10	Reported:	Jun 20, 1995

TOTAL PETROLEUM HYDROCARBONS-GASOLINE RANGE

Sample Number	Sample Description	Sample Result µg/L (ppb)	Surrogate Recovery %
B506122-10	MW-43	N.D.	92
B506122-11	MW-44	N.D.	87
B506122-12	MW-45	8,100	93
B506122-13	MW-46	N.D.	84
B506122-14	MW-47	73	90
BLK060995	Method Blank	N.D.	91

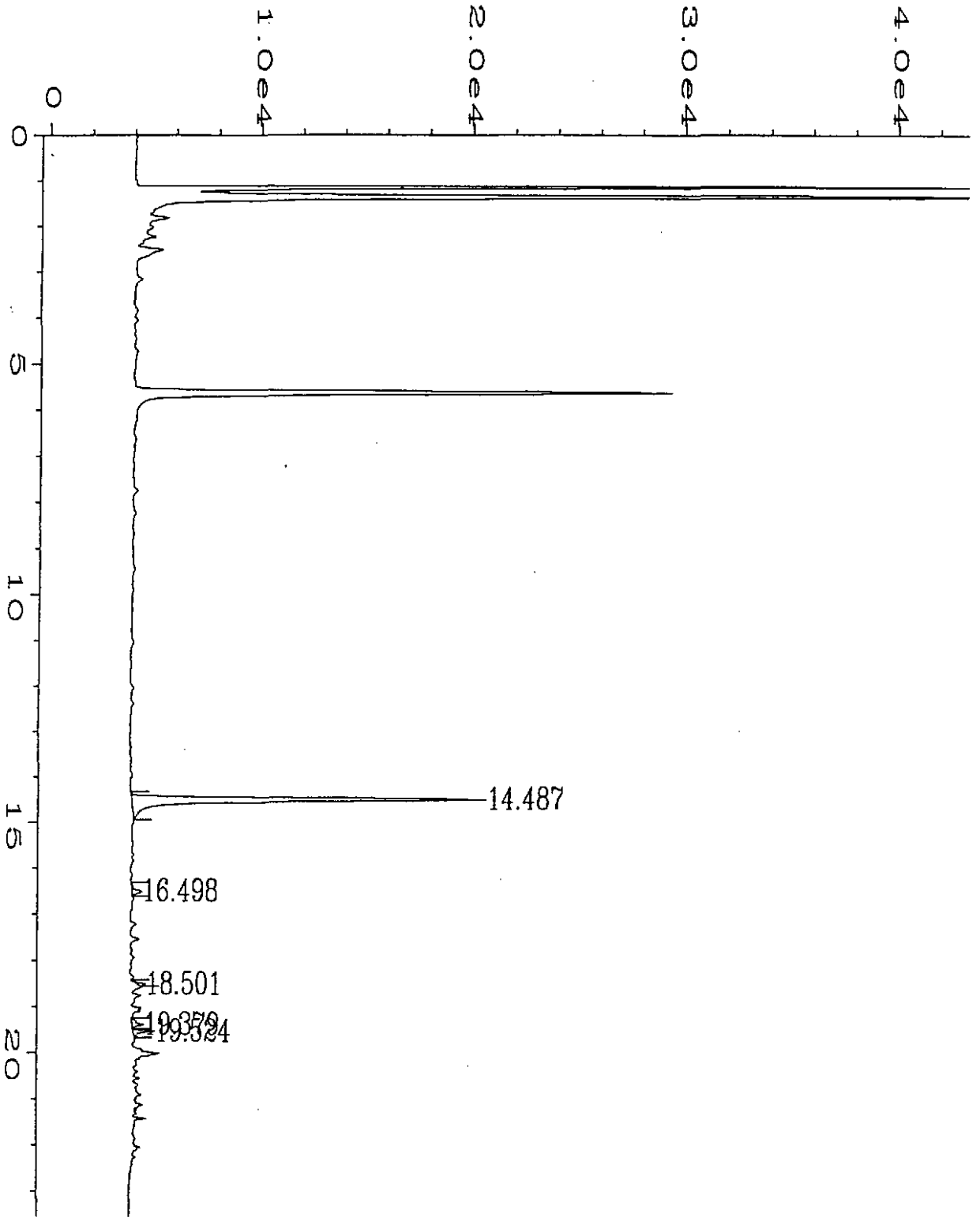
Reporting Limit: 50

4-Bromofluorobenzene surrogate recovery control limits are 50 - 150 %.
Volatile Total Petroleum Hydrocarbons are quantitated as Gasoline Range Organics (toluene - dodecane).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

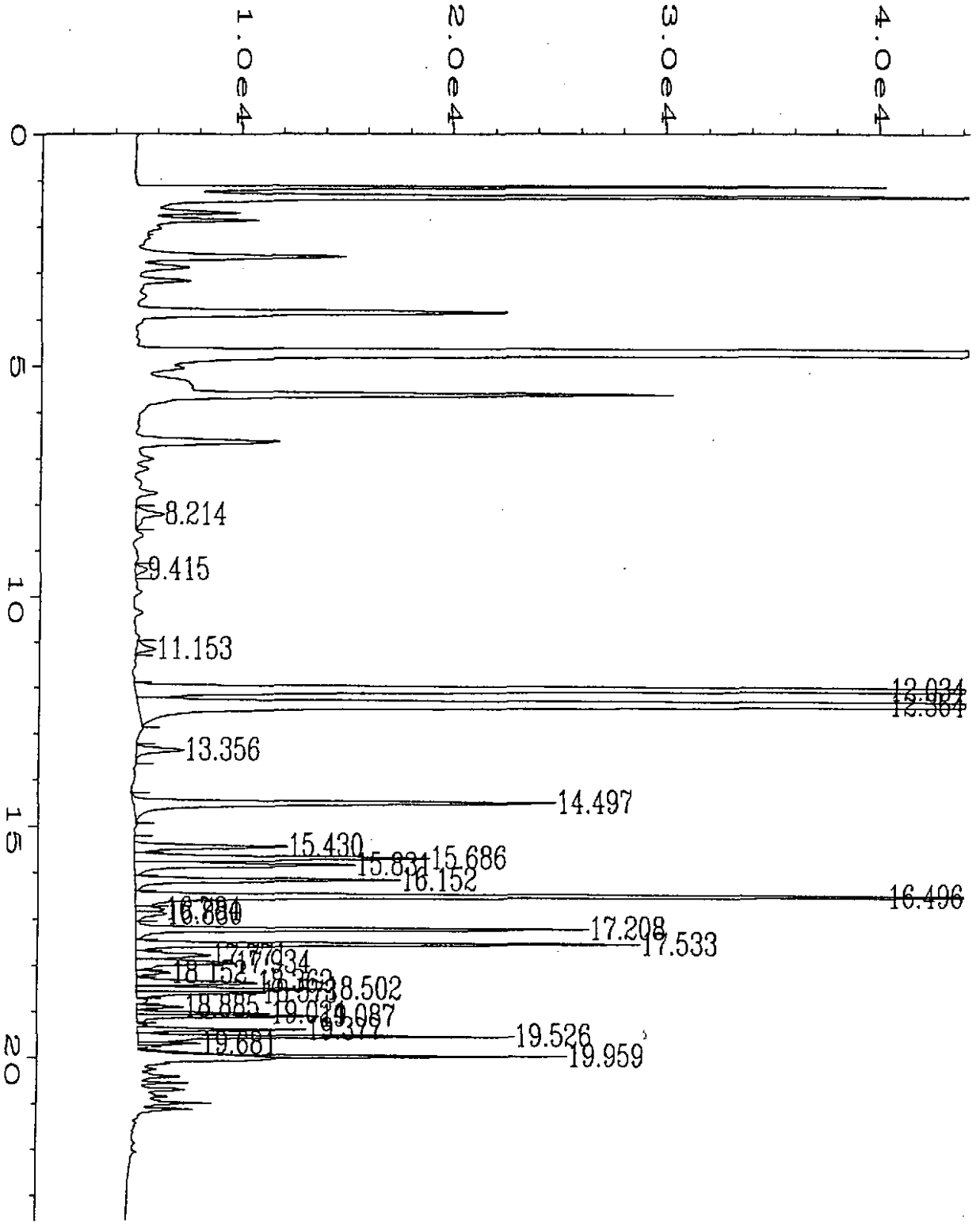
Laura Dutton

Laura Dutton
Project Manager



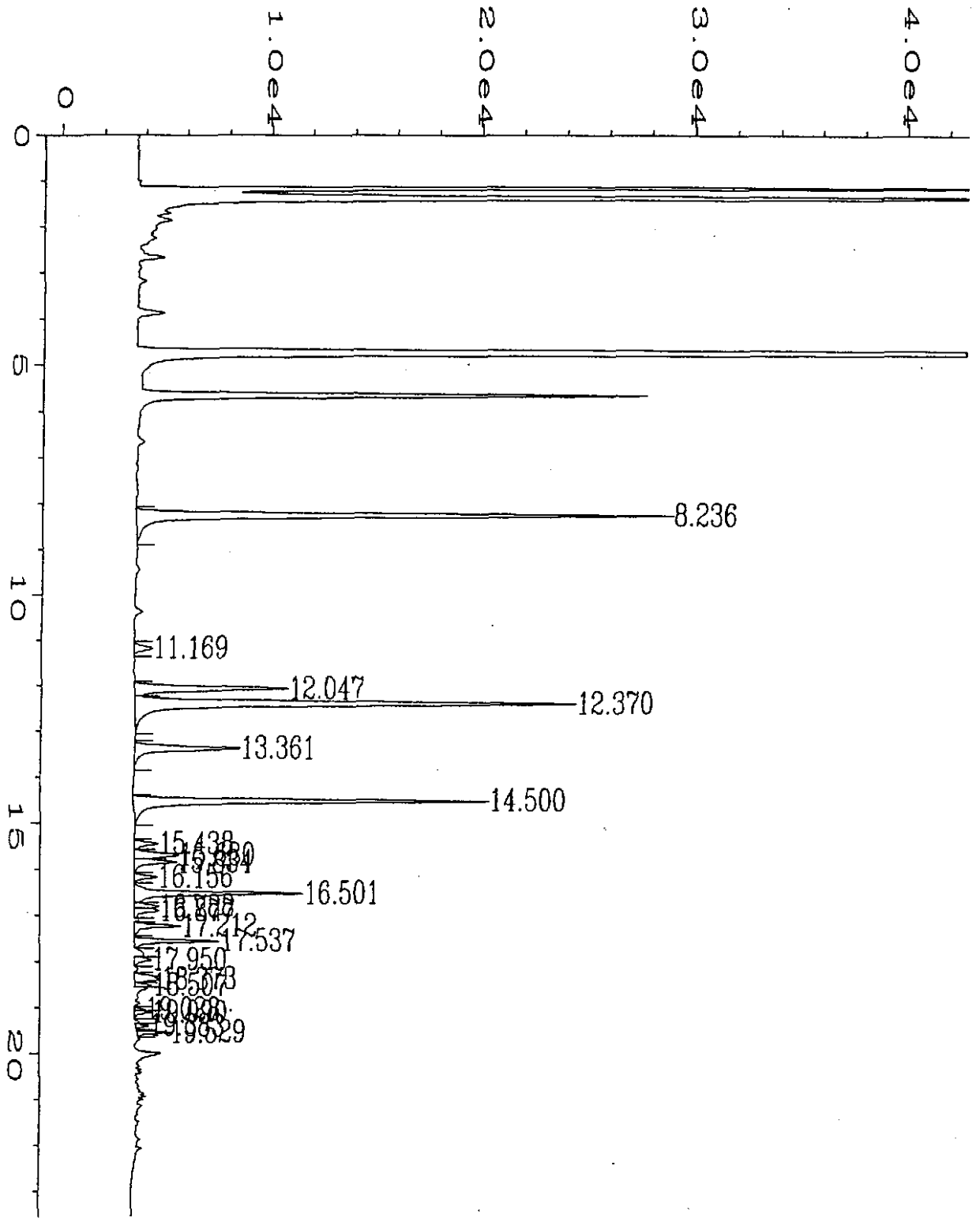
Data File Name : C:\HPCHEM\2\DATA\060995\007F0301.D
Operator :
Instrument : GC#6
Sample Name : b506122-01
Run Time Bar Code:
Acquired on : 09 Jun 95 02:16 PM
Report Created on: 09 Jun 95 02:40 PM
Sample Info : 5 ml

Page Number : 1
Vial Number : 7
Injection Number : 1
Sequence Line : 3
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



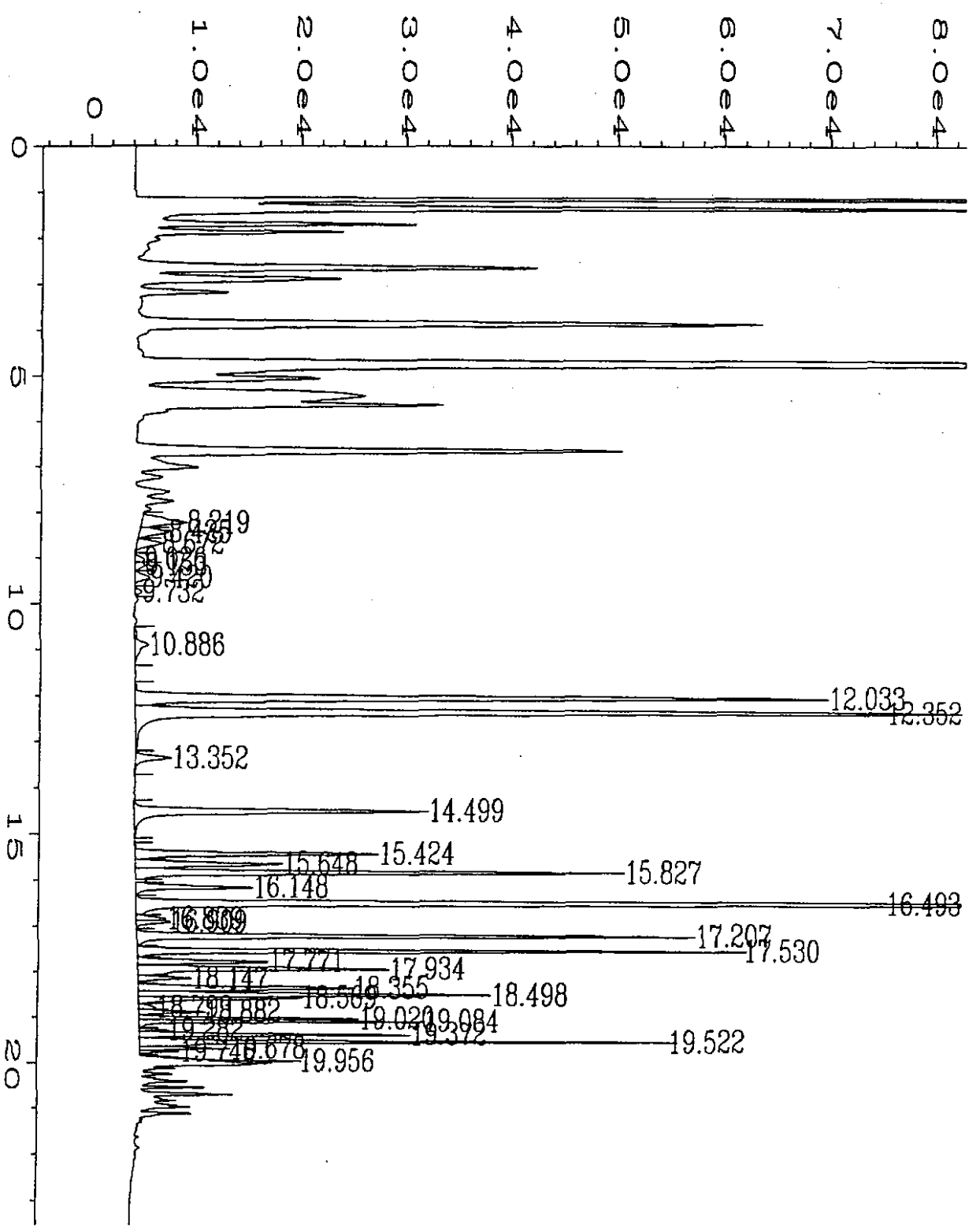
Data File Name : C:\HPCHEM\2\DATA\060995\021F0701.D
Operator :
Instrument : GC#6
Sample Name : b506122-02 dup
Run Time Bar Code:
Acquired on : 09 Jun 95 09:09 PM
Report Created on: 09 Jun 95 09:32 PM
Multiplier : 100
Sample Info : 50 ul

Page Number : 1
Vial Number : 21
Injection Number : 1
Sequence Line : 7
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



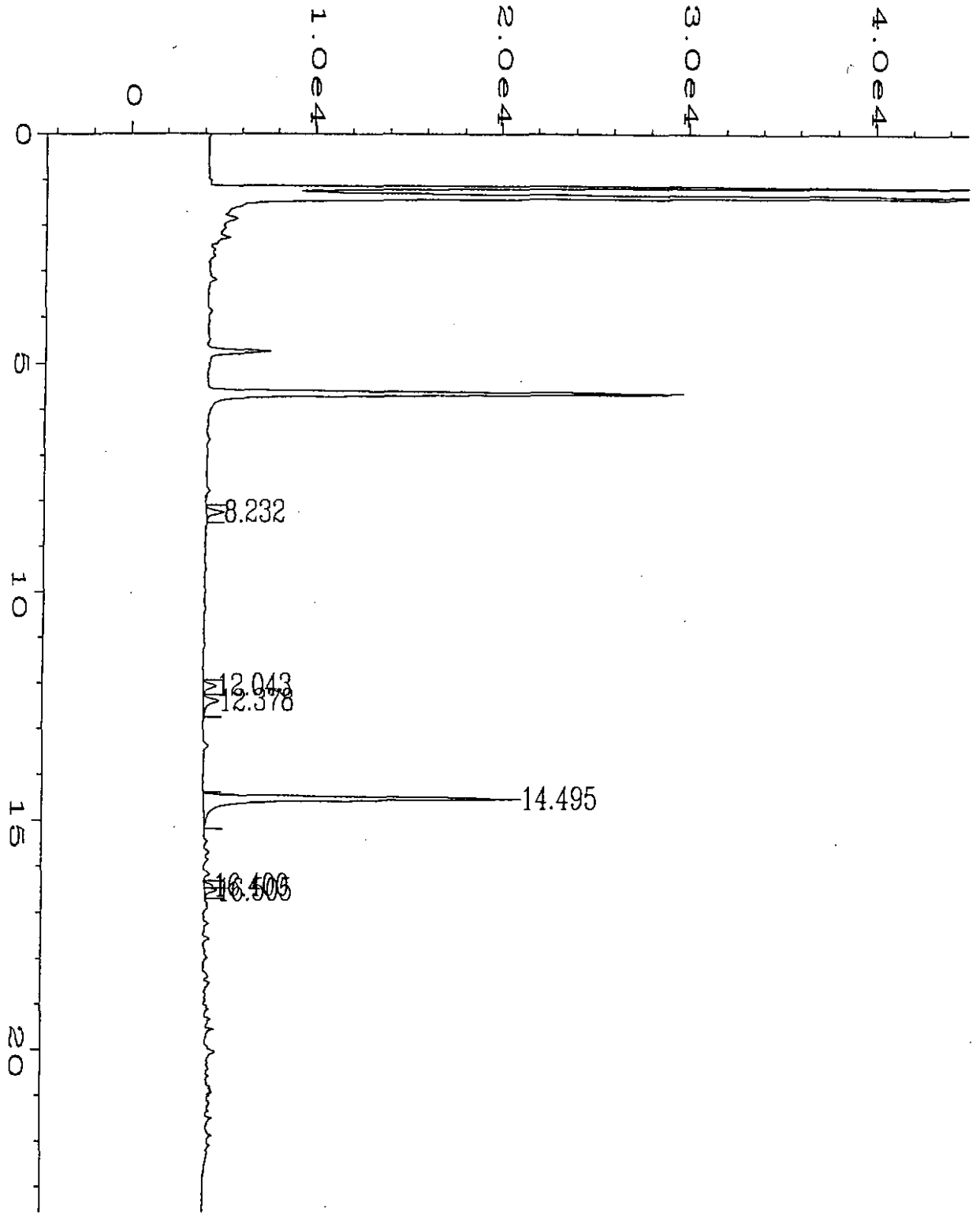
Data File Name : C:\HPCHEM\2\DATA\061295\015F0801.D
Operator :
Instrument : GC#6
Sample Name : b506122-03 r2
Run Time Bar Code:
Acquired on : 12 Jun 95 02:04 PM
Report Created on: 12 Jun 95 02:27 PM
Multiplier : 100
Sample Info : 50 ul

Page Number : 1
Vial Number : 15
Injection Number : 1
Sequence Line : 8
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



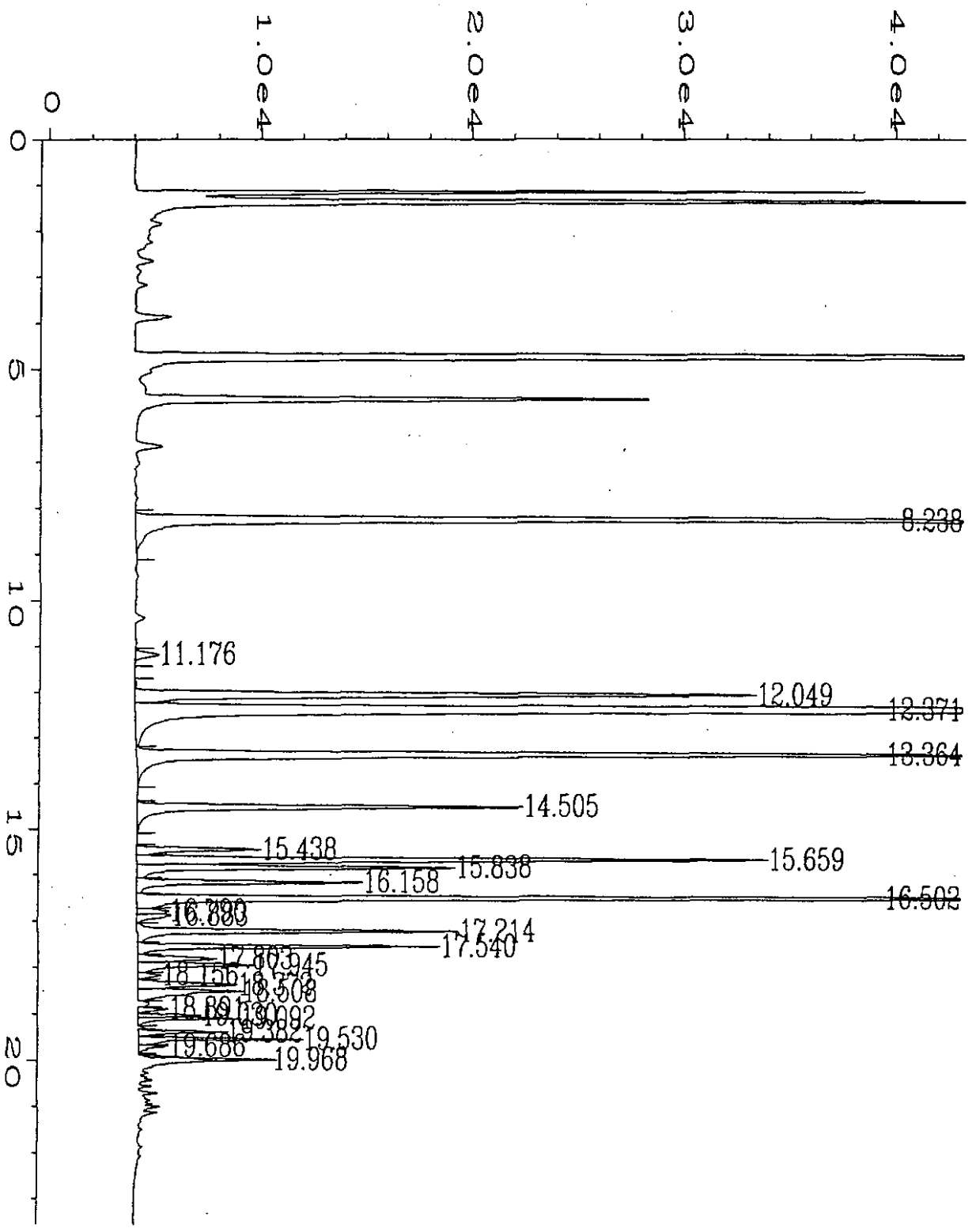
Data File Name : C:\HPCHEM\2\DATA\060995\011F0501.D
Operator :
Instrument : GC#6
Sample Name : b506122-04
Run Time Bar Code:
Acquired on : 09 Jun 95 04:14 PM
Report Created on: 09 Jun 95 04:38 PM
Sample Info : 5 ml

Page Number : 1
Vial Number : 11
Injection Number : 1
Sequence Line : 5
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



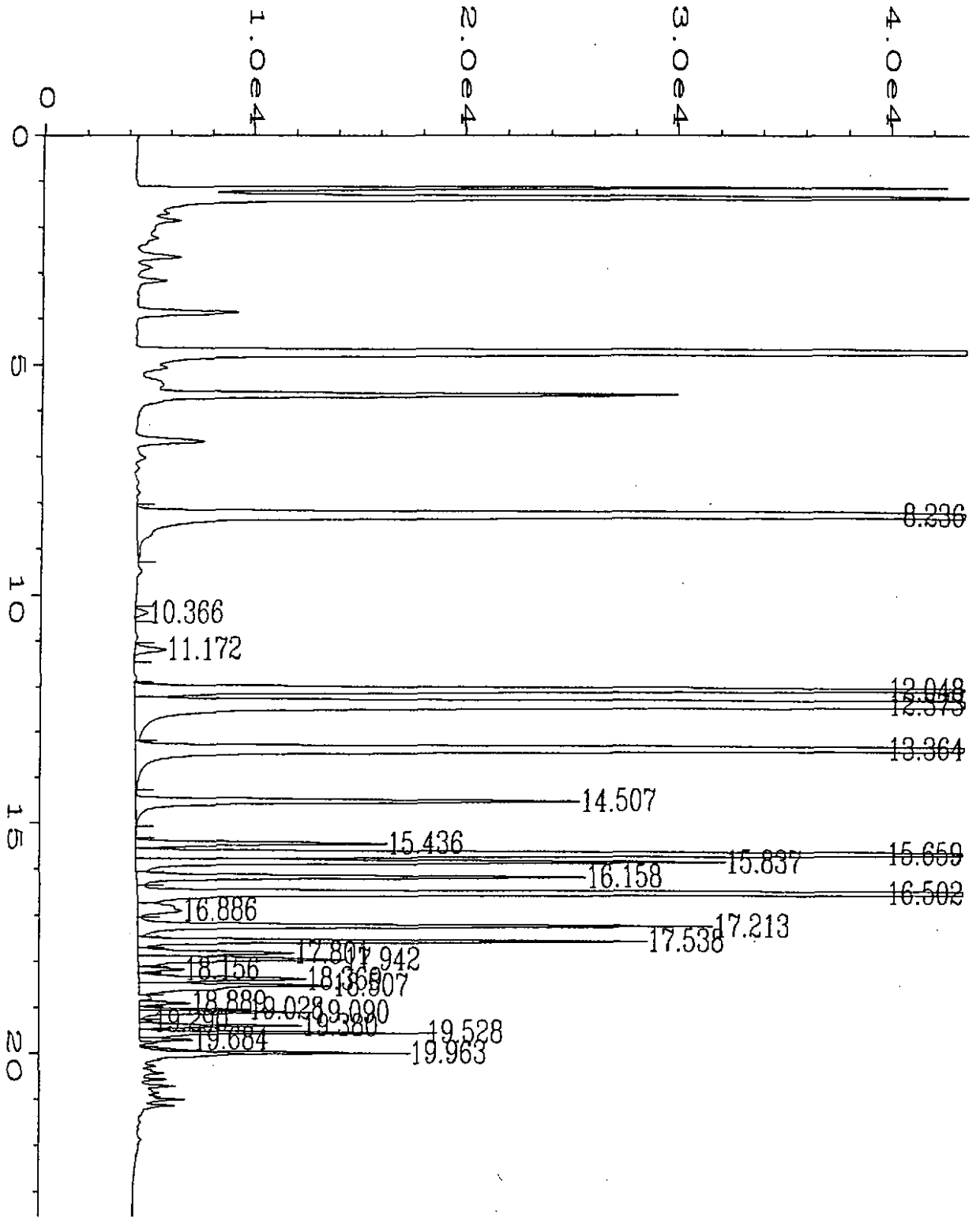
Data File Name : C:\HPCHEM\2\DATA\060995\012F0501.D
Operator :
Instrument : GC#6
Sample Name : b506122-05
Run Time Bar Code:
Acquired on : 09 Jun 95 04:44 PM
Report Created on: 15 Jun 95 01:16 PM

Page Number : 1
Vial Number : 12
Injection Number : 1
Sequence Line : 5
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



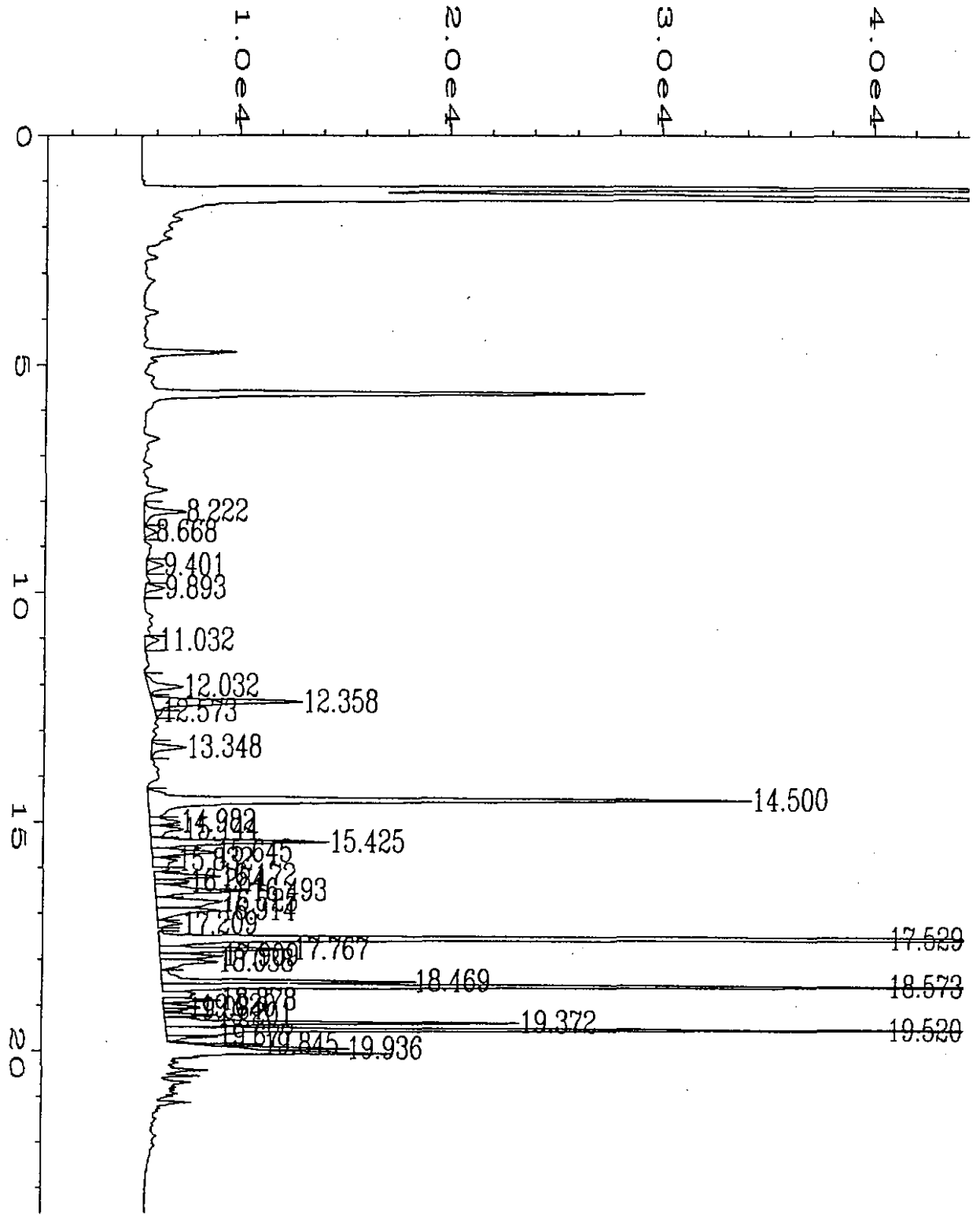
Data File Name : C:\HPCHEM\2\DATA\061295\028F1301.D
Operator :
Instrument : GC#6
Sample Name : b506122-06 A
Run Time Bar Code:
Acquired on : 12 Jun 95 08:30 PM
Report Created on: 12 Jun 95 08:54 PM
Multiplier : 100
Sample Info : 50 ul

Page Number : 1
Vial Number : 28
Injection Number : 1
Sequence Line : 13
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



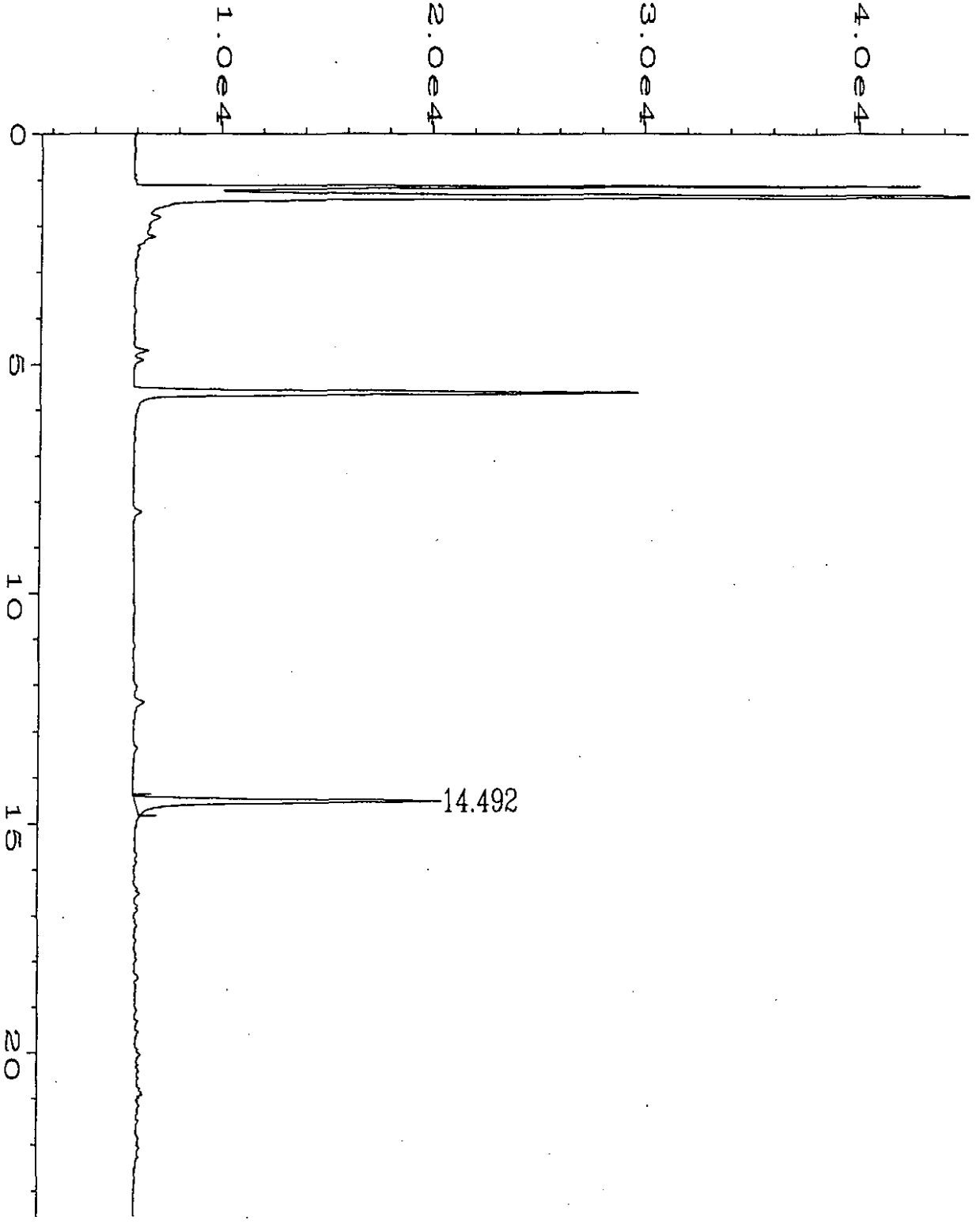
Data File Name : C:\HPCHEM\2\DATA\061295\030F1501.D
Operator :
Instrument : GC#6
Sample Name : b506122-06 B
Run Time Bar Code:
Acquired on : 12 Jun 95 09:29 PM
Report Created on: 12 Jun 95 09:53 PM
Multiplier : 100
Sample Info : 50 ul

Page Number : 1
Vial Number : 30
Injection Number : 1
Sequence Line : 15
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



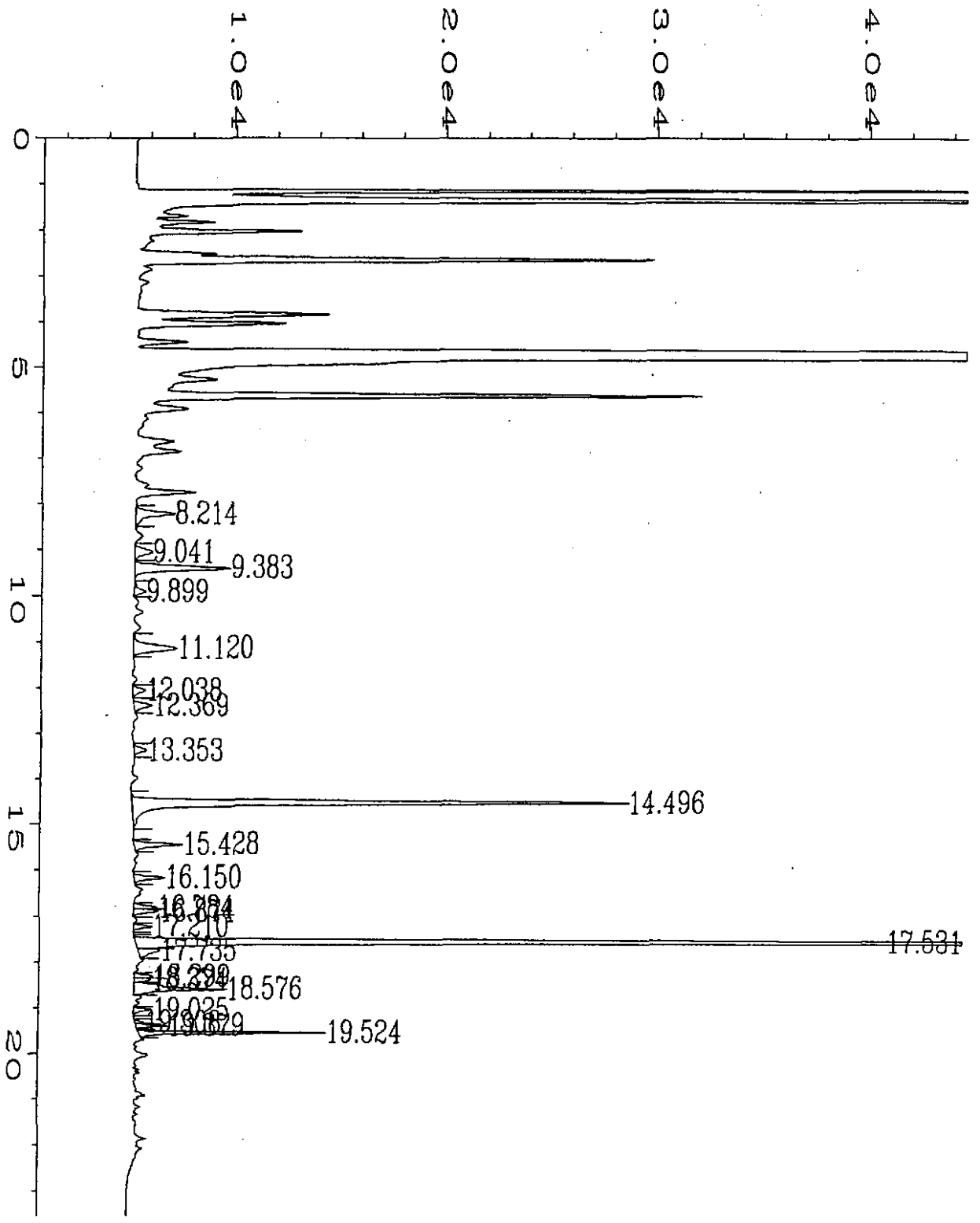
Data File Name : C:\HPCHEM\2\DATA\060995\015F0701.D
Operator :
Instrument : GC#6
Sample Name : b506122-07
Run Time Bar Code:
Acquired on : 09 Jun 95 06:12 PM
Report Created on: 09 Jun 95 06:36 PM
Multiplier : 5
Sample Info : 1 ml

Page Number : 1
Vial Number : 15
Injection Number : 1
Sequence Line : 7
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



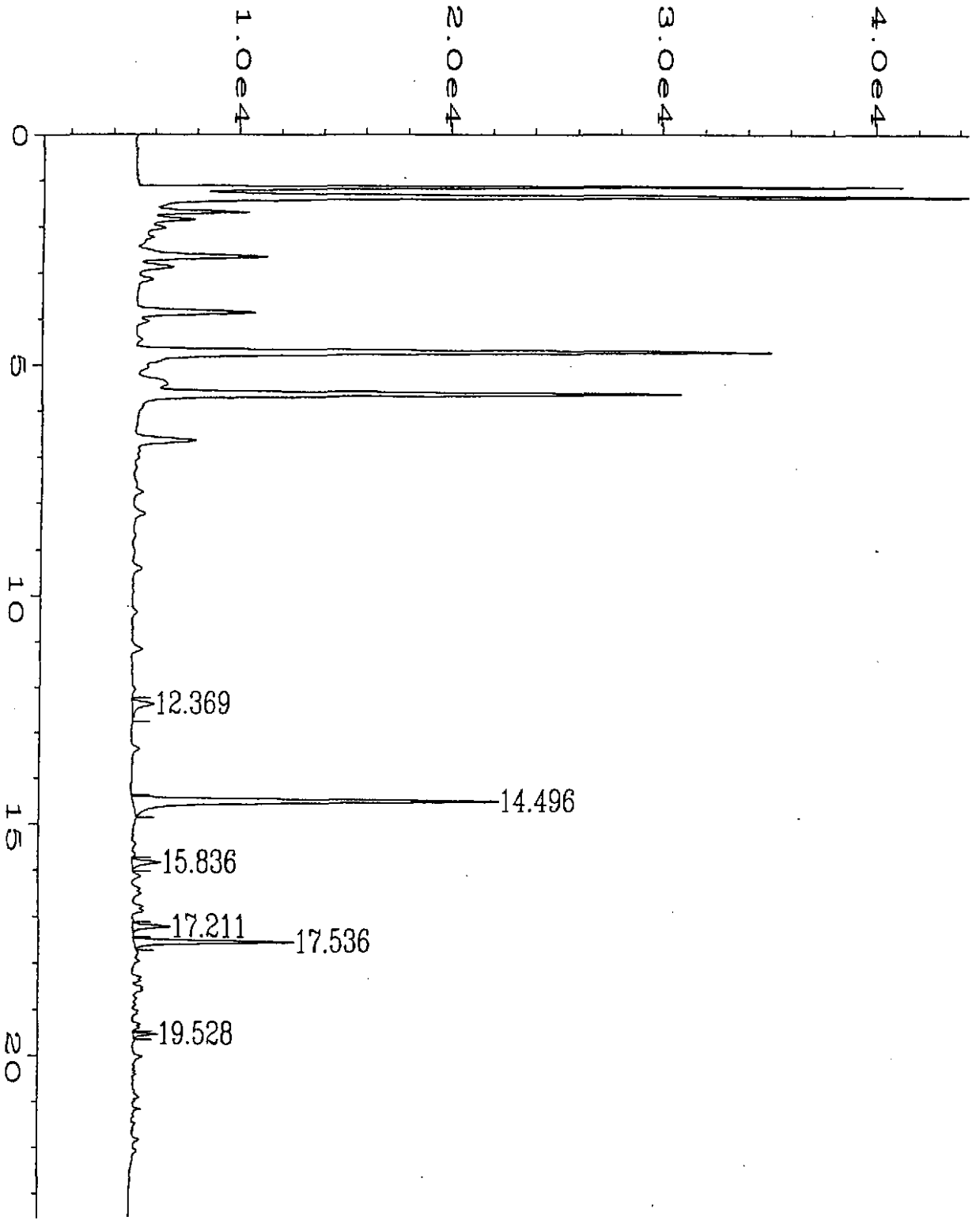
Data File Name : C:\HPCHEM\2\DATA\060995\016F0701.D
Operator :
Instrument : GC#6
Sample Name : b506122-08
Run Time Bar Code:
Acquired on : 09 Jun 95 06:41 PM
Report Created on: 09 Jun 95 07:05 PM
Sample Info : 5 ml

Page Number : 1
Vial Number : 16
Injection Number : 1
Sequence Line : 7
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



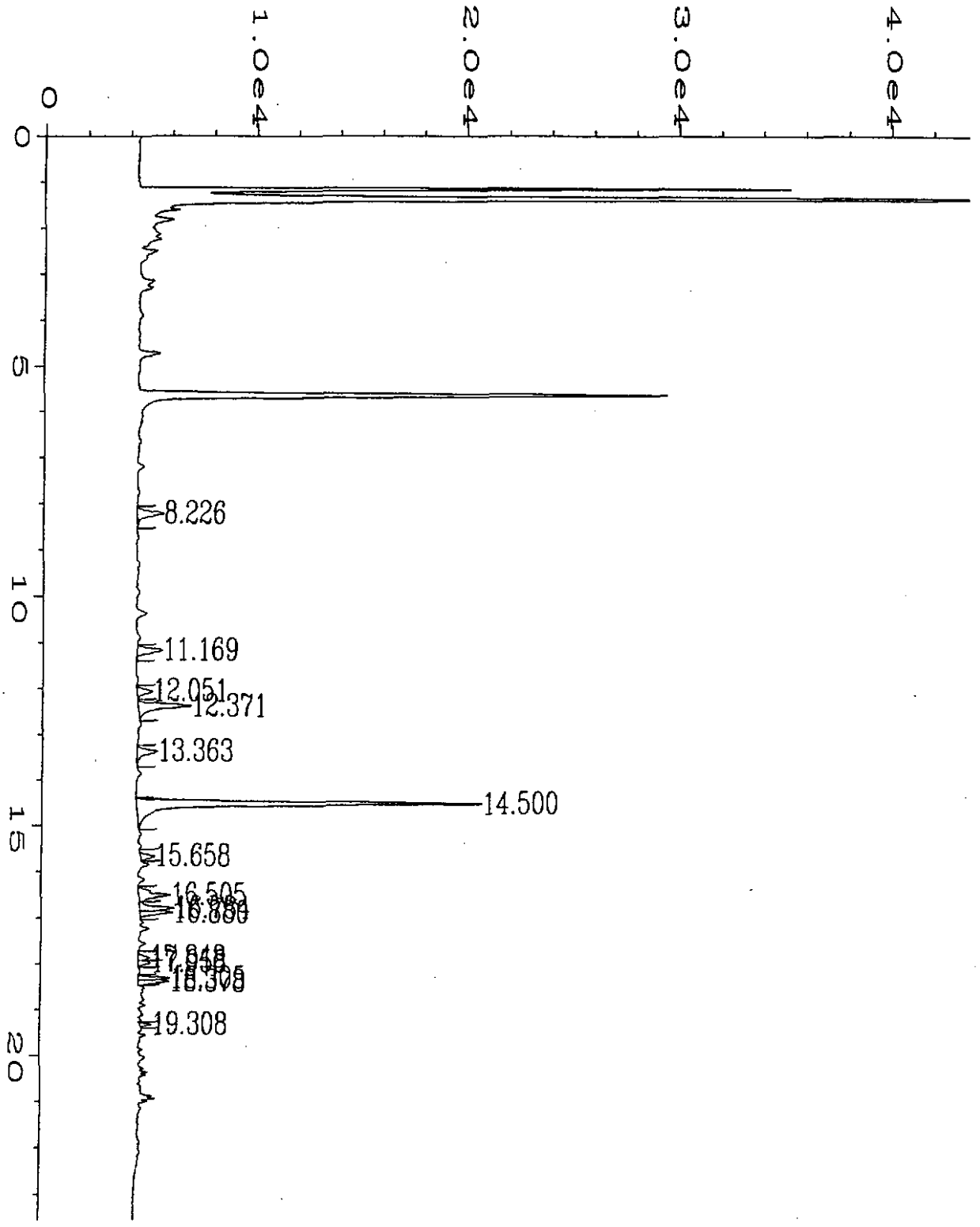
Data File Name : C:\HPCHEM\2\DATA\060995\019F0701.D
Operator :
Instrument : GC#6
Sample Name : b506122-09
Run Time Bar Code:
Acquired on : 09 Jun 95 08:10 PM
Report Created on: 09 Jun 95 08:33 PM
Sample Info : 5 ml

Page Number : 1
Vial Number : 19
Injection Number : 1
Sequence Line : 7
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



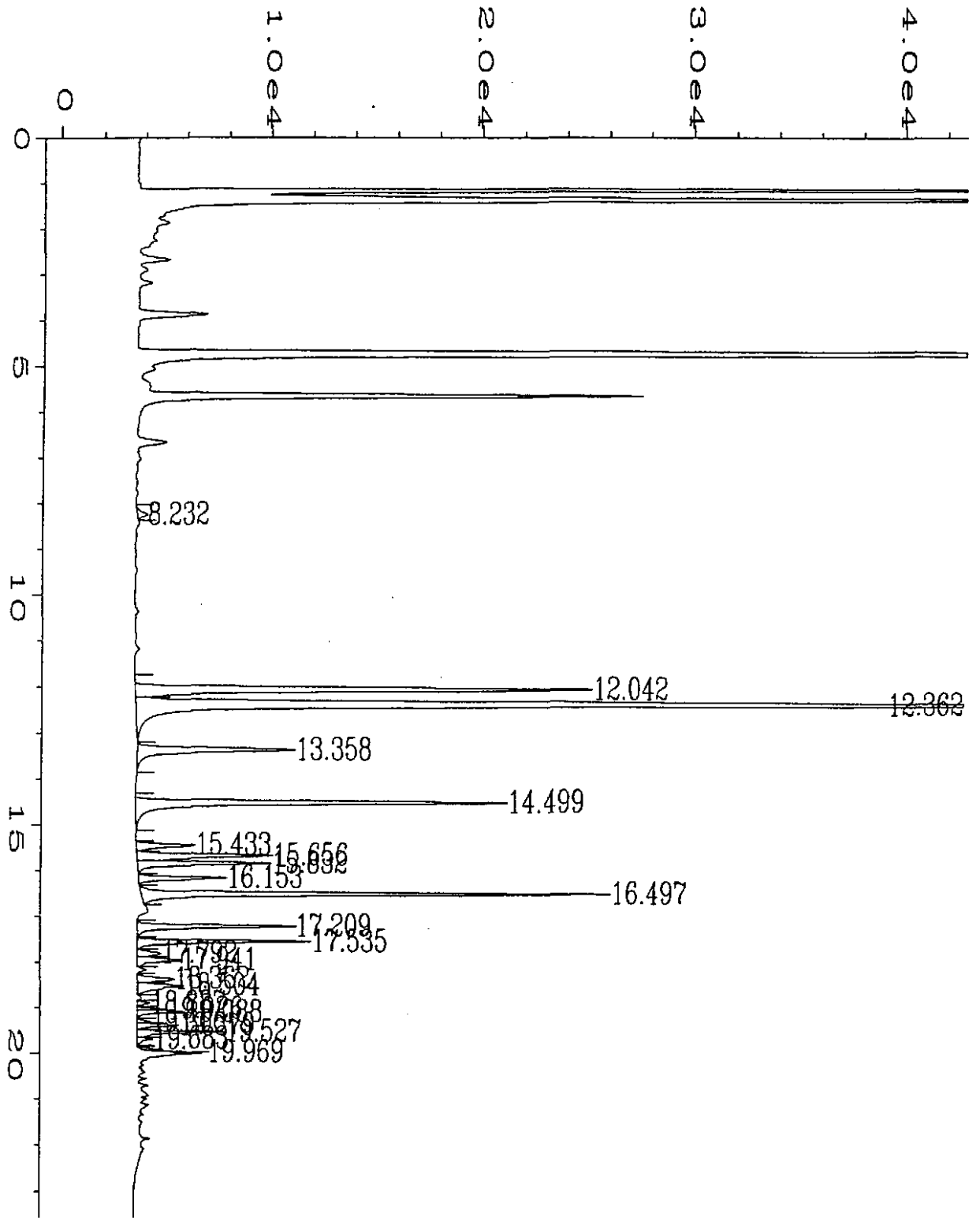
Data File Name : C:\HPCHEM\2\DATA\060995\020F0701.D
Operator :
Instrument : GC#6
Sample Name : b506122-10
Run Time Bar Code:
Acquired on : 09 Jun 95 08:39 PM
Report Created on: 09 Jun 95 09:03 PM
Sample Info : 5 ml

Page Number : 1
Vial Number : 20
Injection Number : 1
Sequence Line : 7
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



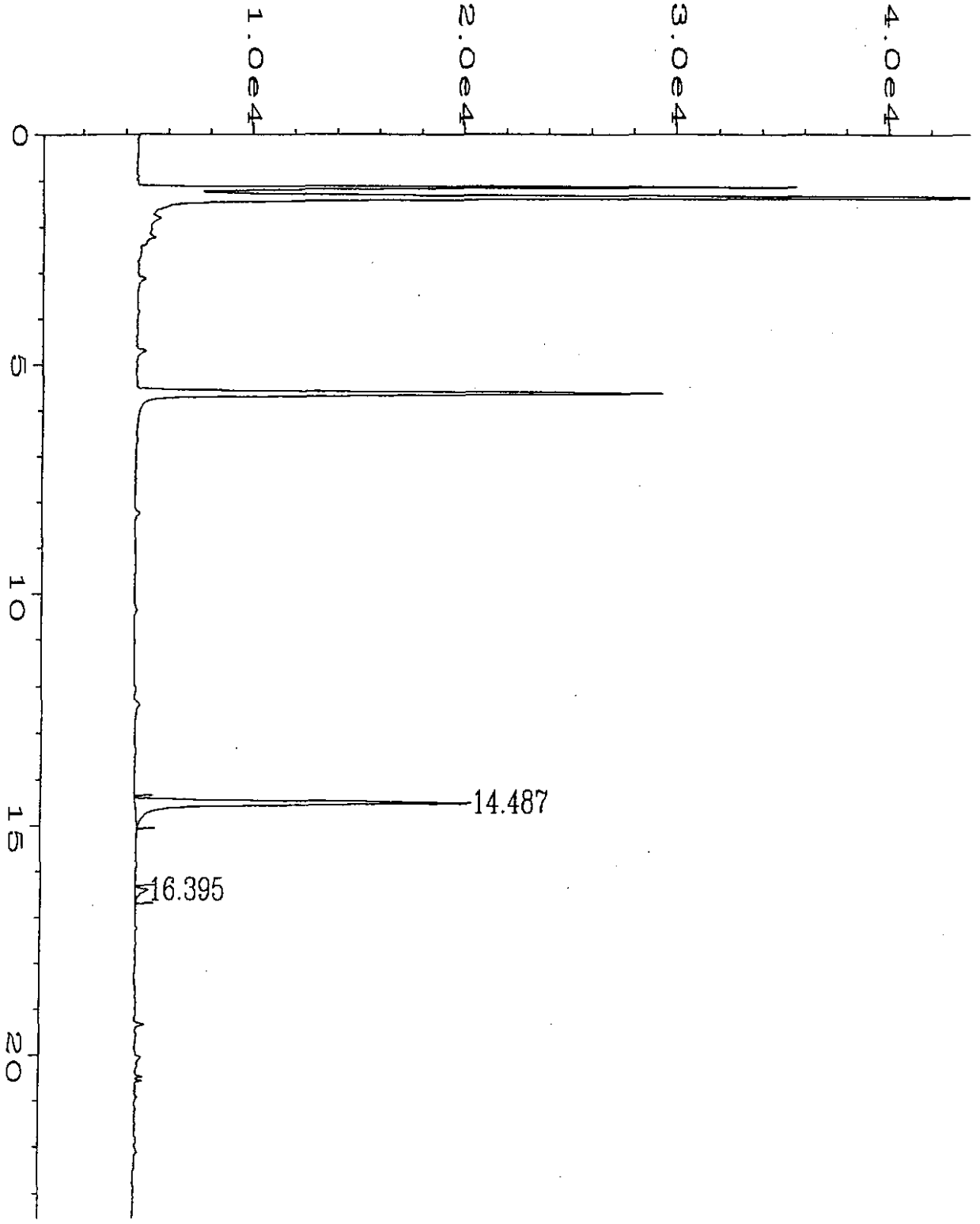
Data File Name : C:\HPCHEM\2\DATA\060995\027F0901.D
Operator :
Instrument : GC#6
Sample Name : b506122-11
Run Time Bar Code:
Acquired on : 10 Jun 95 00:05 AM
Report Created on: 10 Jun 95 00:29 AM
Sample Info : 5 ml

Page Number : 1
Vial Number : 27
Injection Number : 1
Sequence Line : 9
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



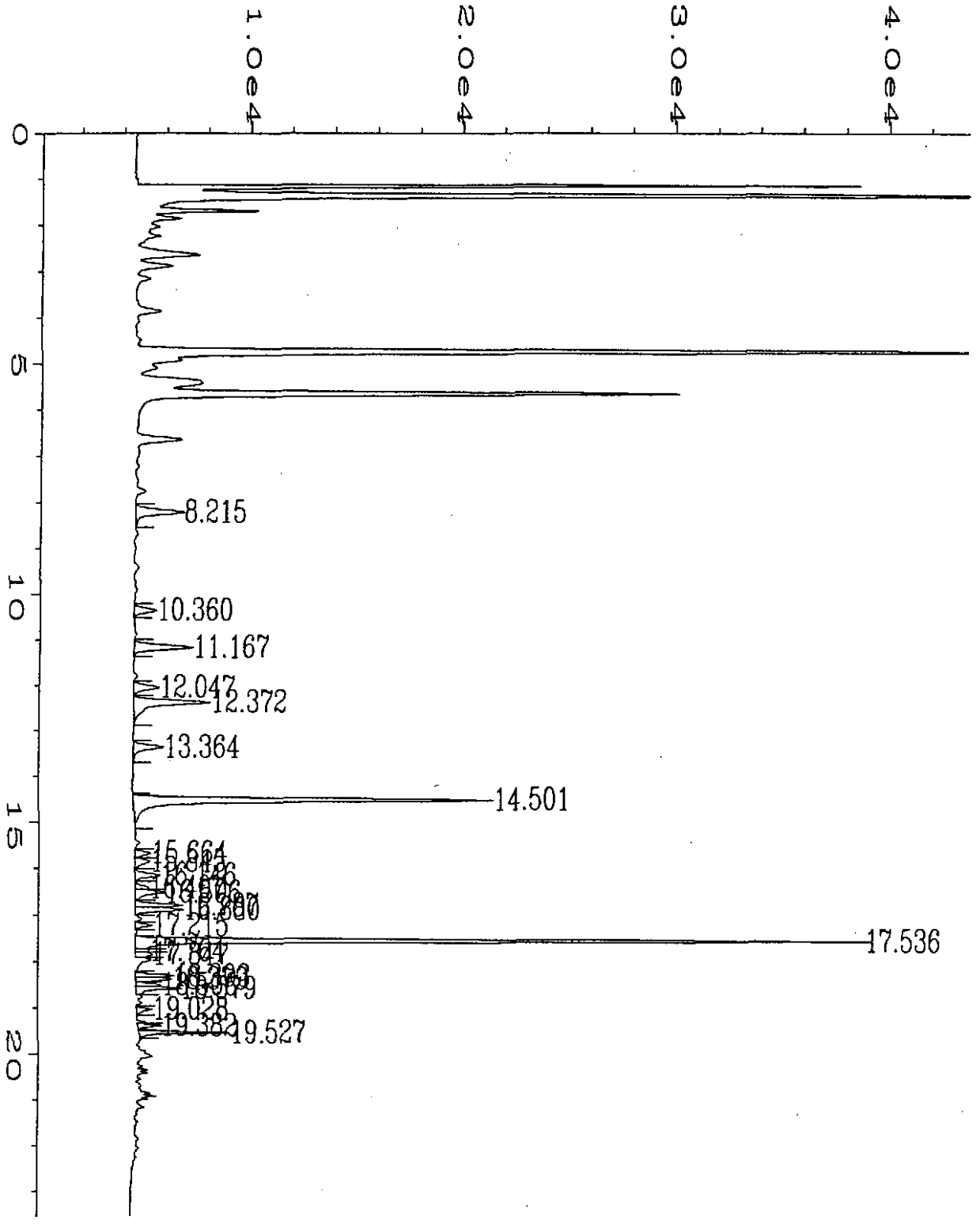
Data File Name : C:\HPCHEM\2\DATA\061295\019F0801.D
Operator :
Instrument : GC#6
Sample Name : b506122-12 r2
Run Time Bar Code:
Acquired on : 12 Jun 95 04:01 PM
Report Created on: 12 Jun 95 04:25 PM
Multiplier : 50
Sample Info : 100 ul

Page Number : 1
Vial Number : 19
Injection Number : 1
Sequence Line : 8
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



Data File Name : C:\HPCHEM\2\DATA\061095\009F0101.D
Operator :
Instrument : GC#6
Sample Name : b506122-13 r1
Run Time Bar Code:
Acquired on : 10 Jun 95 02:49 PM
Report Created on: 10 Jun 95 03:13 PM
Sample Info : 5 ml reshot

Page Number : 1
Vial Number : 9
Injection Number : 1
Sequence Line : 1
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH



Data File Name : C:\HPCHEM\2\DATA\060995\031F1101.D
Operator :
Instrument : GC#6
Sample Name : b506122-14
Run Time Bar Code:
Acquired on : 10 Jun 95 02:03 AM
Report Created on: 10 Jun 95 02:27 AM
Sample Info : 5 ml

Page Number : 1
Vial Number : 31
Injection Number : 1
Sequence Line : 11
Instrument Method: WA-WATER.MTH
Analysis Method : WA-WATER.MTH

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GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Attention: Norm Puri

Client Project ID: UNOCAL Seattle, #5353
Sample Matrix: Water
Analysis Method: WTPH-G
Units: µg/L (ppb)

Analyst: B. Christlieb, F. Shino
Analyzed: Jun 9-12, 1995
Reported: Jun 20, 1995

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT
Laboratory Control Sample

	Gasoline
Spike Conc. Added:	100
Spike Result:	99
% Recovery:	99
Upper Control Limit %:	132
Lower Control Limit %:	56

PRECISION ASSESSMENT
Sample Duplicate

	Gasoline Range Organics	Gasoline Range Organics
Sample Number:	B506122-02	B506122-14
Original Result:	41,000	73
Duplicate Result:	43,000	56
Relative % Difference:	4.8	Q-5
Maximum RPD:	50	50

Q-5 = RPD values are not reported at sample concentration levels <10 X the Reporting Limit.

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Laura Dutton
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled: Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received: Jun 7, 1995
Redmond, WA 98052	Analysis Method:	EPA 8020	Analyzed: Jun 9-12, 1995
Attention: Norm Puri	First Sample #:	B506122-01	Reported: Jun 20, 1995

BTEX DISTINCTION

Sample Number	Sample Description	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)	Surrogate Recovery %
B506122-01	SMW-3	N.D.	N.D.	N.D.	N.D.	96
B506122-02	SMW-4	9,400	44	2,700	4,900	106
B506122-03	MW-34	4,200	1,000	330	1,200	98
B506122-04	MW-35	62	1.4	27	36	120
B506122-05	MW-36	1.0	N.D.	N.D.	N.D.	96
B506122-06	MW-37, VOA A	3,700	2,400	1,300	7,900	103
B506122-06	MW-37, VOA B	5,100	6,000	2,400	14,000	108
B506122-07	MW-40	6.8	4.3	4.1	21	133
B506122-08	MW-41	N.D.	N.D.	N.D.	N.D.	88
B506122-09	MW-42	500	0.59	N.D.	N.D.	107
Reporting Limits:		**0.50**	**0.50**	**0.50**	**1.0**	

4-Bromofluorobenzene surrogate recovery control limits are 59 - 144 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

506122.GEO <6>

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East 11115 Montgomery, Suite B • Spokane, WA 99206-4776 (509) 924-9200 • FAX 924-9290
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GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Jun 7, 1995
Redmond, WA 98052	Analysis Method:	EPA 8020	Analyzed:	Jun 9-12, 1995
Attention: Norm Puri	First Sample #:	B506122-10	Reported:	Jun 20, 1995

BTEX DISTINCTION

Sample Number	Sample Description	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)	Surrogate Recovery %
B506122-10	MW-43	8.2	N.D.	N.D.	N.D.	97
B506122-11	MW-44	N.D.	N.D.	N.D.	1.6	95
B506122-12	MW-45	1,700	10	500	1,500	102
B506122-13	MW-46	N.D.	N.D.	N.D.	N.D.	94
B506122-14	MW-47	15	0.59	N.D.	2.3	96
BLK060995	Method Blank	N.D.	N.D.	N.D.	N.D.	95
Reporting Limits:		**0.50**	**0.50**	**0.50**	**1.0**	

4-Bromofluorobenzene surrogate recovery control limits are 59 - 144 %.
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

NORTH CREEK ANALYTICAL

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GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Attention: Norm Puri

Client Project ID: UNOCAL Seattle, #5353
Sample Matrix: Water
Analysis Method: EPA 8020
Units: µg/L (ppb)
QC Sample #: B506122-01

Analyst: B. Christlieb, F. Shino
Analyzed: Jun 9, 1995
Reported: Jun 20, 1995

MATRIX SPIKE QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Sample Result:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10.0	10.0	10.0	30.0
Spike Result:	8.9	9.3	9.6	29.6
Spike % Recovery:	89%	93%	96%	99%
Spike Dup. Result:	9.0	9.4	9.9	30.2
Spike Duplicate % Recovery:	90%	94%	99%	101%
Upper Control Limit %:	115	116	122	122
Lower Control Limit %:	82	81	85	85
Relative % Difference:	1.1%	1.1%	3.1%	2.0%
Maximum RPD:	16	16	16	17

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

% Recovery: $\frac{\text{Spike Result - Sample Result}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Spike Result - Spike Dup. Result}}{\text{(Spike Result + Spike Dup. Result) / 2}} \times 100$

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East 11115 Montgomery, Suite B • Spokane, WA 99206-4776 (509) 924-9200 • FAX 924-9290
9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Jun 7, 1995
Redmond, WA 98052	Analysis Method:	WTPH-D Extended	Extracted:	Jun 12, 1995
Attention: Norm Puri	First Sample #:	B506122-01	Analyzed:	Jun 14-19, 1995
			Reported:	Jun 20, 1995

TOTAL PETROLEUM HYDROCARBONS - DIESEL RANGE EXTENDED

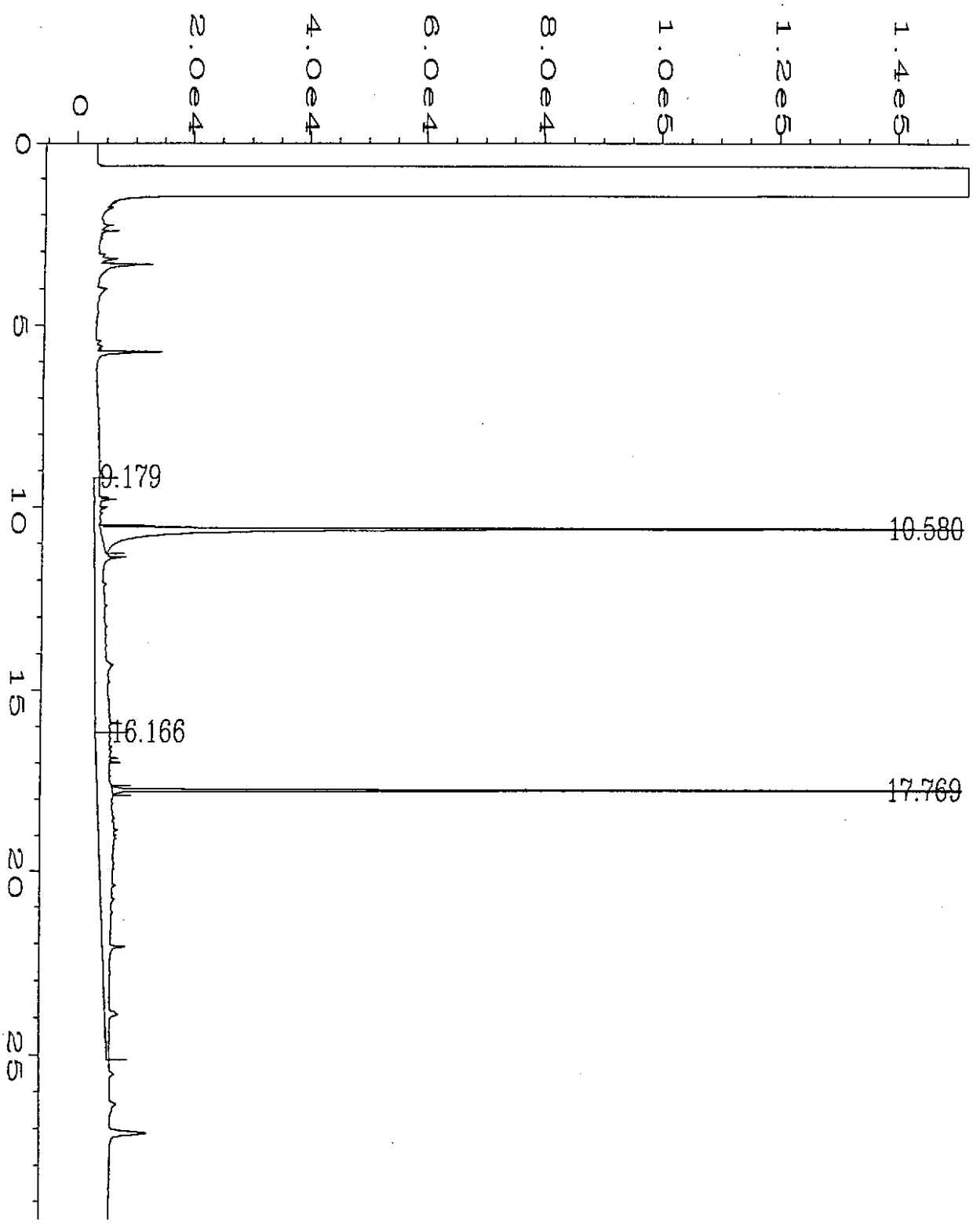
Sample Number	Sample Description	Diesel Result mg/L (ppm)	Heavy Oil Result mg/L (ppm)	Surrogate Recovery %
B506122-01	SMW-3	N.D.	N.D.	85
B506122-02	SMW-4	5.5 D-1	N.D.	119
B506122-03	MW-34	2.3 D-1	N.D.	86
B506122-04	MW-35	1.0 D-1	0.93	72
B506122-05	MW-36	N.D.	N.D.	74
B506122-06	MW-37	4.6 D-1	2.5	67
B506122-07	MW-40	2.3	1.6	60
B506122-08	MW-41	N.D.	N.D.	78
B506122-09	MW-42	0.92	1.5	84
B506122-10	MW-43	0.69	1.5	87
Reporting Limit:		**0.25**	**0.75**	

2-Fluorobiphenyl surrogate recovery control limits are 50 - 150%.
Extractable Hydrocarbons are quantitated as Diesel Range Organics (C12 - C24) and Heavy Oil Range Organics (>C24).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

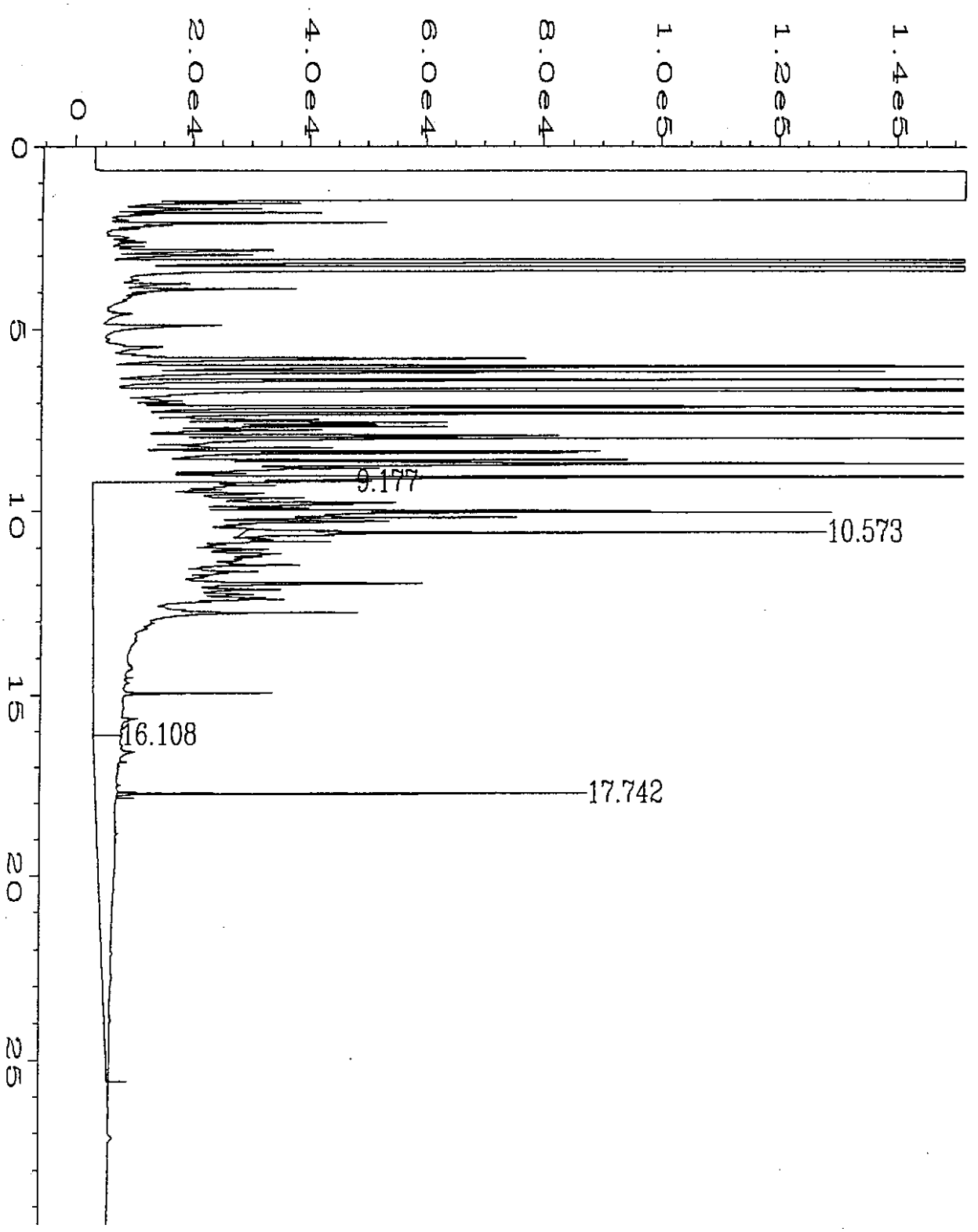
Laura Dutton

Laura Dutton
Project Manager



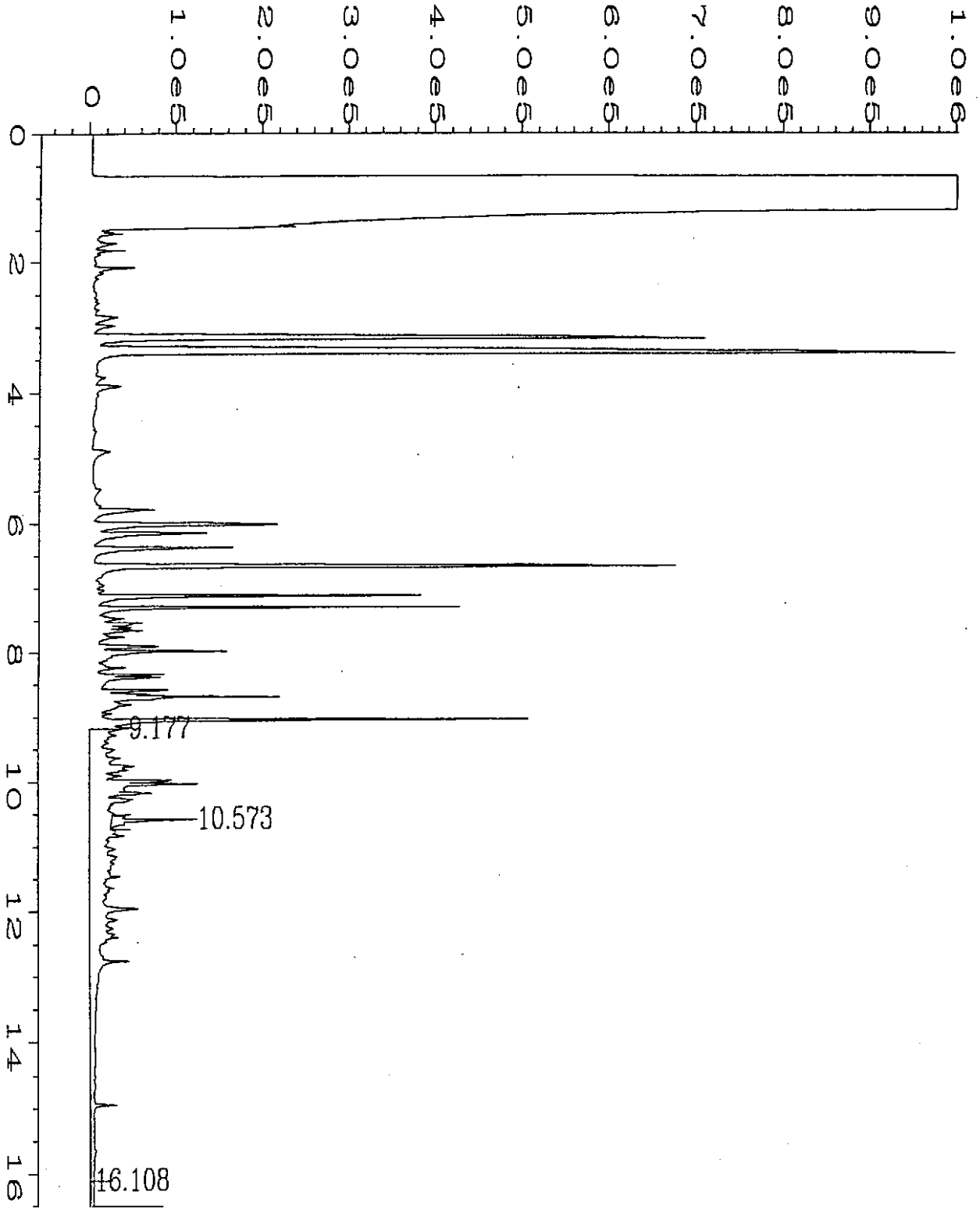
Data File Name : C:\HPCHEM\2\DATA\JUN13\029F1301.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-01W
Run Time Bar Code:
Acquired on : 14 Jun 95 08:03 AM
Report Created on: 15 Jun 95 12:56 PM

Page Number : 1
Vial Number : 29
Injection Number : 1
Sequence Line : 13
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



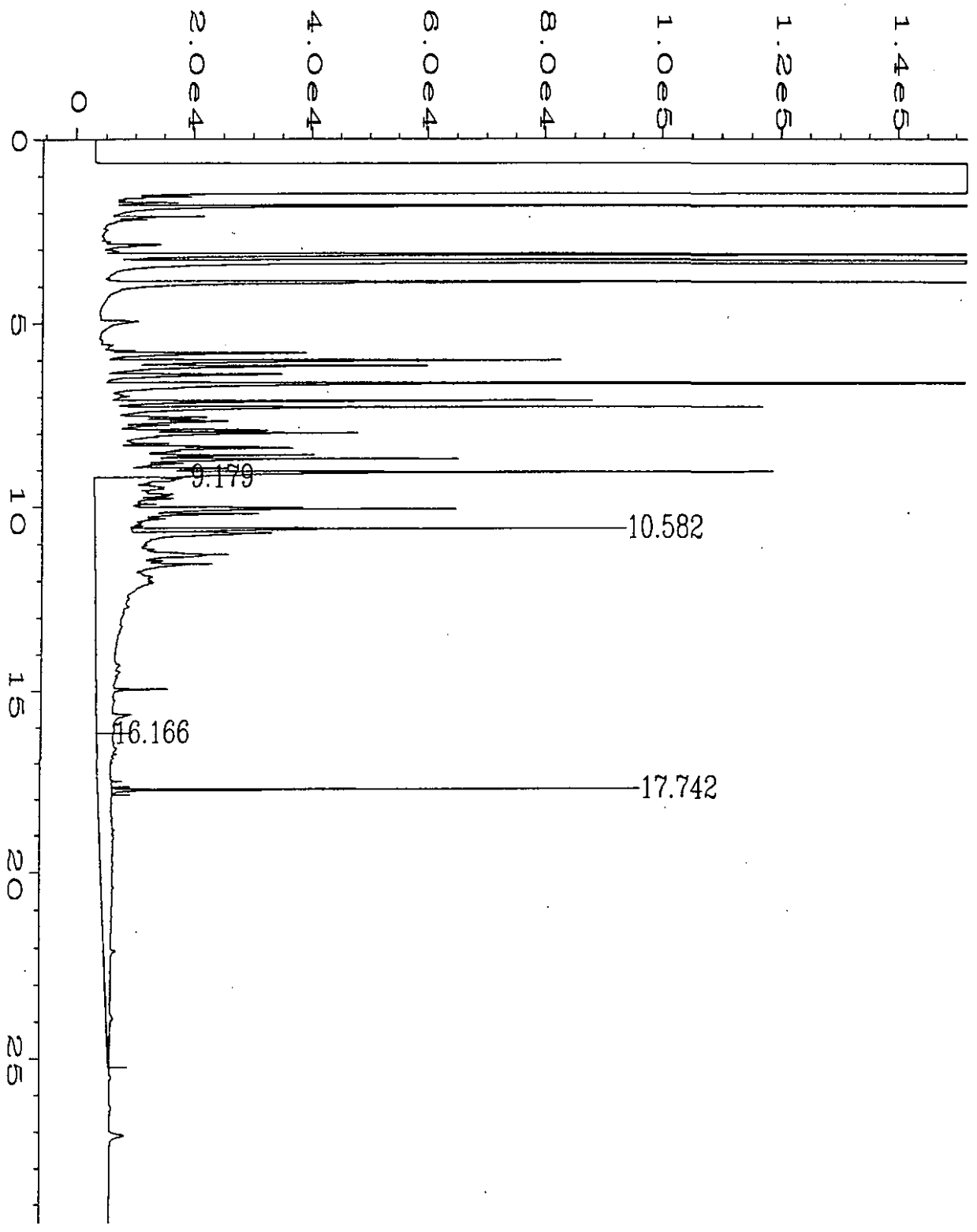
Data File Name : C:\HPCHEM\2\DATA\JUN13\031F1501.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-02W 5X
Run Time Bar Code:
Acquired on : 14 Jun 95 10:01 AM
Report Created on: 15 Jun 95 12:58 PM

Page Number : 1
Vial Number : 31
Injection Number : 1
Sequence Line : 15
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



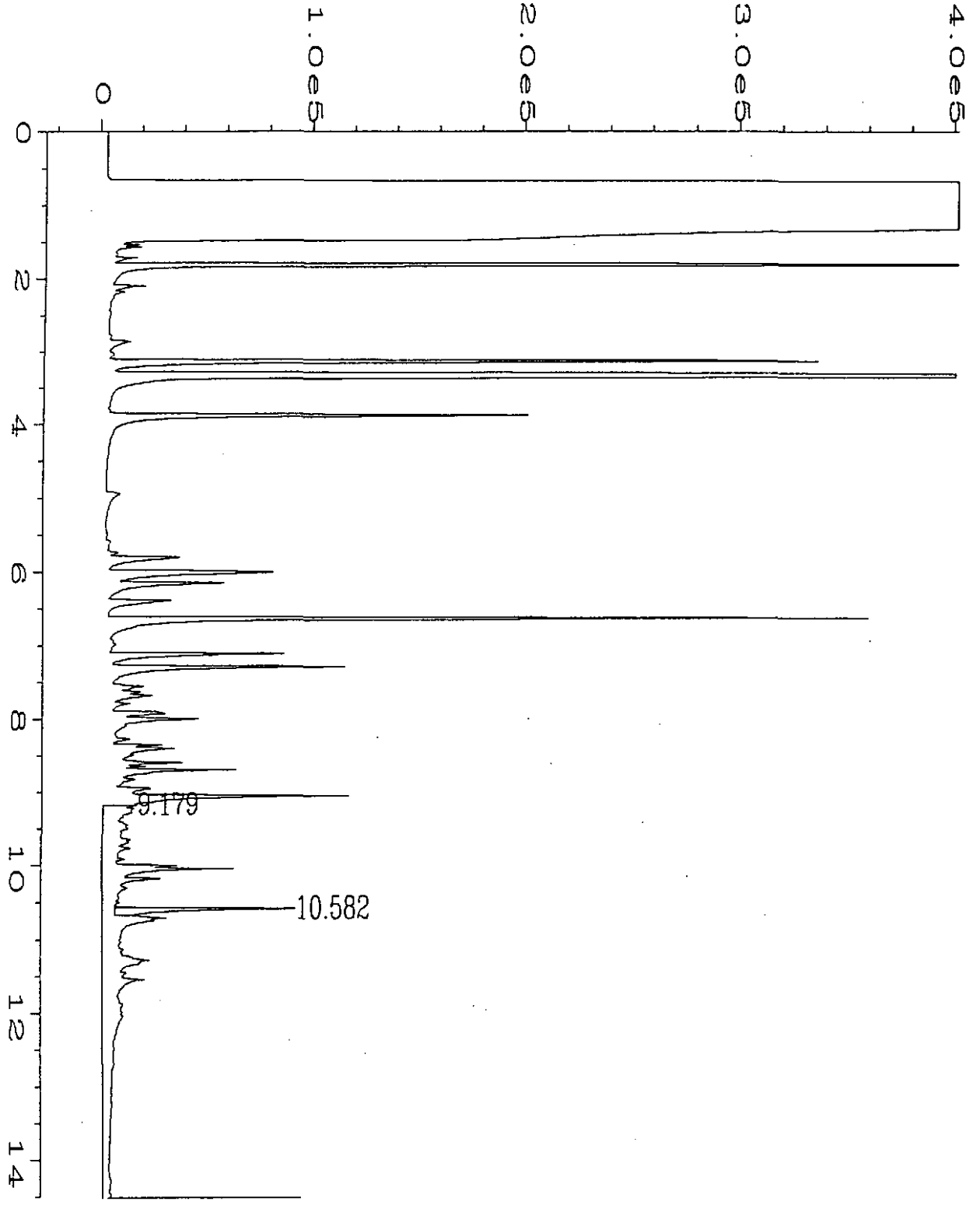
Data File Name : C:\HPCHEM\2\DATA\JUN13\031F1501.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-02W 5X
Run Time Bar Code:
Acquired on : 14 Jun 95 10:01 AM
Report Created on: 15 Jun 95 12:59 PM

Page Number : 1
Vial Number : 31
Injection Number : 1
Sequence Line : 15
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



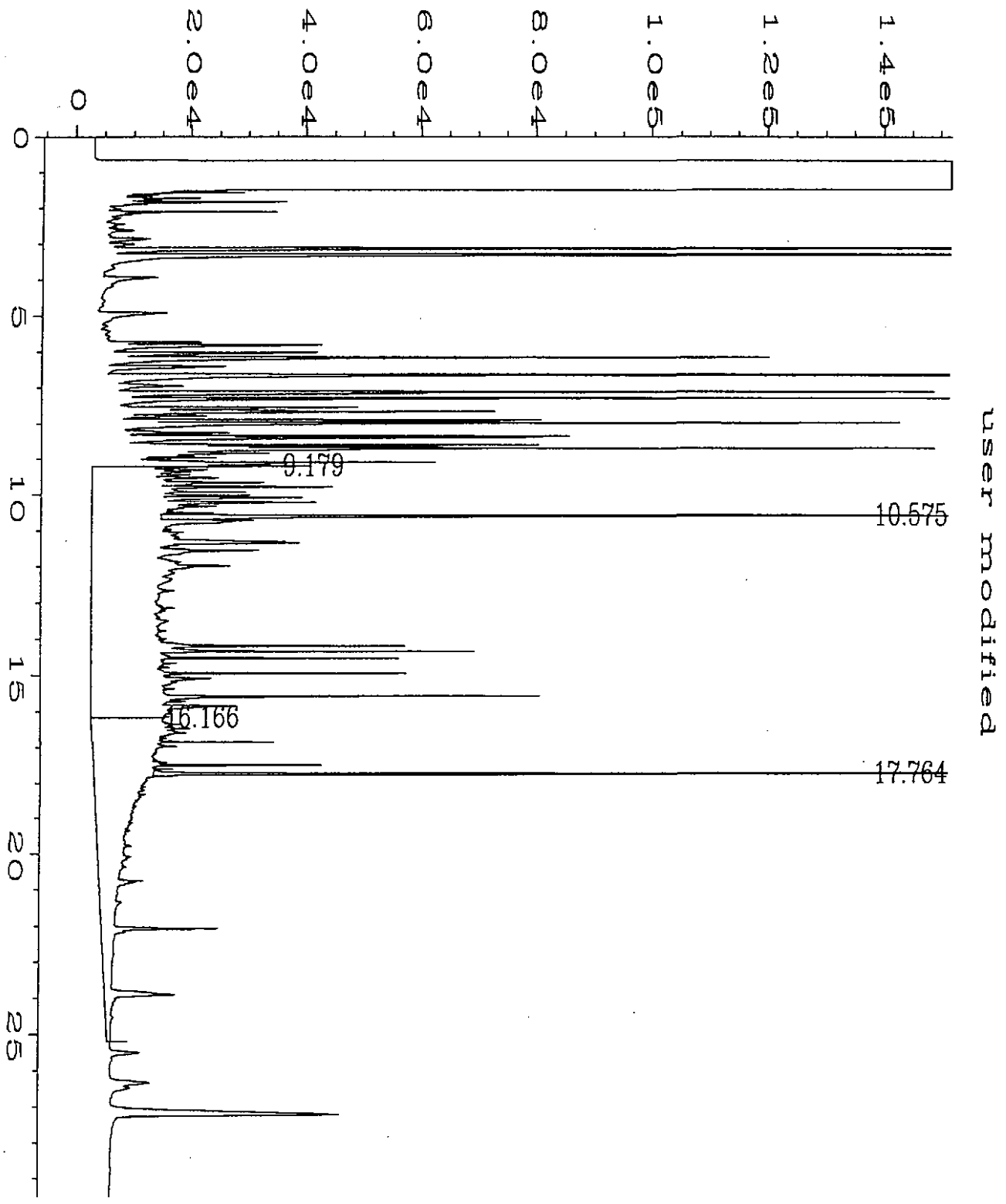
Data File Name : C:\HPCHEM\2\DATA\JUN13\032F1601.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-03W 5X
Run Time Bar Code:
Acquired on : 14 Jun 95 10:41 AM
Report Created on: 15 Jun 95 01:01 PM

Page Number : 1
Vial Number : 32
Injection Number : 1
Sequence Line : 16
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



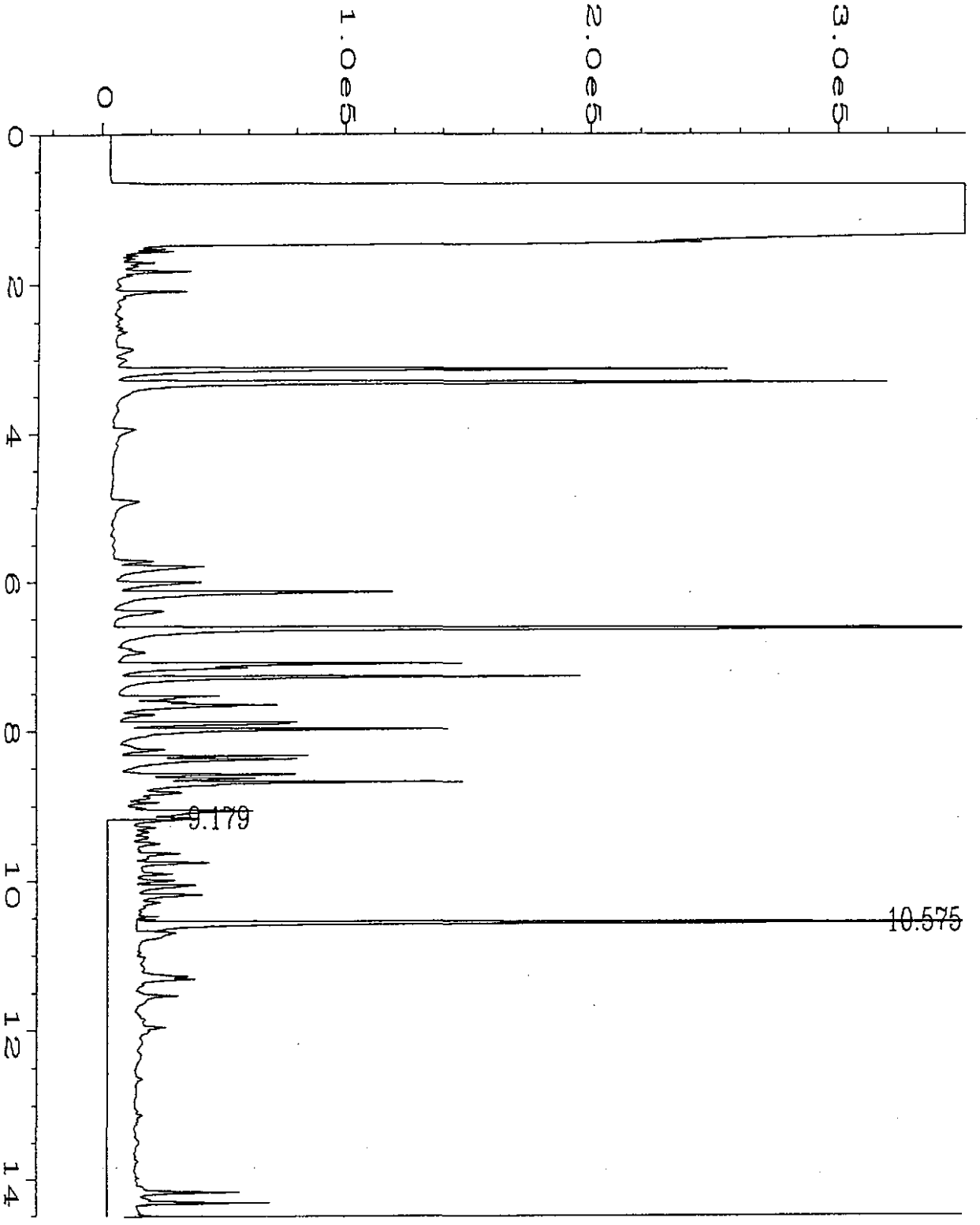
Data File Name : C:\HPCHEM\2\DATA\JUN13\032F1601.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-03W 5X
Run Time Bar Code:
Acquired on : 14 Jun 95 10:41 AM
Report Created on: 15 Jun 95 01:02 PM

Page Number : 1
Vial Number : 32
Injection Number : 1
Sequence Line : 16
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



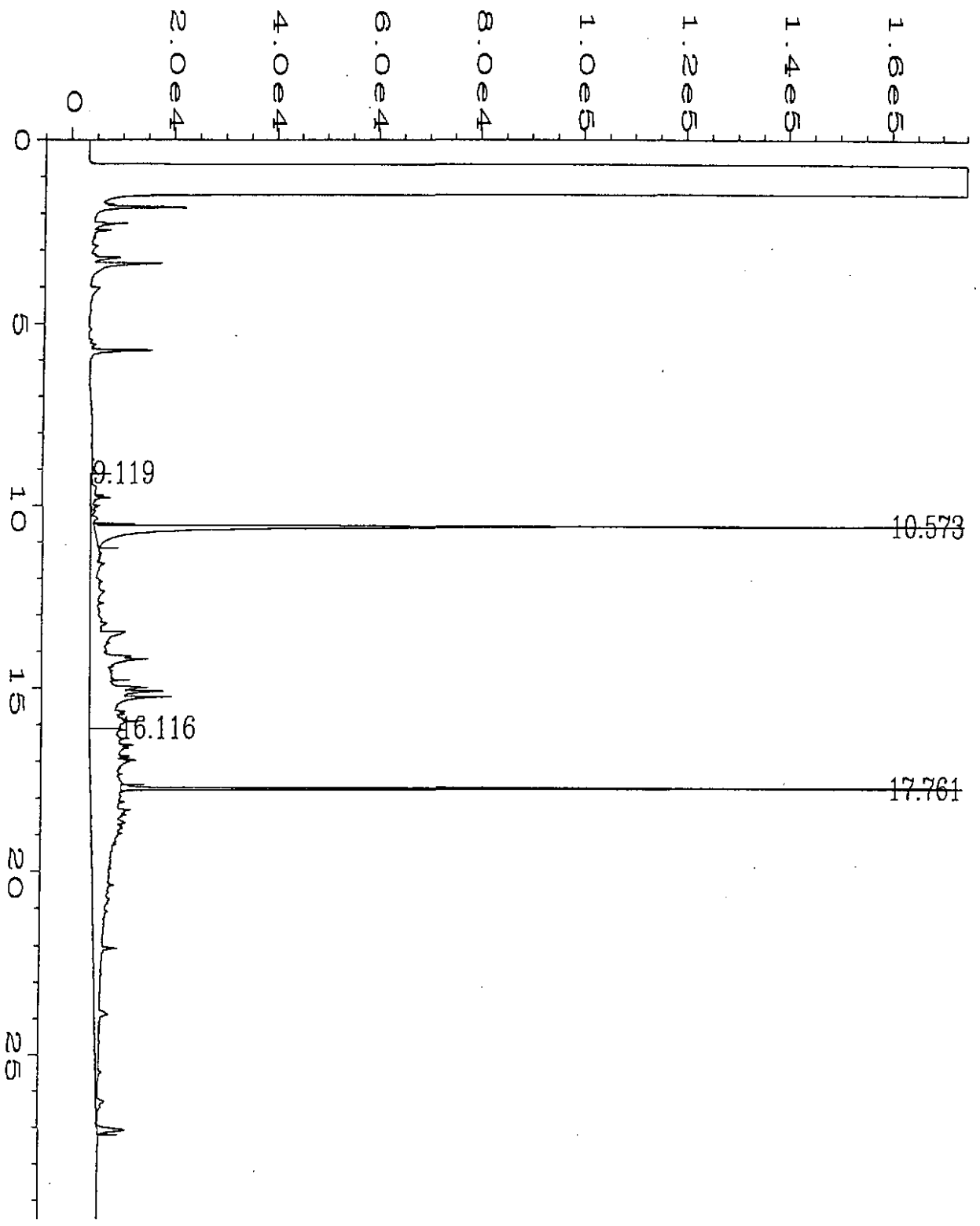
Data File Name : C:\HPCHEM\2\DATA\JUN13\033F1601.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-04W
Run Time Bar Code:
Acquired on : 14 Jun 95 11:20 AM
Report Created on: 15 Jun 95 01:03 PM

Page Number : 1
Vial Number : 33
Injection Number : 1
Sequence Line : 16
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



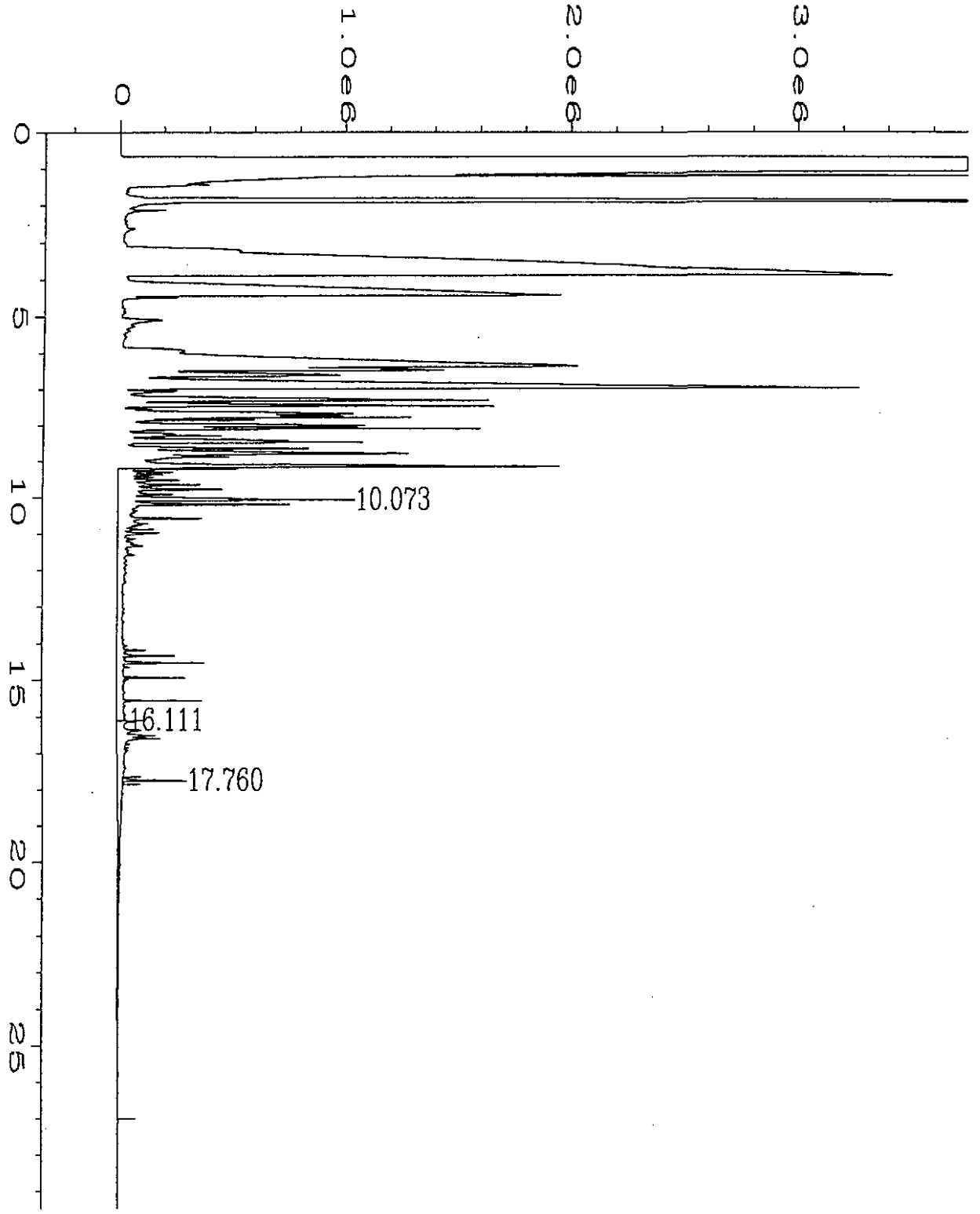
Data File Name : C:\HPCHEM\2\DATA\JUN13\033F1601.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-04W
Run Time Bar Code:
Acquired on : 14 Jun 95 11:20 AM
Report Created on: 15 Jun 95 01:04 PM

Page Number : 1
Vial Number : 33
Injection Number : 1
Sequence Line : 16
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



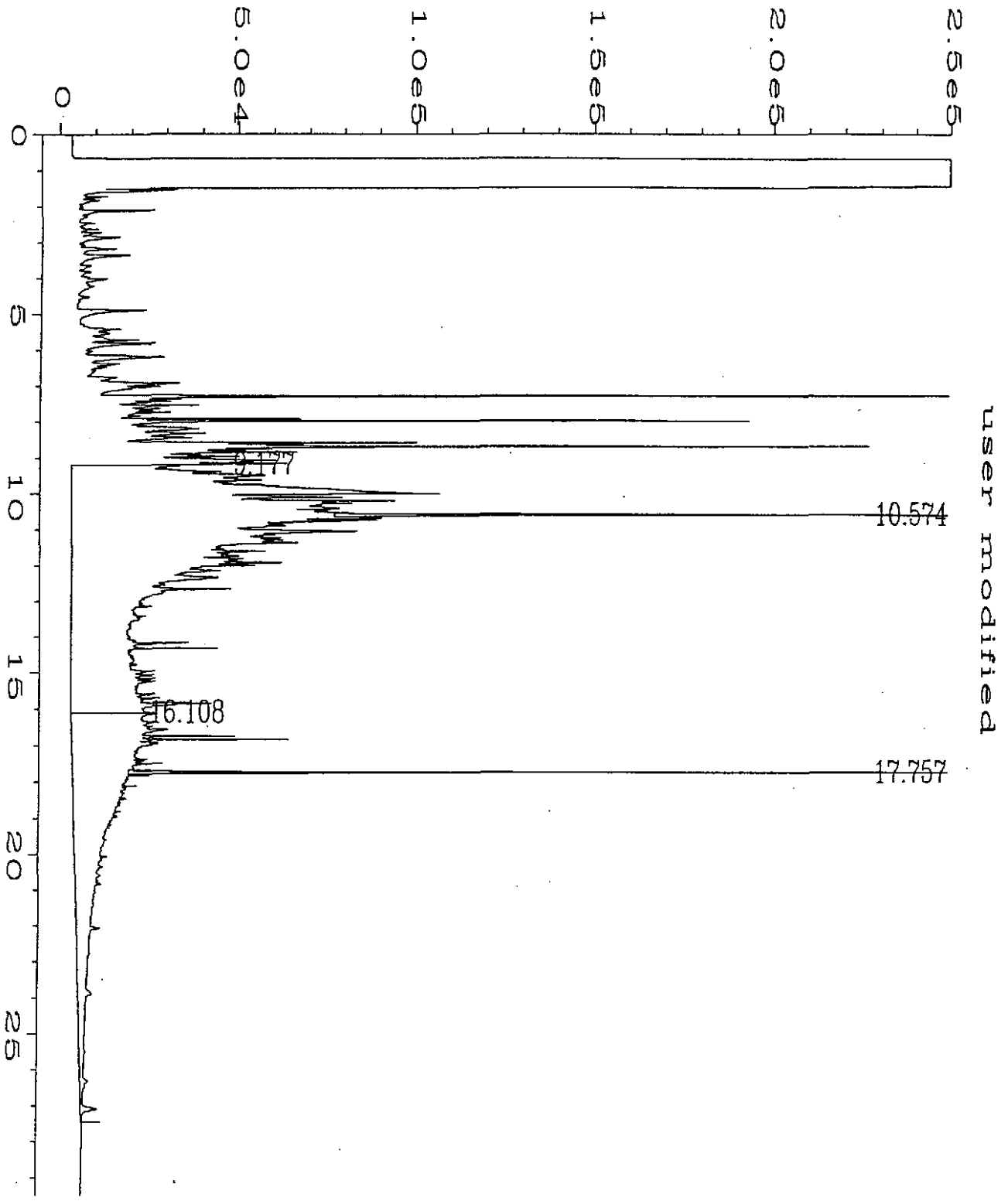
Data File Name : C:\HPCHEM\2\DATA\JUN15\005F0501.D
Operator : TF
Instrument : BOB
Sample Name : 506122-05W
Run Time Bar Code:
Acquired on : 15 Jun 95 08:50 PM
Report Created on: 16 Jun 95 07:28 AM

Page Number : 1
Vial Number : 5
Injection Number : 1
Sequence Line : 5
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



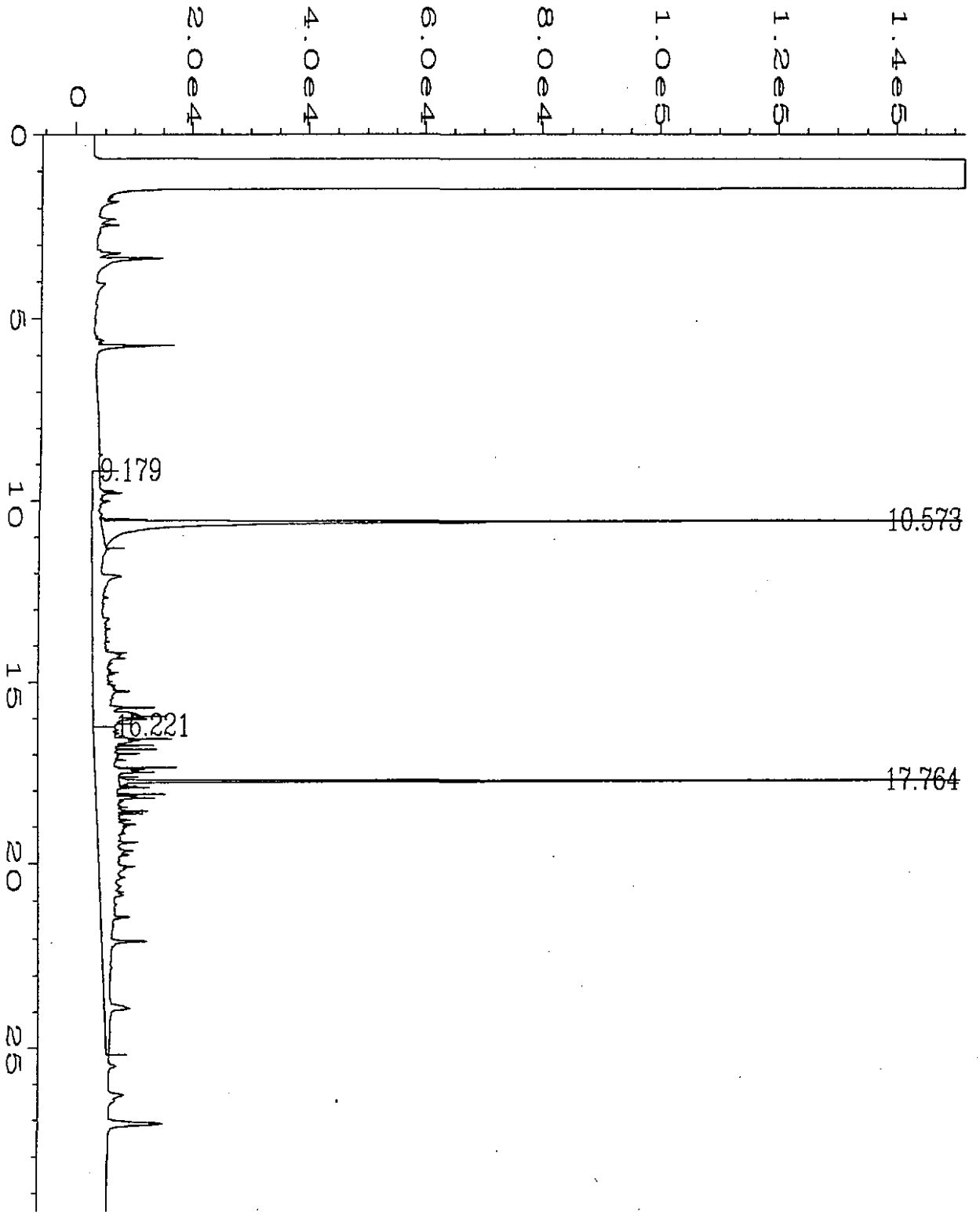
Data File Name : C:\HPCHEM\2\DATA\JUN15\006F0501.D
Operator : TF
Instrument : BOB
Sample Name : 506122-06W
Run Time Bar Code:
Acquired on : 15 Jun 95 09:41 PM
Report Created on: 16 Jun 95 07:29 AM

Page Number : 1
Vial Number : 6
Injection Number : 1
Sequence Line : 5
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



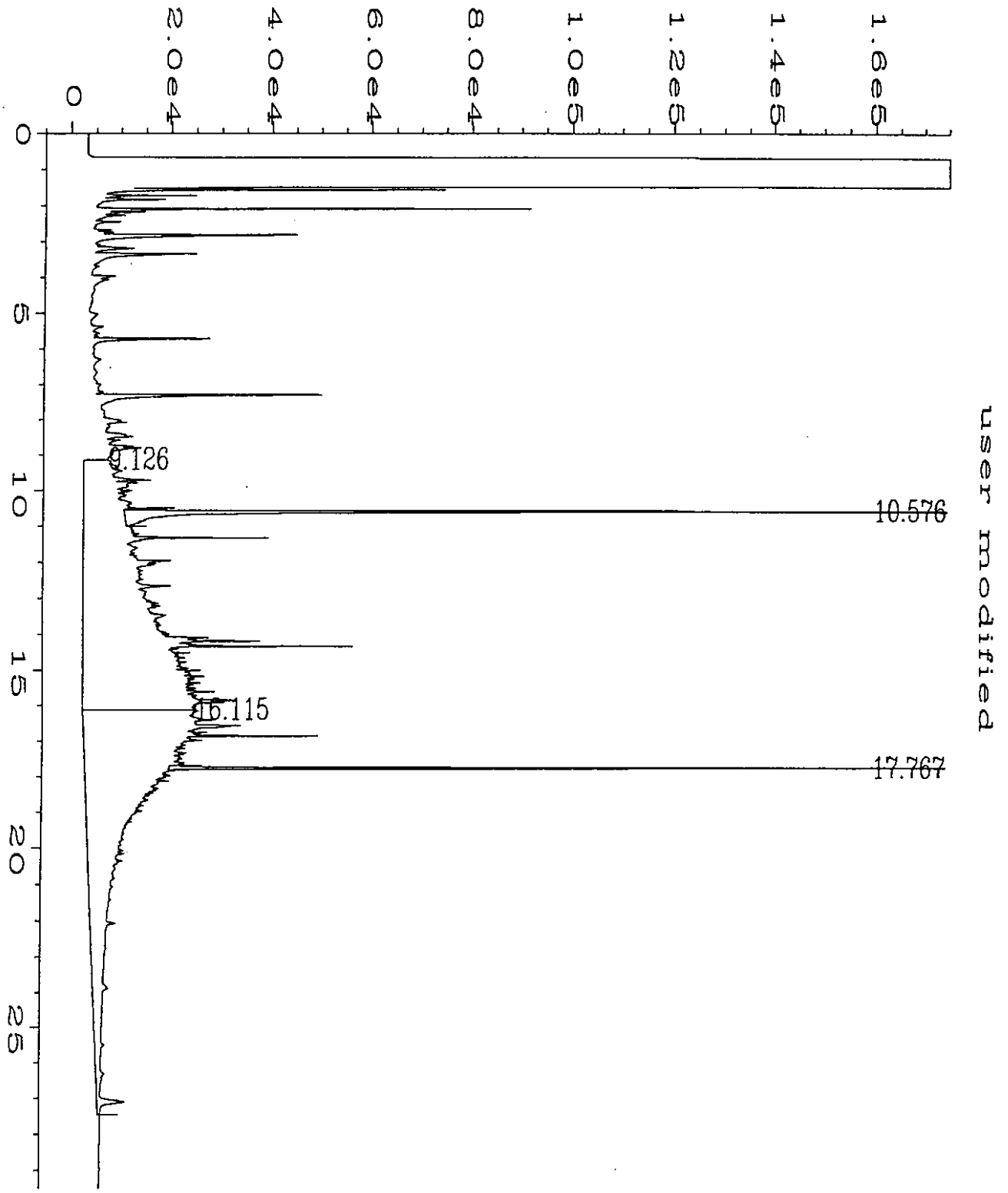
Data File Name : C:\HPCHEM\2\DATA\JUN15\007F0501.D
Operator : TF
Instrument : BOB
Sample Name : 506122-07W
Run Time Bar Code:
Acquired on : 15 Jun 95 10:13 PM
Report Created on: 16 Jun 95 07:31 AM

Page Number : 1
Vial Number : 7
Injection Number : 1
Sequence Line : 5
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



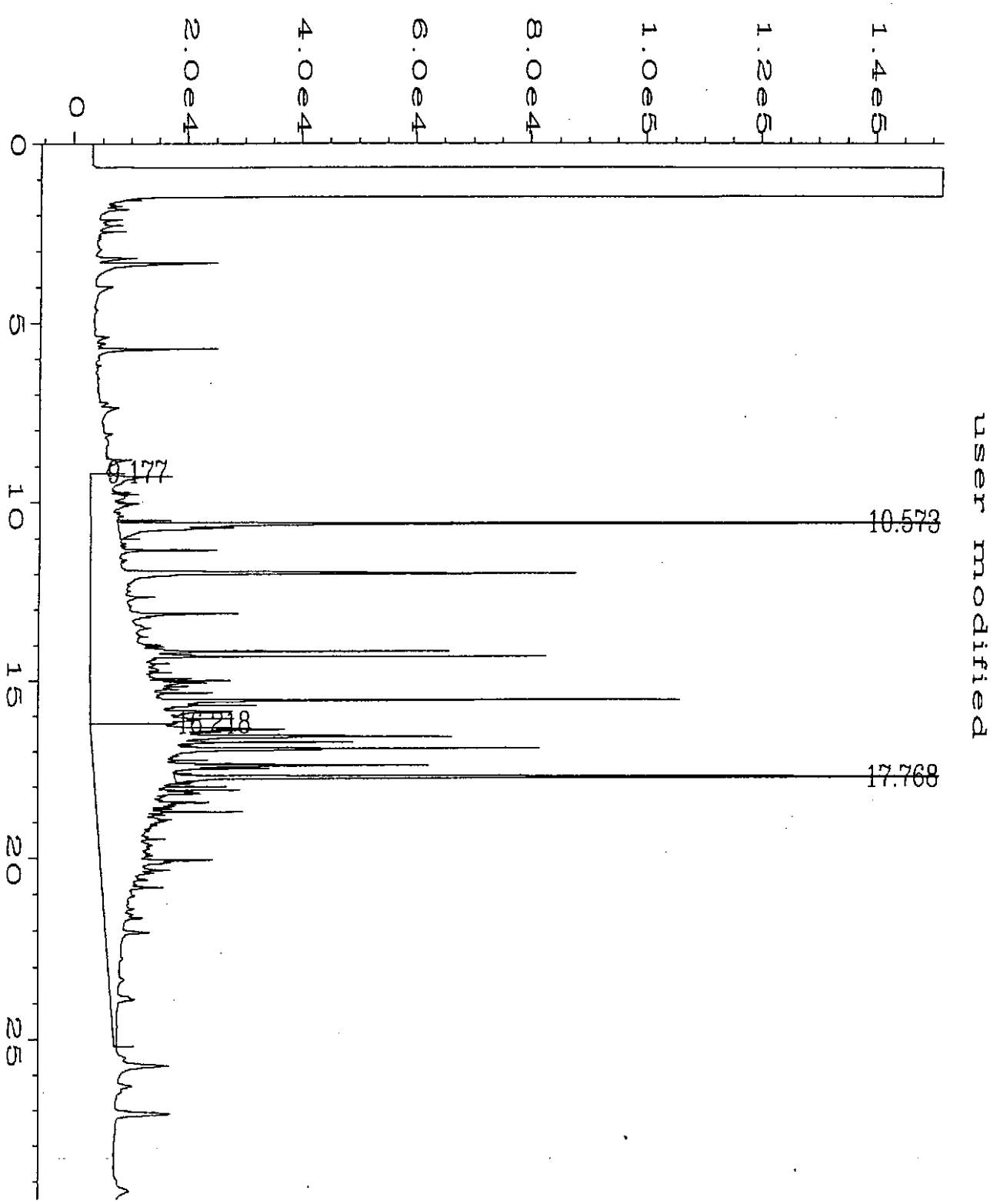
Data File Name : C:\HPCHEM\2\DATA\JUN13\037F2001.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-08W
Run Time Bar Code:
Acquired on : 14 Jun 95 03:17 PM
Report Created on: 15 Jun 95 01:07 PM

Page Number : 1
Vial Number : 37
Injection Number : 1
Sequence Line : 20
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



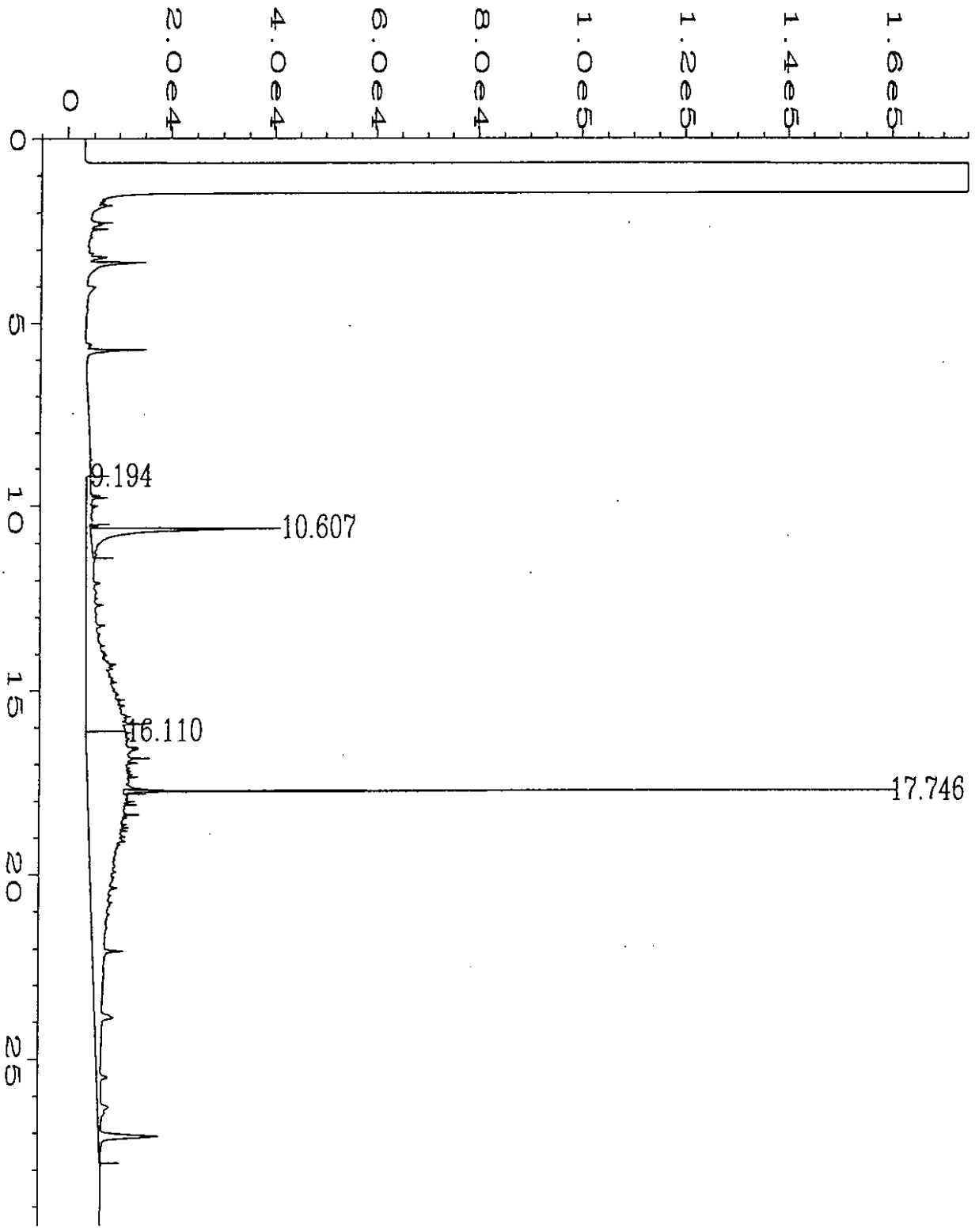
Data File Name : C:\HPCHEM\2\DATA\JUN15\008F0701.D
Operator : TF
Instrument : BOB
Sample Name : 506122-09W
Run Time Bar Code:
Acquired on : 15 Jun 95 11:32 PM
Report Created on: 16 Jun 95 07:32 AM

Page Number : 1
Vial Number : 8
Injection Number : 1
Sequence Line : 7
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



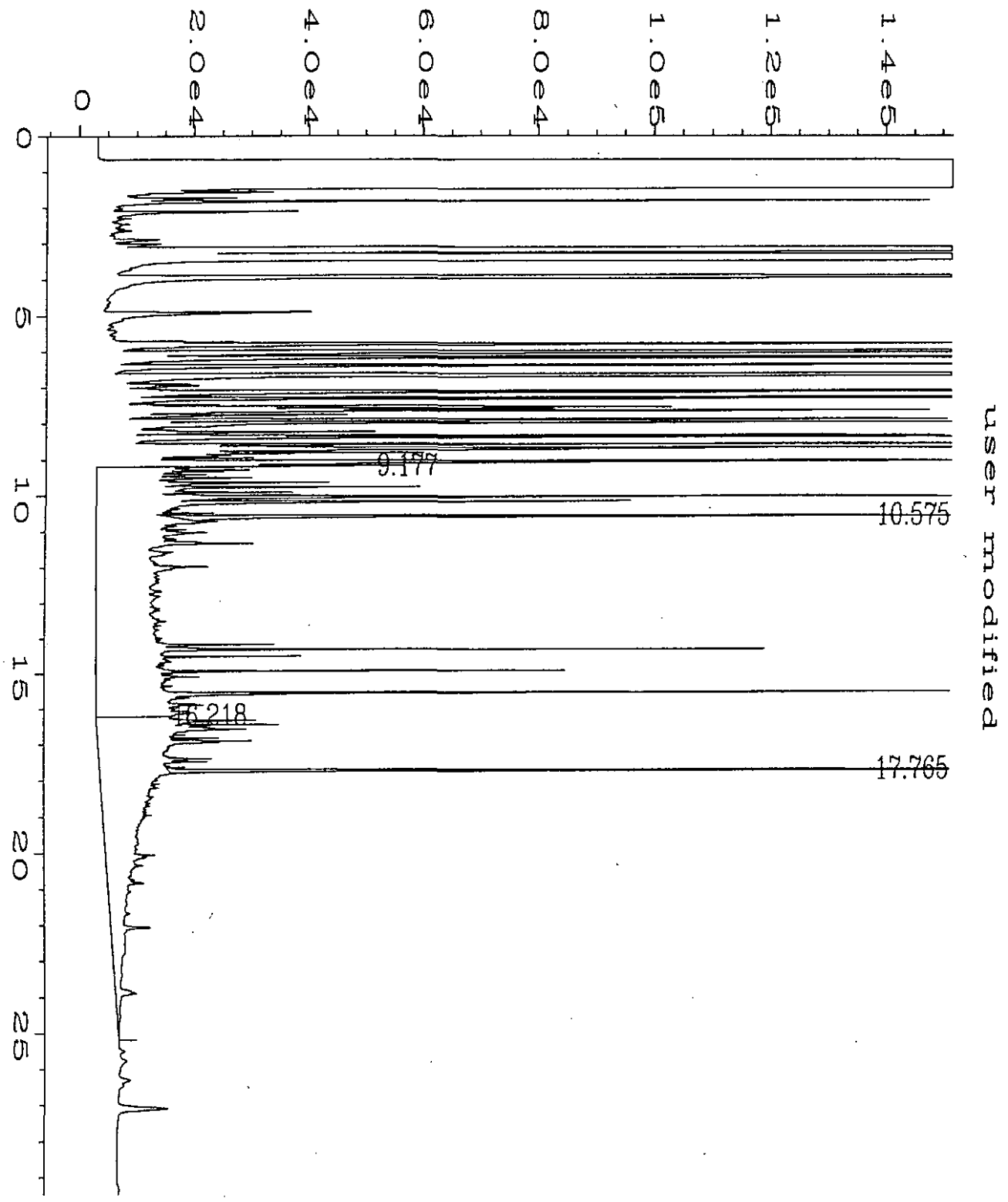
Data File Name : C:\HPCHEM\2\DATA\JUN13\076F2301.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-10W
Run Time Bar Code:
Acquired on : 14 Jun 95 06:32 PM
Report Created on: 15 Jun 95 01:23 PM

Page Number : 1
Vial Number : 76
Injection Number : 1
Sequence Line : 23
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



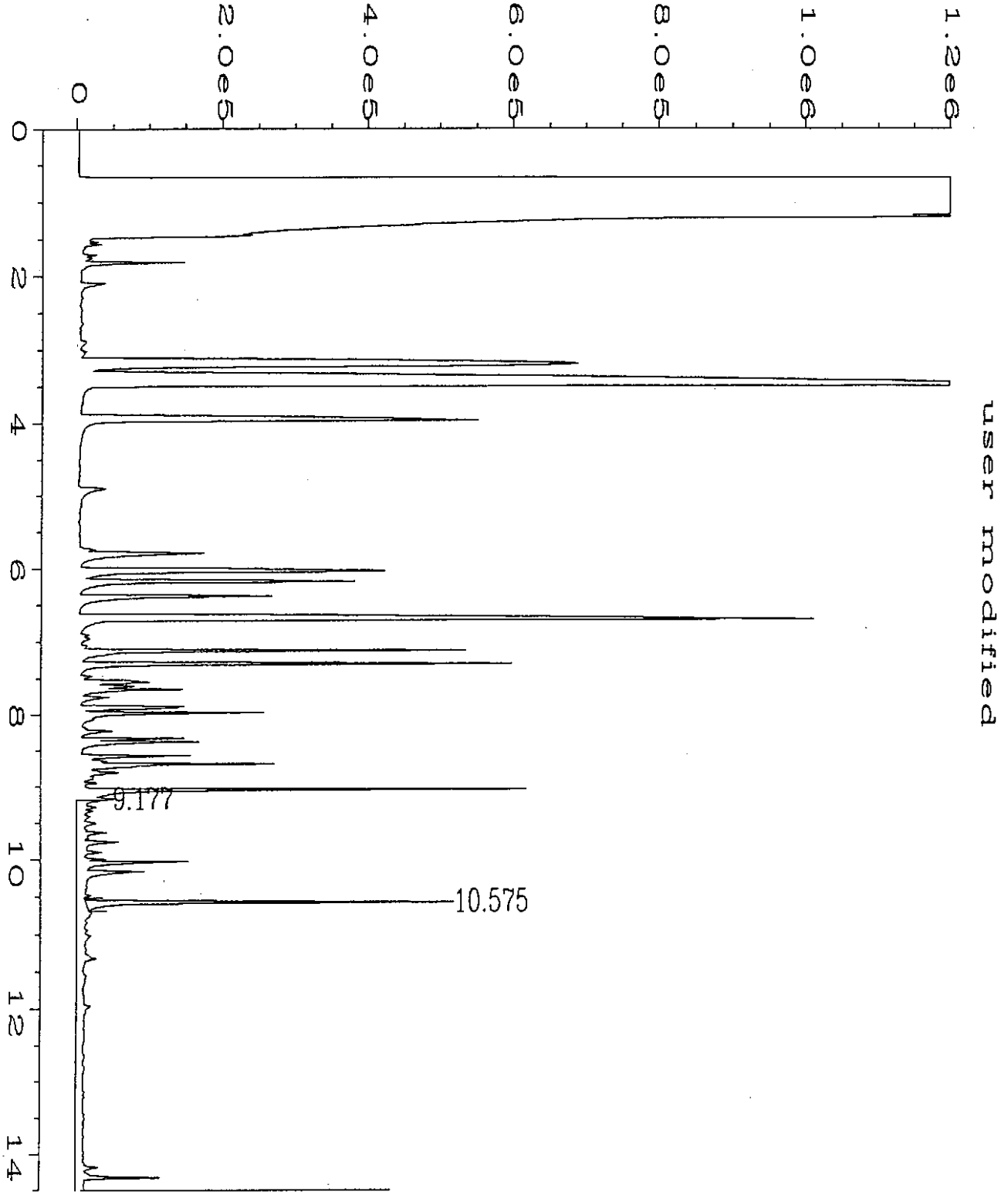
Data File Name : C:\HPCHEM\2\DATA\JUN15\010F0701.D
Operator : TF
Instrument : BOB
Sample Name : 506122-11W
Run Time Bar Code:
Acquired on : 16 Jun 95 00:50 AM
Report Created on: 16 Jun 95 07:34 AM

Page Number : 1
Vial Number : 10
Injection Number : 1
Sequence Line : 7
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



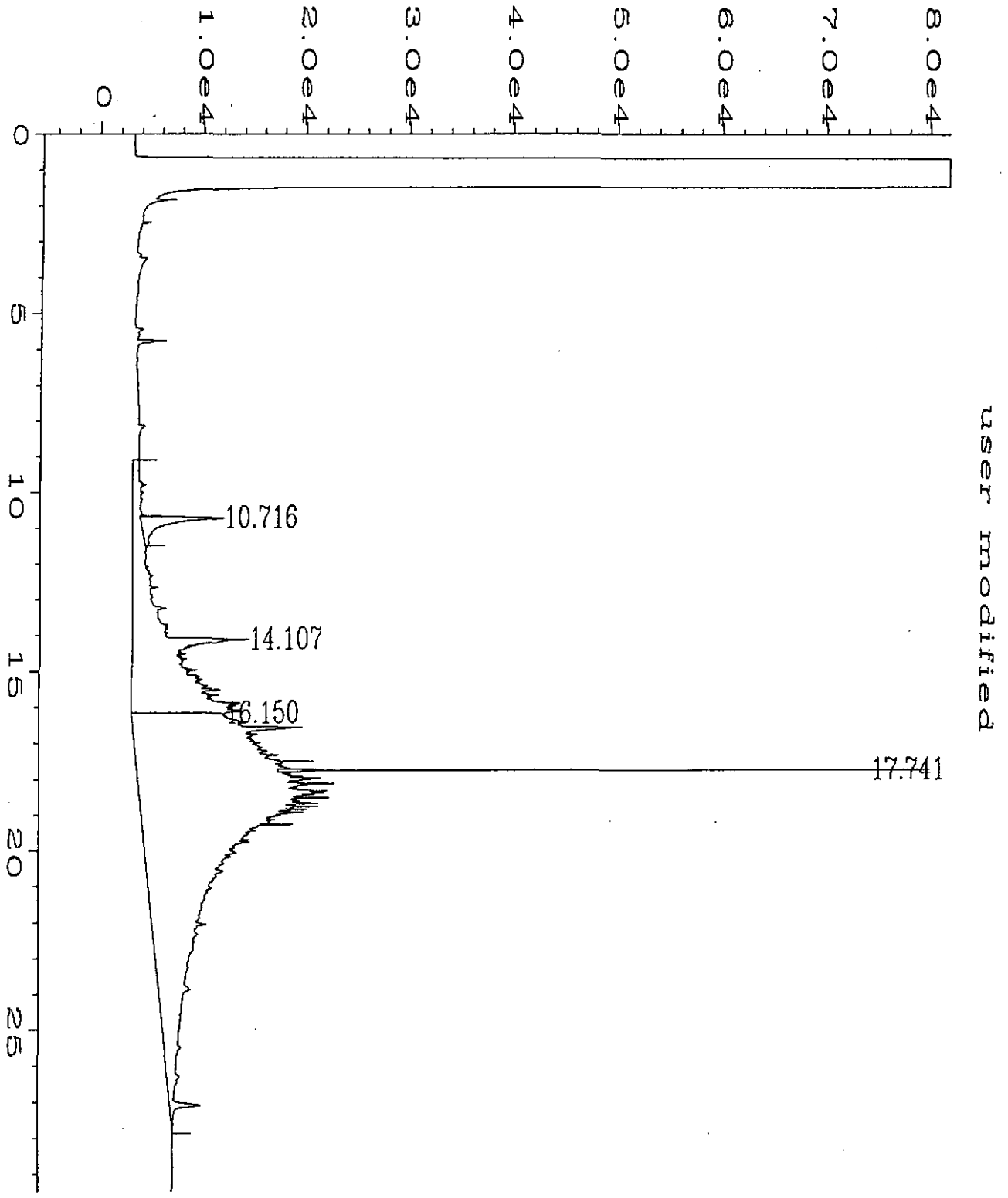
Data File Name : C:\HPCHEM\2\DATA\JUN13\078F2301.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-12W
Run Time Bar Code:
Acquired on : 14 Jun 95 07:51 PM
Report Created on: 15 Jun 95 01:26 PM

Page Number : 1
Vial Number : 78
Injection Number : 1
Sequence Line : 23
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



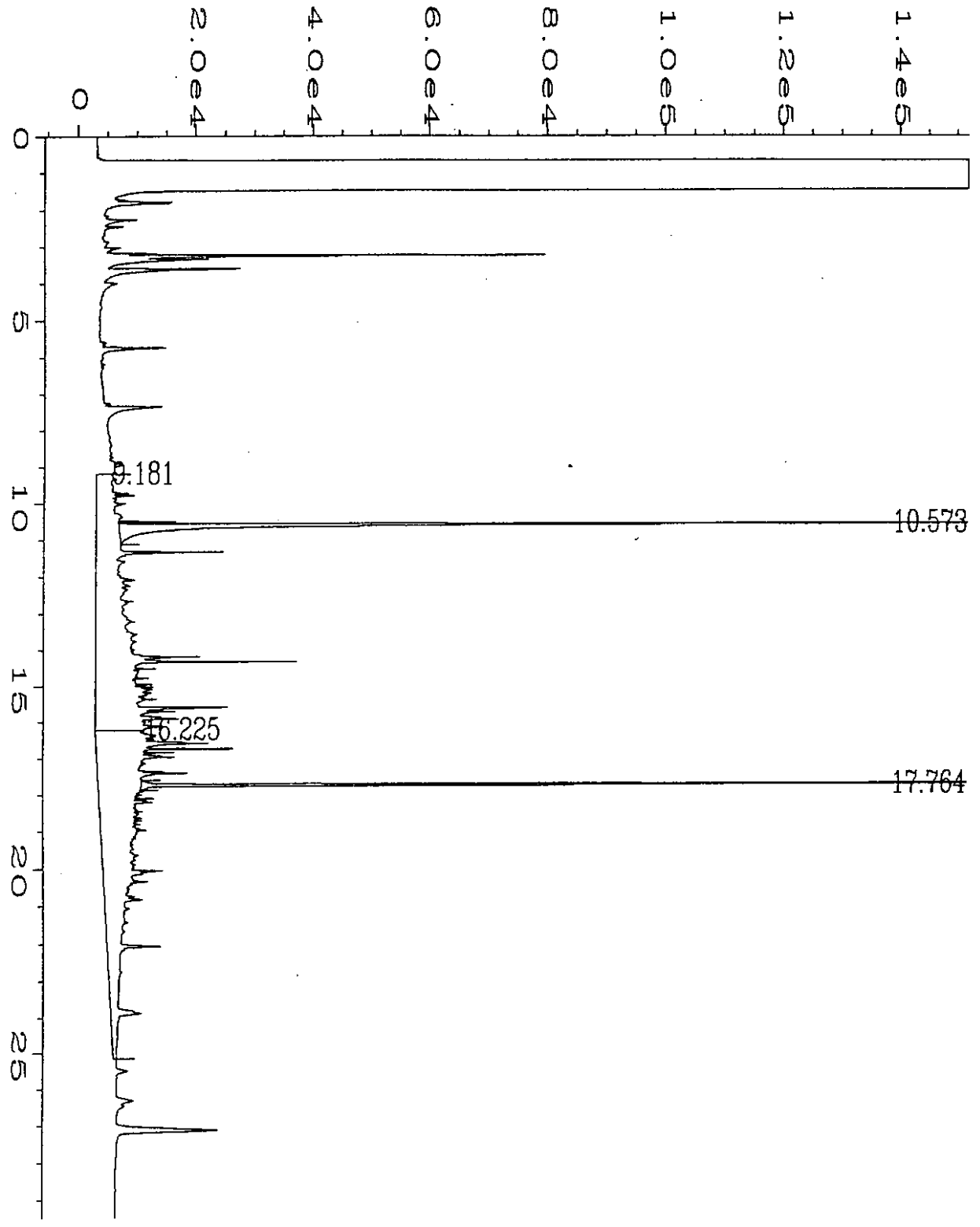
Data File Name : C:\HPCHEM\2\DATA\JUN13\078F2301.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-12W
Run Time Bar Code:
Acquired on : 14 Jun 95 07:51 PM
Report Created on: 15 Jun 95 01:29 PM

Page Number : 1
Vial Number : 78
Injection Number : 1
Sequence Line : 23
Instrument Method: TPHD.MTH
Analysis Method : TPHD.MTH



Data File Name : C:\HPCHEM\2\DATA\JUN15\009F0701.D
Operator : TF
Instrument : BOB
Sample Name : 506122-13W 5X
Run Time Bar Code:
Acquired on : 16 Jun 95 00:11 AM
Report Created on: 16 Jun 95 07:33 AM

Page Number : 1
Vial Number : 9
Injection Number : 1
Sequence Line : 7
Instrument Method: TPHDX.MTH
Analysis Method : TPHE.MTH



Data File Name : C:\HPCHEM\2\DATA\JUN13\080F2501.D
Operator : TAG
Instrument : BOB
Sample Name : 506122-14W
Run Time Bar Code:
Acquired on : 14 Jun 95 09:50 PM
Report Created on: 15 Jun 95 09:06 PM

Page Number : 1
Vial Number : 80
Injection Number : 1
Sequence Line : 25
Instrument Method: TPHD.MTH
Analysis Method : TPHE.MTH

NORTH CREEK ANALYTICAL

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HYDROCARBON ANALYSIS FOOTNOTES

2/94, Rev. 3

VOLATILE HYDROCARBONS - GASOLINE RANGE ORGANICS

G 1 This sample appears to contain extractable diesel range organics.

G 2 The chromatogram for this sample does not resemble a typical gasoline pattern. Please refer to the sample chromatogram.

G 3 The total hydrocarbon result in this sample is primarily due to an individual compound(s) eluting in the volatile hydrocarbon range. Identification and quantitation by EPA 8010, 8021 or 8240 is recommended.

G 4 This sample contains compound(s) not identified as Benzene, Toluene, Ethyl benzene or Xylene.

G 5 This sample appears to contain or be saturated with gasoline product.

EXTRACTABLE HYDROCARBONS - DIESEL RANGE ORGANICS

D 1 This sample appears to contain volatile gasoline range organics.

D 2 The hydrocarbons present in this sample resemble heavy, non-resolvable oil range organics. Quantitation by TPH-Diesel Extended or TPH 418.1 is recommended.

D 3 The hydrocarbon concentration result in this sample is partially due to an individual peak(s) eluting in the diesel / motor oil carbon range.

D 4 The hydrocarbons present in this sample are a complex mixture of diesel range and heavy oil range organics.

D 5 The hydrocarbon result shown is an estimated (greater than) value due to the high concentration. Reanalysis is being performed to yield a quantitative result. An amended report will follow.

D 6 The sample chromatographic pattern does not resemble the fuel standard used for quantitation. A fuel fingerprint is advised.

D 7 This sample appears to contain or be saturated with diesel product.

Oils and Lubricants
[----------]
TRPH 418.1

Diesel & Fuel Oils
[----------]
Extractable Hydrocarbons (TPH-D)

Gasoline
[----------]
Volatile Hydrocarbons (TPH-G)

HYDROCARBON BOILING POINT RANGE

LOW LOW TO MEDIUM MEDIUM MEDIUM TO HIGH VERY HIGH

CARBON RANGE:

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31+

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.	Client Project ID:	UNOCAL Seattle, #5353	Sampled:	Jun 6, 1995
8410 154th Avenue N.E.	Sample Matrix:	Water	Received:	Jun 7, 1995
Redmond, WA 98052	Analysis Method:	WTPH-D Extended	Extracted:	Jun 12, 1995
Attention: Norm Puri	First Sample #:	B506122-11	Analyzed:	Jun 14-19, 1995
			Reported:	Jun 20, 1995

TOTAL PETROLEUM HYDROCARBONS - DIESEL RANGE EXTENDED

Sample Number	Sample Description	Diesel Result mg/L (ppm)	Heavy Oil Result mg/L (ppm)	Surrogate Recovery %
B506122-11	MW-44	N.D.	0.82	S-1
B506122-12	MW-45	1.0 D-1	0.98	76
B506122-13	MW-46	N.D.	1.4	55
B506122-14	MW-47	0.38	0.78	76
BLK061295	Method Blank	N.D.	N.D.	82

Reporting Limit:	**0.25**	**0.75**

2-Fluorobiphenyl surrogate recovery control limits are 50 - 150%.
Extractable Hydrocarbons are quantitated as Diesel Range Organics (C12 - C24) and Heavy Oil Range Organics (>C24).
Analytes reported as N.D. were not detected above the stated Reporting Limit.

NORTH CREEK ANALYTICAL Inc.

Laura Dutton

Laura Dutton
Project Manager

Please Note:
S-1. The Surrogate Recovery for this sample is not available due to sample dilution required from high analyte concentration or matrix interference.

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9405 S.W. Nimbus Avenue • Beaverton, OR 97008-7132 (503) 643-9200 • FAX 644-2202

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Attention: Norm Puri

Client Project ID: UNOCAL Seattle, #5353
Sample Matrix: Water
Analysis Method: WTPH-D
Units: mg/L (ppm)

Analyst: T. Fitzgibbon

Extracted: Jun 12, 1995
Analyzed: Jun 14-19, 1995
Reported: Jun 20, 1995

HYDROCARBON QUALITY CONTROL DATA REPORT

ACCURACY ASSESSMENT

Laboratory Control Sample

	Diesel
Spike Conc. Added:	2.0
Spike Result:	1.4
% Recovery:	70
Upper Control Limit %:	119
Lower Control Limit %:	74

PRECISION ASSESSMENT

Sample Duplicate

	Diesel Range Organics	Diesel Range Organics
Sample Number:	B506122-01	B506165-05
Original Result:	N.D.	N.D.
Duplicate Result:	N.D.	N.D.
Relative % Difference:	Relative Percent Difference values are not reported at sample concentration levels less than 10 times the Reporting Limit.	
Maximum RPD:	44	44

NORTH CREEK ANALYTICAL Inc.

Laura Dutton
Project Manager

% Recovery: $\frac{\text{Spike Result}}{\text{Spike Concentration Added}} \times 100$

Relative % Difference: $\frac{\text{Original Result - Duplicate Result}}{(\text{Original Result + Duplicate Result}) / 2} \times 100$

506122.GEO <11>

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9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 643-9200 FAX 644-2202

UNOCAL CHAIN OF CUSTODY REPORT

UNOCAL INFORMATION

Facility Number: 5353
Site Address: Westlake & Mercer
City, State, ZIP: Seattle, WA 98144
Site Release Number:
Unocal Manager: Dr Mark Brearley - R.G.
CERT INFO: (check one) ●Evaluation o Remediation
o Detection o Demolition o Closure o Miscellaneous

CONSULTANT INFORMATION

Firm: GeoEngineers Project Number: 9161-013-R04
Address: 8410 154th Ave NE
Redmond, WA 98052
Phone: (206) 861-6000 Fax: (206) 861-6050
Project Manager: Norm Puri
Sample Collection by: DEW/TMK

Chain of Custody Record #:

Quality Assurance Data Level: [A] [X]
A: Standard Summary
B: Standard + Chromatograms

Laboratory Turnaround Days: [X] 10 | 5 | 3 | 2 | 1

o Oregon o Washington Hydrocarbon Methods

SAMPLE IDENTIFICATION	SAMPLING DATE / TIME	MATRIX (W,S,O)	# OF CONTAINERS	TPH-HCID	TPH-Gas	BTEX (EPA 8020 Mod.)	TPH-Gas + BTEX	TPH-Diesel	TPH-Diesel Extended	TPH-418.1	Halogen. Volatiles (EPA 8010)	Aromatic Volatiles (EPA 8020)	Pesticides/PCBs or PCBs Only	GC/MS Volatiles (EPA 8240/8260)	GC/MS SemiVols. (EPA 8270)	PAHs by HPLC (EPA 8310)	Lead: Total or Dissolved	TCLP Metals (8)	NCA SAMPLE NUMBER
1. SMW-3	6/6/95/1900	W	3				X		X										506122-01
2. SMW-4	1915																		02
3. MW-34	1930																		03
4. MW-35	2000																		04
5. MW-36	2015																		05
6. MW-37	2030																		06
7. MW-40	2100																		07
8. MW-41	2115																		08
9. MW-42	2130																		09
10. MW-43	2200																		10

Relinquished by:	Firm:	Date & Time	Received by:	Firm:	Date & Time
1. Tina King	GeoEngineers	0535/6/7/95	Jeff Carlson	NCA	6/7/95 1700
2.					
3.					

Final Report Approval

Were all requested results provided? [yes] [no] Define
Were results within requested turnaround? [yes] [no] "No" on back
Final Approval Signature:
Firm: Date:

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Rev. 2.2, 11/94

Comments: Please fax drop results to Norm Puri.

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NORTH CREEK ANALYTICAL
East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 (509) 924-9200 FAX 924-9290
9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 643-9200 FAX 644-2202

UNOCAL CHAIN OF CUSTODY REPORT

UNOCAL INFORMATION

Facility Number: 5353
Site Address: Westlake & Mercer
City, State, ZIP: Seattle, WA 98144
Site Release Number:
Unocal Manager: Dr Mark Brearley
CERT INFO: (check one) ●Evaluation o Remediation
o Detection o Demolition o Closure o Miscellaneous

CONSULTANT INFORMATION

Firm: GEI Project Number: 9161-013-R04
Address: 8410 154th Ave NE
Redmond, WA 98052
Phone: (206) 861-6000 Fax: (206) 861-6050
Project Manager: Norm Puri
Sample Collection by: DEW/TMK

Chain of Custody Record #:

Quality Assurance Data Level: [A] [B]
A: Standard Summary
B: Standard + Chromatograms
Laboratory Turnaround Days: [10] [5] [3] [2] [1]

o Oregon o Washington Hydrocarbon Methods

SAMPLE IDENTIFICATION	SAMPLING DATE / TIME	MATRIX (W,S,O)	# OF CONTAINERS	TPH-HCID	TPH-Gas	BTEX (EPA 8020 Mod.)	TPH-Gas + BTEX	TPH-Diesel	TPH-Diesel Extended	TPH-418.1	Halogen. Volatiles (EPA 8010)	Aromatic Volatiles (EPA 8020)	Pesticides/PCBs or PCBs Only	GC/MS Volatiles (EPA 8240/8260)	GC/MS SemiVols. (EPA 8270)	PAHs by HPLC (EPA 8310)	Lead: Total or Dissolved	TCLP Metals (8)	NCA SAMPLE NUMBER
1. MW-44	6/6/95/2215	W	3				X		X										B506122-11
2. MW-45	2230																		-12
3. MW-46	2310																		-13
4. MW47							✓	✓	✓	✓									
5.																			
6.																			
7.																			
8.																			
9.																			
10.																			

Relinquished by:	Firm:	Date & Time	Received by:	Firm:	Date & Time
1. Irina Key	GEI	6/7/95/0935	Jeff Carrier	NCA	6/7/95 1700
2.					
3.					

Final Report Approval

Were all requested results provided? [yes] [no] Define
Were results within requested turnaround? [yes] [no] "No" on back
Final Approval Signature:
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Rev. 2.2, 11/94

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