Report of Geoenvironmental Services
Results of Ground Water Monitoring
Unocal Service Station 5353
Seattle, Washington

June 10, 1994

For

Unocal CERT - Northern Region

GeoEngineers

June 10, 1994

Geotechnical, Geoenvironmental and Geologic Services

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

Attention: Dr. Mark Brearley, R.G.

We are submitting two copies of our report "Report of Geoenvironmental Services, Results of Ground Water Monitoring" for Unocal Service Station 5353 in Seattle, Washington. This report summarizes ground water monitoring activities conducted October 7, 1993 to April 7, 1994. Contractual terms for our services are described in blanket contract number B1982G.

We appreciate the opportunity to be of continued service to Unocal. Please call if you have questions regarding this report.

Yours very truly,

GeoEngineers, Inc.

Stephen C. Perrigo
Principal

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RESULTS OF GROUND WATER MONITORING
UNOCAL SERVICE STATION 5353
SEATTLE, WASHINGTON
FOR
UNOCAL CERT - NORTHERN REGION

INTRODUCTION

This report summarizes the results of GeoEngineers' ground water monitoring activities conducted at and in the vicinity of Unocal Service Station 5353 from October 7, 1993 to April 7, 1994. 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. Approximately 80,000 gallons of leaded premium gasoline was released from a product line at the Unocal site in 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.

The land use in the area of the site between the late 1800s and the present was primarily commercial, light industrial and heavy industrial, based on our historical research. Approximately 20 potential petroleum storage facilities, both former and current, have been identified within a quarter-mile radius of the site.

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 1965 to 1968 and has owned the site since 1968. 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 operating. 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 and south beneath Mercer Street.

A free product recovery system was installed at the site in June 1980. The recovery system was 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. We estimate that the vapor equivalent of approximately 4,700 gallons of gasoline was recovered by the VES during this period.

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, Mercer Street, Terry Avenue 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 which still exist are shown in Figure 1.

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 consisting of sawdust and wood chips was 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 those borings that extended to this depth.

GROUND WATER CONDITIONS

Ground water is present at a depth of 8 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 specific scope of our ground water monitoring services during this reporting period is as follows.

1. Measure the depths to ground water in selected monitoring wells during the December 29 and 30, 1993, and the April 7, 1994 sampling visit, and calculate water table elevations relative to an assumed site datum. Our field procedures are described in Appendix A.
2. Measure combustible vapor concentrations in the airspace of selected monitoring well casings using a Bacharach TLV Sniffer calibrated to hexane.
3. Obtain product or ground water samples from monitoring wells MW-34, MW-37 and MW-40 on October 7, 1993; MW-2 on October 15, 1993; MW-32A, MW-33, MW-34, MW-35, MW-36, MW-40, MW-41, MW-42, MW-43, MW-45 and MW-47 on December 29 or 30, 1993; MW-37 on January 6, 1994; and MW-32A, MW-33, MW-34, MW-35, MW-37, MW-40, MW-42, MW-45 and MW-47 on April 7, 1994. 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 oil-range hydrocarbons by Ecology Method WTPH-D extended. Submit selected samples for laboratory analysis of one or more of the following: HVOCs (halogenated volatile organic compounds) by EPA Method 8010 and total or dissolved (field filtered) lead by EPA Method 7421.

GROUND WATER AND FREE PRODUCT SAMPLING

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in the well casings of monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-36, MW-37, MW-40, MW-41, MW-42, MW-45 and MW-47 on December 29 or 30, 1993, and monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-37, MW-40, MW-42, MW-45 and MW-47 on April 7, 1994 using a Bacharach TLV Sniffer. The results are summarized in Table 1. Combustible vapors were measured in the well casings at concentrations greater than 10,000 ppm (parts per million) in all wells except MW-33 and MW-34 (less than 400 ppm) and MW-41 (5,500 ppm) on December 29 or 30. Combustible vapors were measured in the well casings at concentrations greater than 10,000 ppm in all wells except MW-32A, MW-33, MW-34 and MW-35 (all less than 400 ppm) on April 7.

GROUND WATER ELEVATIONS

Ground water levels were measured in the well casings of monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-36, MW-37, MW-40, MW-41, MW-42, MW-45 and MW-47 on December 29 or 30, 1993, and monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-37, MW-40, MW-42, MW-45 and MW-47 on April 7, 1994 using an electric water level indicator. The depths to water and the corresponding calculated ground water elevations are summarized in Table 1. The depths to water measured in the monitoring wells ranged from 8.79 to 11.24 feet on December 29 and 30. The depths to water measured in the monitoring wells ranged from 8.22 to 10.88 feet on April 7. Approximately 0.4 feet of free product was present in MW-37 on December 30, and approximately 0.08 feet on April 7. Ground water elevations, inferred ground water contours and flow direction based on December 29 and 30 measurements are shown in Figure 2.

GROUND WATER SAMPLING AND ANALYSIS

GeoEngineers obtained ground water samples from monitoring wells MW-34 and MW-40, and a product sample from monitoring well MW-37 on October 7, 1993. We obtained a sample of ground water-product mixture from monitoring well MW-2 on October 15, 1993. We obtained ground water samples from monitoring wells MW-32A, MW-33, MW-34, MW-35, MW-36, MW-40, MW-42, MW-43, MW-45 and MW-47 on December 29 and 30, 1993. We obtained a free product sample from monitoring well MW-37 on January 6, 1994. We obtained ground water samples from MW-32A, MW-33, MW-34, MW-35, MW-40, MW-42, MW-45 and MW-47, and a ground water-product sample from MW-37 on April 7, 1994. Monitoring well locations are shown in Figure 1. Each sample was submitted for laboratory analysis of BETX, and gasoline-, diesel- and heavy oil-range hydrocarbons. In addition, the October 15 sample from MW-2 and October 7 sample from MW-37 were analyzed for HVOCs; the October 7 samples from MW-34, MW-37 and MW-40 were analyzed for total lead; and the October 7 samples from MW-34 and MW-40 were analyzed for dissolved lead. The portions of the samples that were submitted for analysis of dissolved lead were field filtered. Sampling procedures are described in Appendix A. Chemical analytical results are summarized in Table 2 and Figure 3. The laboratory reports and our review of the laboratory QA/QC program are included in Appendix B.

Dissolved-phase benzene, ethylbenzene, toluene and/or xylenes were detected at concentrations exceeding the MTCA Method A ground water cleanup levels in the samples obtained from monitoring wells MW-2 (October 15), MW-32A (December 29 and April 7), MW-33 (December 29 and April 7), MW-34 (October 7, December 29 and April 7), MW-35 (December 29 and April 7), MW-40 (December 29 and April 7), MW-42 (December 30 and April 7), MW-43 (December 30) and MW-45 (December 29 and April 7). 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-2 (October 15), MW-32A

(December 29 and April 7), MW-33 (December 29 and April 7), MW-34 (October 7, December 29 and April 7), MW-35 (December 29 and April 7), MW-36 (December 30), MW-40 (October 7, December 30 and April 7), MW-42 (December 30 and April 7) and MW-45 (December 29 and April 7). BETX, and gasoline-, diesel- and/or heavy oil-range hydrocarbons were detected in the free product samples obtained from monitoring well MW-37 on October 7, January 6 and April 7. Identification of the products present in the samples is discussed in the section titled "Laboratory Data Evaluation."

LABORATORY DATA EVALUATION

The laboratory data for the ground water samples were reviewed by EcoChem (EcoChem, Inc.) to evaluate the types of petroleum compounds and products present in the sample and compare them to the types of petroleum compounds and products present at the Rosen site to the south of the Unocal site, as discussed in our draft report dated May 9, 1994. EcoChem's methodology and conclusions are presented in their report dated May 3, 1994, included as Appendix C. The apparent identities of the contaminants present in the ground water samples, based on EcoChem's report, are summarized in Table 2.

Based on EcoChem's evaluation of the data, the samples from MW-40, located downgradient of the Rosen site, contained aged gasoline and motor oil similar to the aged gasoline and motor oil present in soil samples obtained from the Rosen site. The samples obtained from MW-2, MW-32A, MW-33, MW-34, MW-35, MW-37, MW-42, MW-43 and MW-45 contained a fresher gasoline product that did not resemble the aged gasoline present in MW-40 and at the Rosen site. The samples obtained from MW-2 and MW-42 also contained motor oil. The petroleum hydrocarbons present in MW-36 and MW-47 were not possible to identify because of the low concentrations in these samples.

DISCUSSION

Free product is present in MW-37, located beneath Mercer Street to the south of the site, and occasionally in MW-2, located in the northern portion of the site. Petroleum-related ground water contamination is present beneath the site at concentrations exceeding the applicable cleanup levels.

Petroleum-related ground water contamination also is present at concentrations exceeding the applicable cleanup levels in the following off-site wells.

- MW-40, located crossgradient or upgradient of the Unocal site and downgradient of the Rosen site
- MW-43, located crossgradient of the Unocal site
- MW-42, located crossgradient of the Unocal site
- MW-36, located downgradient of the Unocal site

EcoChem's evaluation of the laboratory data indicated that the product present in MW-40, located between the Unocal site and the Rosen site, consisted of aged gasoline and motor oil. The product present in all of the remaining wells tested consisted of fresher gasoline. Motor oil also was present in MW-2 and MW-42. EcoChem's evaluation indicated that the product present in MW-40 was distinctly different from the product present in the remaining wells, and probably was not related to the 1980 release at the Unocal site.

High concentrations of combustible vapors were detected in all wells during this reporting period with the exception of MW-33 and MW-34. Previous studies indicate that the combustible vapors predominantly consist of methane. The combustible vapor concentrations in several of the monitoring wells fluctuated widely during this reporting period. The cause of these fluctuations is not known.

To further delineate the limits of the plume of contaminated ground water, we plan to obtain samples from monitoring wells MW-39, MW-44, MW-46 and MW-48 during the next sampling visit. In addition, samples will be obtained from monitoring wells SMW-3 and SMW-4, if possible.

LIMITATIONS

We have prepared this report for use by Unocal in their evaluation of ongoing vapor recovery efforts at Service Station 5353. This report may be made available to potential buyers of the property and to regulatory agencies. This report is not intended for use by others and the information contained herein may not be applicable to other sites.

Our services have been completed in accordance with generally accepted practices in this area at the time the report was prepared. No other warranty or conditions, express or implied, should be understood.

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.

Norman L. Puri, P.E.
Environmental Engineer

Stephen C. Perrigo
Principal

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Document ID: 0161013.GW1

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	12/29/93	10.73	9.97	>10,000
	04/07/94	10.65	10.05	<400
MW-33	12/29/93	10.82	9.93	<400
	04/07/94	10.60	10.15	<400
MW-34	12/29/93	11.01	10.41	<400
	04/07/94	10.88	10.54	<400
MW-35	12/29/93	10.23	9.87	>10,000
	04/07/94	9.91	10.19	<400
MW-36	12/30/93	9.42	8.38	>10,000
MW-37	12/30/93	10.59[4]	10.74	>10,000
	04/07/94	10.49[5]	10.59	>10,000
MW-40	12/30/93	10.68	10.21	>10,000
	04/07/94	9.35	11.54	>10,000
MW-41	12/29/93	11.24	15.76	5,500
MW-42	12/30/93	9.62	10.72	>10,000
	04/07/94	9.36	10.98	>10,000
MW-45	12/29/93	8.79	9.36	>10,000
	04/07/94	8.22	9.93	>10,000
MW-47	12/30/93	9.50	10.33	>10,000
	04/07/94	10.47	9.36	>10,000

Notes:

[1]Approximate locations of monitoring wells are shown in Figures 1 through 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 slip cap.

[4]0.40 foot of product was measured in MW-37 on 12/30/93.

[5]0.08 foot of product was measured in MW-37 on 04/07/94.

Field procedures are described in Appendix A.

TABLE 2 (Page 1 of 2)
SUMMARY OF MONITORING WELL GROUND WATER AND FREE PRODUCT[1]
CHEMICAL ANALYTICAL DATA

Sample Number	Date Sampled	BETX[2] (µg/l) B	E	T	X	Gasoline-range Hydrocarbons[3] (mg/l)	Diesel-range Hydrocarbons[4] (mg/l)	Heavy Oil-range Hydrocarbons[4] (mg/l)	Product Type[5]
MW-2[6]	10/15/93[7]	1,300	310	1,700	4,100	50	200	150	G MO
MW-32A	12/29/93	6,300	940	990	1,700	19	2.9	1.3	G
	04/07/94	3,900	490	150	590	11.0	2.1	1.3	
MW-33	12/29/93	560	250	100	1,100	7.2	1.1	<0.75	G
	04/07/94	220	80	1.5	190	3.5	1.0	1.1	
MW-34	10/07/93[8]	1,400	120	480	440	4.2	1.6	0.97	G
	12/29/93	15,000	1,500	11,000	7,000	52	2.2	<0.75	
	04/07/94	4,500	260	930	840	9.8	1.4	<0.75	
MW-35	12/29/93	580	200	40	720	4.2	1.0	<0.75	G
	04/07/94	480	140	51	550	5.3	0.87	<0.75	
MW-36	12/30/93	0.7	<0.5	<0.5	<0.5	<0.1	0.37	0.94	?
MW-37	10/07/93[7,9]	7,500[10]	28,000[10]	69,000[10]	170,000[10]	2,000,000[10]	82,000[10]	<94,000[10,11]	G
	01/06/94[9]	6,200[10]	27,000[10]	63,000[10]	150,000[10]	1,600,000[10]	90,000[10]	14,000[10]	
	04/07/94	660	1,500	3,600	9,500	92.0	18	<0.75	
MW-40	10/07/93[12]	36	2.1	1.8	5.3	0.93	1.8	1.9	aG MO
	12/30/93	34	11	1.1	7.4	1.5	5.4	4.2	
	04/07/94	29	6.9	1.1	2.6	1.2	2.2	2.0	
MW-41	12/29/93	4.6	<0.5	<0.5	<0.5	<0.1	<0.25	<0.75	--
MW-42	12/30/93	570	<0.5	0.5	0.7	<0.1	1.3	2.4	G MO
	04/07/94	620	<1.0	<1.0	<1.0	<0.2	0.84	1.1	
MW-43	12/30/93	82	11	0.5	100	0.34	0.32	<0.75	G
MW-45	12/29/93	2,900	680	760	3,000	11	1.1	0.86	G
	04/07/94	2,500	580	620	2,500	16.0	0.83	<0.75	
MW-47	12/30/93	2.0	<0.5	<0.5	1.0	<0.1	0.31	<0.75	?
	04/07/94	2.5	<0.5	<0.5	<0.5	<0.1	0.30	<0.75	
MTCA Method A Ground Water Cleanup Levels		5	30	40	20	1.0[13]			

Notes appear on page 2 of 2.

TABLE 2 (Page 2 of 2)

Notes:

[1]All samples are ground water unless otherwise noted.

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

[3]Analyzed by Ecology Method WTPH-G.

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

[5]Evaluated by inspection of chromatogram by EcoChem. G = gasoline, aG = aged gasoline, S = Stoddard solvent, D = diesel, MO = motor oil.

[6]Sample consisted of a product-ground water mixture.

[7]Sample also was analyzed for HVOCs (halogenated volatile organic compounds) by EPA Method 8010. HVOCs were not detected.

[8]Sample also was analyzed for total and dissolved (field filtered) lead by EPA Method 7421. Total and dissolved lead were detected at concentrations of 0.067 and 0.0078 mg/l, respectively.

[9]Sample consisted of free product. Sample also was analyzed for total lead by EPA Method 7421. Total lead was detected at a concentration of 180 mg/kg.

[10]Concentrations are in units of mg/kg.

[11]Laboratory detection level exceeds the MTCA Method A cleanup level.

[12]Sample also was analyzed for total and dissolved (field filtered) lead by EPA Method 7421. Total lead was detected at a concentration of 0.054 mg/l. Dissolved lead was not detected.

[13]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.

µg/l = micrograms per liter

mg/l = milligrams per liter

mg/kg = milligrams per kilogram

Shading indicates concentration exceeding the MTCA Method A ground water cleanup level.

EXPLANATION:

MW-2 ● MONITORING WELL INSTALLED IN 1980

MW-33 ◑ MONITORING WELL INSTALLED IN 1991 OR 1992

SMW-2S ⊗ MONITORING WELL INSTALLED BY SCS

N

0 80 160

SCALE IN FEET

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

MW-36

MW-38 MW-46

MW-47

Denny's Restaurant

Unocal Property Line

MW-48

MW-29

MW-40

Rosen Site

Remedial Excavation

MW-45

City of Seattle Property

MW-32

MW-49

MW-3

MW-33

MW-19

MW-35

MW-37

Unocal SS-5353

SMW-1S

MW-2

MW-18

MW-24

SMW-3

SMW-4

SMW-5

MW-32A

MW-34

SMW-2S

MW-1

City Park

MW-17

MW-42

MW-11

MW-27

MW-13

MW-41

WESTLAKE AVENUE NORTH

MW-14

MW-15

MW-16

MW-43

MW-44

WESTLAKE AVENUE NORTH

BROAD STREET

MW-39

SMW-2

Note: The locations of all features shown are approximate.

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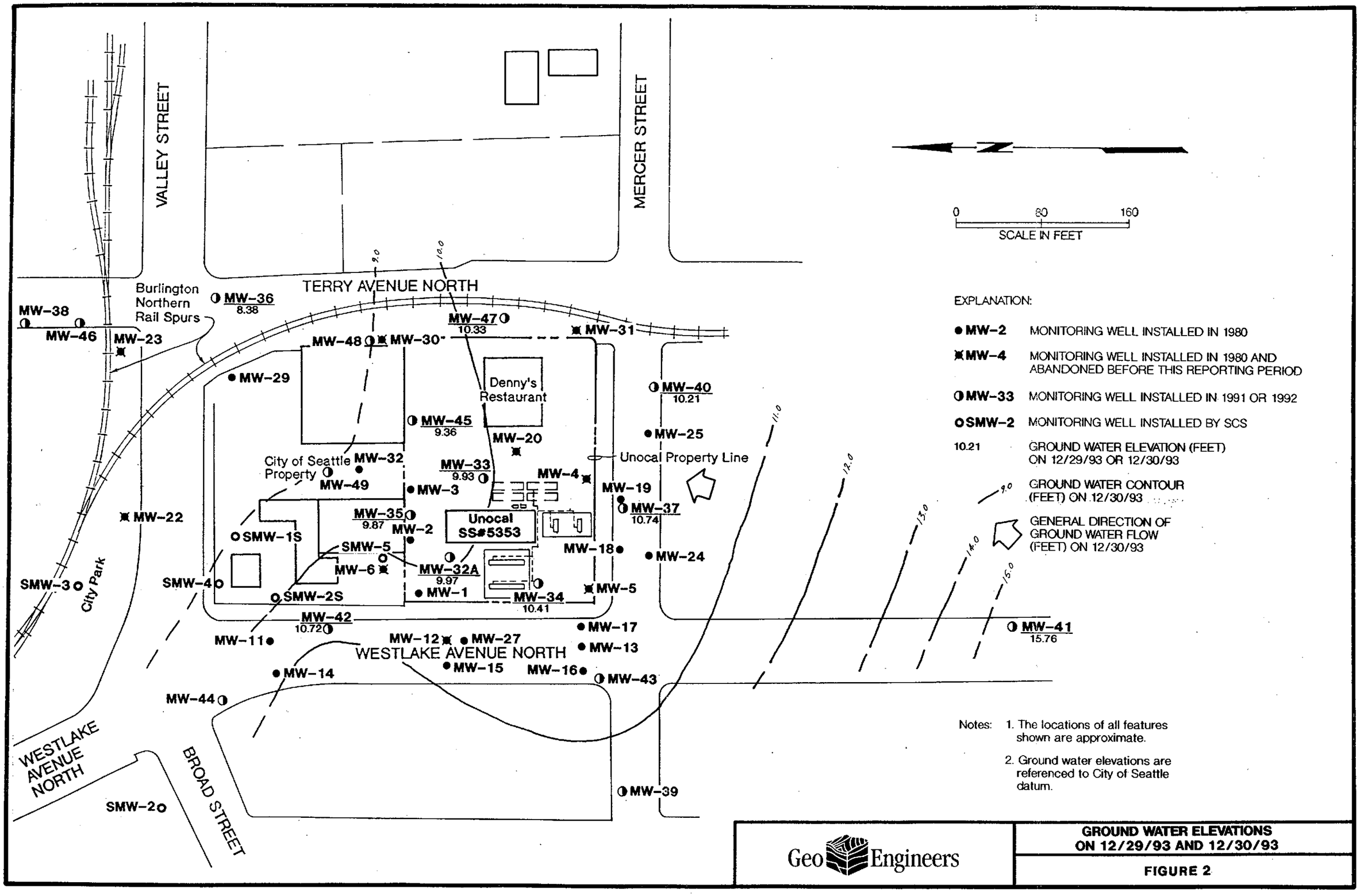
SITE VICINITY AND MONITORING WELL LOCATIONS

FIGURE 1

NLP:ANG:KKT 013B002.DWG 0161013R69:020194



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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GROUND WATER ELEVATIONS ON 12/29/93 AND 12/30/93

FIGURE 2

0161-013-R6.9 NLP:BDH 6/24/95(B)

MW-30	B	G	D	O
12/30/93	0.7	<0.1	0.37	0.94
MTCA	5.0	1.0		

MW-47	B	G	D	O
12/30/93	2.0	<0.1	0.31	<0.75
04/07/94	2.5	<0.1	0.30	<0.75
MTCA	5.0	1.0		

MW-40	B	G	D	O
10/07/93	36	0.93	1.8	1.9
12/30/93	34	1.5	5.4	4.2
04/07/94	29	1.2	2.2	2.0
MTCA	5.0	1.0		

MW-39	B	G	D	O
12/29/93	560	7.2	1.1	<0.75
04/07/94	220	3.5	1.0	1.1
MTCA	5.0	1.0		

MW-45	B	G	D	O
12/29/93	2,900	11	1.0	0.86
04/07/94	2,500	16.0	0.83	<0.75
MTCA	5.0	1.0		

MW-35	B	G	D	O
12/29/93	580	4.2	1.0	<0.75
04/07/94	480	5.3	0.87	<0.75
MTCA	5.0	1.0		

MW-2	B	G	D	O
10/15/93	1,300	50	200	150
MTCA	5.0	1.0		

MW-37	B	G	D	O
10/07/93	Free Product-Gasoline			
01/06/94	Free Product-Gasoline			
04/07/94	660	92.0	18	<0.75
MTCA	5.0	1.0		

MW-32A	B	G	D	O
12/29/93	6,300	19	2.9	1.3
04/07/94	3,900	11.0	2.1	1.3
MTCA	5.0	1.0		

MW-34	B	G	D	O
10/07/93	1,400	4.2	1.6	0.97
12/29/93	15,000	52	2.2	<0.75
04/07/94	4,500	9.8	1.4	<0.75
MTCA	5.0	1.0		

MW-41	B	G	D	O
12/29/93	4.6	<0.1	<0.25	<0.75
MTCA	5.0	1.0		

MW-43	B	G	D	O
12/30/93	82	0.34	0.32	<0.75
MTCA	5.0	1.0		

MW-42	B	G	D	O
12/30/93	570	<0.1	1.3	2.4
04/07/94	620	<0.2	0.84	1.1
MTCA	5.0	1.0		

VALLEY STREET

MERCER STREET

TERRY AVENUE NORTH

WESTLAKE AVENUE NORTH

BROAD STREET

WESTLAKE AVENUE NORTH

MW-38 MW-46 MW-48 MW-29 MW-32 MW-49 MW-3 MW-19 MW-18 MW-24 MW-11 MW-27 MW-17 MW-13 MW-15 MW-14 MW-16 MW-44 MW-39

SMW-1S SMW-3 SMW-4 SMW-5 SMW-2S MW-1 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 3

NLP:ANG:KKT 013B005.DWG 0161013R69:060294

APPENDIX A

APPENDIX 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 1. The water level measurements were made using an electric water level indicator. Product thickness was measured with a translucent disposable bailer. The electric water level indicator was cleaned with a Liquinox 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-34 and MW-40 on October 7, 1993; MW-32A through MW-36, MW-40 through MW-43, MW-45 and MW-47 on December 29 or 30, 1993; and MW-32A through MW-35, MW-37, MW-40, MW-42, MW-45 and MW-47 on April 7, 1994. The water 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 water samples were transferred in the field to laboratory-prepared sample containers. The water samples were kept cold during transport to the testing laboratory. Chain-of-custody procedures were followed during transport of the water samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix B.

PRODUCT SAMPLING

Product or product-water samples were obtained from monitoring wells MW-37 on October 7, 1993, January 6 and April 7, 1994, and MW-2 on October 15, 1993. The product samples were obtained with a new disposable bailer and clean bailing rope from each well casing. These samples were "grab" samples, as each well was not purged prior to sampling. The product or product-water samples were transferred in the field to laboratory-prepared sample containers. Chain-of-custody procedures were followed in transporting the samples to the testing laboratory. The laboratory data sheets and chain-of-custody records are provided in Appendix B.

COMBUSTIBLE VAPOR CONCENTRATIONS

Combustible vapor concentrations were measured in monitoring well casings on the dates indicated in Table 1. A Bacharach TLV Sniffer calibrated to hexane was used to measure the combustible vapor concentrations in the well casings. A 2-inch-diameter slip cap was used to produce a temporary seal in the monitoring well casings when obtaining vapor concentrations. The lower threshold of significance for the TLV Sniffer in this application is 400 ppm (parts per million), equivalent to 4 percent of the LEL (lower explosive limit) of hexane.

APPENDIX B

APPENDIX 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

No significant data quality exceptions were noted in the laboratory report or during our review. Based on our data quality review, it is our opinion that the analytical data are of acceptable quality for their intended use.

Analytical**Technologies,**Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
Karen L. Mixon, Laboratory Manager

ATI I.D. # 9310-078

October 15, 1993

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

GeoEngineers
OCT 20 1993
Routing NLP
File

Attention : Norm Puri

Project Number : 0161-013-R69

Project Name : Unocal - WL&M

Dear Mr. Puri:

On October 7, 1993, Analytical Technologies, Inc. (ATI), received three samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Donna M. McKinney
Senior Project Manager

DM/hal/jj/elf

Enclosure

Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

ATI I.D. # 9310-078

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9310-078-1	MW-37	10/07/93	PRODUCT
9310-078-2	MW-40	10/07/93	WATER
9310-078-3	MW-34	10/07/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	2
PRODUCT	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

ANALYSIS	TECHNIQUE	REFERENCE	LAB
PURGEABLE HALOCARBONS	GC/ELCD	EPA 8010	R
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R
LEAD	AA/GF	EPA 7421	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9310-078

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE: VOLATILE ORGANICS ANALYSIS

One (1) product sample was received by ATI on October 7, 1993, for the following analysis: EPA method 8010.

The sample was analyzed at a 100-fold dilution. The surrogate was consequently diluted out and not recovered. The result was flagged with an "I"; surrogate out of limits due to sample dilution.

All corresponding quality assurance and quality control results defined as blank spike/blank spike duplicate (BS/BSD), method blank and surrogate recoveries were within the ATI established control limits.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/08/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BROMODICHLOROMETHANE	<0.10
BROMOFORM	<0.10
BROMOMETHANE	<0.50
CARBON TETRACHLORIDE	<0.10
CHLOROBENZENE	<0.25
CHLOROETHANE	<0.50
CHLOROFORM	<0.10
CHLOROMETHANE	<1.0
1,2-DIBROMOETHANE (EDB)	<0.25
1,2-DICHLOROBENZENE	<0.25
1,3-DICHLOROBENZENE	<0.25
1,4-DICHLOROBENZENE	<0.25
DIBROMOCHLOROMETHANE	<0.10
1,1-DICHLOROETHANE	<0.10
1,2-DICHLOROETHANE	<0.10
1,1-DICHLOROETHENE	<0.10
CIS-1,2-DICHLOROETHENE	<0.10
TRANS-1,2-DICHLOROETHENE	<0.10
1,2-DICHLOROPROPANE	<0.10
CIS-1,3-DICHLOROPROPENE	<0.10
TRANS-1,3-DICHLOROPROPENE	<0.10
METHYLENE CHLORIDE	<1.0
1,1,2,2-TETRACHLOROETHANE	<0.10
TETRACHLOROETHENE	<0.10
1,1,1-TRICHLOROETHANE	<0.10
1,1,2-TRICHLOROETHANE	<0.10
TRICHLOROETHENE	<0.10
TRICHLOROFLUOROMETHANE	<0.25
VINYL CHLORIDE	<0.50

SURROGATE PERCENT RECOVERY		LIMITS
BROMOCHLOROMETHANE	88	38 - 140

Analytical Technologies, Inc.

ATI I.D. # 9310-078-1

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/08/93
CLIENT I.D.	: MW-37	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 100

COMPOUNDS	RESULTS
BROMODICHLOROMETHANE	<10
BROMOFORM	<10
BROMOMETHANE	<50
CARBON TETRACHLORIDE	<10
CHLOROBENZENE	<25
CHLOROETHANE	<50
CHLOROFORM	<10
CHLOROMETHANE	<100
1,2-DIBROMOETHANE (EDB)	<25
1,2-DICHLOROBENZENE	<25
1,3-DICHLOROBENZENE	<25
1,4-DICHLOROBENZENE	<25
DIBROMOCHLOROMETHANE	<10
1,1-DICHLOROETHANE	<10
1,2-DICHLOROETHANE	<10
1,1-DICHLOROETHENE	<10
CIS-1,2-DICHLOROETHENE	<10
TRANS-1,2-DICHLOROETHENE	<10
1,2-DICHLOROPROPANE	<10
CIS-1,3-DICHLOROPROPENE	<10
TRANS-1,3-DICHLOROPROPENE	<10
METHYLENE CHLORIDE	<100
1,1,2,2-TETRACHLOROETHANE	<10
TETRACHLOROETHENE	<10
1,1,1-TRICHLOROETHANE	<10
1,1,2-TRICHLOROETHANE	<10
TRICHLOROETHENE	<10
TRICHLOROFLUOROMETHANE	<25
VINYL CHLORIDE	<50

SURROGATE PERCENT RECOVERY		LIMITS
BROMOCHLOROMETHANE	I	38 - 140

I = Surrogate out of limits due to sample dilution.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

VOLATILE ORGANICS ANALYSIS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 10/08/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8010		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
CHLOROBENZENE	<0.250	4.00	4.58	115	4.54	114	1
1,1-DICHLOROETHENE	<0.100	4.00	4.34	109	4.09	102	6
TRICHLOROETHENE	<0.100	4.00	4.44	111	4.46	112	0

CONTROL LIMITS	% REC.	RPD
CHLOROBENZENE	71 - 163	20
1,1-DICHLOROETHENE	30 - 161	22
TRICHLOROETHENE	55 - 146	24

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOCHLOROMETHANE	96	91	38 - 140

Analytical Technologies, Inc.

ATI I.D. # 9310-078

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	110	76 - 120
TRIFLUOROTOLUENE	103	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078-2

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-40	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	36
ETHYLBENZENE	2.1
TOLUENE	1.8
TOTAL XYLENES	5.3
FUEL HYDROCARBONS	930
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	112	76 - 120
TRIFLUOROTOLUENE	113	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078-3

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-34	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS	
BENZENE	1400	D6
ETHYLBENZENE	120	
TOLUENE	480	
TOTAL XYLENES	440	
FUEL HYDROCARBONS	4200	
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	111	76 - 120
TRIFLUOROTOLUENE	101	50 - 150

D6 = Value from a 50 fold diluted analysis.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : 9310-051-2
DATE EXTRACTED : N/A
DATE ANALYZED : 10/07/93
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	1.78	N/A	N/A	20.0	20.9	96	20.7	95	1
TOLUENE	<0.500	N/A	N/A	20.0	20.4	102	20.7	103	1
TOTAL XYLENES	65.0	N/A	N/A	40.0	104	98	102	93	2
GASOLINE	1070	1060	1	1000	1970	90	1950	88	1

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	110	109	76 - 120
TRIFLUOROTOLUENE	104	105	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	18.9	95	N/A	N/A	N/A
TOLUENE	<0.500	20.0	19.8	99	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	39.9	100	N/A	N/A	N/A
GASOLINE	<100	1000	1070	107	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	109	N/A	76 - 120
TRIFLUOROTOLUENE	105	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	111	52 - 116
TRIFLUOROTOLUENE	102	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-37	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 500

COMPOUNDS	RESULTS
BENZENE	7500
ETHYLBENZENE	28000
TOLUENE	69000
TOTAL XYLENES	170000
FUEL HYDROCARBONS	2000000*
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	109	52 - 116
TRIFLUOROTOLUENE	119	50 - 150

* Sample results confirmed by reextraction and reanalysis.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G/8020(BETX)		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.0250	1.00	0.970	97	N/A	N/A	N/A
TOLUENE	<0.0250	1.00	1.02	102	N/A	N/A	N/A
TOTAL XYLENES	<0.0250	1.00	2.03	101	N/A	N/A	N/A
GASOLINE	<5.00	50.0	53.5	107	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	63 - 115	20
TOLUENE	75 - 110	20
TOTAL XYLENES	79 - 109	20
GASOLINE	80 - 119	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	110	N/A	50 - 116
TRIFLUOROTOLUENE	107	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/07/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<0.25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	99	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/07/93
CLIENT I.D.	: MW-40	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.8
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	1.9
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	87	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/07/93
CLIENT I.D.	: MW-34	DATE ANALYZED	: 10/08/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.6
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	0.97
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	96	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9309-348-2
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	<0.250	<0.250	NC	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
DIESEL	N/A	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
O-TERPHENYL	97	87	50 - 150

NC = Not Calculable.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9310-051-1
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	0.280	0.293	5	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
DIESEL	50 - 150	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
O-TERPHENYL	96	95	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9309-348-5
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIESEL	3.22	2.46	5.83	104	5.37	90	8

CONTROL LIMITS	% REC.	RPD
DIESEL	50 - 150	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
O-TERPHENYL	102	103	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-D

SAMPLE I.D. # : BLANK
DATE EXTRACTED : 10/07/93
DATE ANALYZED : 10/07/93
UNITS : mg/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIESEL	<0.250	2.50	2.33	93	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
DIESEL	70 - 115	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
O-TERPHENYL	96	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/07/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

Analytical Technologies, Inc.

ATI I.D. # 9310-078-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/07/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 10/07/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/07/93
CLIENT I.D.	: MW-37	DATE ANALYZED	: 10/07/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 10

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	82000 L
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<94000 L
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

L = Sample chromatogram indicates petroleum hydrocarbons characteristic of gasoline.

Analytical Technologies, Inc.

ATI I.D. # 9310-078

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD (SAMPLES -2T, -3T, -2D)	10/08/93	10/08/93
LEAD (SAMPLE -3D)	10/08/93	10/09/93

Analytical Technologies, Inc.

ATI I.D. # 9310-078

TOTAL
METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M UNITS : mg/L

ATI I.D. #	CLIENT I.D.	LEAD
9310-078-2	MW-40	0.054
9310-078-3	MW-34	0.067
METHOD BLANK	-	<0.0030

Analytical Technologies, Inc.

ATI I.D. # 9310-078

DISSOLVED
METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M UNITS : mg/L

ATI I.D. #	CLIENT I.D.	LEAD
9310-078-2	MW-40	<0.0030
9310-078-3	MW-34	0.0078
METHOD BLANK	-	<0.0030

Analytical Technologies, Inc.

ATI I.D. # 9310-078

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC. MATRIX : WATER
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M UNITS : mg/L

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9310-039-17T	<0.0030	<0.0030	NC	0.0268	0.0250	107
LEAD	BLANK	<0.0030	N/A	N/A	0.0256	0.0250	102

NC = Not Calculable.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Sample Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9310-078

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	10/08/93	10/08/93

Analytical Technologies, Inc.

ATI I.D. # 9310-078

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9310-078-1	MW-37	180
METHOD BLANK	-	<0.15

Analytical Technologies, Inc.

ATI I.D. # 9310-078

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WL&M

MATRIX : PRODUCT
UNITS : mg/Kg

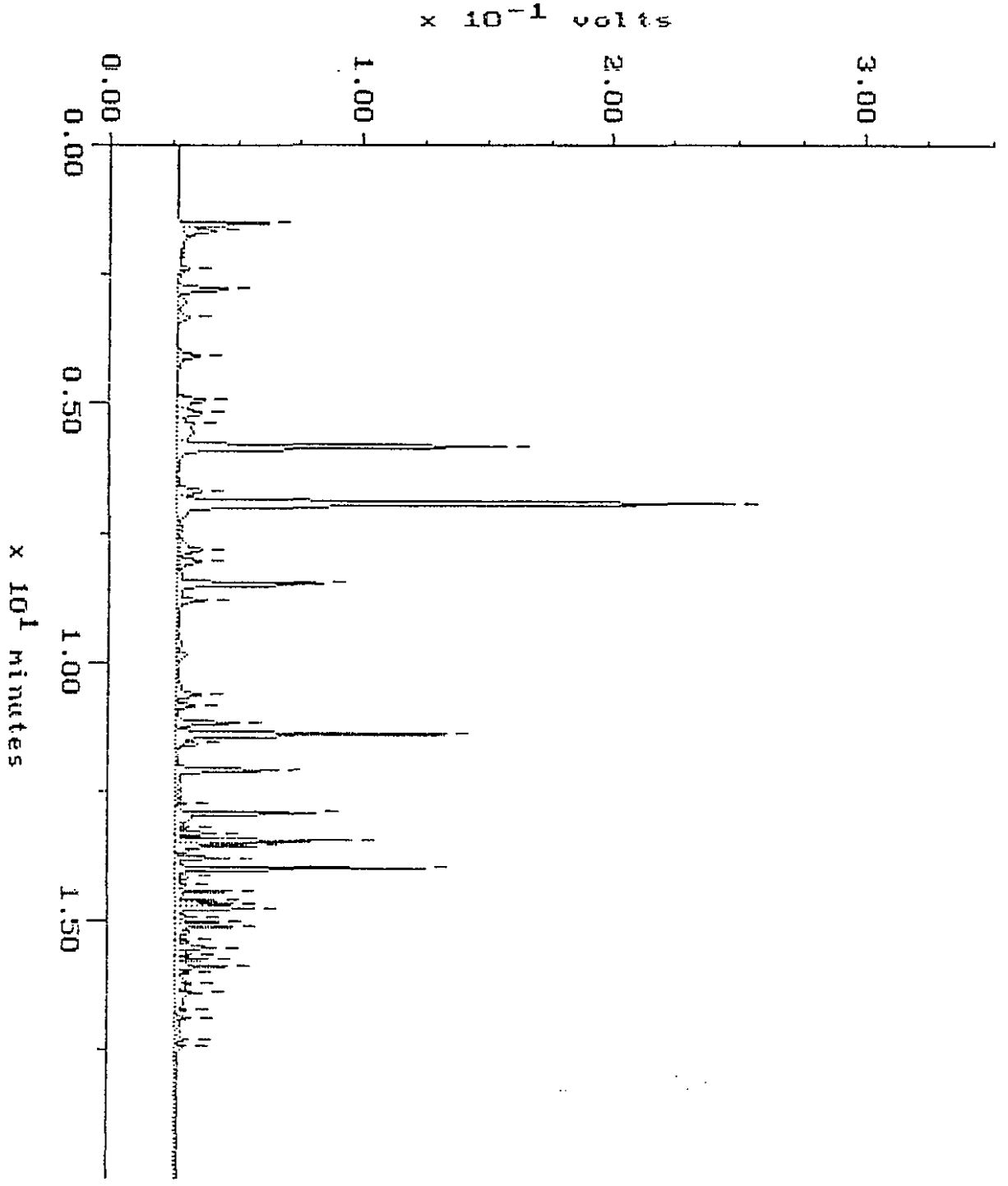
ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9310-055-8	3.9	3.5	11	5.20	1.28	102
LEAD	BLANK	<0.15	N/A	N/A	1.23	1.25	98

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Sample Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

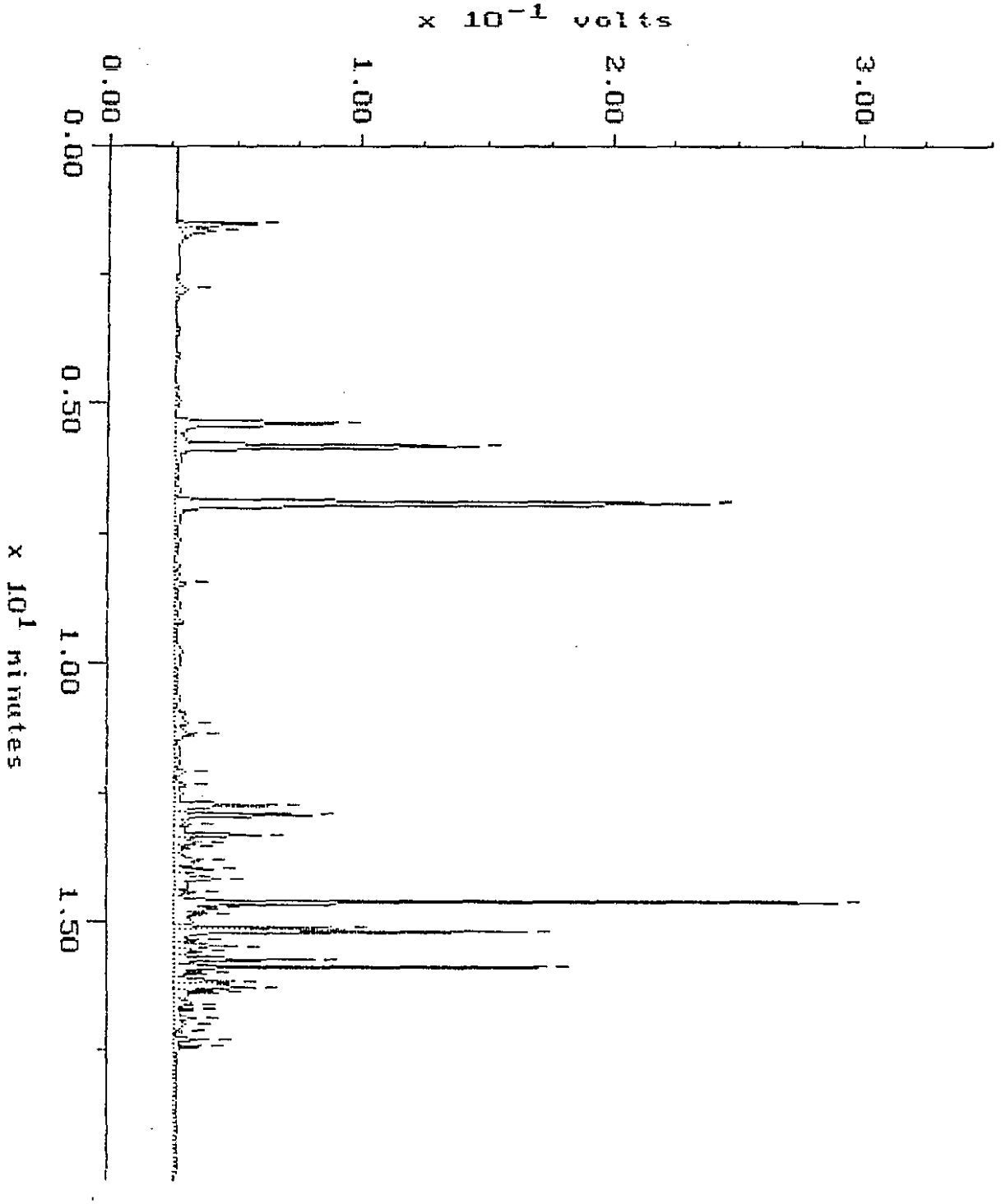
WA DOE WTPH-G

Sample: 9310-078-1 Channel: FID Filename: RA079F34
Acquired: 08-OCT-93 5:18 Method: F:\BRO2\MAXDATA\PICARD\100793PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



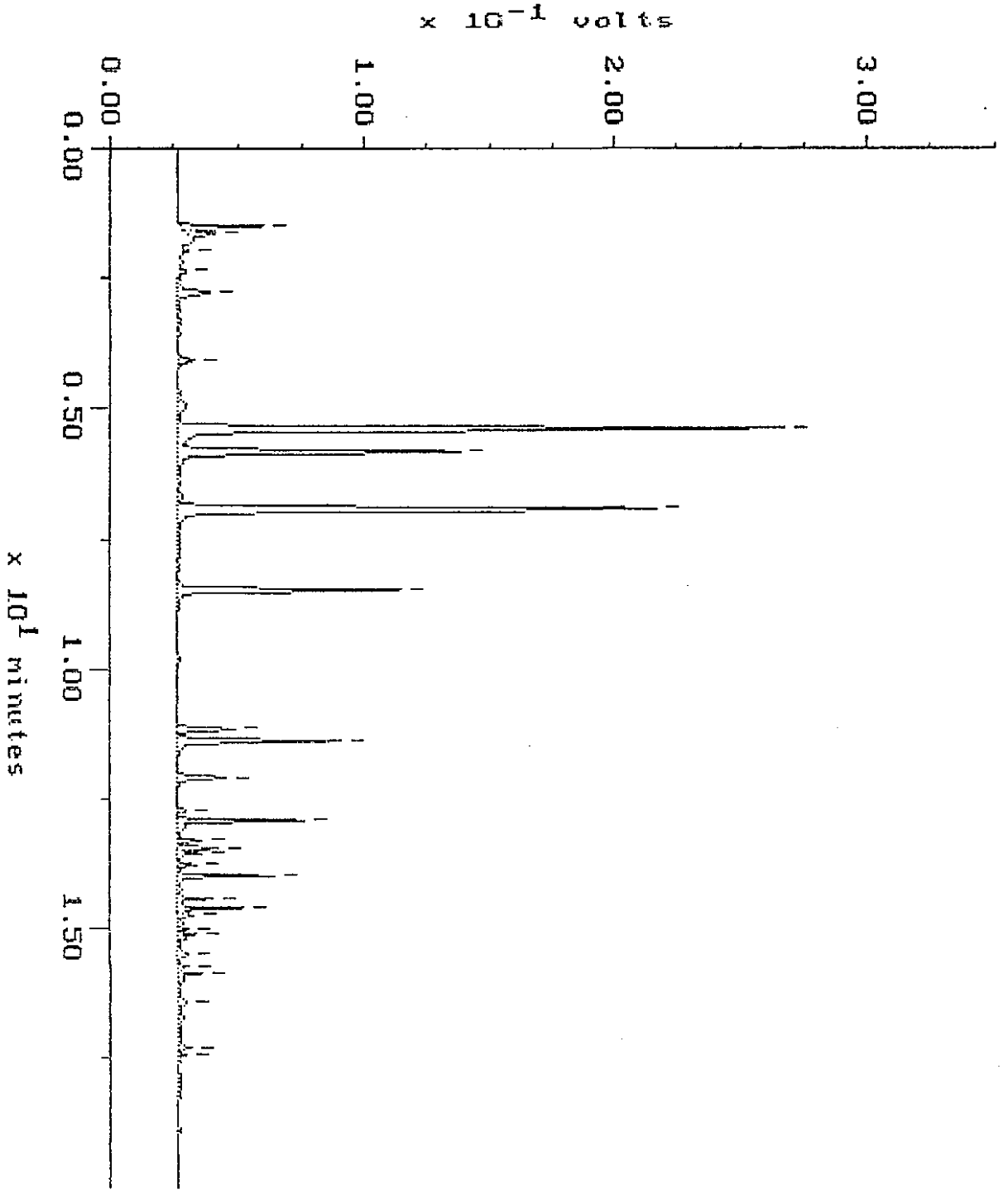
WA DOE WTPH-G

Sample: 9310-078-2 Channel: FID Filename: RA079F33
Acquired: 06-OCT-93 4:47 Method: F:\BRD2\MAXDATA\PICARD\100793PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



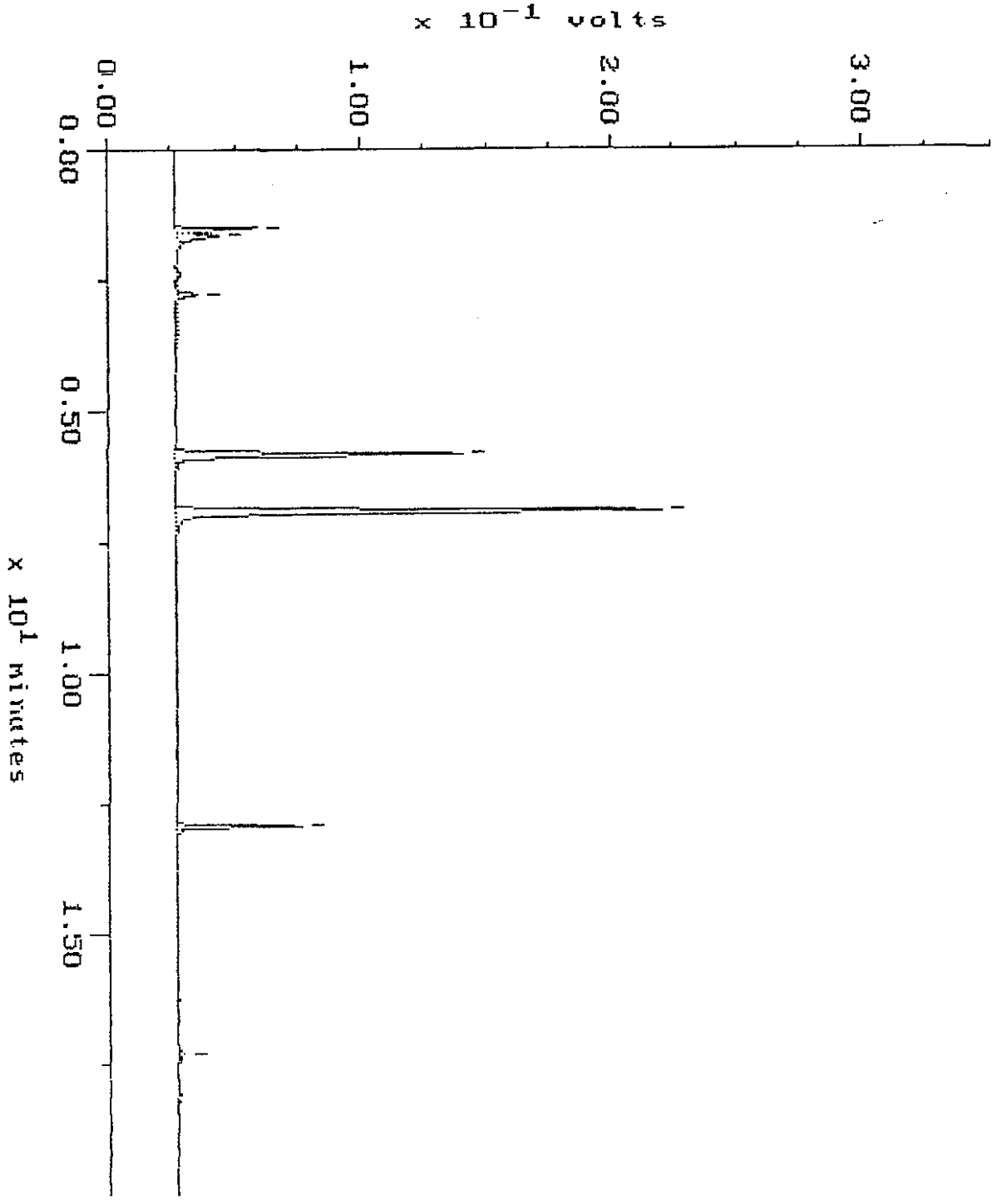
WA DOE WTPH-G

Sample: 9310-078-3 DIL Channel: FID Filename: RA089P06
Acquired: 08-OCT-93 11:31 Method: F:\BRO2\MAXDATA\PICARD\100893PC Operator: ATI
Dilution: 1 : 10.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

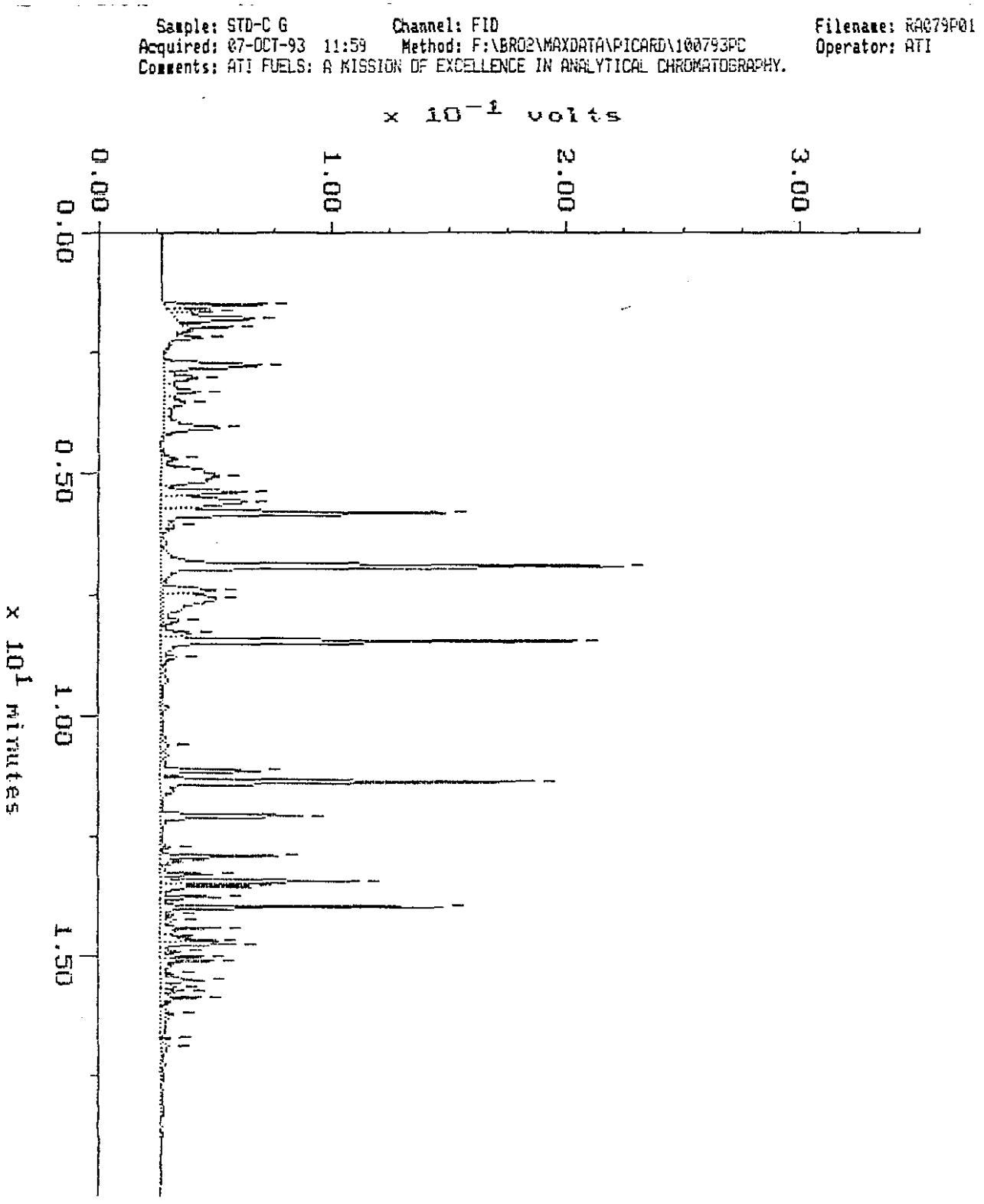


WA DOE WTPH-G Blank

Sample: WRB 10-7 Channel: FID Filename: RA079P03
Acquired: 07-OCT-93 13:27 Method: F:\BRO2\MAXDATA\PICARD\100793PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

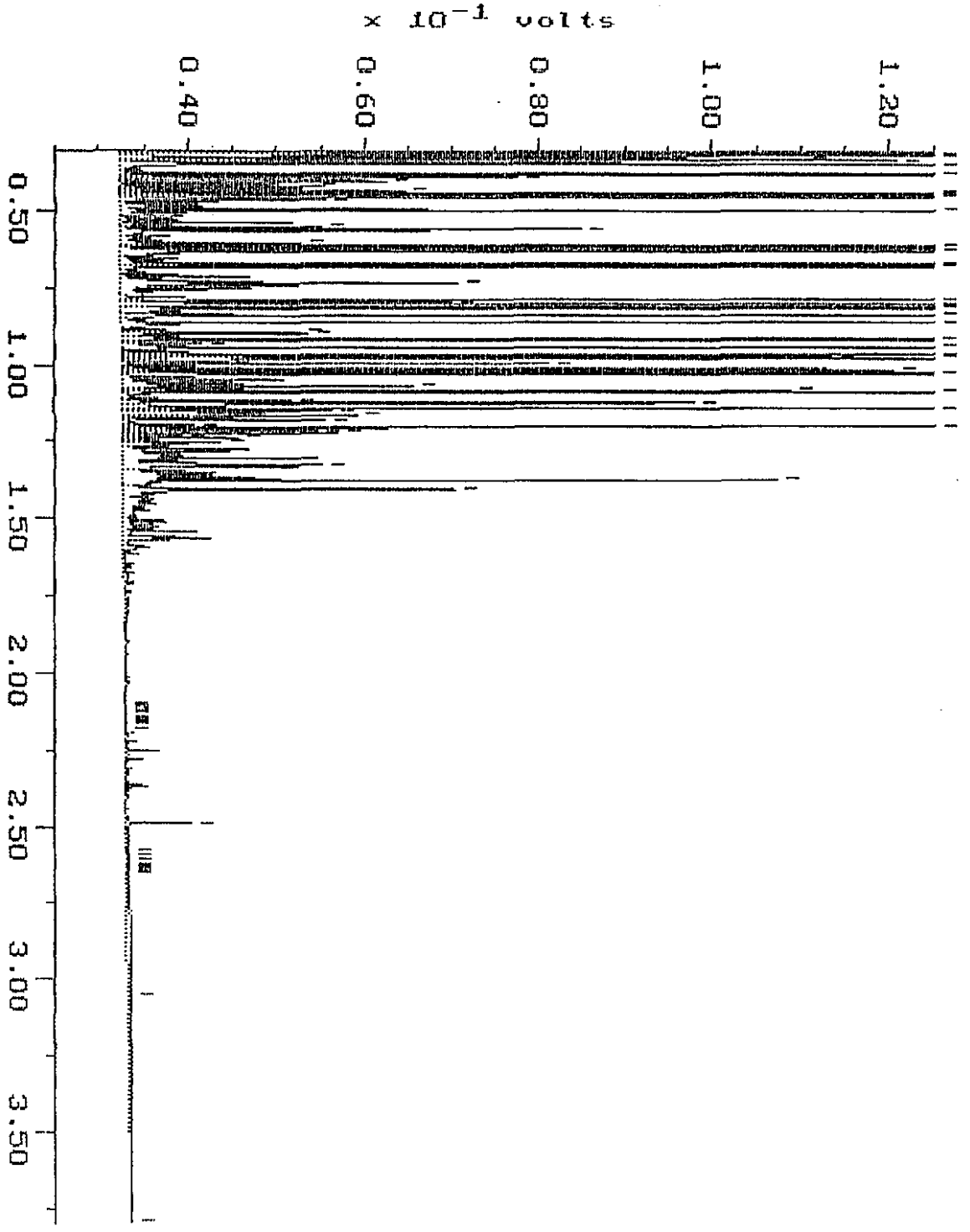


Continuing Calibration



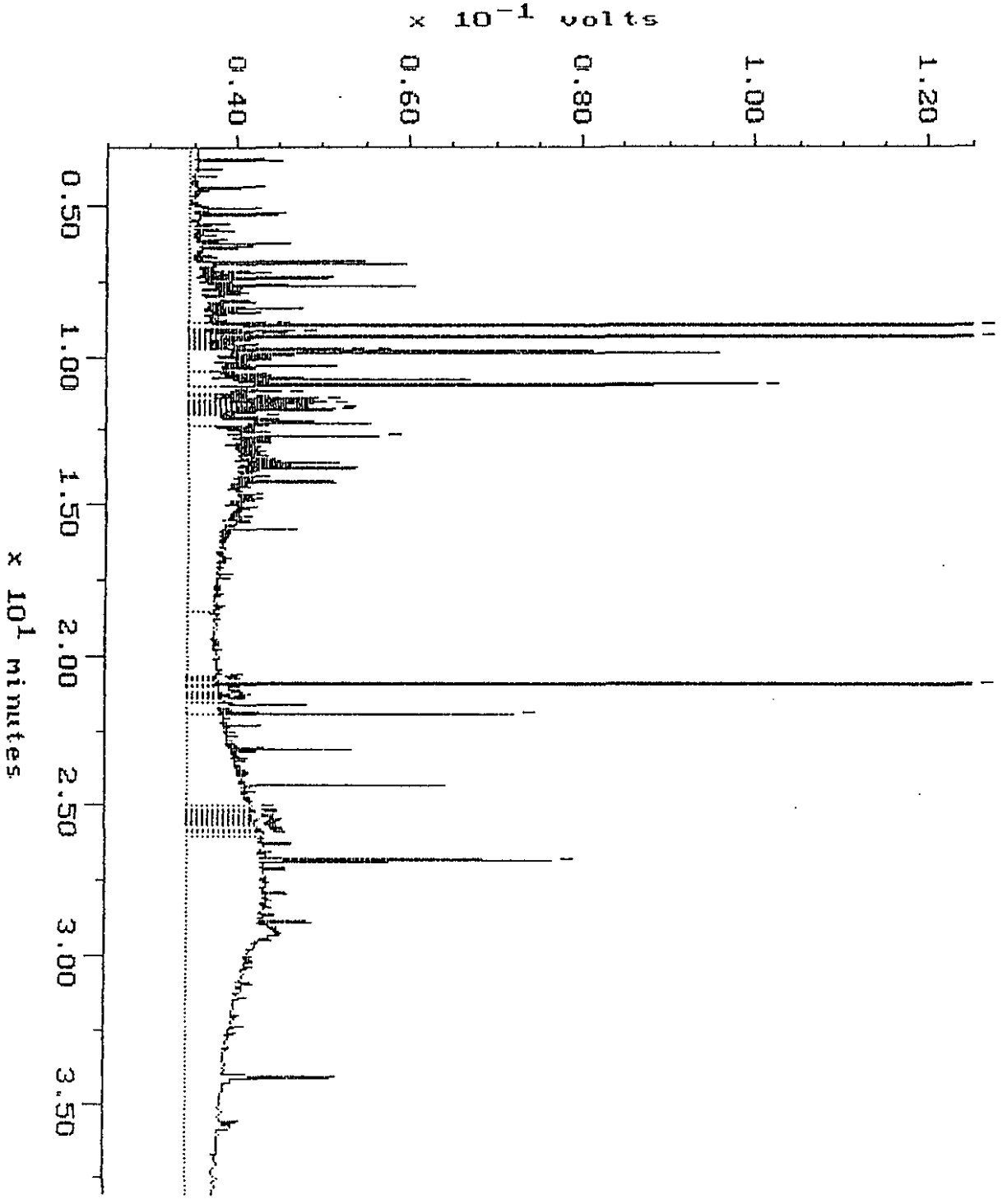
WA DOE WTPH-D

Sample: 9310-078-1DIL Channel: FRED Filename: RA078F04
Acquired: 07-OCT-93 15:42 Method: F:\EKO2\MAXDATA\FRED\FUEL1007 Operator: ATI
Dilution: 1 : 10.000
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



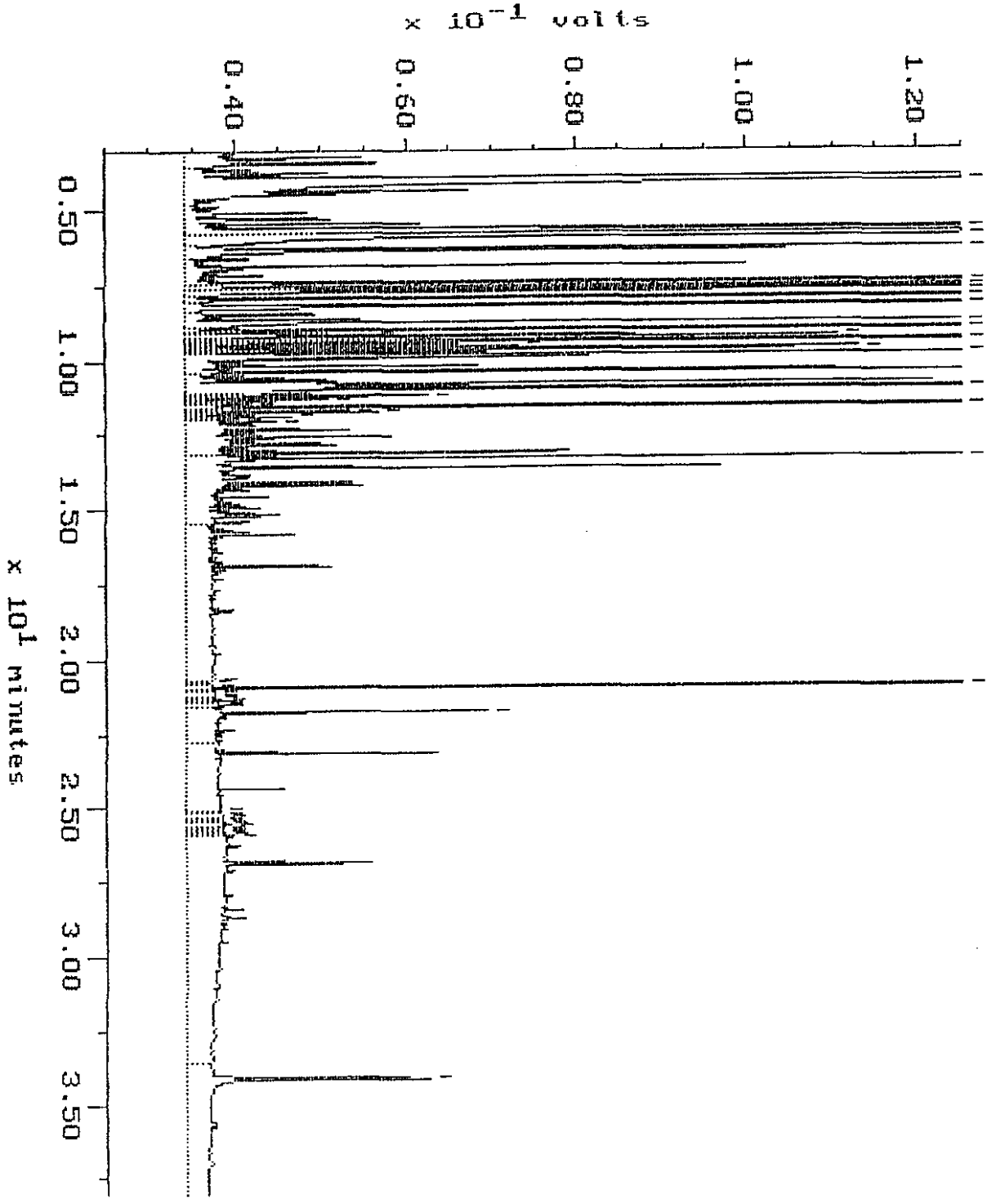
WA DOE WTPH-D

Sample: 9310-078-2 Channel: DEMITRI Filename: RA078D34
Acquired: 08-OCT-93 10:44 Method: F:\BRO2\MAXDATA\SERGE-D\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY

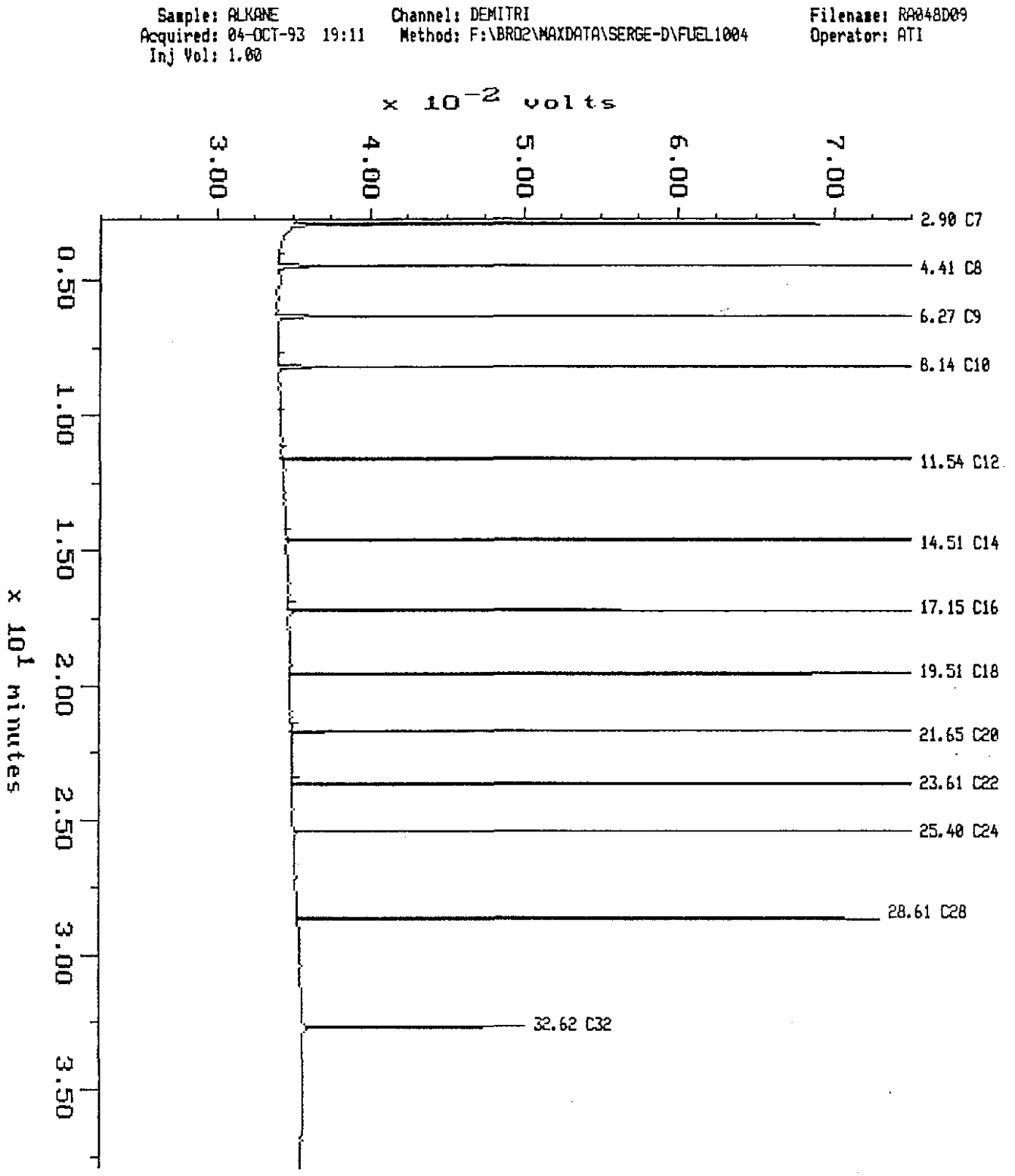


WA DOE WTPH-D

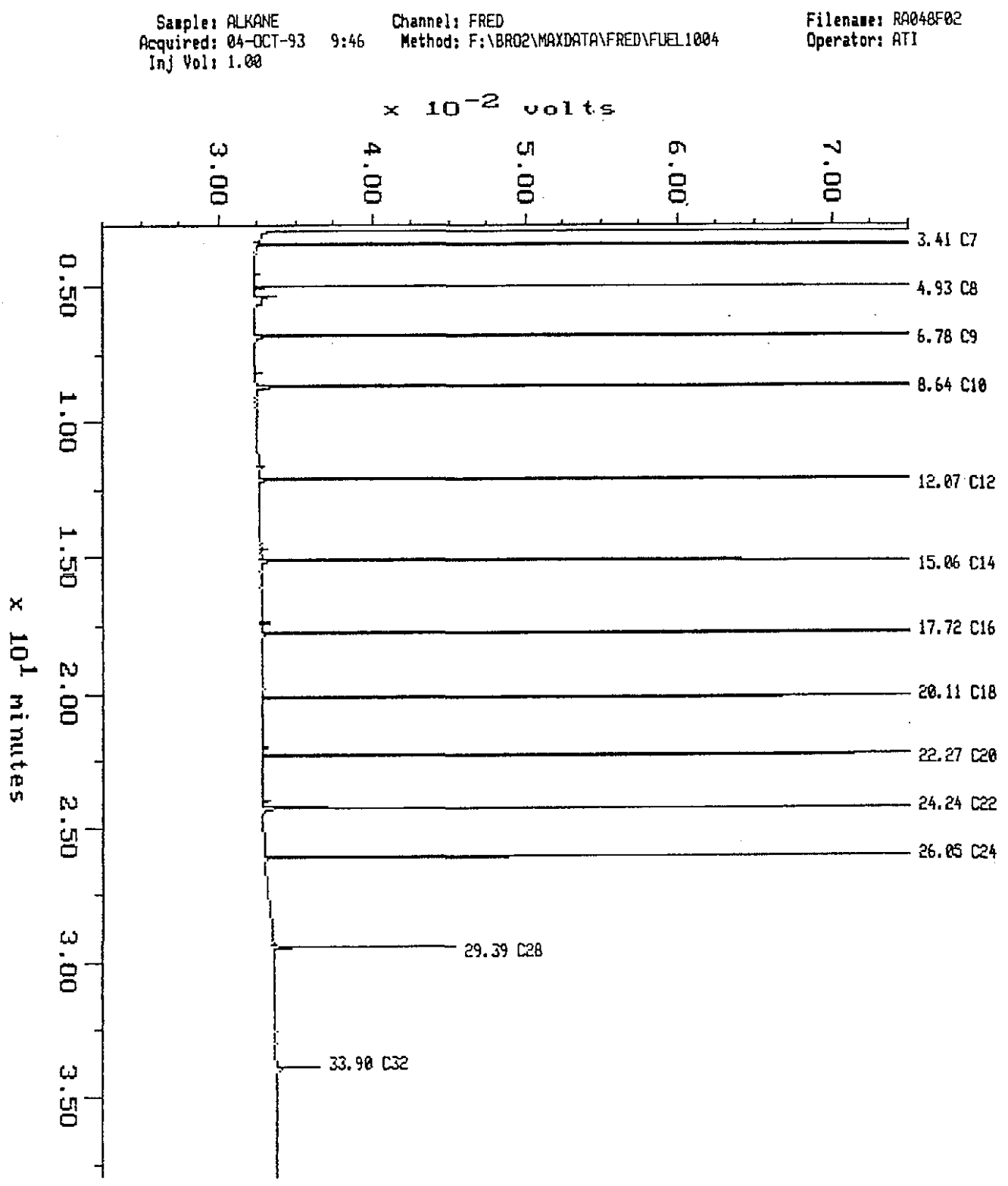
Sample: 9310-078-3 Channel: DEMITRI Filename: RA078D35
Acquired: 08-OCT-93 11:31 Method: F:\BRDE\MAXDATA\SERGE-D\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Alkane


Sample: ALKANE
Acquired: 04-OCT-93 19:11
Inj Vol: 1.00
Channel: DEMITRI
Method: F:\BRD2\MAXDATA\SERGE-D\FUEL1004
Filename: RA048D09
Operator: ATI
x 10^-2 volts
3.00
4.00
5.00
6.00
7.00
x 10^1 minutes
0.50
1.00
1.50
2.00
2.50
3.00
3.50
2.90 C7
4.41 C8
6.27 C9
8.14 C10
11.54 C12
14.51 C14
17.15 C16
19.51 C18
21.65 C20
23.61 C22
25.40 C24
28.61 C28
32.62 C32

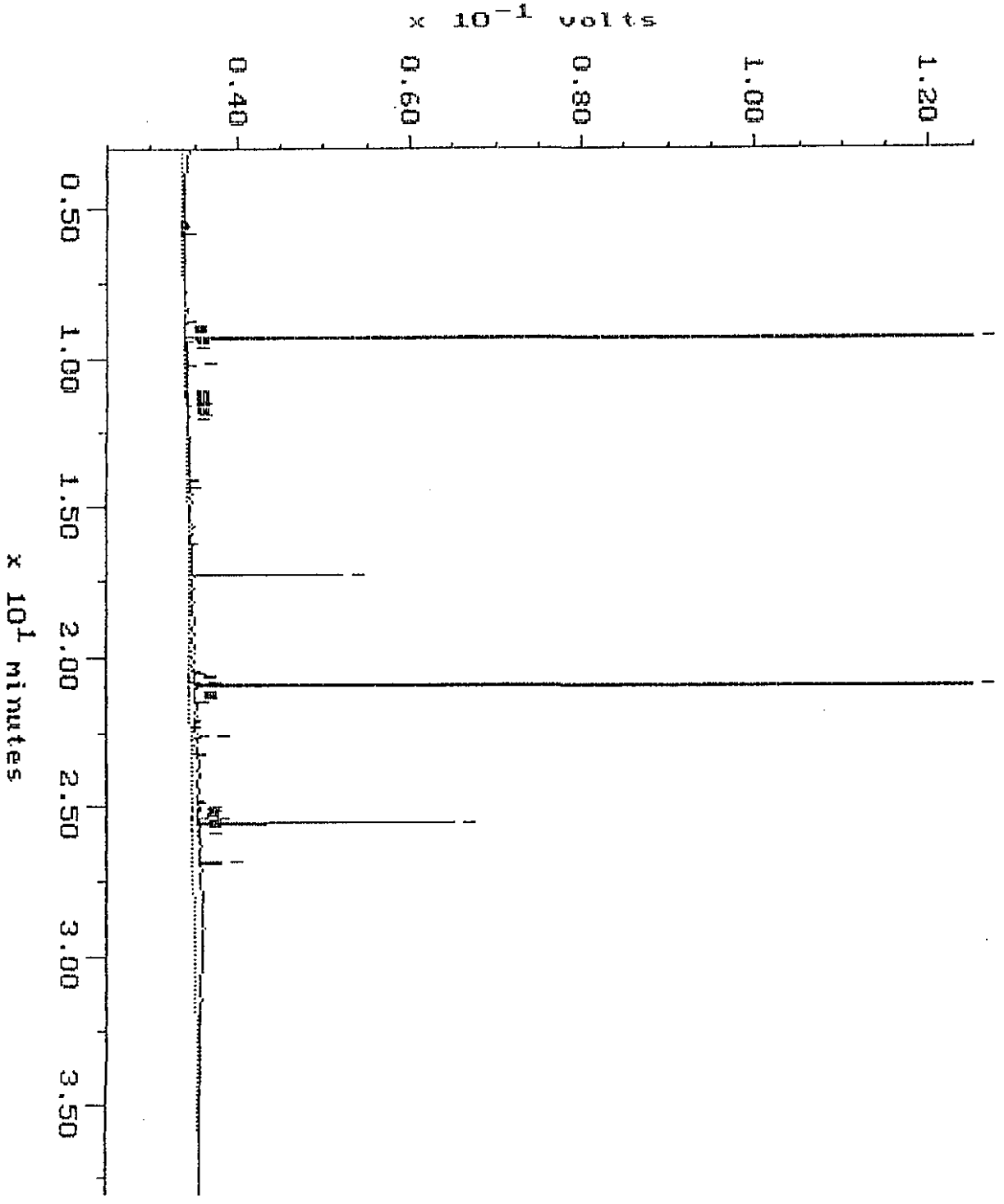
Alkane


Sample: ALKANE
Acquired: 04-OCT-93 9:46
Inj Vol: 1.00
Channel: FRED
Method: F:\BRO2\MAXDATA\FRED\FUEL1004
Filename: RA048F02
Operator: ATI
x 10^-2 volts
3.00
4.00
5.00
6.00
7.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10^1 minutes
3.41 C7
4.93 C8
6.78 C9
8.64 C10
12.07 C12
15.06 C14
17.72 C16
20.11 C18
22.27 C20
24.24 C22
26.05 C24
29.39 C28
33.90 C32

Blank

WA DOE WTPH-D

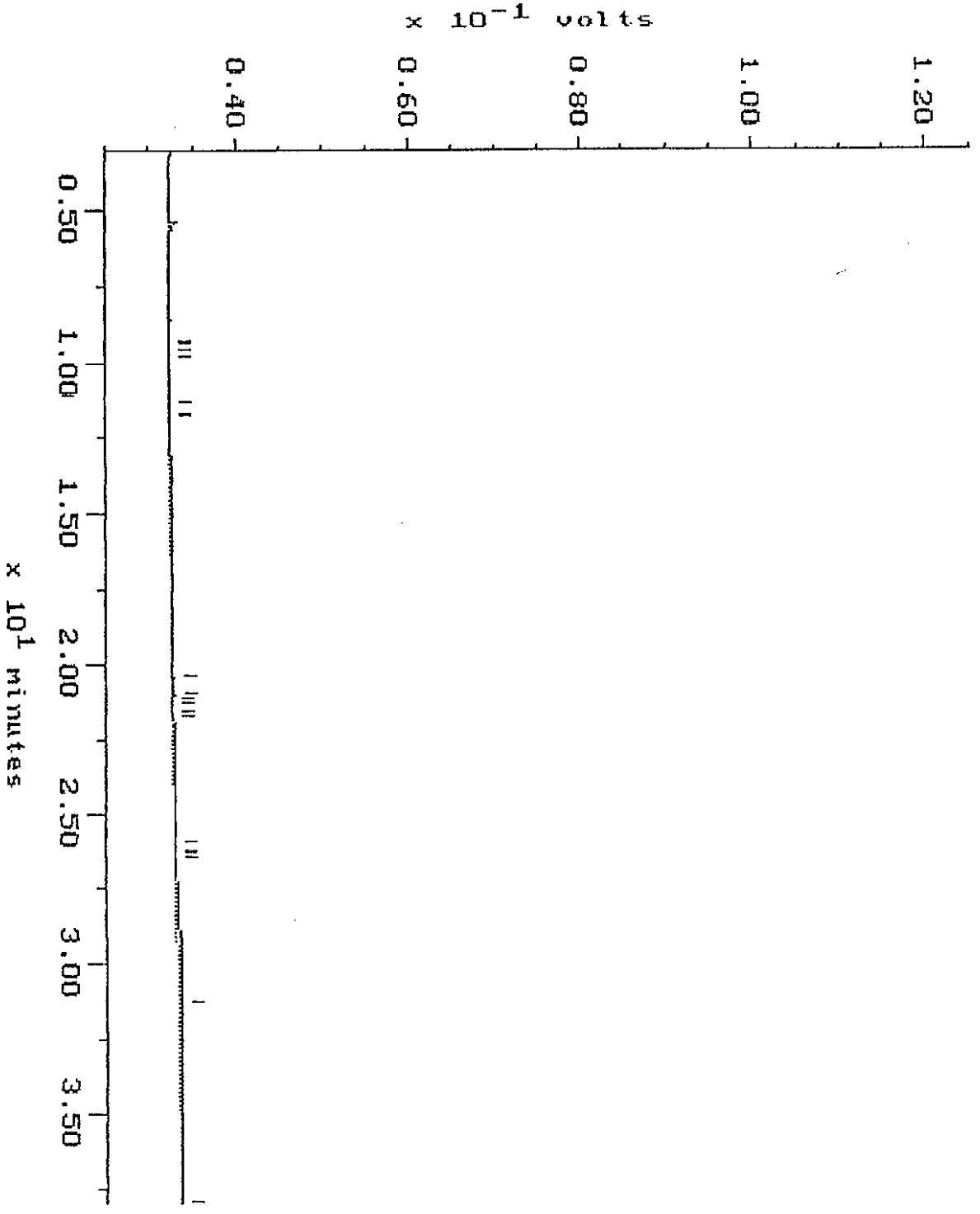
Sample: WRB 10-7 Channel: DEMITRI Filename: RA078D10
Acquired: 07-OCT-93 16:12 Method: F:\BRD2\MAXDATA\SERGE-D\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



WA DOE WTPH-D

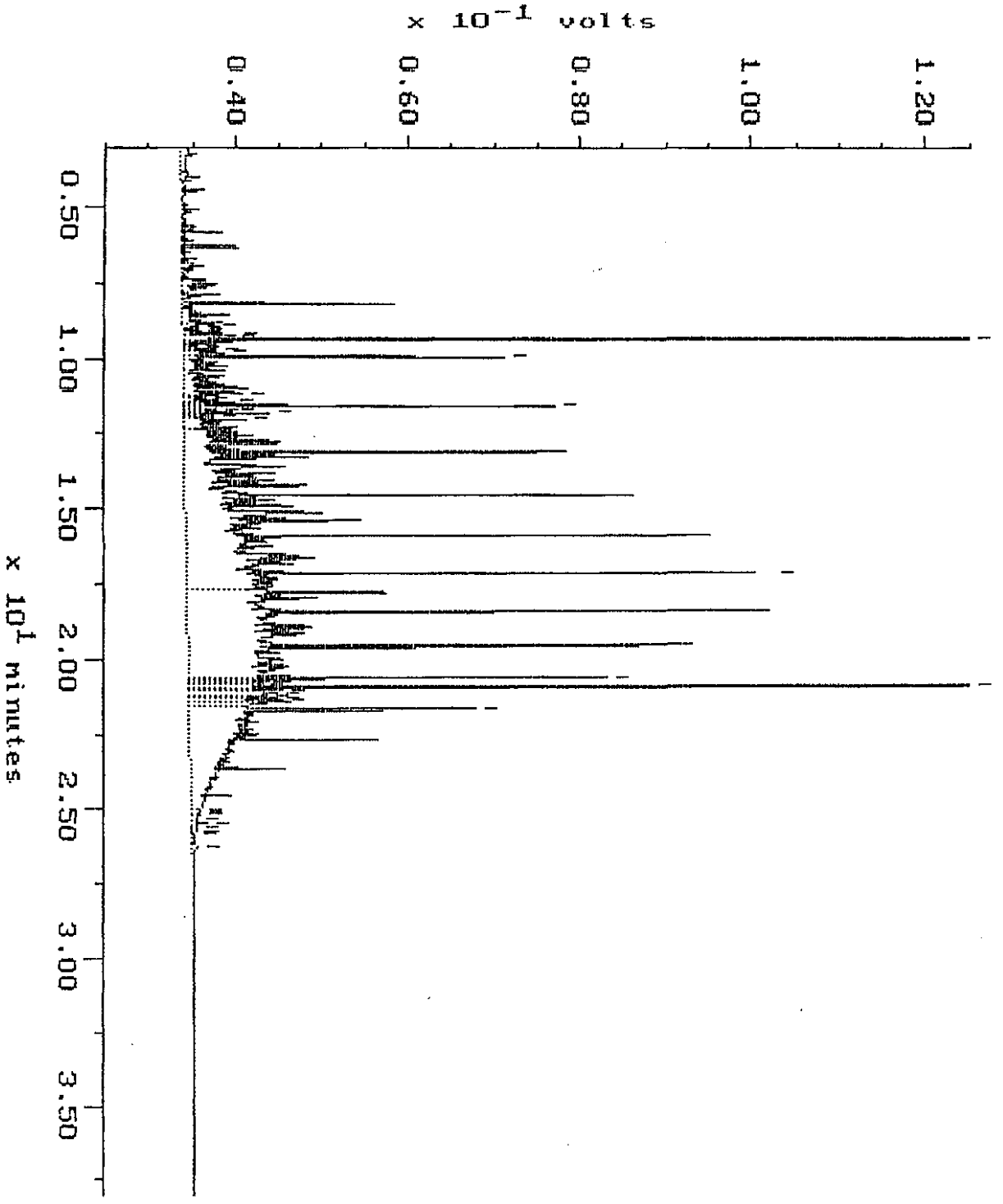
Blank

Sample: RINSE BLK 10-7 Channel: FRED Filename: RA078F05
Acquired: 07-OCT-93 17:08 Method: F:\BRD2\MAXDATA\FRED\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



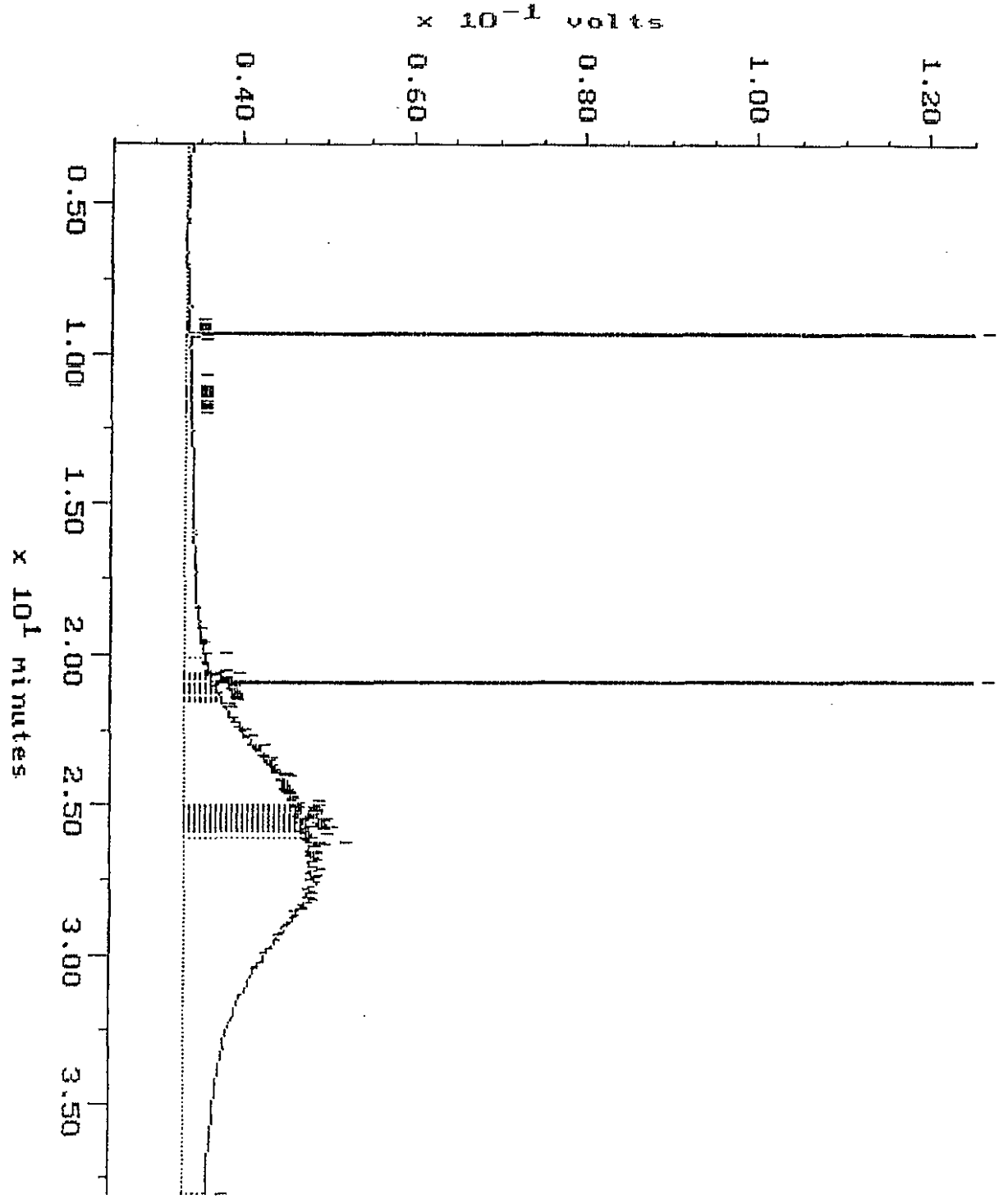
Continuing Calibration

Sample: D 500 Channel: DEMITRI Filename: R0078D08
Acquired: 07-OCT-93 13:44 Method: F:\BRO2\MAXDATA\SERGE-D\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



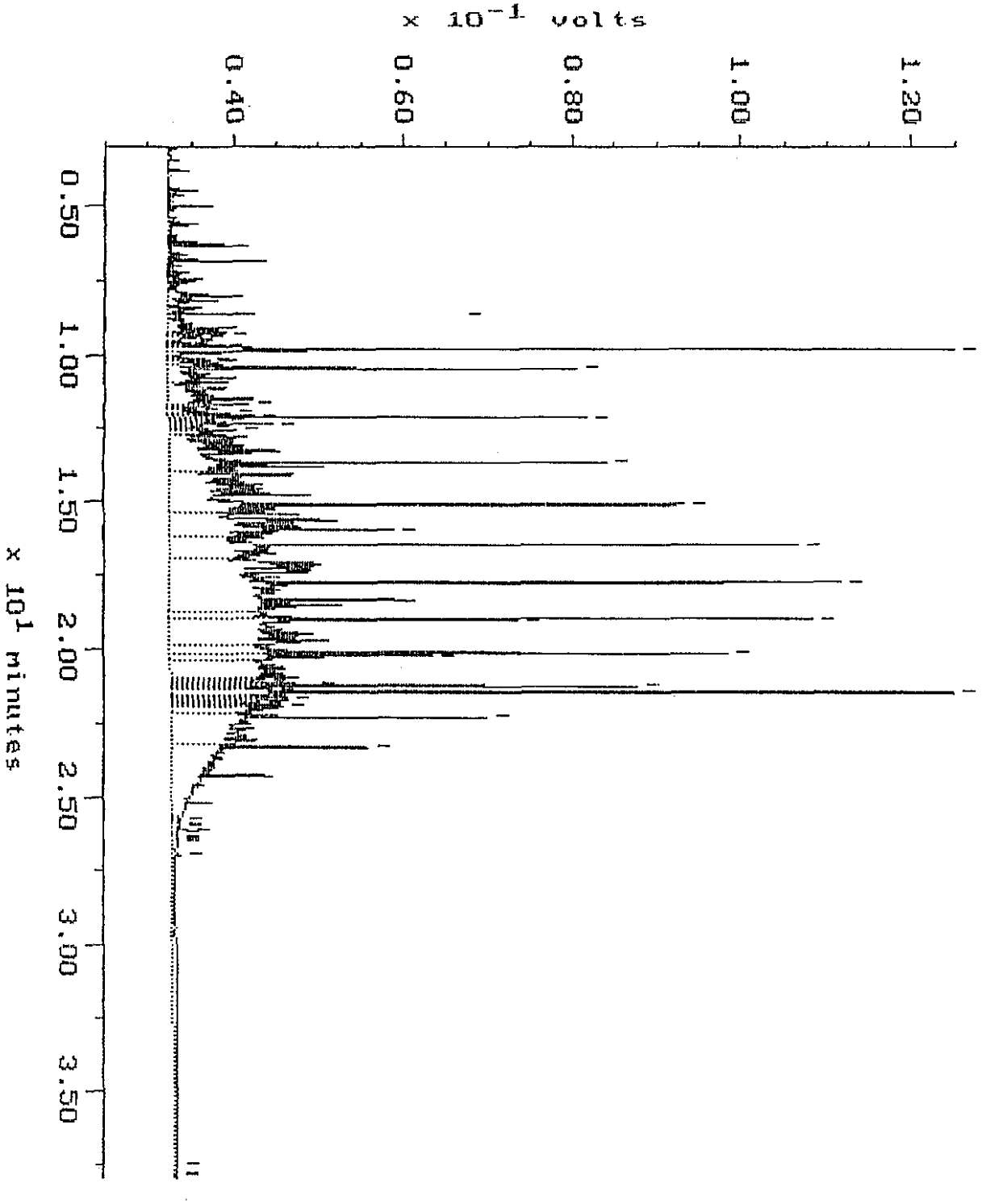
Continuing Calibration

Sample: MO 500 Channel: DEMITRI Filename: R0078D09
Acquired: 07-OCT-93 15:18 Method: F:\BRU2\MAXDATA\SERGE-D\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



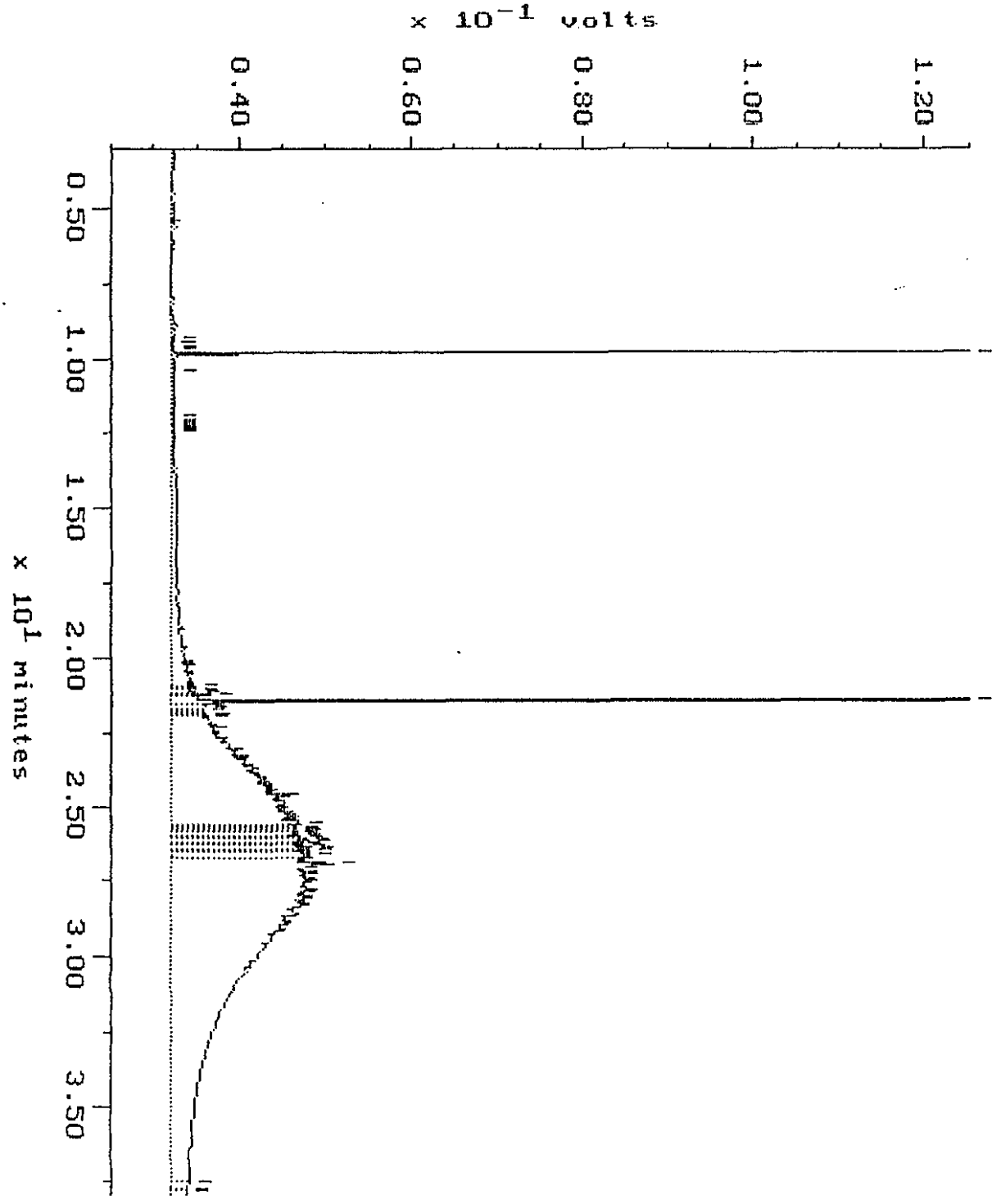
Continuing Calibration

Sample: D 500 Channel: FRED Filename: RA078F02
Acquired: 07-OCT-93 13:09 Method: F:\BRG2\MAXDATA\FRED\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Continuing Calibration

Sample: MO 500 Channel: FRED Filename: RA078F03
Acquired: 07-OCT-93 13:56 Method: F:\BRO2\MAXDATA\FRED\FUEL1007 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Analytical Technologies, Inc.

DATE: 10/7/93 Page 1 of 1 ATI ACCESSION # 9310-078

COMPANY: Conestoga
REPORT TO: Norm Puri
ADDRESS: 6400 15th Ave NE
Redmond WA 98074
PHONE: ( ) 861-6018 FAX: ( ) -
PROJECT MANAGER: D. Crist
PROJECT NUMBER: 0161-013-R69
PROJECT NAME: Unocal

ATI will DISPOSE / RETURN samples (circle one)

Sample ID	Date	Time	Matrix	Lab ID
MW-37	10/7/93	430	Water	-1
MW-4C	↓	455	Water	-2
MW-34	↓	700	↓	-3

FUELS											ORGANIC COMPOUNDS											METALS			TCLP					OTHER					
TPH-HCID WA/OR	BETX/TPH-G combo (WA/OR)	BETX (by 8020) WA/OR	TPH-G WA/OR	TPH-D (Extended) WA/OR	8015 modified WA/OR	418.1	413.2	AK-GRO	AK-DRO	8240 GCMS Volatiles	8270 GCMS Semivolatiles	8080 Pesticides/PCBs	PCB only (by 8080) STD/lo level	8010 Halogenated VOCs	8020 Aromatic VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	Metals (Indicate below *)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCLP-Volatiles (ZHE-8240)	TCLP-Semivolatiles (8270)	TCLP-Pesticides (8080)	TCLP-Herbicides (8150)	TCLP-Metals (8 metals)	% Moisture (please indicate)	Extended Range				Total # of Containers/sample
	X			X										X							X												7
	X			X									X	X							X								X				8
	X			X									X	X							X								X				8

Turnaround Time		Sample Receipt	
STANDARD TAT		TOTAL # CONTAINERS RECVD	22
1 WEEK TAT		COC SEALS PRESENT?	NO
4 WORK DAY TAT		COC SEALS INTACT?	NO
3 WORK DAY TAT		RECEIVED COLD?	Y
2 WORK DAY TAT		RECEIVED INTACT?	Y
24 HOUR TAT	✓	RECEIVED VIA:	HAND DEL

Special Instructions: 1) Please fax results to [illegible]
2) Please change MW-19 to MW-37 on final report. This was labelled incorrectly in the field
* Metals needed:

Relinquished By:	Relinquished By:	Relinquished By:
Date: 10/7/93	Date:	Date:
Time: MAXWELL 1415	Time:	Time:
Received By:	**Received By:**	**Received By:**
Date: Rob Sweeney 10/7/93	Date:	Date:
Time: Robin Sweeney 14:15	Time:	Time:

Corporate Offices: 5550 Morehouse Drive, San Diego, CA 92121 (619)458-9141

3) -TPH-D with extended range/BOIL to include EDB & EDC

B - 49

Analytical**Technologies,**Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
Karen L. Mixon, Laboratory Manager

ATI I.D. # 9310-154

November 8, 1993

GeoEngineers
NOV 09 1993
Routing
File

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Attention : Norm Puri

Project Number : 0161-013-R04

Project Name : Unocal - WL&M

Dear Mr. Puri:

On October 18, 1993, Analytical Technologies, Inc. (ATI), received two samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Elaine M. Walker

Elaine M. Walker
Project Manager

EMW/hal/elf

Enclosure

Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

ATI I.D. # 9310-154

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9310-154-1	MW-2	10/15/93	PRODUCT
9310-154-2	COMPOSITE DRUM	10/15/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	1
WATER	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

ANALYSIS	TECHNIQUE	REFERENCE	LAB
PURGEABLE HALOCARBONS	GC/ELCD	EPA 8010	R
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R
OIL & GREASE	IR	EPA 413.2	R
LEAD	AA/GF	EPA 7421	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9310-154

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE: VOLATILE ORGANICS ANALYSIS

One (1) sample was received by ATI on October 18, 1993, for the following analysis: EPA method 8010.

All corresponding quality assurance and quality control results defined as blank spike/blank spike duplicate (BS/BSD), method blank and surrogate recoveries were within the ATI established control limits.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/25/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/25/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BROMODICHLOROMETHANE	<0.10
BROMOFORM	<0.10
BROMOMETHANE	<0.50
CARBON TETRACHLORIDE	<0.10
CHLOROBENZENE	<0.25
CHLOROETHANE	<0.50
CHLOROFORM	<0.10
CHLOROMETHANE	<1.0
1,2-DIBROMOETHANE (EDB)	<0.25
1,2-DICHLOROBENZENE	<0.25
1,3-DICHLOROBENZENE	<0.25
1,4-DICHLOROBENZENE	<0.25
DIBROMOCHLOROMETHANE	<0.10
1,1-DICHLOROETHANE	<0.10
1,2-DICHLOROETHANE	<0.10
1,1-DICHLOROETHENE	<0.10
CIS-1,2-DICHLOROETHENE	<0.10
TRANS-1,2-DICHLOROETHENE	<0.10
1,2-DICHLOROPROPANE	<0.10
CIS-1,3-DICHLOROPROPENE	<0.10
TRANS-1,3-DICHLOROPROPENE	<0.10
METHYLENE CHLORIDE	<1.0
1,1,2,2-TETRACHLOROETHANE	<0.10
TETRACHLOROETHENE	<0.10
1,1,1-TRICHLOROETHANE	<0.10
1,1,2-TRICHLOROETHANE	<0.10
TRICHLOROETHENE	<0.10
TRICHLOROFLUOROMETHANE	<0.25
VINYL CHLORIDE	<0.50

SURROGATE PERCENT RECOVERY		LIMITS
BROMOCHLOROMETHANE	86	38 - 140

Analytical Technologies, Inc.

ATI I.D. # 9310-154-1

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/15/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/25/93
CLIENT I.D.	: MW-2	DATE ANALYZED	: 10/26/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8010	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BROMODICHLOROMETHANE	<0.10
BROMOFORM	<0.10
BROMOMETHANE	<0.50
CARBON TETRACHLORIDE	<0.10
CHLOROBENZENE	<0.25
CHLOROETHANE	<0.50
CHLOROFORM	<0.10
CHLOROMETHANE	<1.0
1,2-DIBROMOETHANE (EDB)	<0.25
1,2-DICHLOROBENZENE	<0.25
1,3-DICHLOROBENZENE	<0.25
1,4-DICHLOROBENZENE	<0.25
DIBROMOCHLOROMETHANE	<0.10
1,1-DICHLOROETHANE	<0.10
1,2-DICHLOROETHANE	<0.10
1,1-DICHLOROETHENE	<0.10
CIS-1,2-DICHLOROETHENE	<0.10
TRANS-1,2-DICHLOROETHENE	<0.10
1,2-DICHLOROPROPANE	<0.10
CIS-1,3-DICHLOROPROPENE	<0.10
TRANS-1,3-DICHLOROPROPENE	<0.10
METHYLENE CHLORIDE	<1.0
1,1,2,2-TETRACHLOROETHANE	<0.10
TETRACHLOROETHENE	<0.10
1,1,1-TRICHLOROETHANE	<0.10
1,1,2-TRICHLOROETHANE	<0.10
TRICHLOROETHENE	<0.10
TRICHLOROFLUOROMETHANE	<0.25
VINYL CHLORIDE	<0.50

SURROGATE PERCENT RECOVERY		LIMITS
BROMOCHLOROMETHANE	79	38 - 140

Analytical Technologies, Inc.

ATI I.D. # 9310-154

VOLATILE ORGANICS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : PRODUCT
EPA METHOD : 8010

SAMPLE I.D. # : BLANK
DATE EXTRACTED : 10/25/93
DATE ANALYZED : 10/25/93
UNITS : mg/Kg

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
CHLOROBENZENE	<0.250	4.00	4.16	104	4.55	114	9
1,1-DICHLOROETHENE	<0.100	4.00	4.08	102	4.34	109	6
TRICHLOROETHENE	<0.100	4.00	4.01	100	4.33	108	8

CONTROL LIMITS	% REC.	RPD
CHLOROBENZENE	71 - 163	20
1,1-DICHLOROETHENE	30 - 161	22
TRICHLOROETHENE	55 - 146	24

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOCHLOROMETHANE	90	93	38 - 140

Analytical Technologies, Inc.

ATI I.D. # 9310-154

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE : BETX - GASOLINE ANALYSIS

Two (2) samples were received by ATI on October 18, 1993, for BETX analysis according to EPA method 8020 and gasoline range hydrocarbons according to WA DOE WTPH-G.

The surrogate recovery of bromofluorobenzene for sample 9310-154-2 (COMPOSITE DRUM) was outside of the ATI established control limits due to matrix interference.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/18/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	111	76 - 120
TRIFLUOROTOLUENE	102	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/19/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	109	76 - 120
TRIFLUOROTOLUENE	102	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/20/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	110	76 - 120
TRIFLUOROTOLUENE	102	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/15/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-2	DATE ANALYZED	: 10/20/93
SAMPLE MATRIX	: PRODUCT	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 50

COMPOUNDS	RESULTS
BENZENE	1300
ETHYLBENZENE	310
TOLUENE	1700
TOTAL XYLENES	4100
FUEL HYDROCARBONS	50000
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	112	76 - 120
TRIFLUOROTOLUENE	99	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154-2

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/15/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: N/A
CLIENT I.D.	: COMPOSITE DRUM	DATE ANALYZED	: 10/20/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
BENZENE	<0.5	
ETHYLBENZENE	1.5	
TOLUENE	1.8	
TOTAL XYLENES	480	D5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	157 F	76 - 120

D5 = Value from a twenty fold diluted analysis.
F = Out of limits due to matrix interference.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : 9310-148-1
DATE EXTRACTED : N/A
DATE ANALYZED : 10/18/93
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.500	N/A	N/A	20.0	19.1	96	18.7	94	2
TOLUENE	<0.500	N/A	N/A	20.0	20.1	101	19.8	99	2
TOTAL XYLENES	<0.500	N/A	N/A	40.0	40.3	101	39.7	99	1
GASOLINE	<100	<100	NC	1000	1090	109	1070	107	2

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	111	110	76 - 120
TRIFLUOROTOLUENE	103	101	50 - 150

NC = Not Calculable.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : BLANK
DATE EXTRACTED : N/A
DATE ANALYZED : 10/18/93
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.0	95	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.1	101	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	40.2	101	N/A	N/A	N/A
GASOLINE	<100	1000	1060	106	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	112	N/A	76 - 120
TRIFLUOROTOLUENE	102	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/19/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.2	96	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.5	102	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	40.7	102	N/A	N/A	N/A
GASOLINE	<100	1000	1110	111	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	110	N/A	76 - 120
TRIFLUOROTOLUENE	103	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : BLANK
DATE EXTRACTED : N/A
DATE ANALYZED : 10/20/93
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.1	96	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.3	102	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	41.0	102	N/A	N/A	N/A
GASOLINE	<100	1000	1160	116	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	111	N/A	76 - 120
TRIFLUOROTOLUENE	104	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE : TOTAL PETROLEUM HYDROCARBONS (WA DOE WTPH-D) ANALYSIS

One (1) water sample was received by ATI on October 18, 1993, for analysis by WA DOE WTPH-D extended method. The sample was extracted on October 18, 1993, and analyzed on October 19, 1993.

The relative percent difference (RPD) between the associated quality control sample 9310-155-1 and its duplicate was outside of ATI established control limits due to a high level of target analytes.

The surrogate recovery for sample 9310-154-1 (MW-2) was outside of ATI established control limits due to sample dilution.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R04	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/18/93
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 10/18/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<0.25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	101	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 10/15/93
PROJECT #	: 0161-013-R04	DATE RECEIVED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE EXTRACTED	: 10/18/93
CLIENT I.D.	: MW-2	DATE ANALYZED	: 10/19/93
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 50

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	200
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	150
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY			LIMITS
O-TERPHENYL	154	I	50 - 150

I = Surrogate out of limits due to sample dilution.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9310-155-1
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/19/93
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	15.7	20.8	28G	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
DIESEL	N/A	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
O-TERPHENYL	139	112	50 - 150

G = Out of limits due to high levels of target analytes in sample.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-D

SAMPLE I.D. # : BLANK
DATE EXTRACTED : 10/18/93
DATE ANALYZED : 10/18/93
UNITS : mg/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIESEL	<0.250	2.50	2.47	99	2.56	102	4

CONTROL LIMITS	% REC.	RPD
DIESEL	70 - 115	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
O-TERPHENYL	103	106	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9310-154

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE : OIL & GREASE ANALYSIS

One (1) water sample was received by ATI on October 18, 1993, for oil and grease analysis. This sample was extracted and analyzed in accordance with EPA method 413.2.

All corresponding quality assurance and quality control results defined as matrix spike/matrix spike duplicate (MS/MSD) and blank spike (BS) were within the ATI established control limits. The BS served as the Laboratory Control Sample (LCS). The relative percent difference (RPD) for sample 9310-138-7 and its duplicate was out of ATI established control limits. These samples were determined to be non-homogeneous.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

OIL & GREASE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE EXTRACTED	: 10/18/93
PROJECT #	: 0161-013-R04	DATE ANALYZED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	UNITS	: mg/L
EPA METHOD	: 413.2	SAMPLE MATRIX	: WATER

ATI I.D. #	CLIENT I.D.	OIL & GREASE
9310-154-2	COMPOSITE DRUM	25
METHOD BLANK	-	<1

Analytical Technologies, Inc.

ATI I.D. # 9310-154

OIL & GREASE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M
EPA METHOD : 413.2
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9310-138-7
DATE EXTRACTED : 10/18/93
DATE ANALYZED : 10/18/93
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
OIL & GREASE	2.70	5.83	73H	10	10.1	74	N/A	N/A	N/A

H = Out of limits.

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9310-154

OIL & GREASE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R04	DATE EXTRACTED	: 10/18/93
PROJECT NAME	: UNOCAL - WL&M	DATE ANALYZED	: 10/18/93
EPA METHOD	: 413.2	UNITS	: mg/L
SAMPLE MATRIX	: WATER		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
OIL & GREASE	<1	N/A	N/A	10	8.92	89	9.20	92	3

$$\% \text{ Recovery} = \frac{(\text{Spiked Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Spike Result} - \text{Dup. Spike Result})|}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

ATI I.D. # 9310-154

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

CASE NARRATIVE: METALS ANALYSIS

EPA SW-846 method 7421 was used to analyze the sample for the content of lead.

The percent recovery for lead in the matrix spike (MS) performed on sample 9310-144-4 was out of ATI established control limits due to matrix interference and has been flagged "F".

All other quality control parameters were within ATI established control limits.

Analytical Technologies, Inc.

ATI I.D. # 9310-154

METALS ANALYSIS

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

ELEMENT	DATE PREPARED	DATE ANALYZED
LEAD	10/20/93	10/28/93

Analytical Technologies, Inc.

ATI I.D. # 9310-154

METALS ANALYSIS
DATA SUMMARY

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD
9310-154-1	MW-2	42
METHOD BLANK	-	<0.15

Analytical Technologies, Inc.

ATI I.D. # 9310-154

METALS ANALYSIS
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R04
PROJECT NAME : UNOCAL - WL&M

MATRIX : PRODUCT
UNITS : mg/Kg

ELEMENT	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
LEAD	9310-144-4	3.2	2.9	10	5.21	1.38	146F
LEAD	BLANK	<0.15	N/A	N/A	1.48	1.25	118

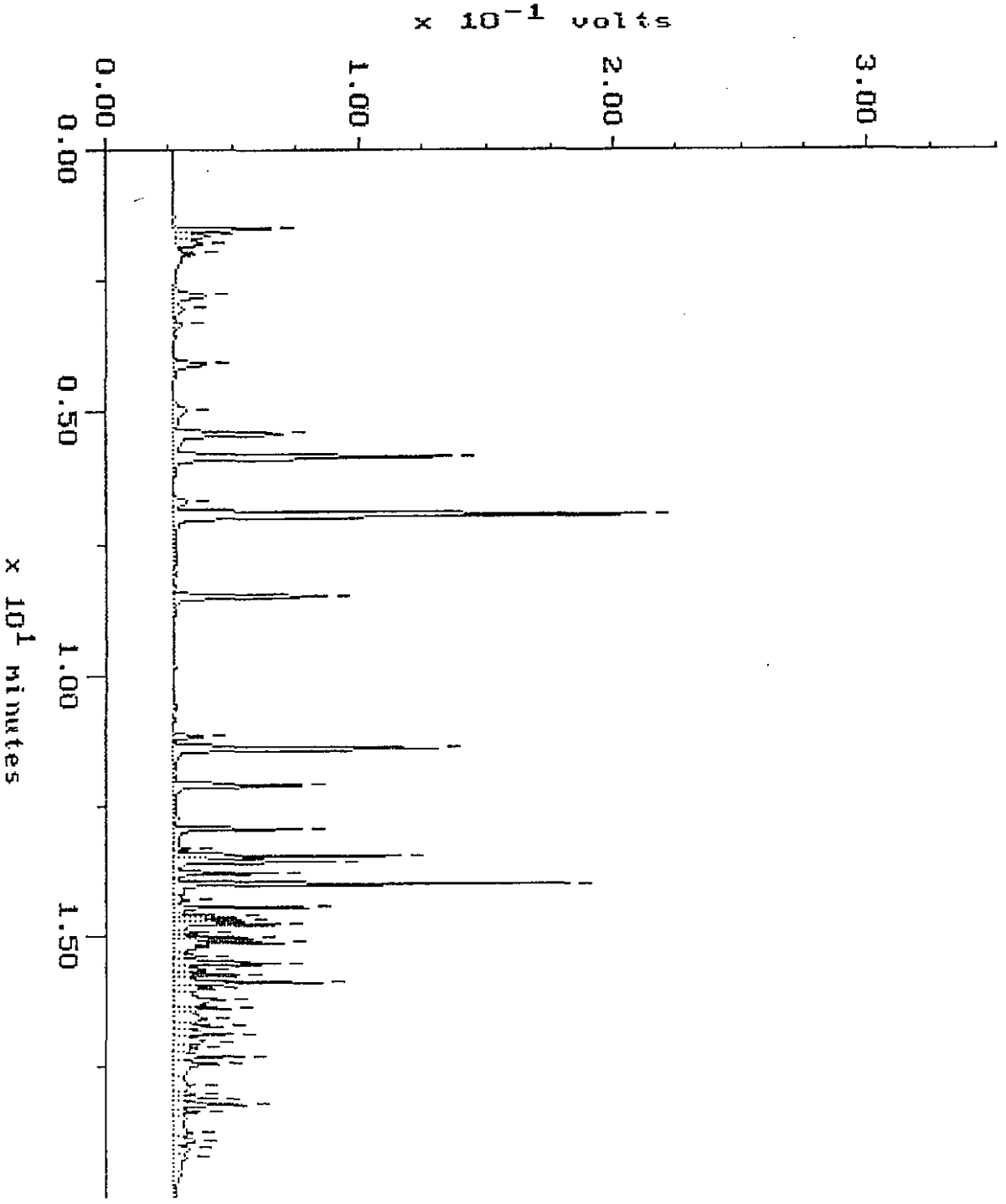
F = Out of limits due to matrix interference.

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{|(\text{Sample Result} - \text{Duplicate Result})|}{\text{Average Result}} \times 100$$

WA DOE WTPH-G

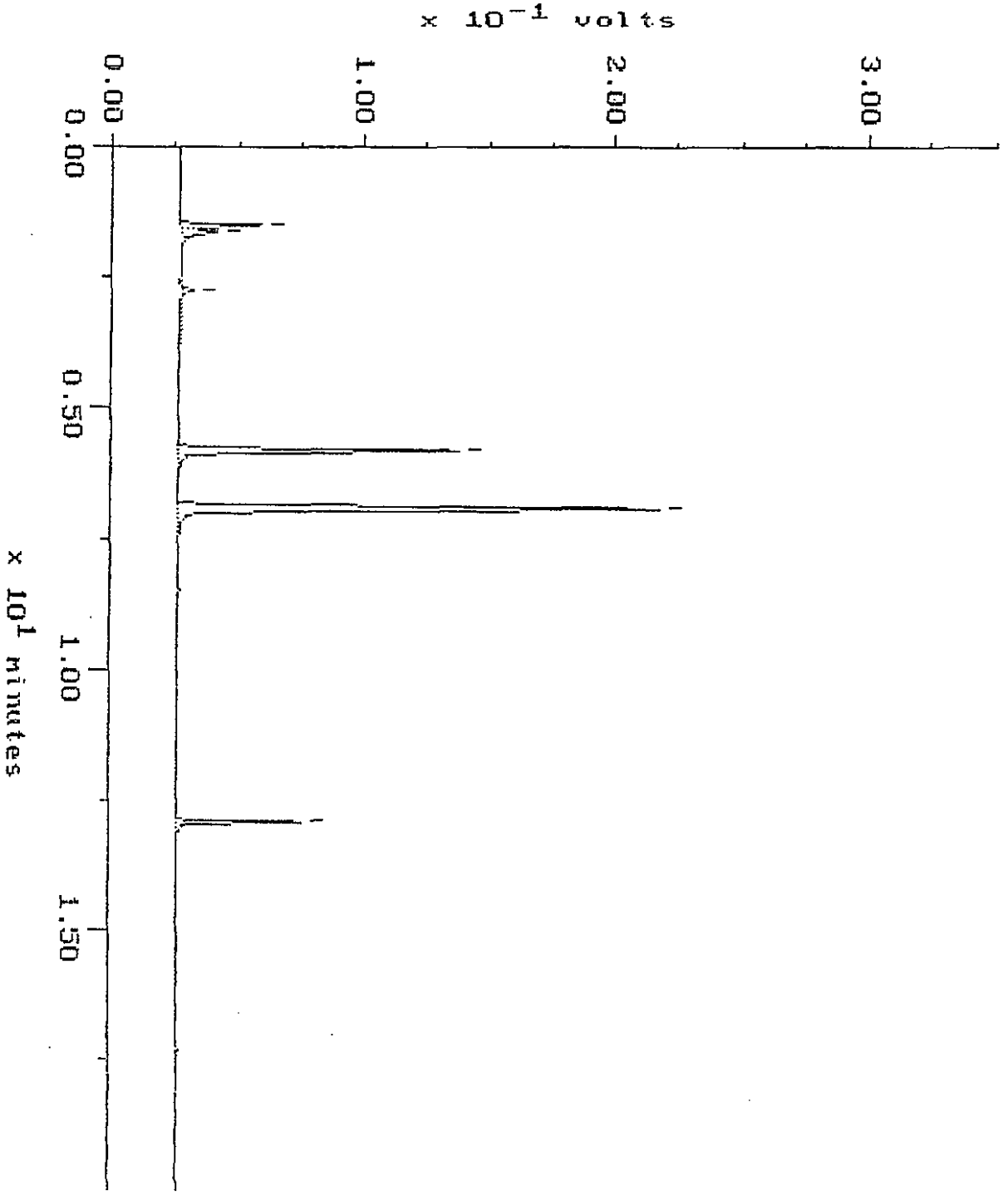
Sample: 9310-154-1 DIL Channel: FID Filename: RA199P37
Acquired: 20-OCT-93 4:43 Method: F:\BRD2\MAXDATA\PICARD\101993PC Operator: ATI
Dilution: 1 : 50.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Blank

WA DOE WTPH-G

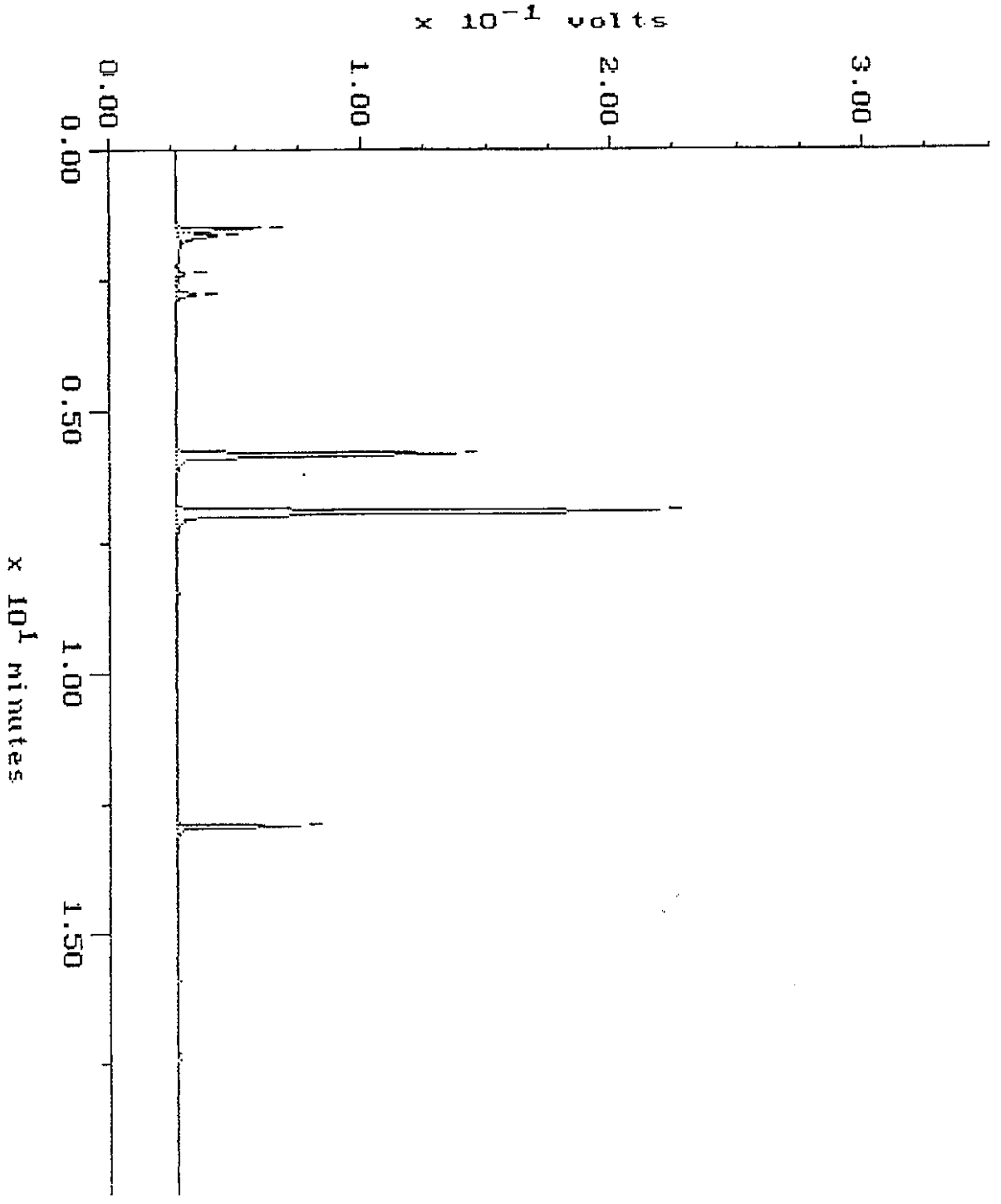
Sample: WRB 10-18 Channel: FID Filename: RA189P04
Acquired: 18-OCT-93 8:16 Method: F:\BRD2\MAXDATA\PICARD\101893PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



WA DOE WTPH-G

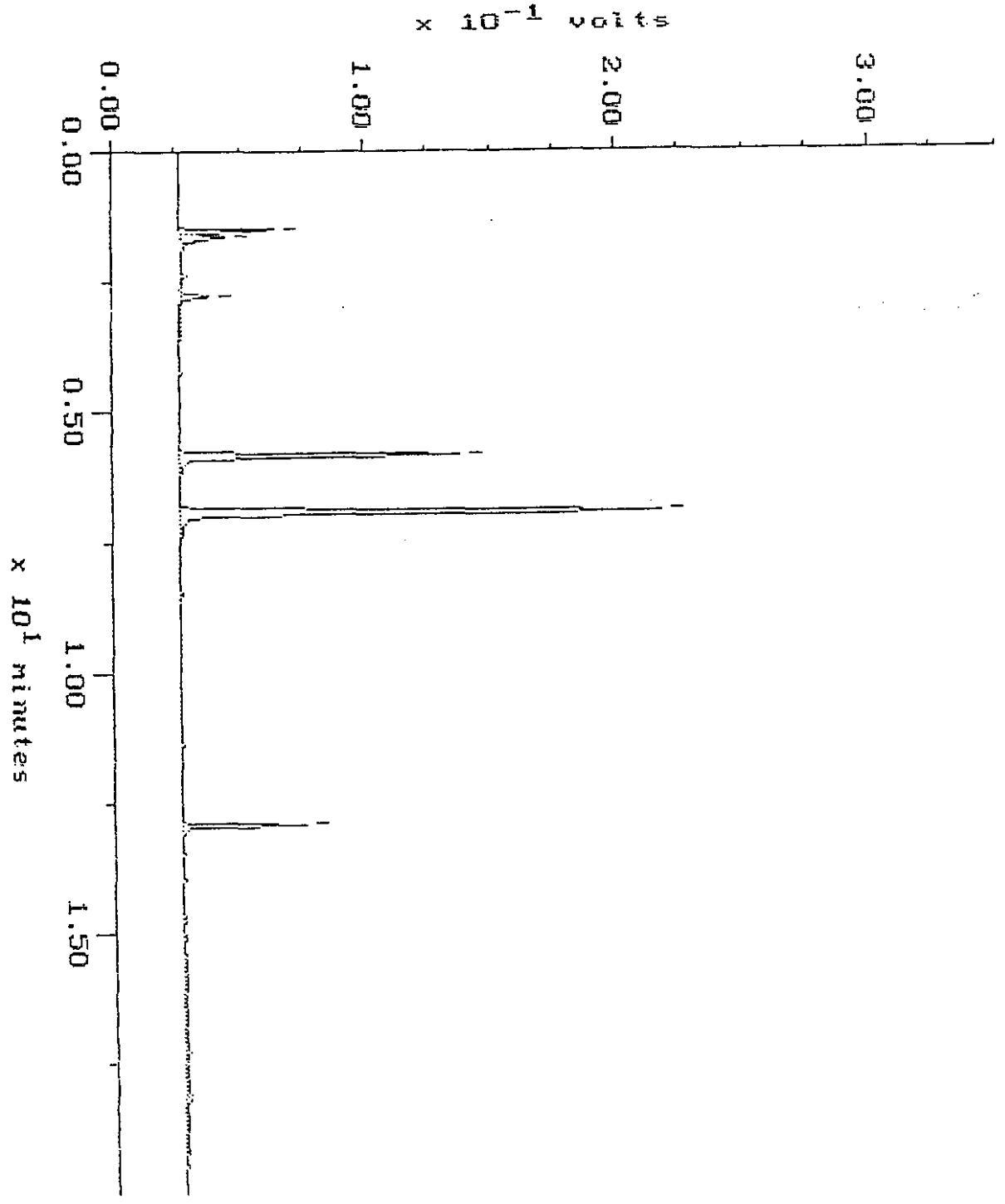
Blank

Sample: WRB 10-19 Channel: FID Filename: RA199F03
Acquired: 19-OCT-93 10:10 Method: F:\BRD2\MAXDATA\PICARD\101993PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



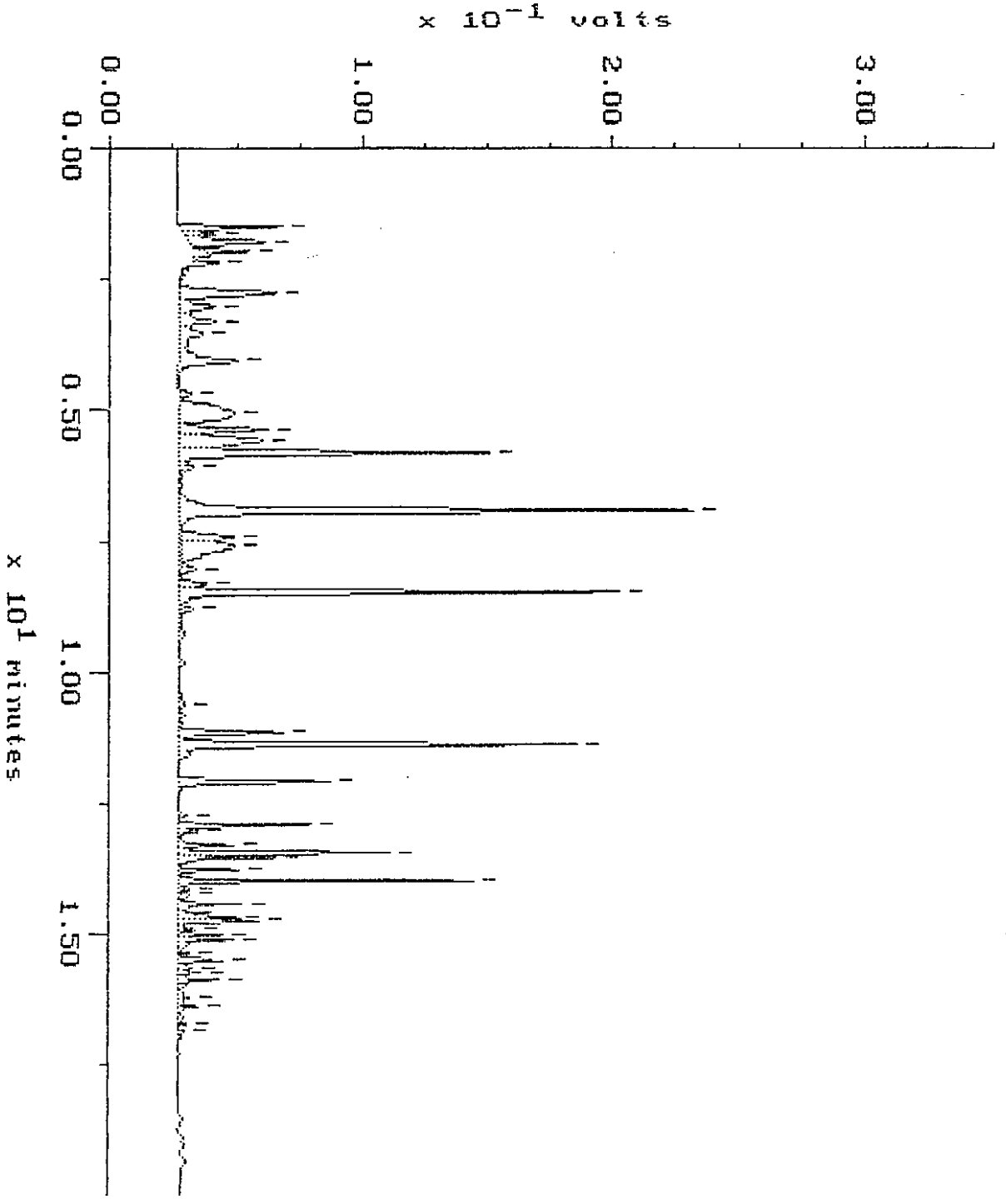
Blank WA DOE WTPH-G

Sample: WRB 10-20 Channel: FID Filename: RA209P05
Acquired: 20-OCT-93 9:46 Method: F:\BRD2\MAXDATA\PICARD\102093PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



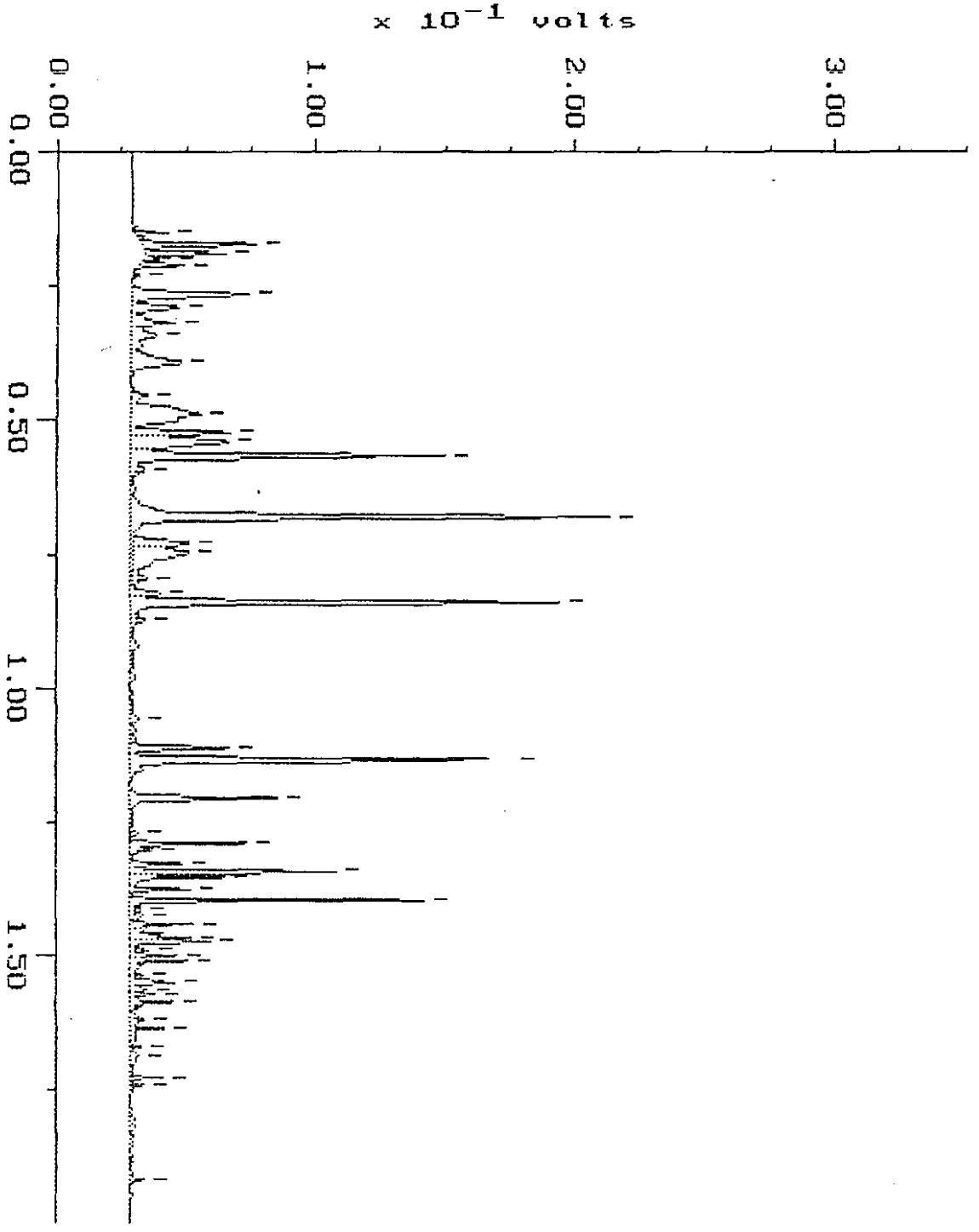
Continuing Calibration

Sample: STD-C 6 Channel: FID Filename: RA189P01
Acquired: 18-OCT-93 6:25 Method: F:\BRD2\MAXDATA\PICARD\101893PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



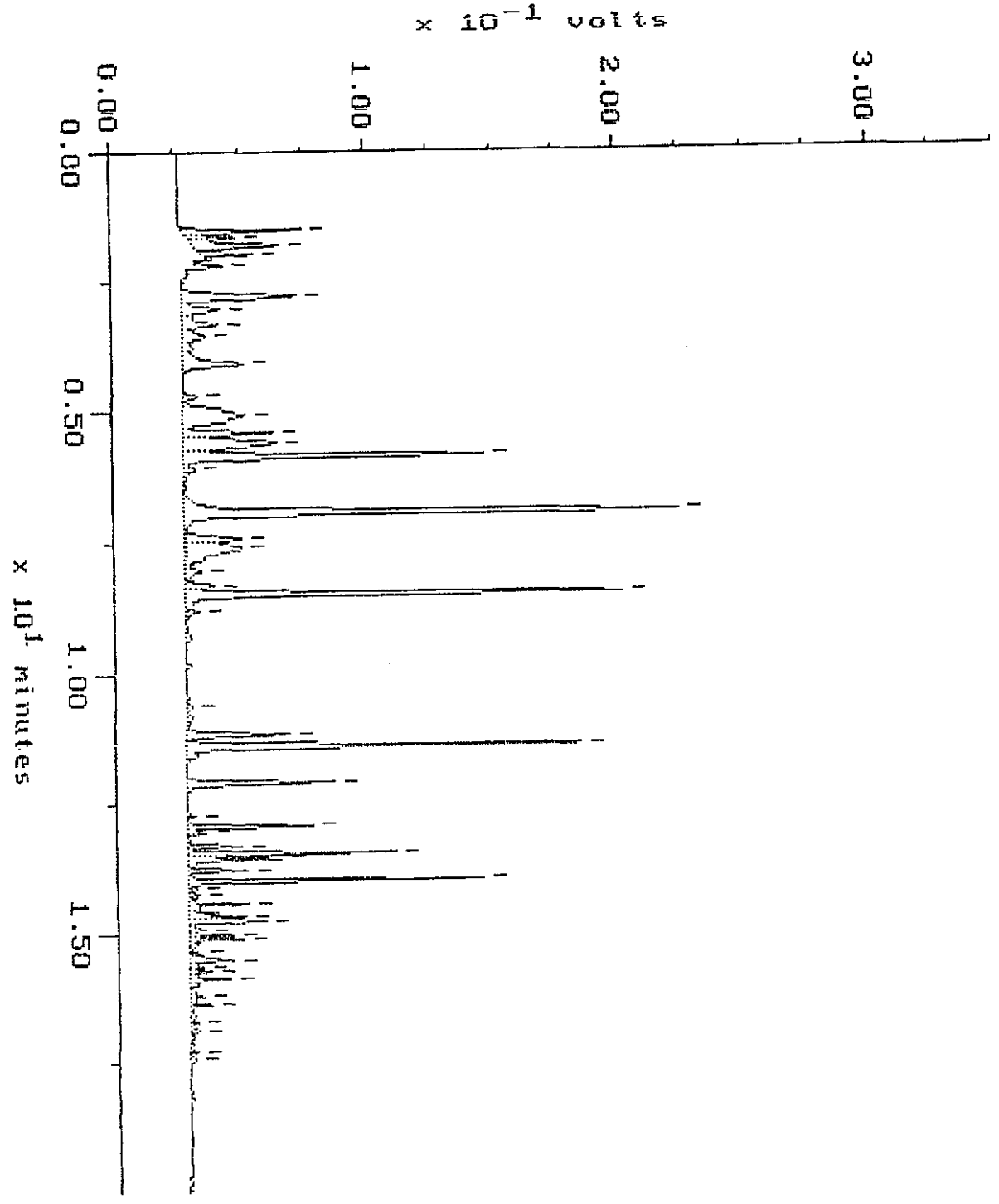
Continuing Calibration

Sample: STD-C 6 Channel: FID Filename: RA199P01
Acquired: 19-OCT-93 8:58 Method: F:\BRD2\MAXDATA\PICARD\101993PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



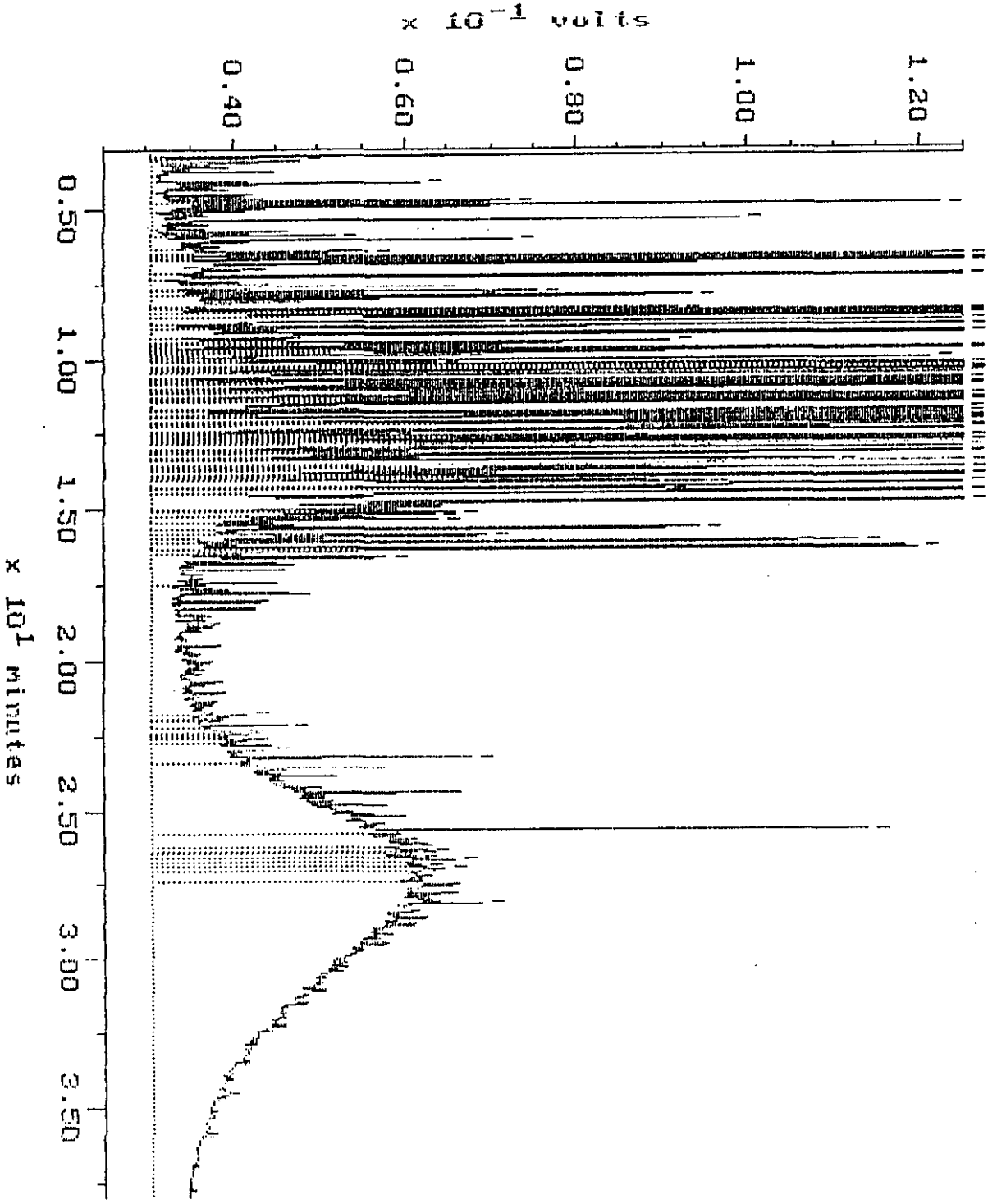
Continuing Calibration

Sample: STD-C 6 Channel: FID Filename: RA209P03
Acquired: 20-OCT-93 8:37 Method: F:\BRO2\MAXDATA\PICARD\102093PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

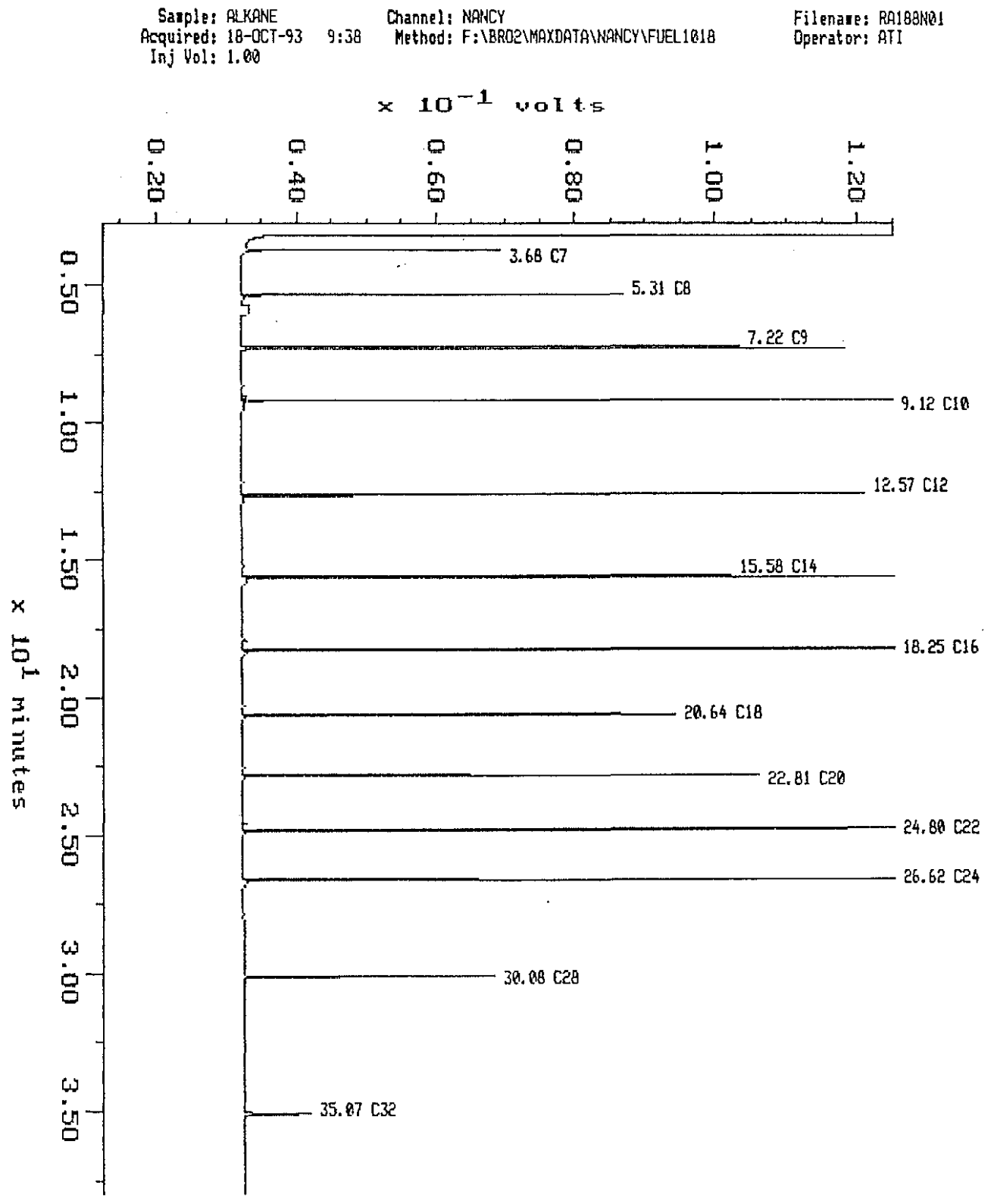


WA DOE WTPH-D

Sample: 9310-154-1 DIL Channel: NANCY Filename: RA198N07
Acquired: 19-OCT-93 15:18 Method: F:\BKO2\MAXDATA\NANCY\FUEL1019 Operator: ATI
Dilution: 1 : 50.000
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE

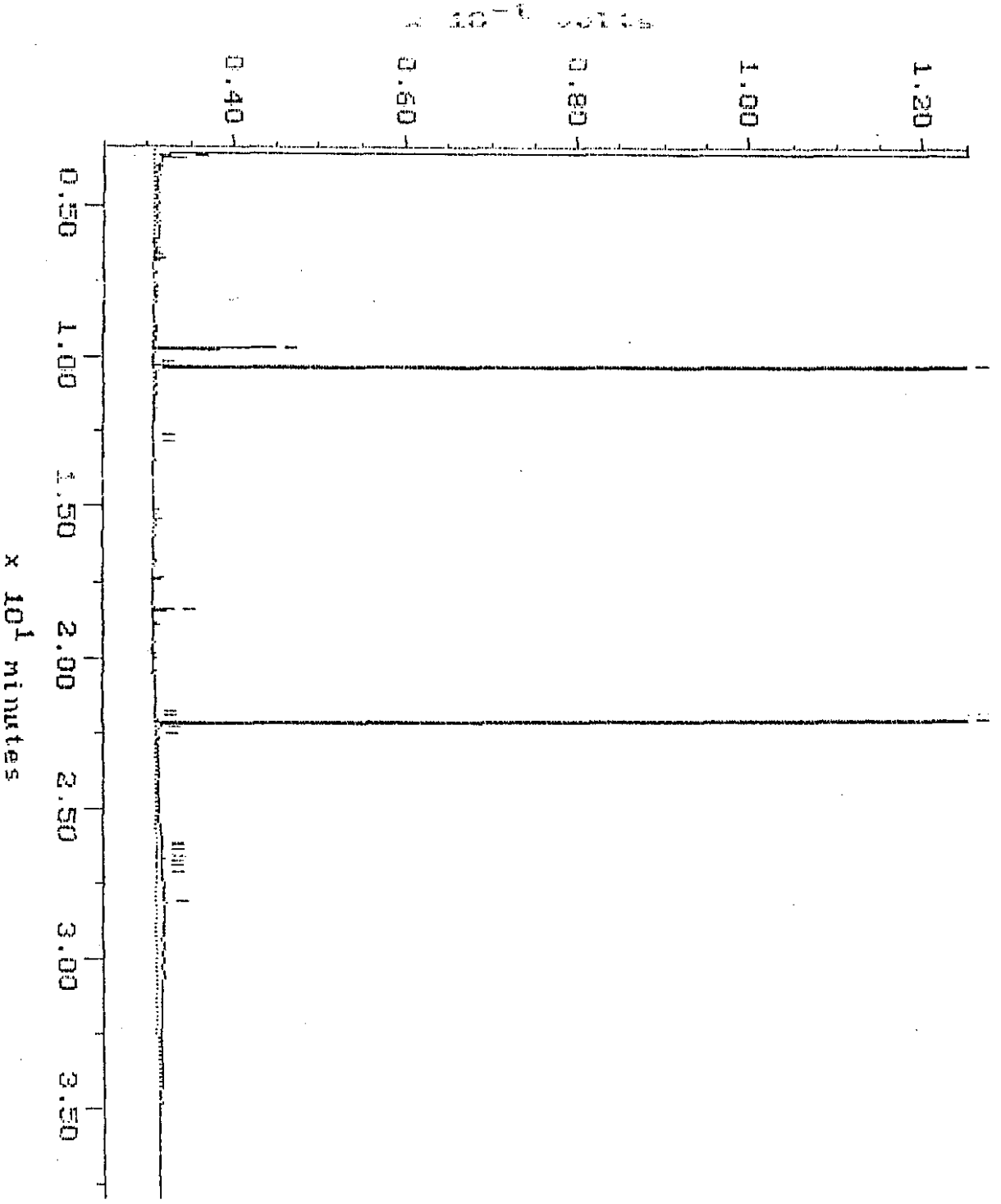


Alkane


Sample: ALKANE
Acquired: 18-OCT-93 9:38
Inj Vol: 1.00
Channel: NANCY
Method: F:\BRO2\MAXDATA\NANCY\FUEL1018
Filename: RA188N01
Operator: ATI
x 10⁻¹ volts
0.20
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes
3.68 C7
5.31 C8
7.22 C9
9.12 C10
12.57 C12
15.58 C14
18.25 C16
20.64 C18
22.81 C20
24.80 C22
26.62 C24
30.08 C28
35.07 C32

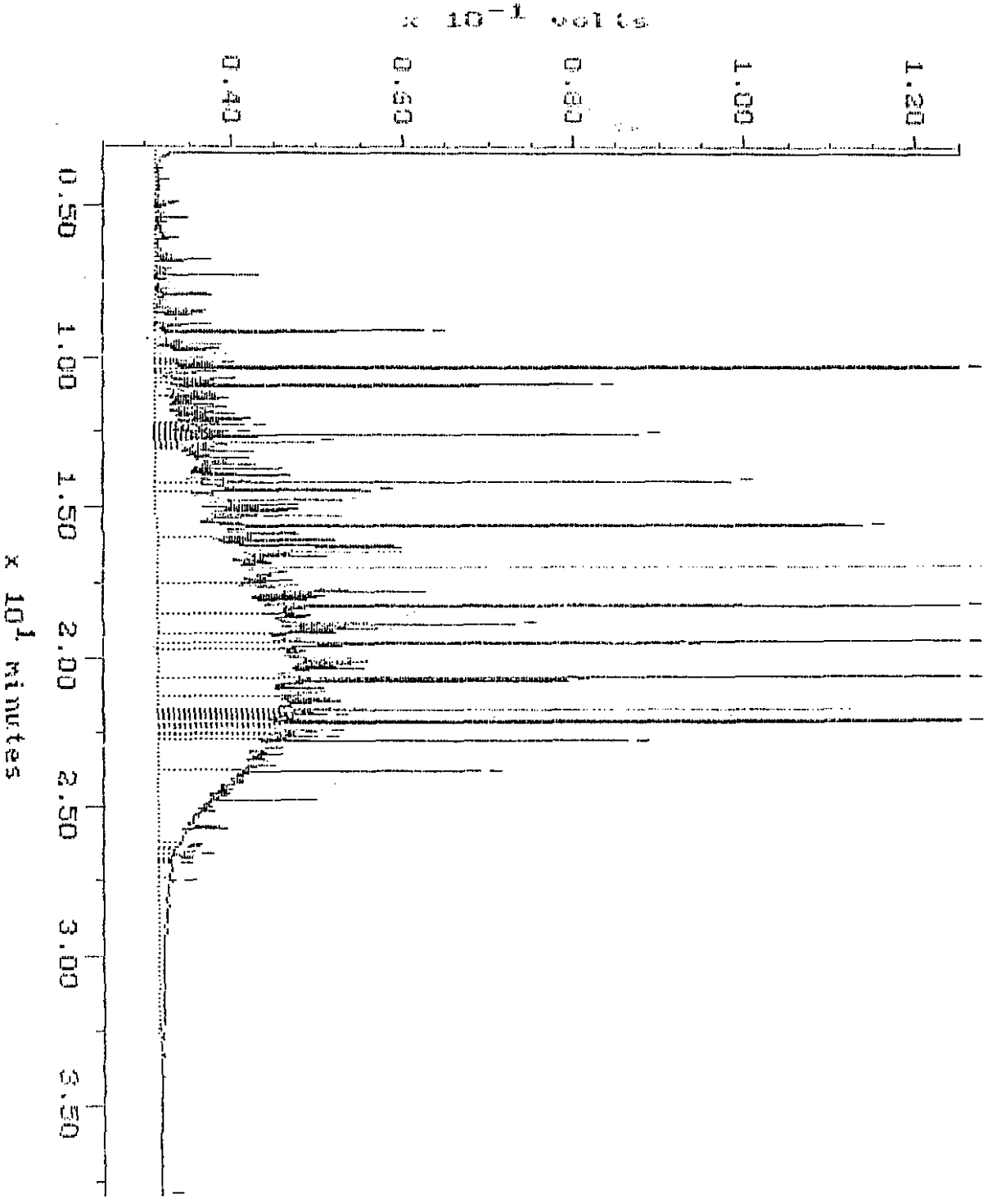
Blank

Sample: WRB 10-18 Channel: MAXCY Filename: AR18CR88
Acquired: 18-OCT-93 15:28 Method: F:\BRO2\MAXDATA\MAXCY\FUEL1018 Operator: ATI
Comments: ATI NUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE



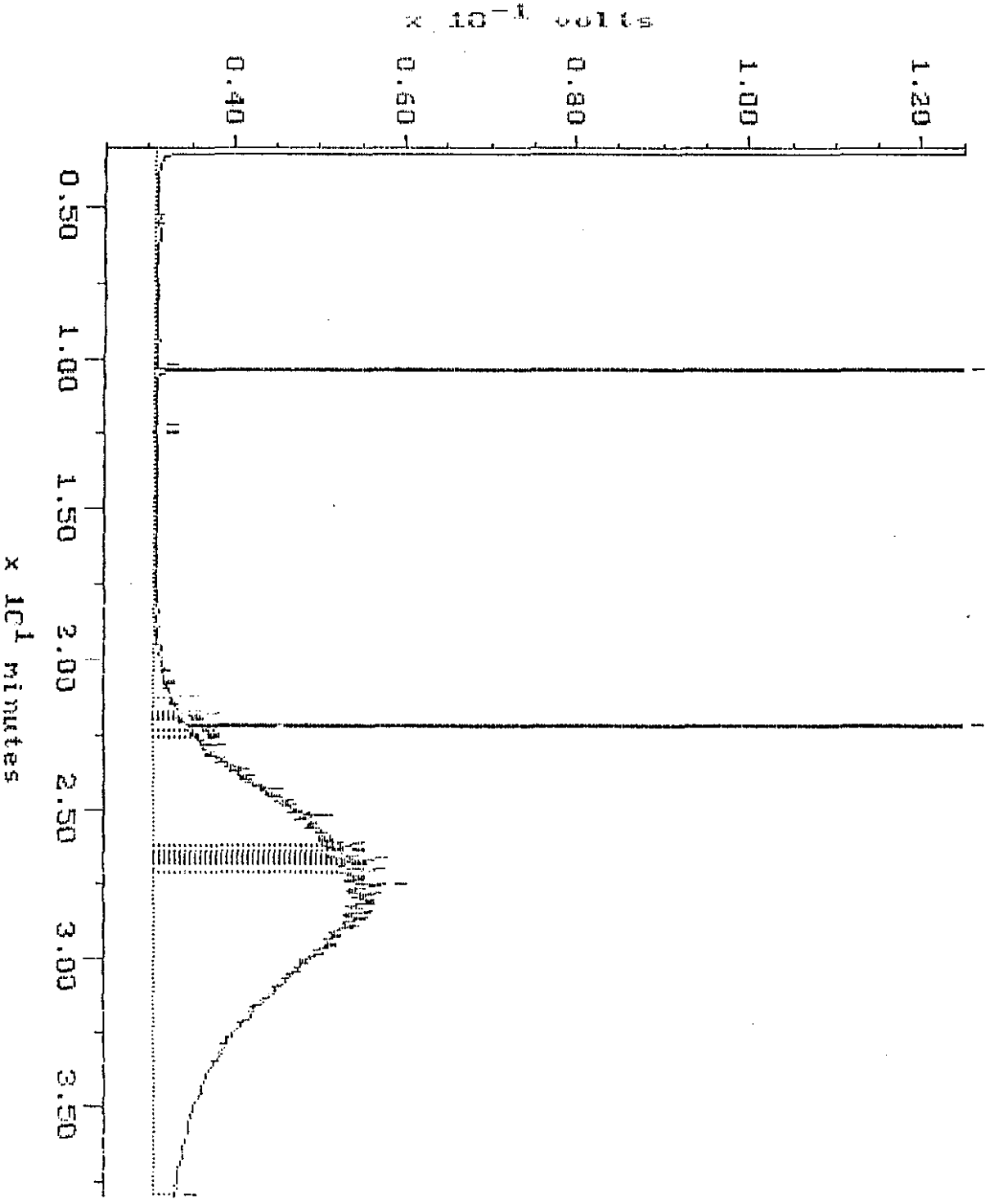
Continuing Calibration

Sample: D 566 Channel: HRRC1 Filename: RR166R06
Acquired: 16-OCT-95 13:33 Method: F:\RMOZ\WRKDATA\RRRC1\FUEL1016 Operator: RTI
Comments: RTI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE



Continuing Calibration

Sample: NO 500 Channel: NANCY Filename: RA166H07
Acquired: 18-OCT-93 14:28 Method: F:\BR02\MAXDATA\NANCY\FUEL1018 Operator: ATI
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE



560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335

AnalyticalTechnologies, Inc.

DATE: 10/15/93 Page 1 of 1 ATI ACCESSION # 7310-154

COMPANY: GROUNDWATER S
REPORT TO: MARK ARI
ADDRESS: 5710 154TH AVE NE
REDMOND WA 98052
PHONE: (206) 881-6000 FAX: (206) 861-6050
PROJECT MANAGER: MARK ARI
PROJECT NUMBER: 161-013-004
PROJECT NAME: CHEVRON WEARE

ATI will (DISPOSE) / RETURN samples (circle one)

Sample ID	Date	Time	Matrix	LabID
MW-2	10/15/93	0900	WDP	1
COMPOSITE-A	10/15/93	0830	W	2

	FUELS										ORGANIC COMPOUNDS										METALS			TCLP					OTHER					
	TPH-HCID WA/OR	BETX/TPH-G combo (WA/OR)	BETX (by 8020) WA/OR	TPH-G WA/OR	TPH-D (Extended) (WA/OR)	8015 modified WA/OR	418.1	413.2	AK-GRO	AK-DRO	8240 GCMS Volatiles	8270 GCMS Semivolatiles	8080 Pesticides/PCBs	PCB only (by 8080) STD/lo level	8010 Halogenated VOCs	8020 Aromatic VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	Metals (Indicate below *)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCLP-Volatiles (ZHE-8240)	TCLP-Semivolatiles (8270)	TCLP-Pesticides (8080)	TCLP-Herbicides (8150)	TCLP-Metals (8 metals)	% Moisture (please indicate)					Total # of Containers/sample
MW-2		X			X										X							X											6
COMPOSITE-A			X					X																									2

Turnaround Time

STANDARD TAT	X
1 WEEK TAT	
4 WORK DAY TAT	
3 WORK DAY TAT	
2 WORK DAY TAT	
24 HOUR TAT	

Sample Receipt

TOTAL # CONTAINERS RECVD	9
COC SEALS PRESENT?	Y
COC SEALS INTACT?	Y
RECEIVED COLD?	Y
RECEIVED INTACT?	Y
RECEIVED VIA:	COURIER

Special Instructions:
SOIL TO INCLUDE EDB/EDC
TPH-D W/EXTENDED RANGE.
* Metals needed:

Relinquished By: MARK ARI Date: 10/18/93 Time: MAXWELL 0830
Received By: [signature] Date: 10/14/93 Time: MARIA PEÑA 1605

Relinquished By: Date: Time:
Received By: Date: Time:

Relinquished By: Date: Time:
Received By: Date: Time:

Analytical Technologies, Inc.
560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
Karen L. Mixon, Laboratory Manager

ATI I.D. # 9312-344

January 21, 1994

GeoEngineers
JAN 24 1994
Routing NLP
File

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Attention : Norm Puri

Project Number : 0161-013-R69

Project Name : Unocal - Westlake & Mercer

Dear Mr. Puri:

On December 30, 1993, Analytical Technologies, Inc. (ATI), received 11 samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Elaine M. Walker

Elaine M. Walker
Project Manager

EMW/hal/sb

Enclosure

Corporate Offices: 5550 Morehouse Drive, San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

ATI I.D. # 9312-344

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9312-344-1	MW-32A	12/29/93	WATER
9312-344-2	MW-33	12/29/93	WATER
9312-344-3	MW-34	12/29/93	WATER
9312-344-4	MW-35	12/29/93	WATER
9312-344-5	MW-36	12/30/93	WATER
9312-344-6	MW-40	12/30/93	WATER
9312-344-7	MW-41	12/29/93	WATER
9312-344-8	MW-42	12/30/93	WATER
9312-344-9	MW-43	12/30/93	WATER
9312-344-10	MW-45	12/29/93	WATER
9312-344-11	MW-47	12/30/93	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	11

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9312-344

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	91	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	89	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/06/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	89	76 - 120
TRIFLUOROTOLUENE	92	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-32A	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS	
BENZENE	6300	D8
ETHYLBENZENE	940	
TOLUENE	990	
TOTAL XYLENES	1700	D8
FUEL HYDROCARBONS	19000	
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	110	76 - 120
TRIFLUOROTOLUENE	89	50 - 150

D8 = Value from a 250 fold diluted analysis.

Analytical Technologies, Inc.

ATI I.D. # 9312-344-2

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-33	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
BENZENE	560
ETHYLBENZENE	250
TOLUENE	100
TOTAL XYLENES	1100
FUEL HYDROCARBONS	7200
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	111	76 - 120
TRIFLUOROTOLUENE	90	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-3

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-34	DATE ANALYZED	: 01/06/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 250

COMPOUNDS	RESULTS
BENZENE	15000
ETHYLBENZENE	1500
TOLUENE	11000
TOTAL XYLENES	7000
FUEL HYDROCARBONS	52000
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	102	76 - 120
TRIFLUOROTOLUENE	93	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-4

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-35	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
BENZENE	580
ETHYLBENZENE	200
TOLUENE	40
TOTAL XYLENES	720
FUEL HYDROCARBONS	4200
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	106	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-5

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-36	DATE ANALYZED	: 01/06/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	0.7
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	92	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-6

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-40	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 2

COMPOUNDS	RESULTS
BENZENE	34
ETHYLBENZENE	11
TOLUENE	1.1
TOTAL XYLENES	7.4
FUEL HYDROCARBONS	1500
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	120	76 - 120
TRIFLUOROTOLUENE	93	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-7

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-41	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	4.6
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	91	76 - 120
TRIFLUOROTOLUENE	87	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-8

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-42	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
BENZENE	570	D4
ETHYLBENZENE	<0.5	
TOLUENE	0.5	
TOTAL XYLENES	0.7	
FUEL HYDROCARBONS	<100	
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	93	76 - 120
TRIFLUOROTOLUENE	93	50 - 150

D4 = Value from a ten fold diluted analysis.

Analytical Technologies, Inc.

ATI I.D. # 9312-344-9

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-43	DATE ANALYZED	: 01/06/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	82
ETHYLBENZENE	11
TOLUENE	0.5
TOTAL XYLENES	100
FUEL HYDROCARBONS	340
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	106	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-10

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-45	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 100

COMPOUNDS	RESULTS
BENZENE	2900
ETHYLBENZENE	680
TOLUENE	760
TOTAL XYLENES	3000
FUEL HYDROCARBONS	11000
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	102	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-11

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-47	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	2.0
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	1.0
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	102	76 - 120
TRIFLUOROTOLUENE	88	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : BLANK
DATE EXTRACTED : N/A
DATE ANALYZED : 01/04/94
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.1	96	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.4	102	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	41.3	103	N/A	N/A	N/A
GASOLINE	<100	1000	1160	116	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	96	N/A	76 - 120
TRIFLUOROTOLUENE	98	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.4	97	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.5	102	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	42.1	105	N/A	N/A	N/A
GASOLINE	<100	1000	1170	117	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	96	N/A	76 - 120
TRIFLUOROTOLUENE	95	N/A	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : BLANK
DATE EXTRACTED : N/A
DATE ANALYZED : 01/06/94
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.6	98	N/A	N/A	N/A
TOLUENE	<0.500	20.0	20.5	102	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	42.1	105	N/A	N/A	N/A
GASOLINE	<100	1000	1070	107	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	100	N/A	76 - 120
TRIFLUOROTOLUENE	93	N/A	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9312-344-11
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 01/05/94
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G/8020(BETX)		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
GASOLINE	<100	<100	NC	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
GASOLINE	N/A	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
TRIFLUOROTOLUENE	88	78	50 - 150

NC = Not Calculable.

Analytical Technologies, Inc.

ATI I.D. # 9312-344

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G/8020(BETX)

SAMPLE I.D. # : 9312-332-3
DATE EXTRACTED : N/A
DATE ANALYZED : 01/04/94
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.500	N/A	N/A	20.0	19.1	96	18.9	95	1
TOLUENE	<0.500	N/A	N/A	20.0	20.0	100	19.7	99	2
TOTAL XYLENES	<0.500	N/A	N/A	40.0	41.6	104	40.8	102	2
GASOLINE	<100	<100	NC	1000	1120	112	1170	117	4

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	102	103	76 - 120
TRIFLUOROTOLUENE	94	93	50 - 150

NC = Not Calculable.

Analytical Technologies, Inc.

ATI I.D. # 9312-344

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER

CASE NARRATIVE: TOTAL PETROLEUM HYDROCARBONS (WA DOE WTPH-D) ANALYSIS

Eleven (11) water samples were received by ATI on December 30, 1993, for diesel range hydrocarbons analysis by WA DOE WTPH-D extended according to Washington methodology.

The surrogate recoveries of o-terphenyl for sample 9312-343-1 and its duplicate were outside the ATI established control limits due to sample dilution.

Analytical Technologies, Inc.

ATI I.D. # 9312-344

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/03/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<0.25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	106	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-32A	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	2.9
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	1.3
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
P-TERPHENYL	97	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-2

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-33	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	101	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9312-344-3

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-34	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	2.2
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	97	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-4

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-35	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.0
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	100	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-5

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-36	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	0.37
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	0.94
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	109	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-6

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-40	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	5.4
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	4.2
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	64	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-7

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-41	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<0.25
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	80	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-8

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-42	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.3
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	2.4
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	91	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-9

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-43	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	0.32
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	66	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344-10

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/29/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-45	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1.1
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	0.86
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	105	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9312-344-11

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 12/30/93
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 12/30/93
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE EXTRACTED	: 01/03/94
CLIENT I.D.	: MW-47	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	0.31
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<0.75
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

SURROGATE PERCENT RECOVERY		LIMITS
O-TERPHENYL	108	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: BLANK
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 01/03/94
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 01/03/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIESEL	<0.250	2.50	2.48	99	2.64	106	6

CONTROL LIMITS	% REC.	RPD
DIESEL	70 - 115	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
O-TERPHENYL	105	110	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9312-344

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: GEOENGINEERS, INC.	SAMPLE I.D. #	: 9312-343-1
PROJECT #	: 0161-013-R69	DATE EXTRACTED	: 01/03/94
PROJECT NAME	: UNOCAL - WESTLAKE & MERCER	DATE ANALYZED	: 01/04/94
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-D		

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
DIESEL	63.7	62.3	2	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
DIESEL	N/A	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
O-TERPHENYL	I	I	50 - 150

I = Surrogate out of limits due to sample dilution.

Analytical Technologies, Inc.

ATI I.D. # 9312-344

TOTAL PETROLEUM HYDROCARBONS
QUALITY CONTROL DATA

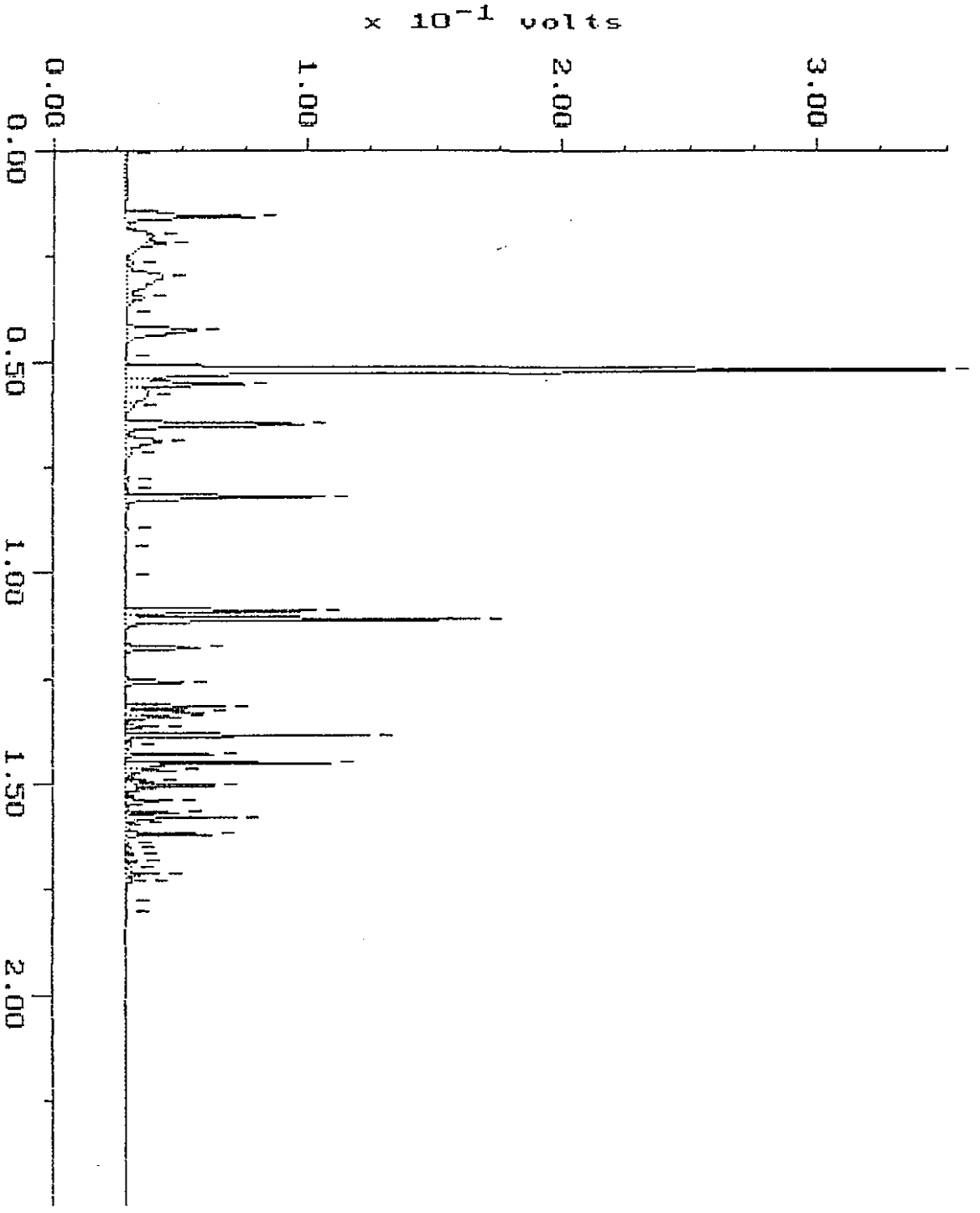
CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WESTLAKE & MERCER
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-D

SAMPLE I.D. # : 9312-334-1
DATE EXTRACTED : 01/03/94
DATE ANALYZED : 01/04/94
UNITS : mg/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
DIESEL	2.73	2.38	5.46	115	5.37	111	2
CONTROL LIMITS				% REC.			RPD
DIESEL				50 - 150			20
SURROGATE RECOVERIES		SPIKE		DUP. SPIKE		LIMITS	
O-TERPHENYL		111		112		50 - 150	

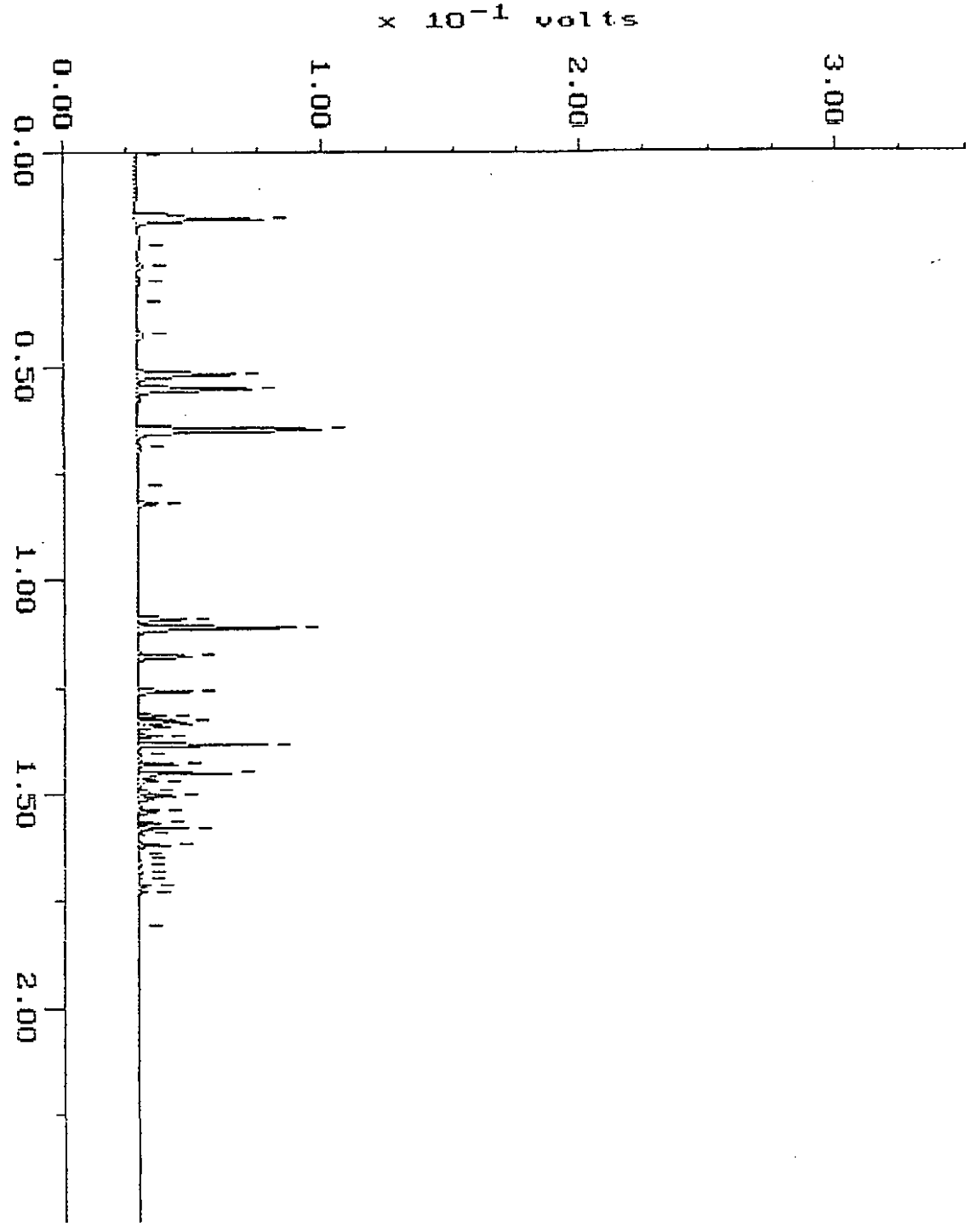
WA DOE WTPH-G

Sample: 9312-344-1 DIL Channel: FID Filename: R1049G29
Acquired: 04-JAN-94 23:41 Method: F:\BRD2\MAXDATA\GLAD\010494GS Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY



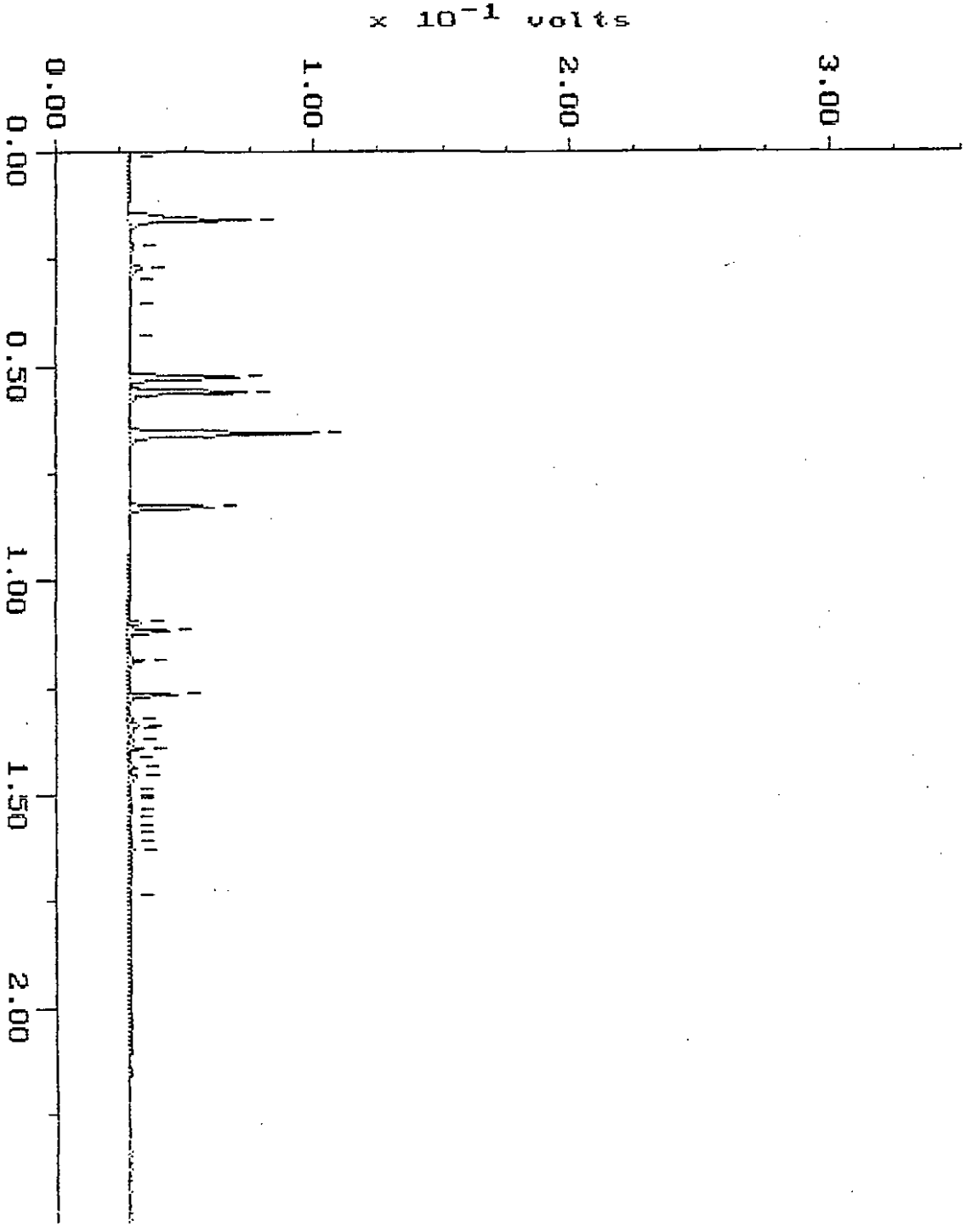
WA DOE WTPH-G

Sample: 9312-344-2 DIL Channel: FID Filename: R1049G30
Acquired: 05-JAN-94 0:10 Method: F:\BRD2\MAXDATA\GLAD\010494GS Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY



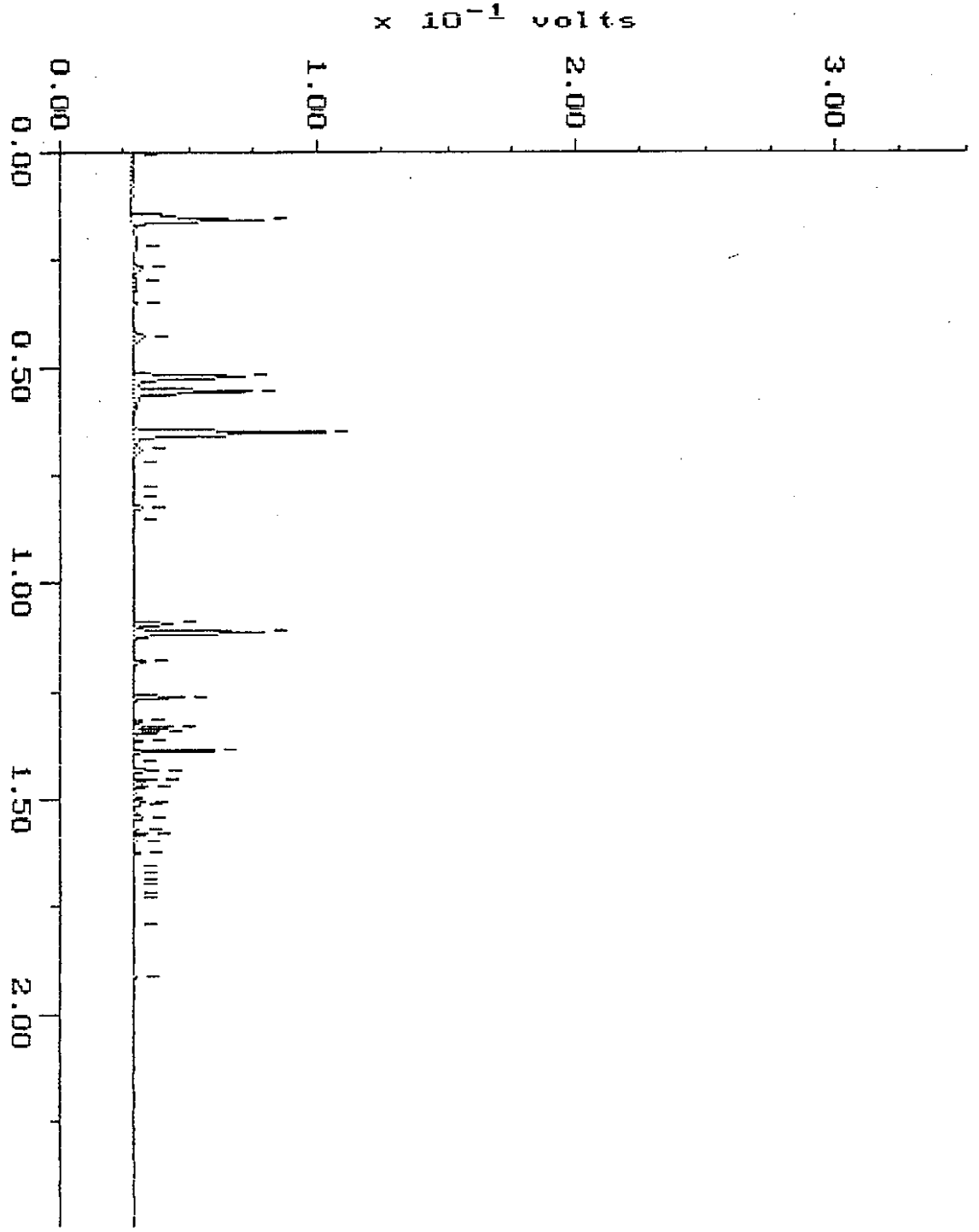
WA[illegible]E WTPH-G

Sample: 9312-344-3 DIL Channel: FID Filename: R1069G08
Acquired: 06-JAN-94 18:05 Method: F:\BR02\MAXDATA\GLAD\010694GS Operator: ATI
Dilution: 1 : 250.000
Comments: ATI : A COMMITMENT TO QUALITY

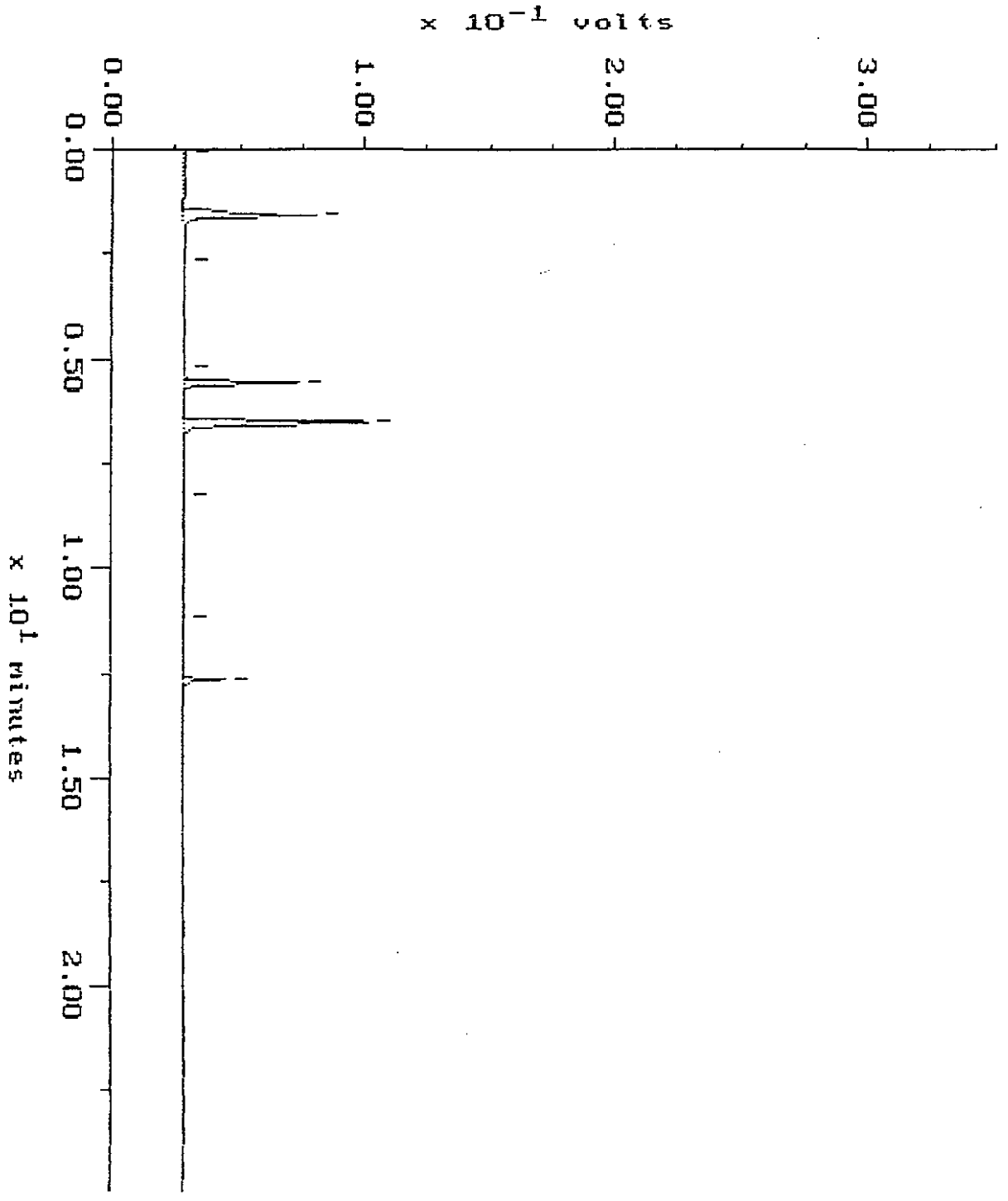


WA[illegible]WTPH-G

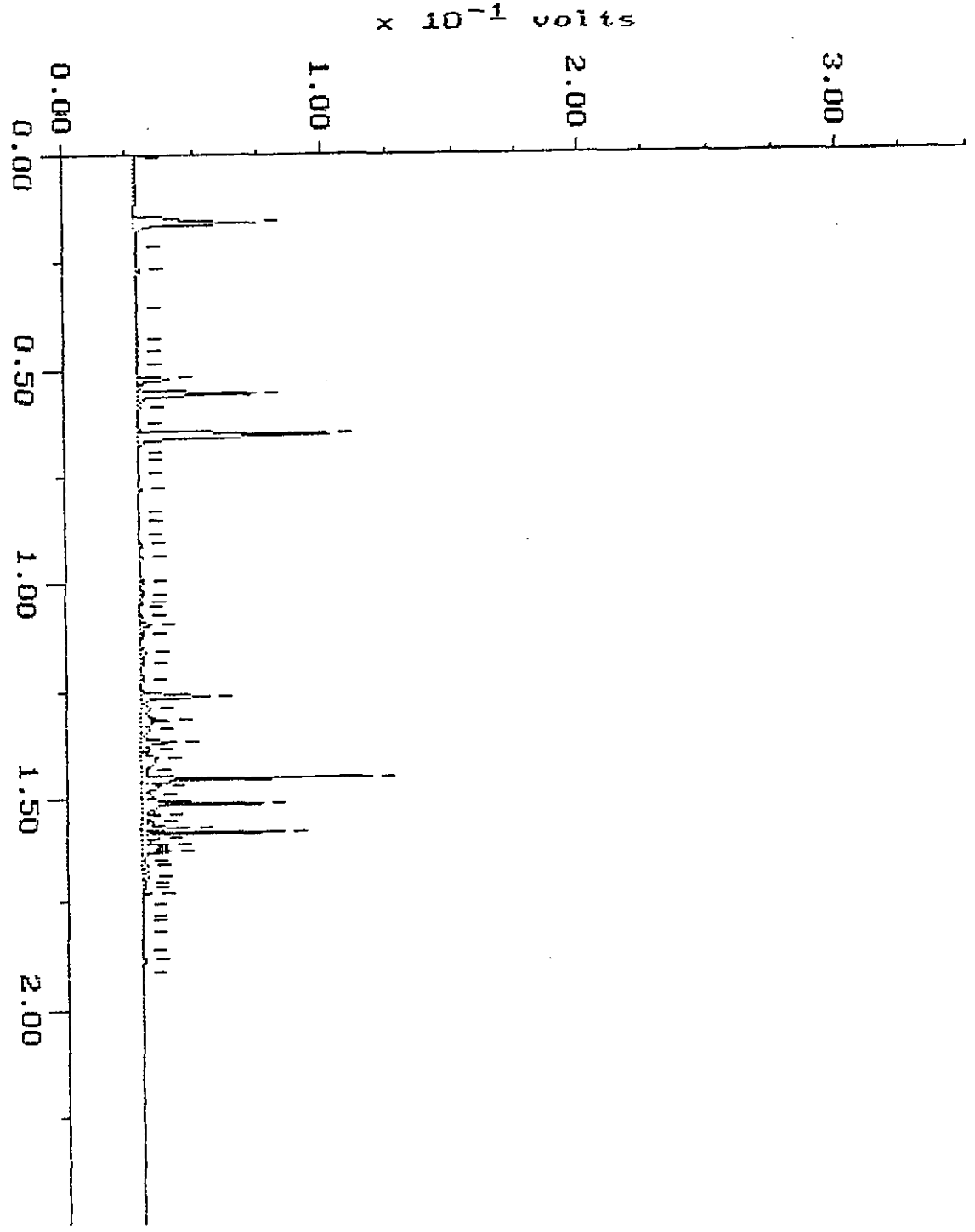
Sample: 9312-344-4 DIL Channel: FID Filename: R1059G21
Acquired: 05-JAN-94 22:25 Method: F:\BRO2\MAXDATA\GLAD\0105946S Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY



Sample: 9312-344-S Channel: FID Filename: R1059G25
Acquired: 06-JAN-94 0:23 Method: F:\BR02\MAXDATA\GLAD\0105946S Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY

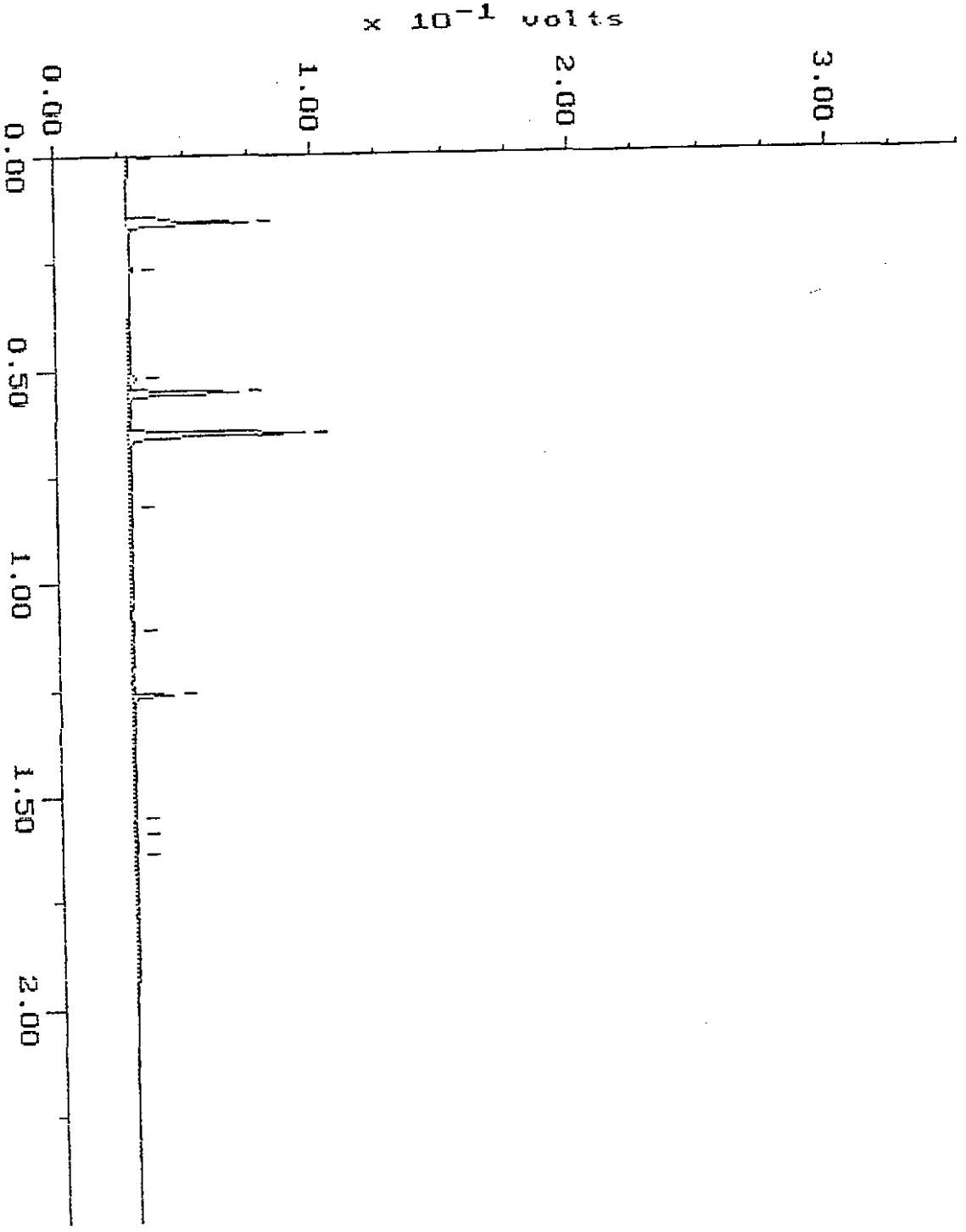


Sample: 9312-344-6 DIL Channel: FID Filename: R1059G23
Acquired: 05-JAN-94 23:24 Method: F:\BRO2\MAXDATA\GLAD\0105946S Operator: ATI
Dilution: 1 : 2.000
Comments: ATI : A COMMITMENT TO QUALITY



WA [illegible] WTPH-G

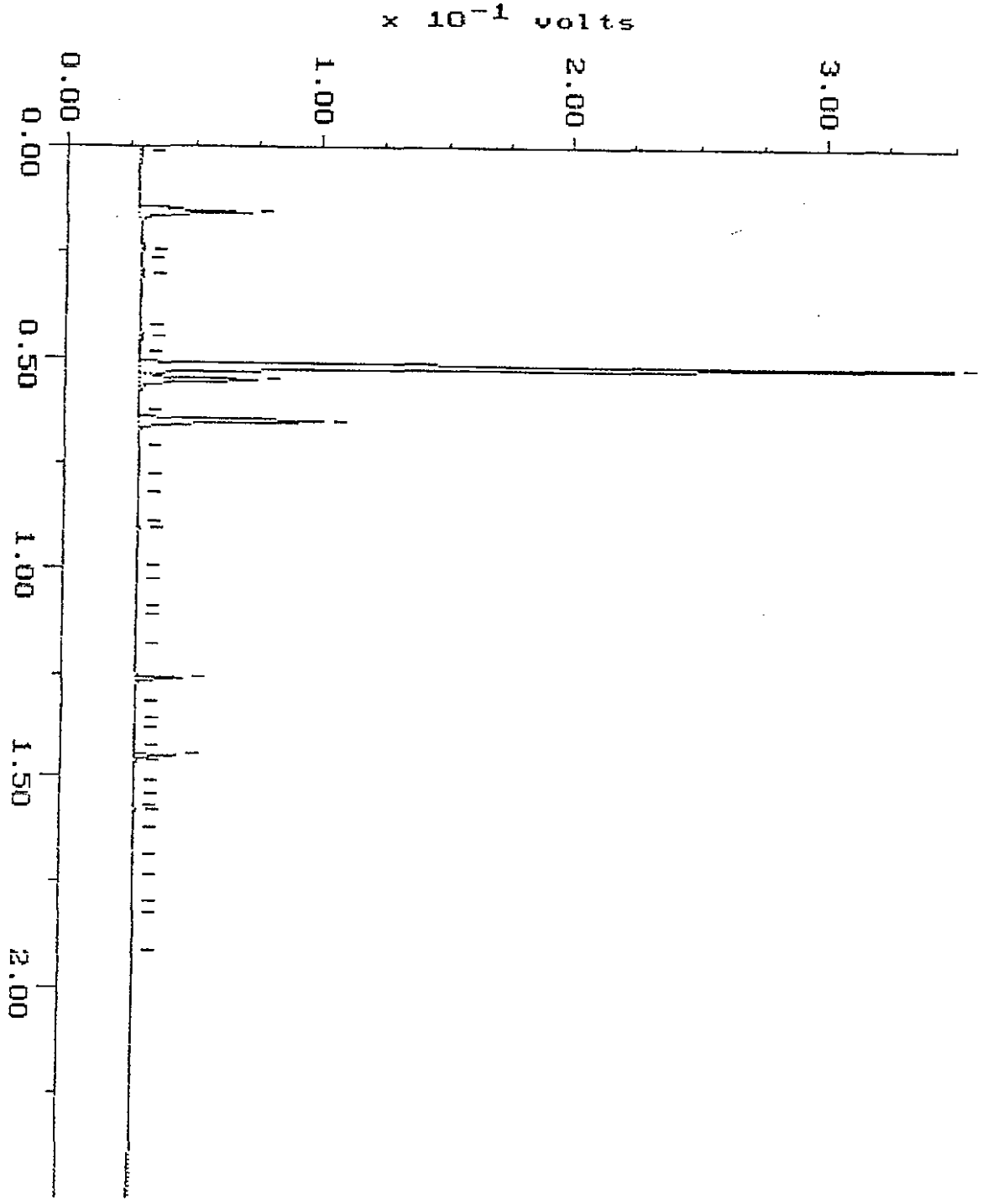
Sample: 9312-344-7 Channel: FID Filename: R1049638
Acquired: 05-JAN-94 4:06 Method: F:\BROE\MAXDATA\GLAD\010494GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



WA DOE WTPH-G

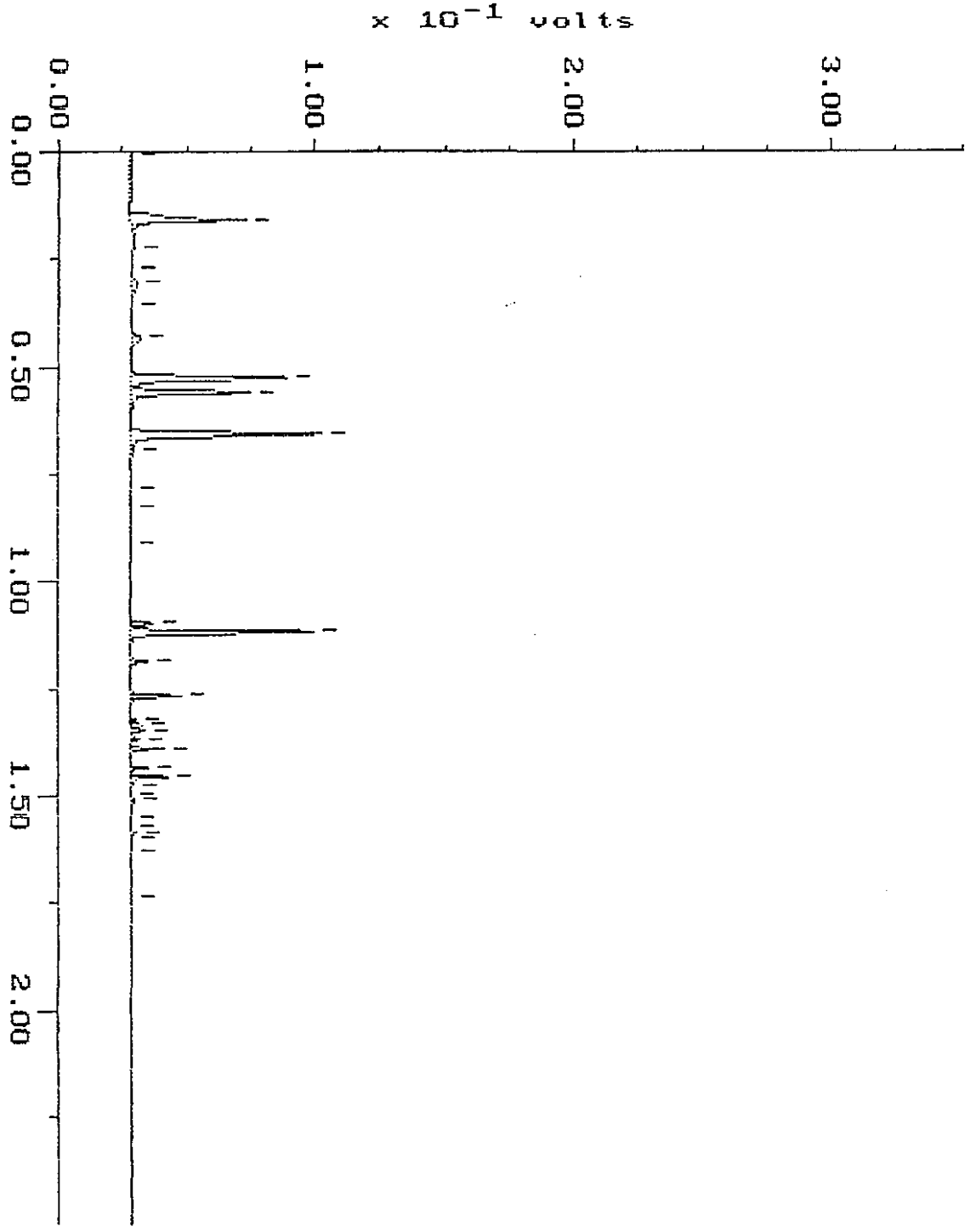
Sample: 9312-344-8 Channel: FID
Acquired: 05-JAN-94 4:35 Method: F:\BRD2\MAXDATA\GLAD\0104946S
Comments: ATI : A COMMITMENT TO QUALITY

Filename: R1049G39
Operator: ATI

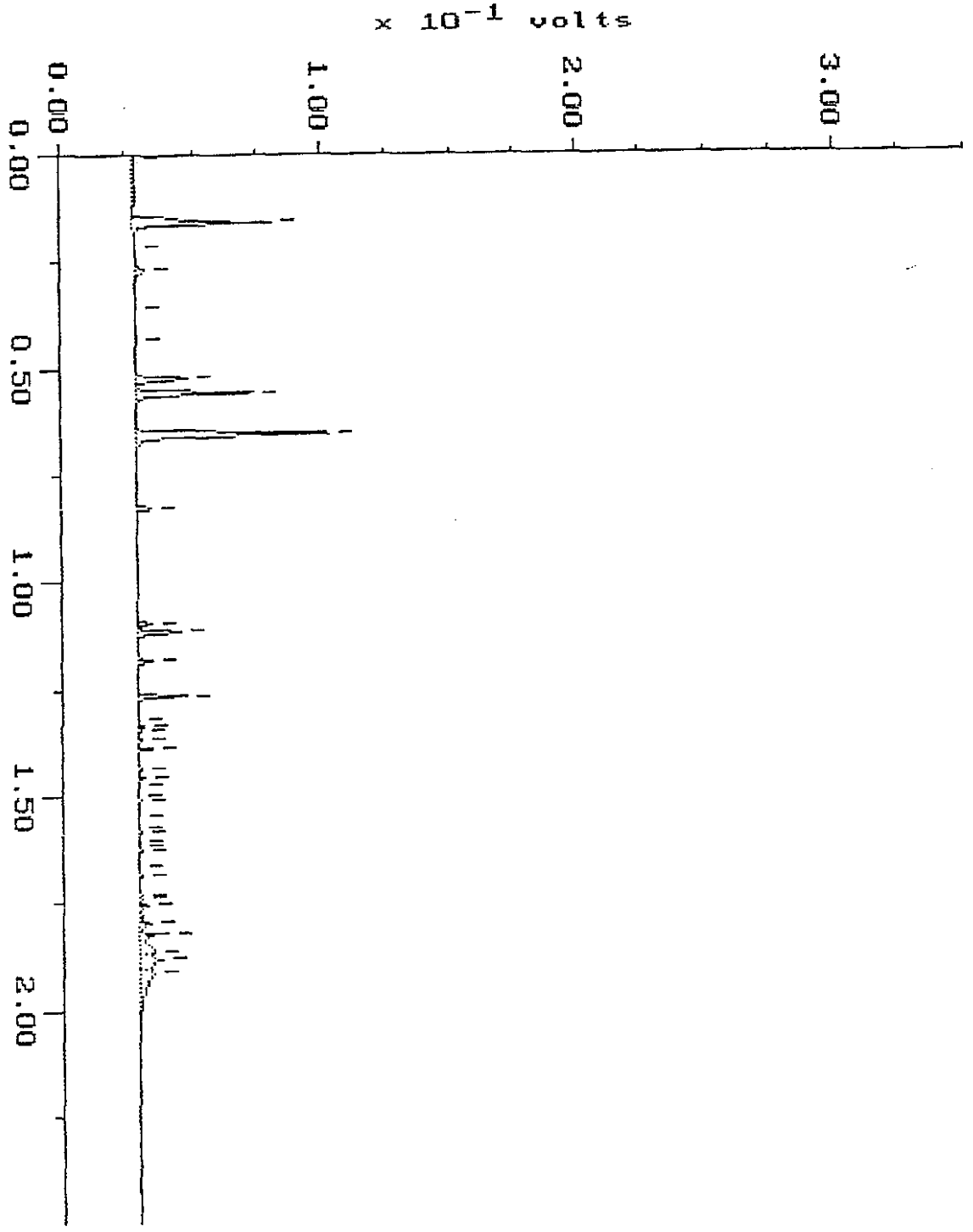


WATER WTPH-G

Sample: 9312-344-9 Channel: FID Filename: R1069506
Acquired: 06-JAN-94 17:03 Method: F:\BRO2\MAXDATA\GLAD\010694GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY

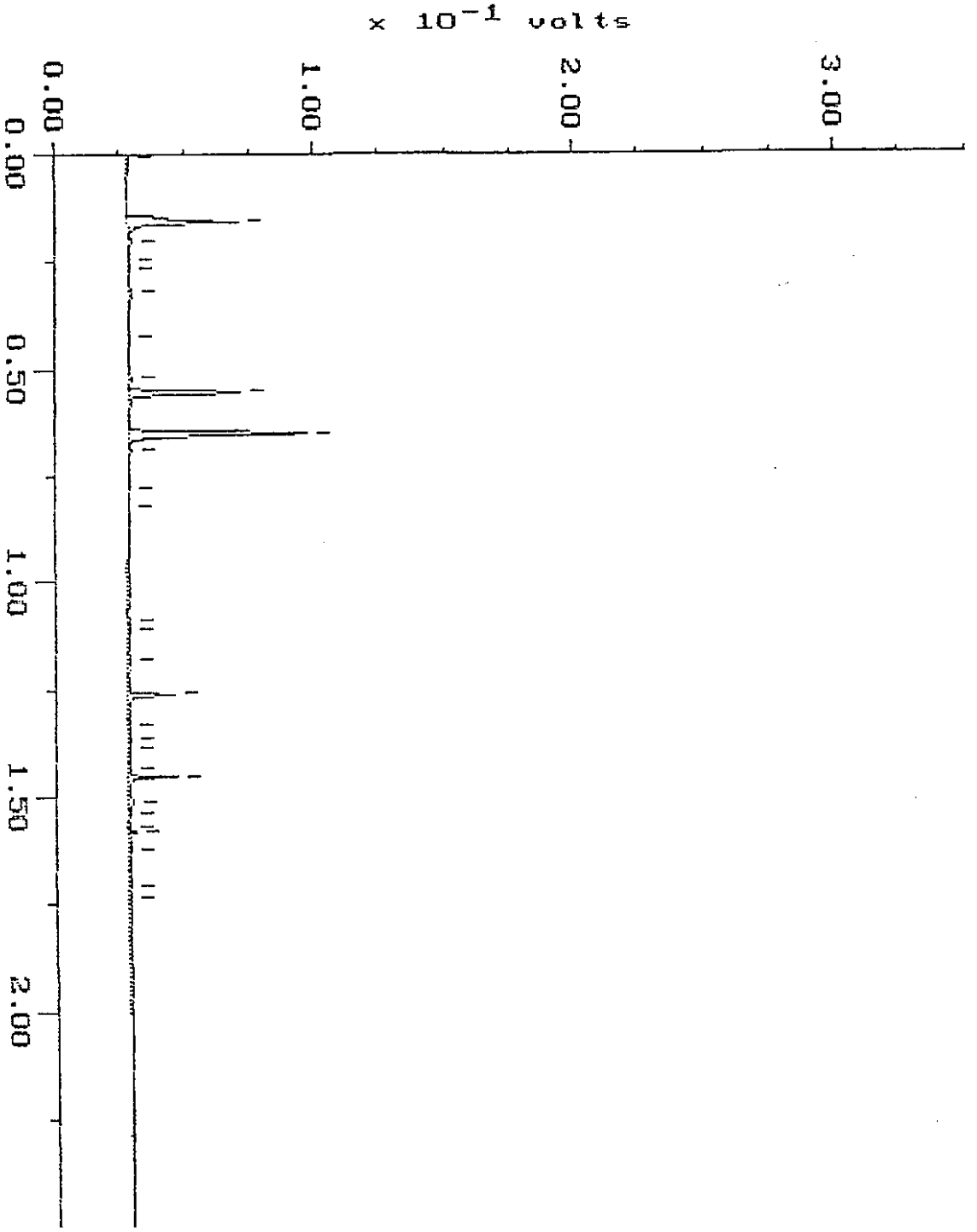


Sample: 9312-344-10 DIL Channel: FID Filename: R1059G22
Acquired: 05-JAN-94 22:55 Method: F:\BRO2\MAXDATA\GLAD\0105946S Operator: ATI
Dilution: 1 : 100.000
Comments: ATI : A COMMITMENT TO QUALITY



WA DOE WTPH-G

Sample: 9312-344-11 Channel: FID Filename: R1049G42
Acquired: 05-JAN-94 6:04 Method: F:\BRO2\MAXDATA\GLAD\010494GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



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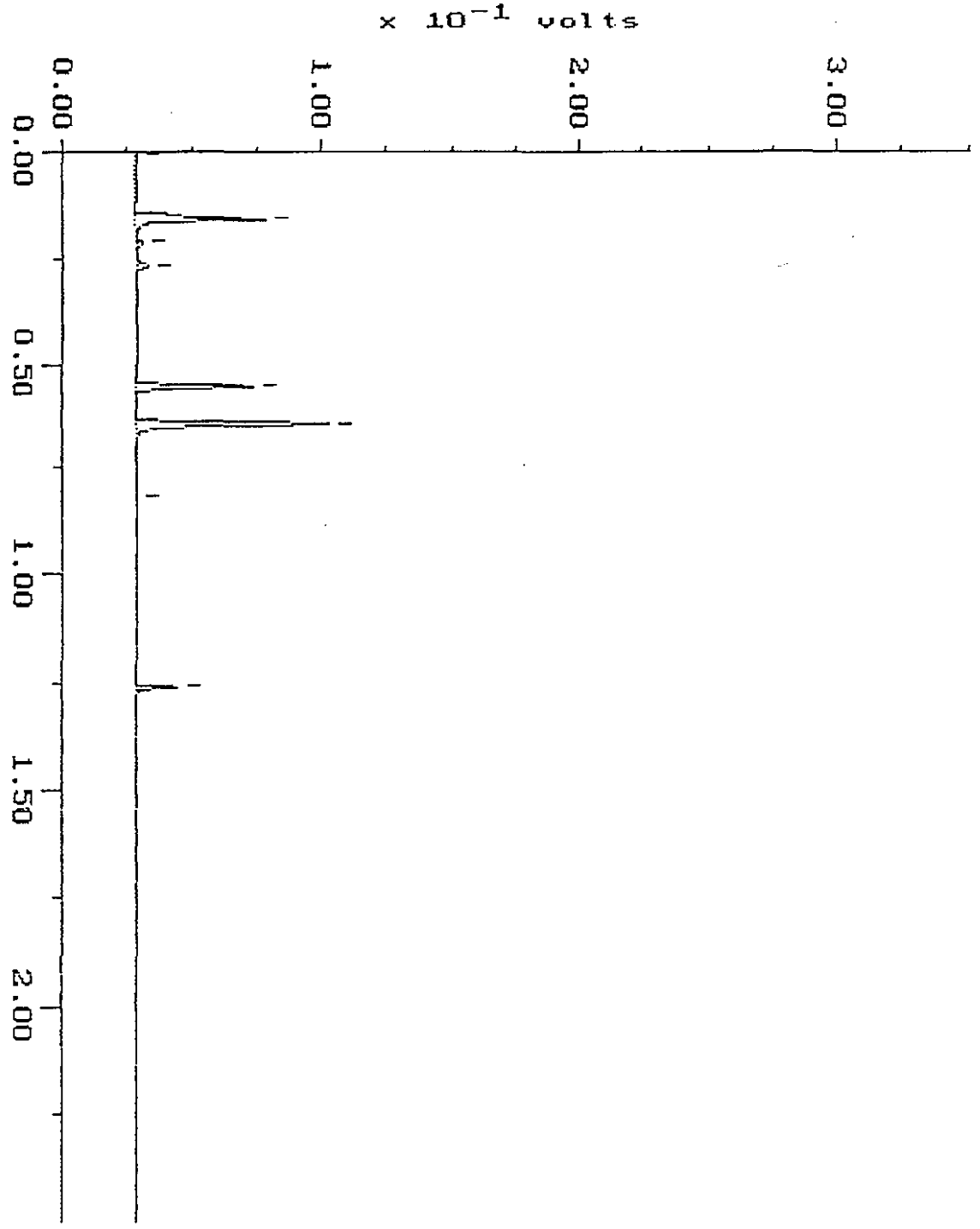
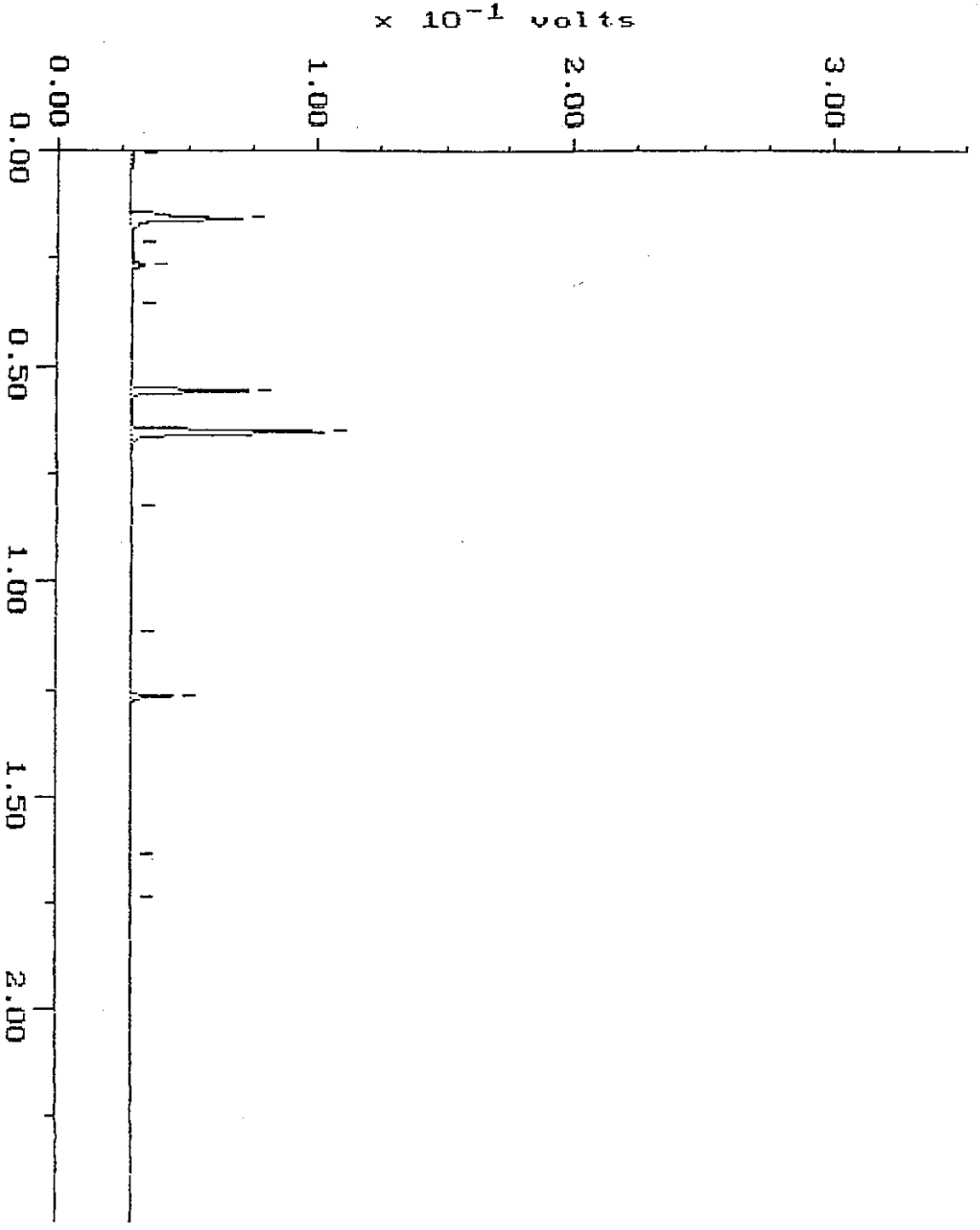
WA [illegible] WTPH-G

Sample: WRB 1-4 Channel: FID Filename: R1049G03
Acquired: 04-JAN-94 9:10 Method: F:\BRD2\MAXDATA\GLAD\010494GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



WA[illegible]WTPH-G Blank

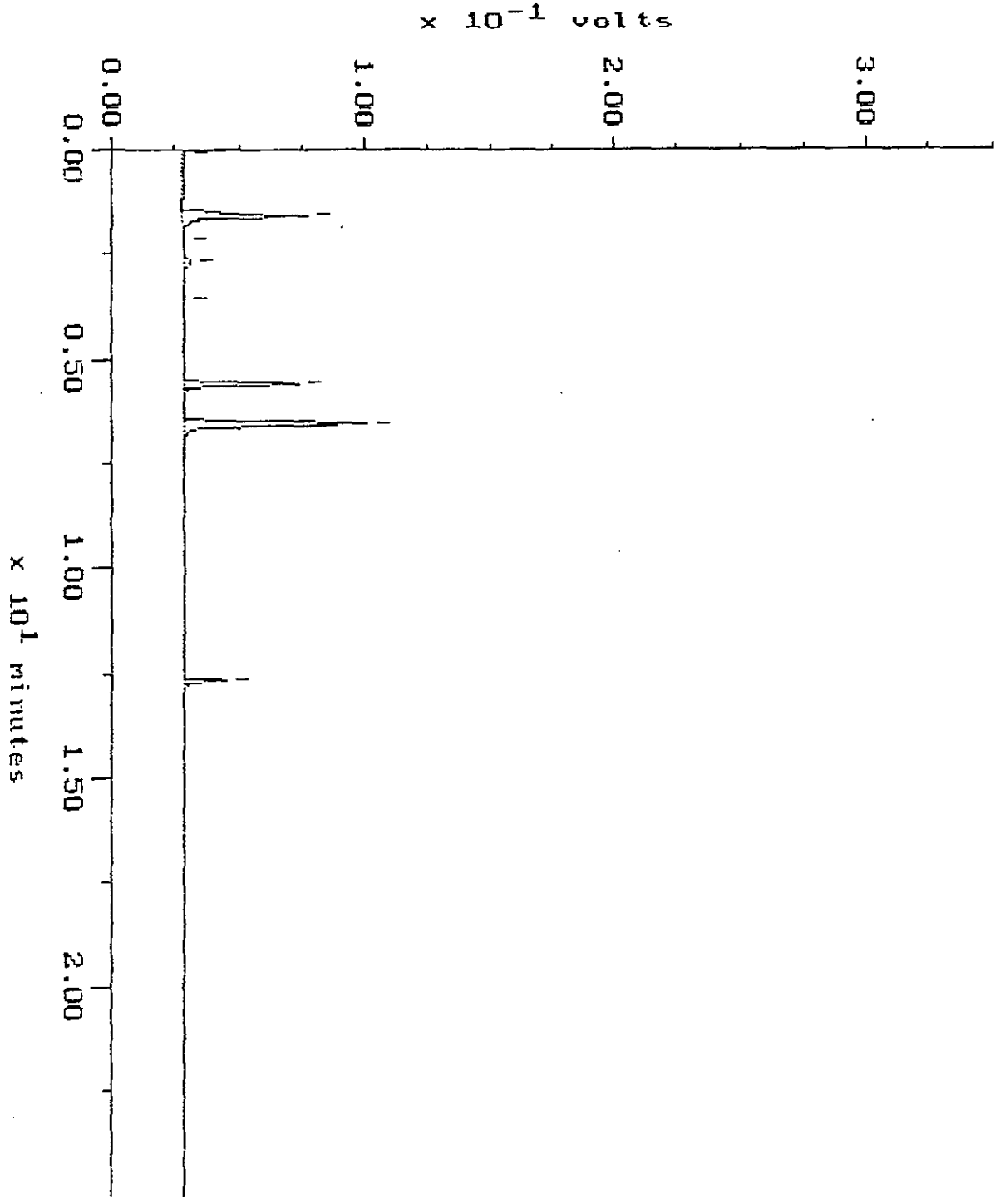
Sample: WRB 1-5 Channel: FID Filename: R1059602
Acquired: 05-JAN-94 9:46 Method: F:\BRO2\MAXDATA\GLAD\01059405 Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



Blank

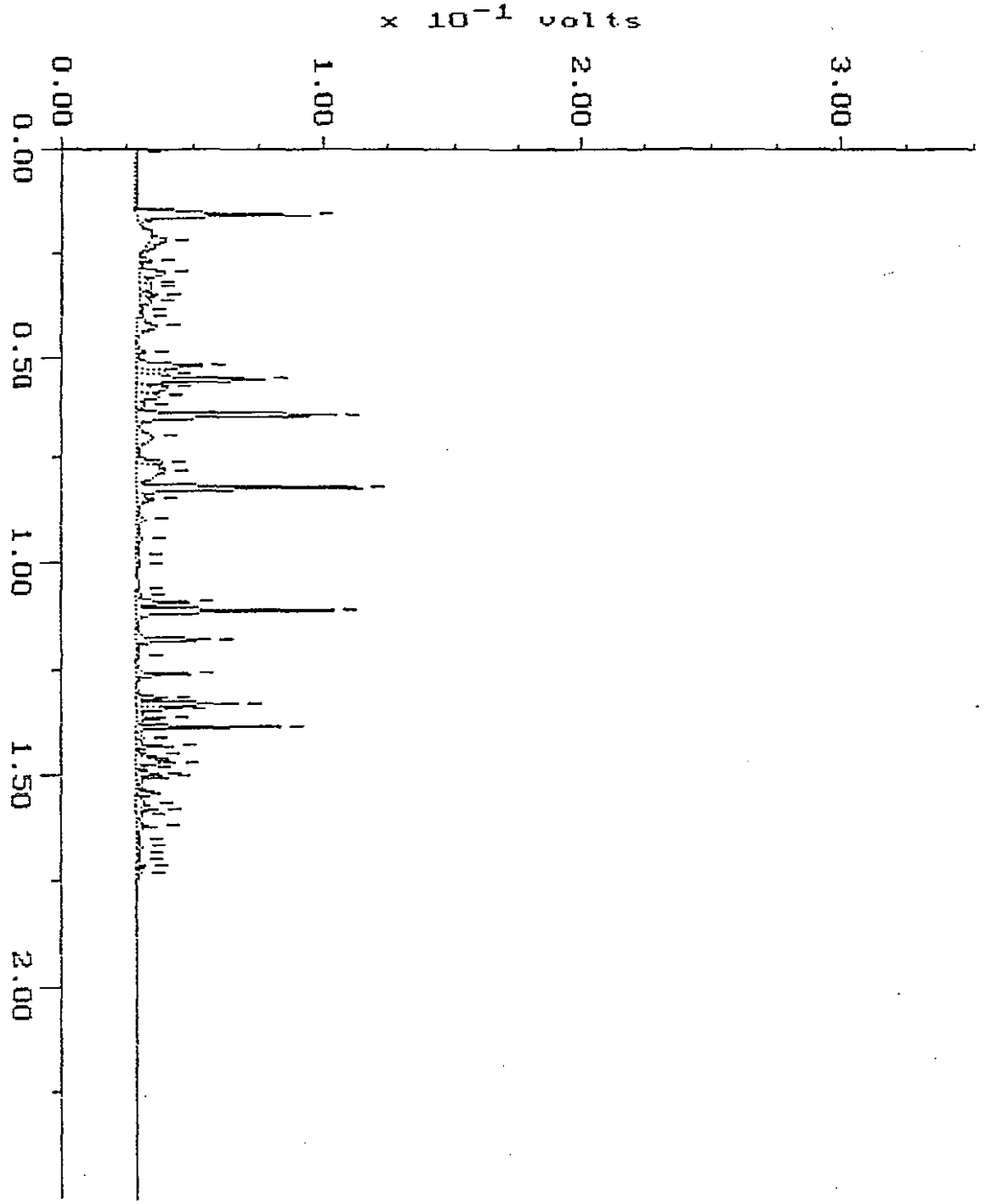
WA [illegible] WTPH-G

Sample: WRB 1-6 Channel: FID Filename: R1069G05
Acquired: 06-JAN-94 15:22 Method: F:\BRO2\MAXDATA\GLAD\0106946S Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



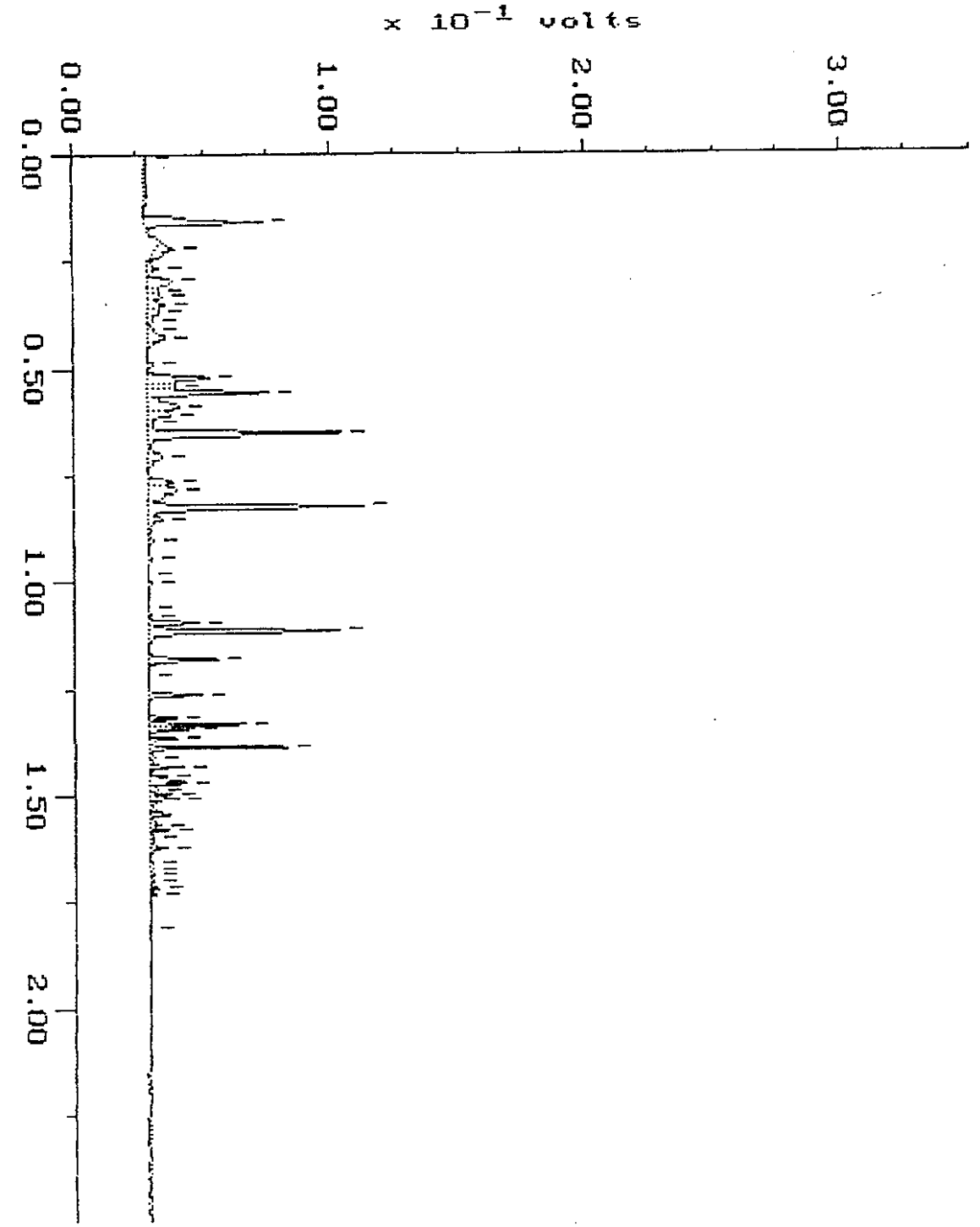
Continuing Calibration

Sample: STD-C 6 Channel: FID Filename: R1049G01
Acquired: 04-JAN-94 8:00 Method: F:\BR02\MAXDATA\GLAD\010494GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



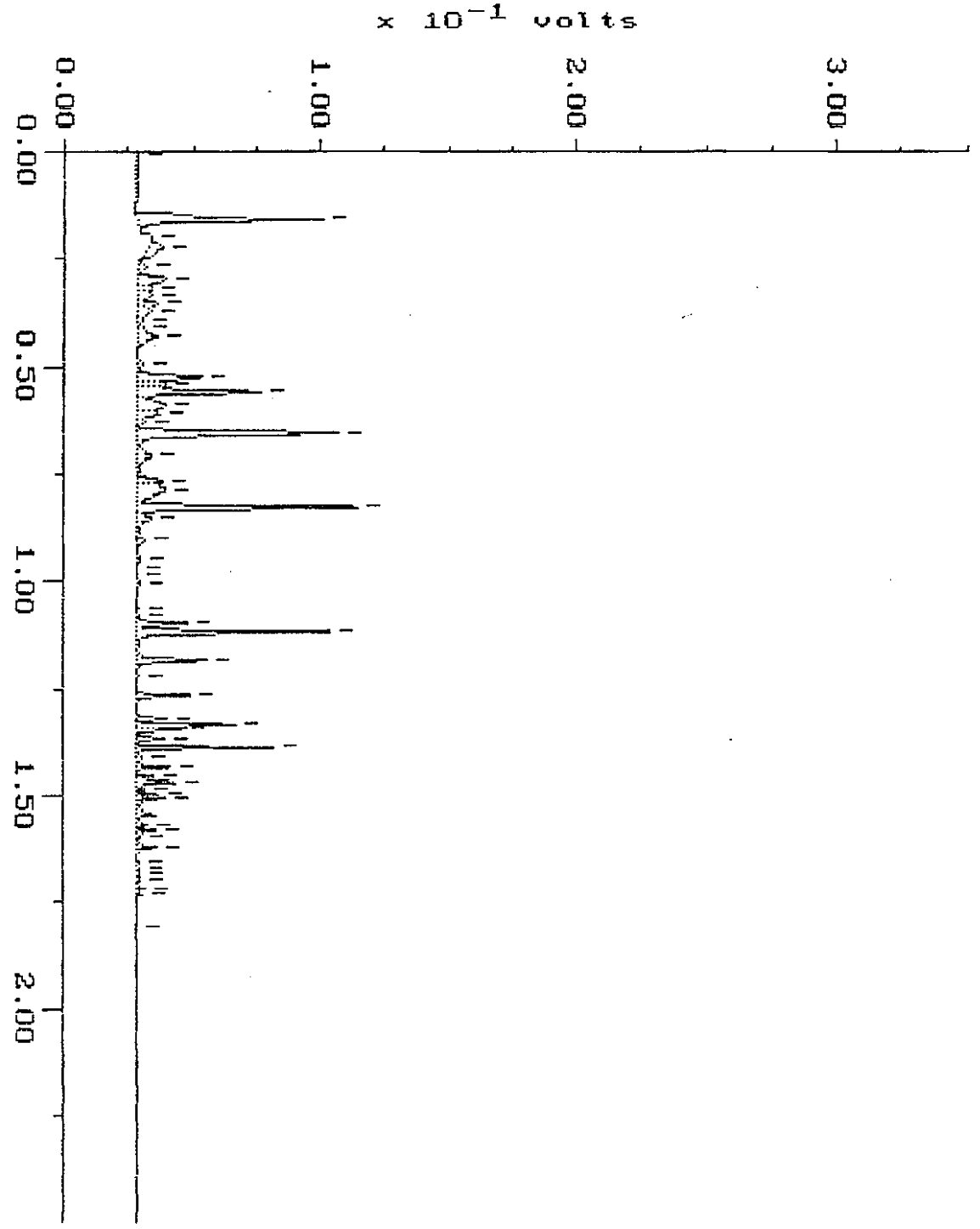
Continuing Calibration

Sample: STD-C G Channel: FID Filename: R1059G01
Acquired: 05-JAN-94 9:17 Method: F:\BRO2\MAXDATA\GLAD\010594GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



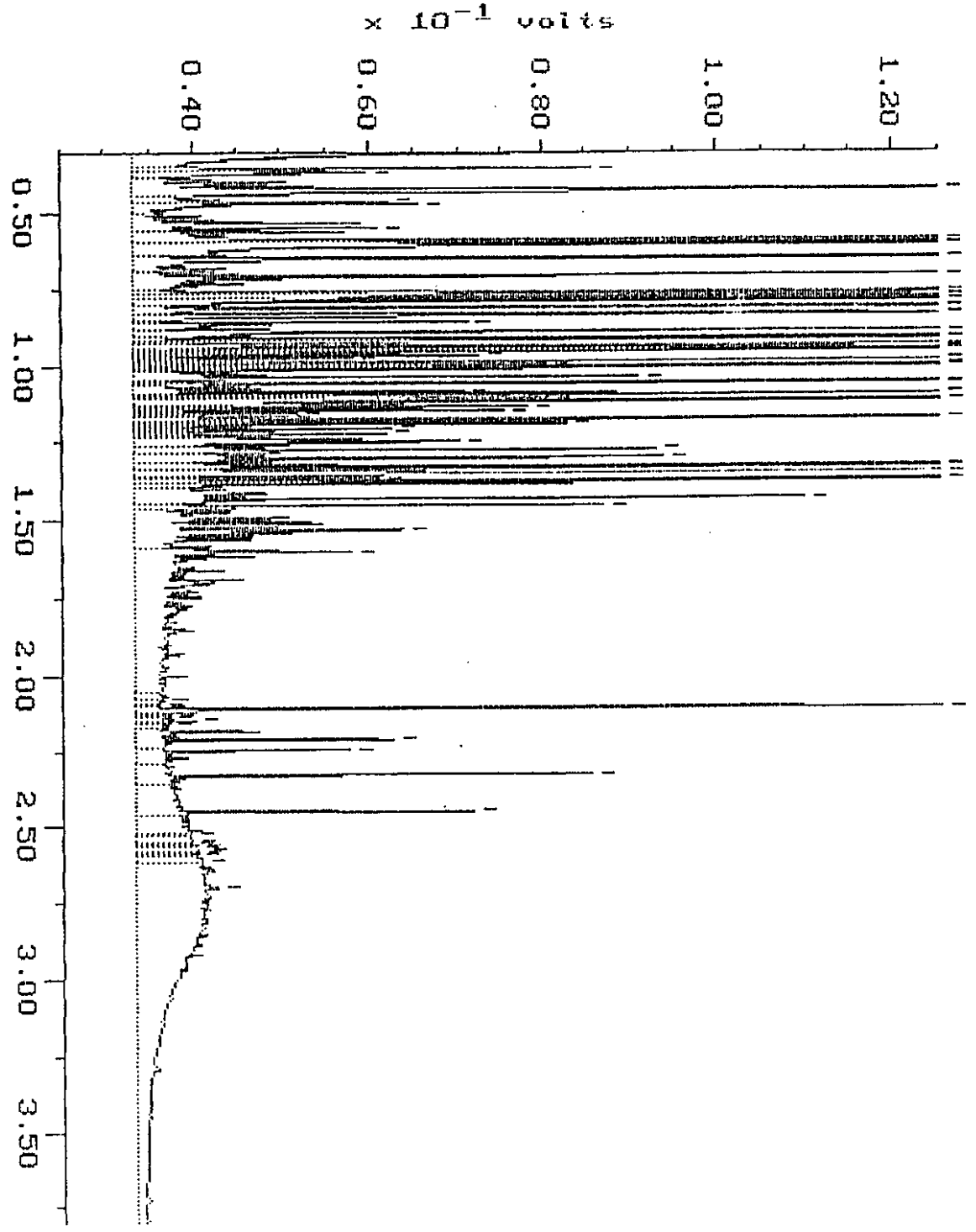
Continuing Calibration

Sample: STD C G Channel: FID Filename: R1069604
Acquired: 06-JAN-94 14:52 Method: F:\BRD2\MAXDATA\GLAD\0106946S Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



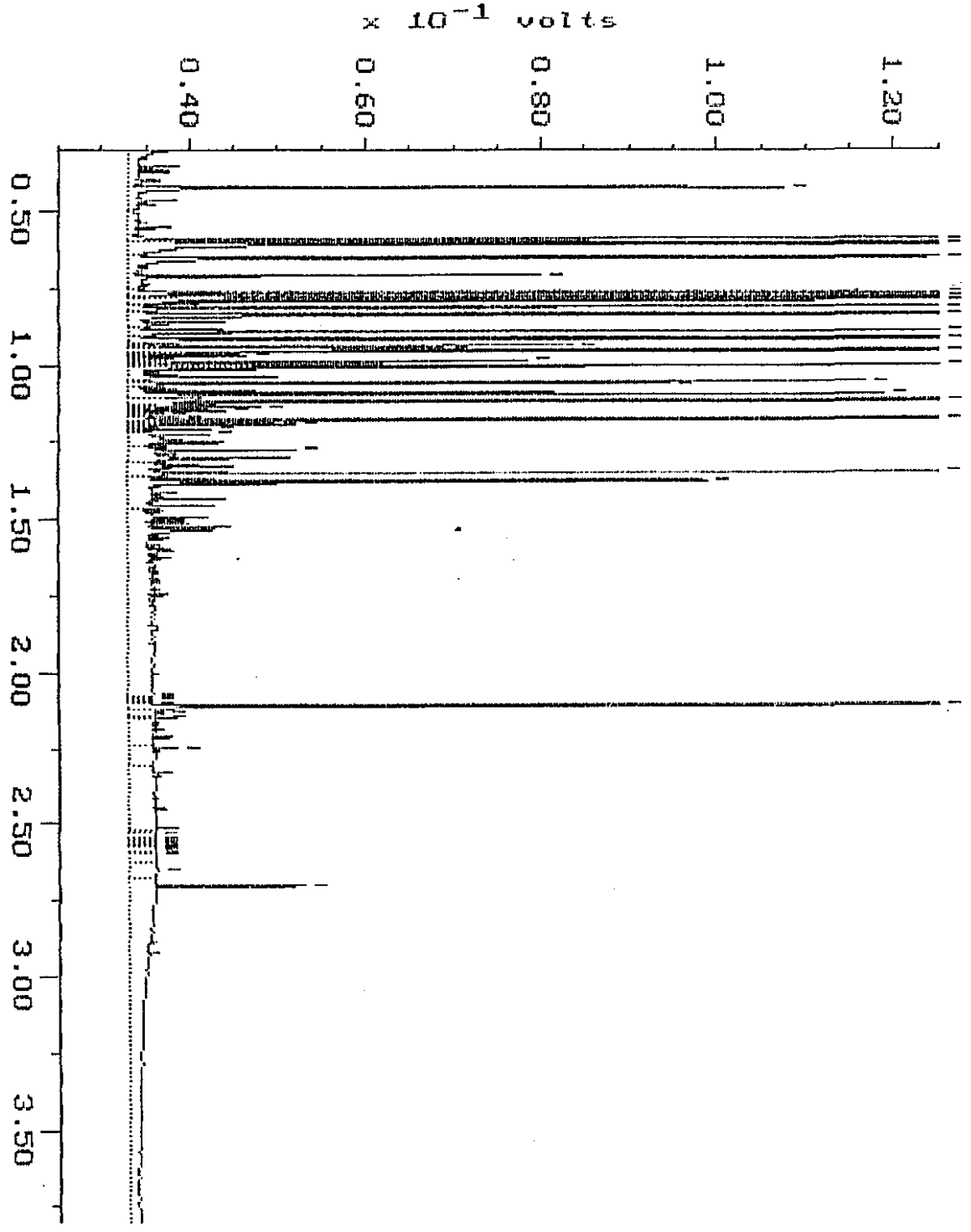
WA DOE

Sample: 9312-344-1 Channel: WILMA Filename: R1038W25
Acquired: 04-JAN-94 9:58 Method: F:\BKD2\MAXDATA\WILMA\FUEL0103 Operator: BKD



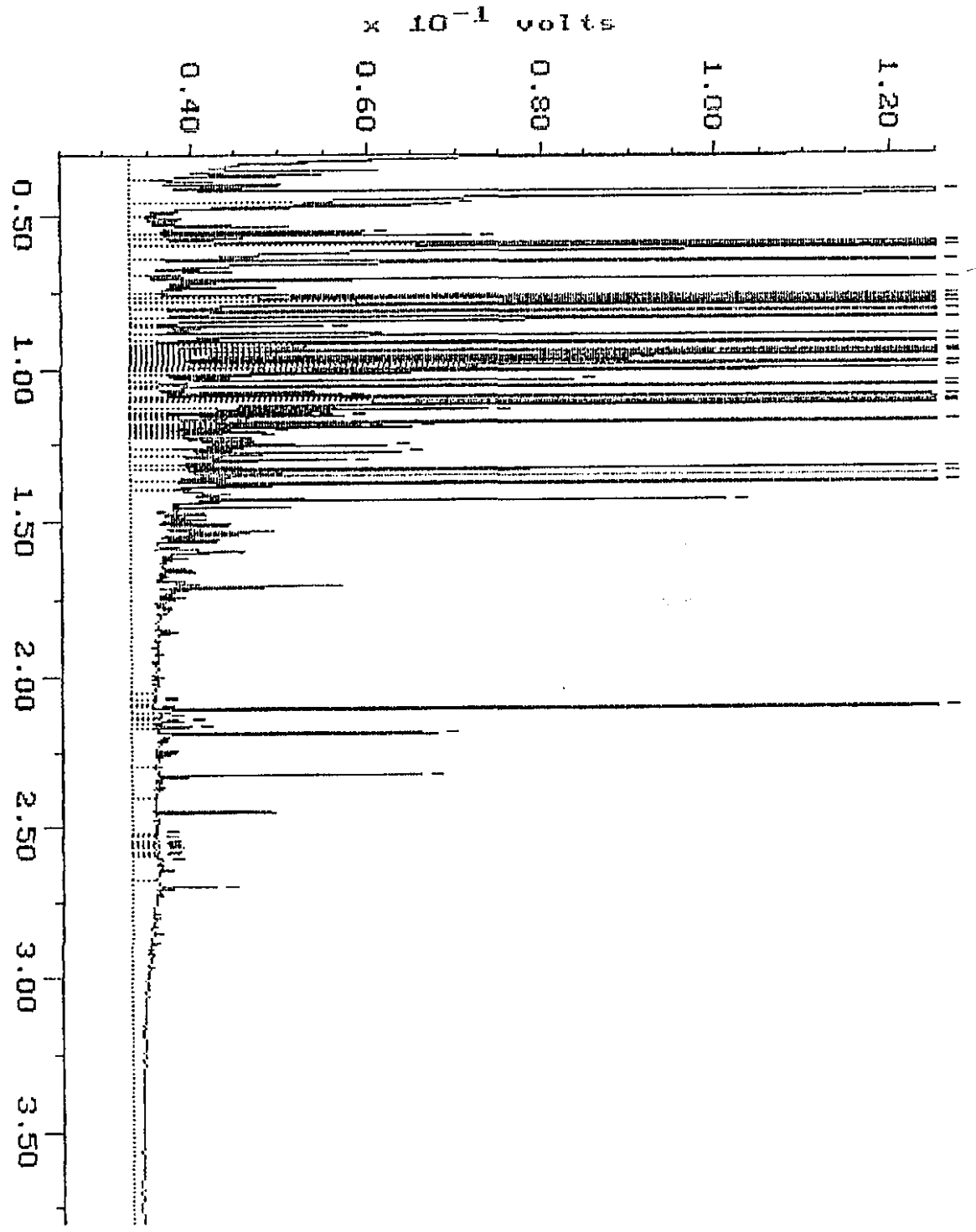
WA DOE WTPH-D

Sample: 9312-344-2 Channel: WILMA Filename: R1038W28
Acquired: 04-JAN-94 12:21 Method: F:\BKO2\MAXDATA\WILMA\FUEL0103 Operator: BKO



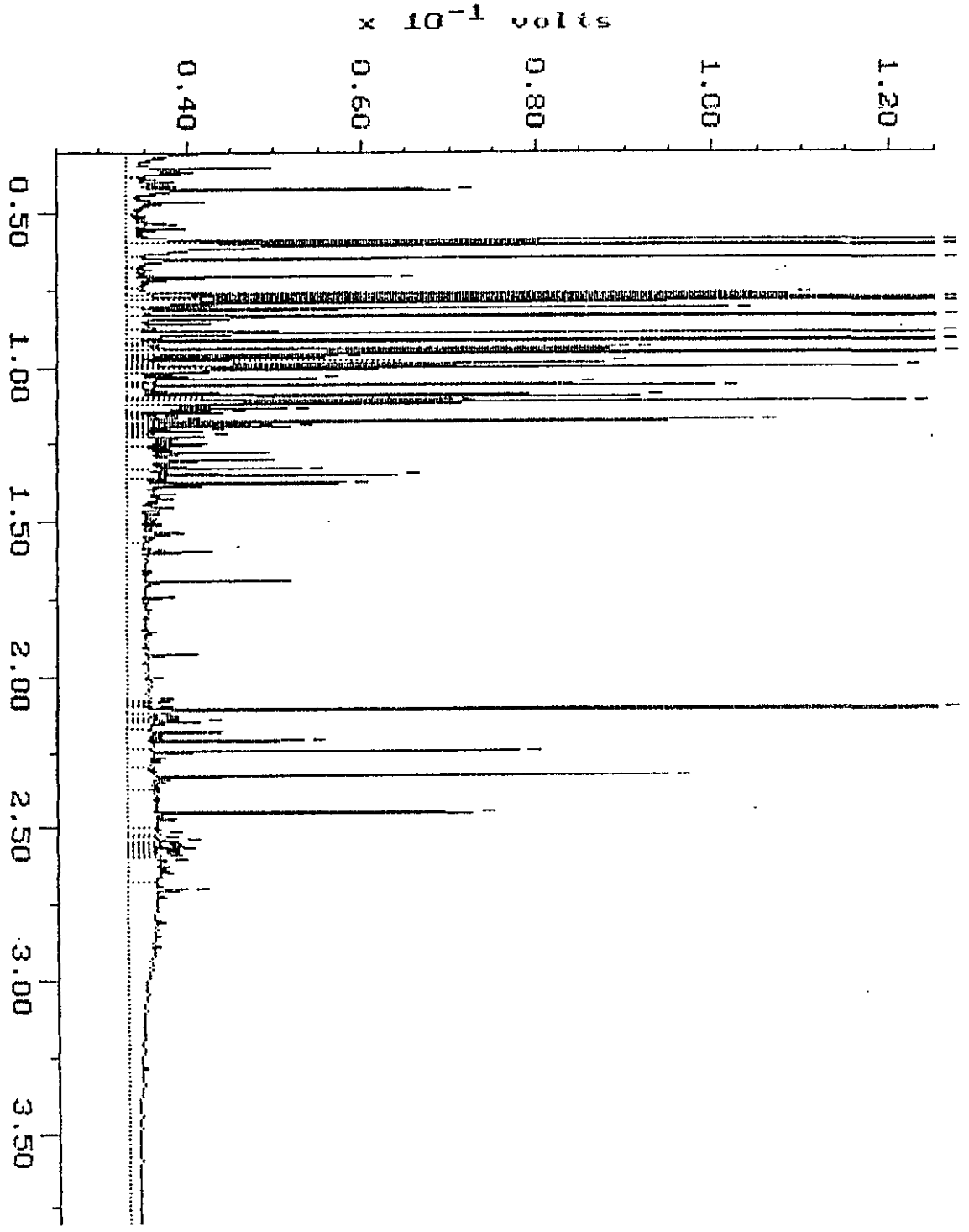
WA DOE WTPH-D

Sample: 9312-344-3 Channel: WILMA Filename: R1038W29
Acquired: 04-JAN-94 13:09 Method: F:\BKD2\MAXDATA\WILMA\FUEL0103 Operator: BKD



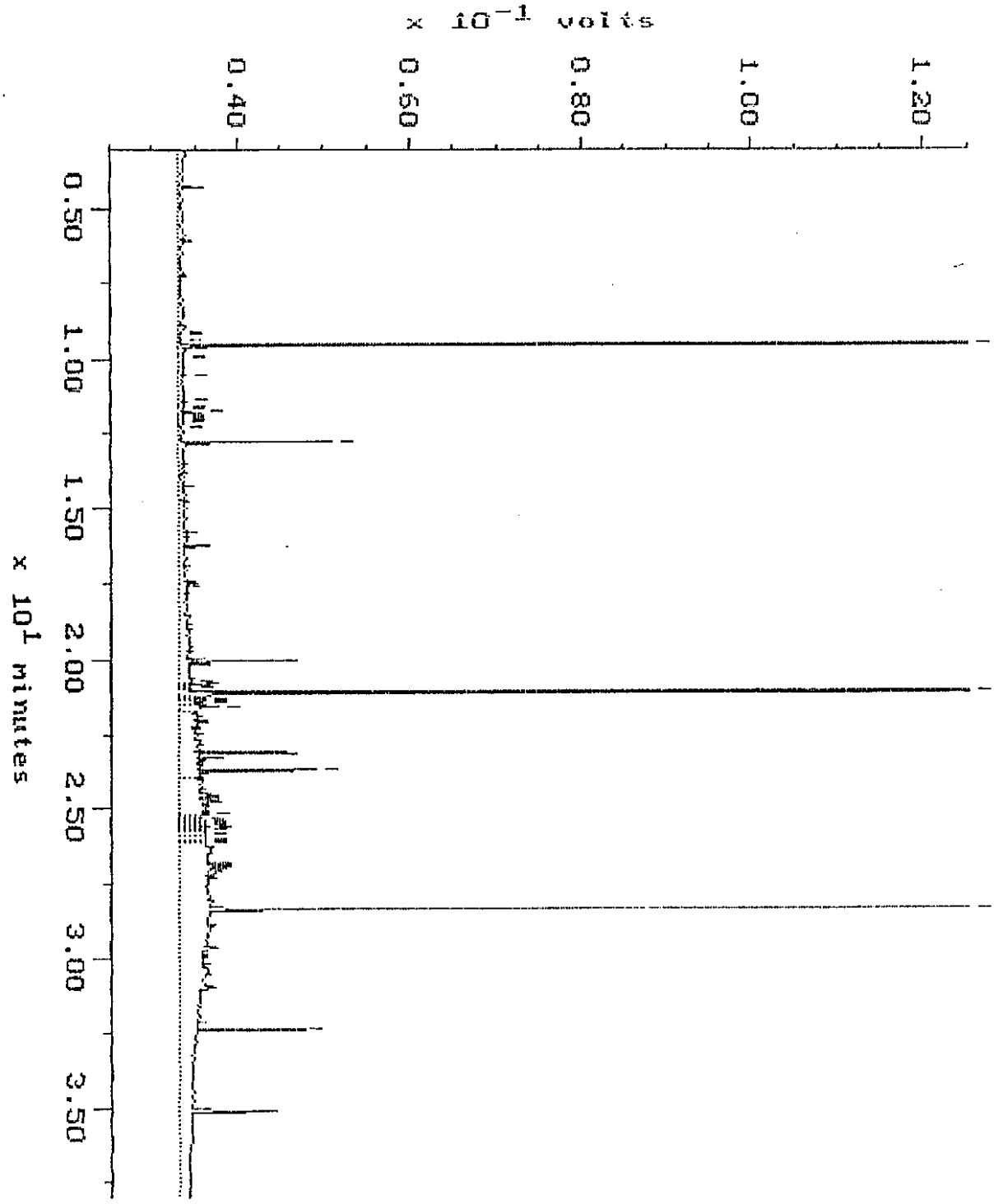
WA DOE WTPH-D

Sample: 9312-344-4 Channel: WILMA Filename: R1038W30
Acquired: 04-JAN-94 13:57 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BKU



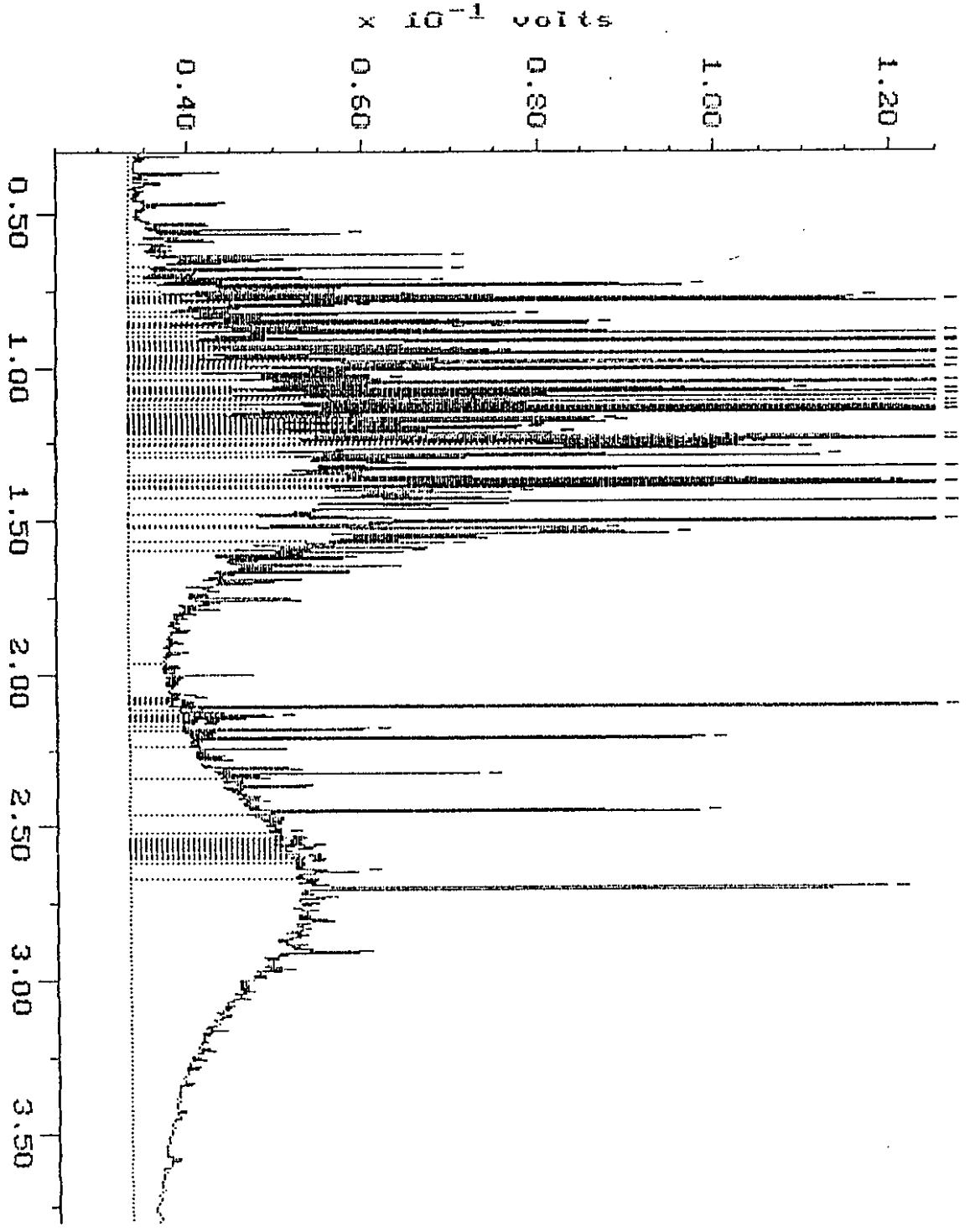
WA DOE WTPH-D

Sample: 9312-344-5 Channel: WILMA Filename: R1038W31
Acquired: 04-JAN-94 14:46 Method: F:\BKO2\MAXDATA\WILMA\FUEL0103 Operator: BKO



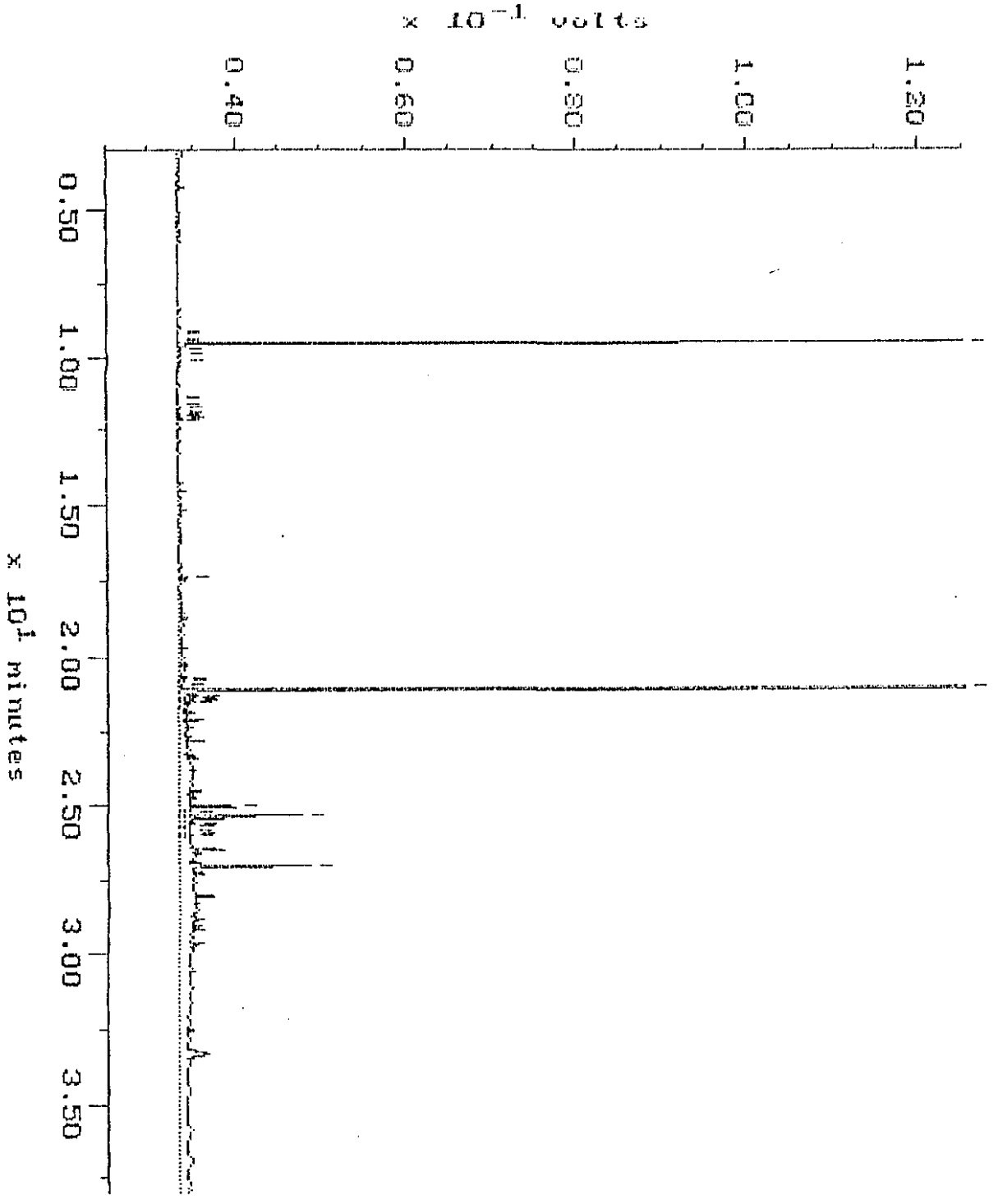
WA DOE WTPH-D

Sample: 9312-344-6 Channel: WILMA Filename: R1038W33
Acquired: 04-JAN-94 16:23 Method: F:\BKO2\MAXDATA\WILMA\FUEL0103 Operator: BKO



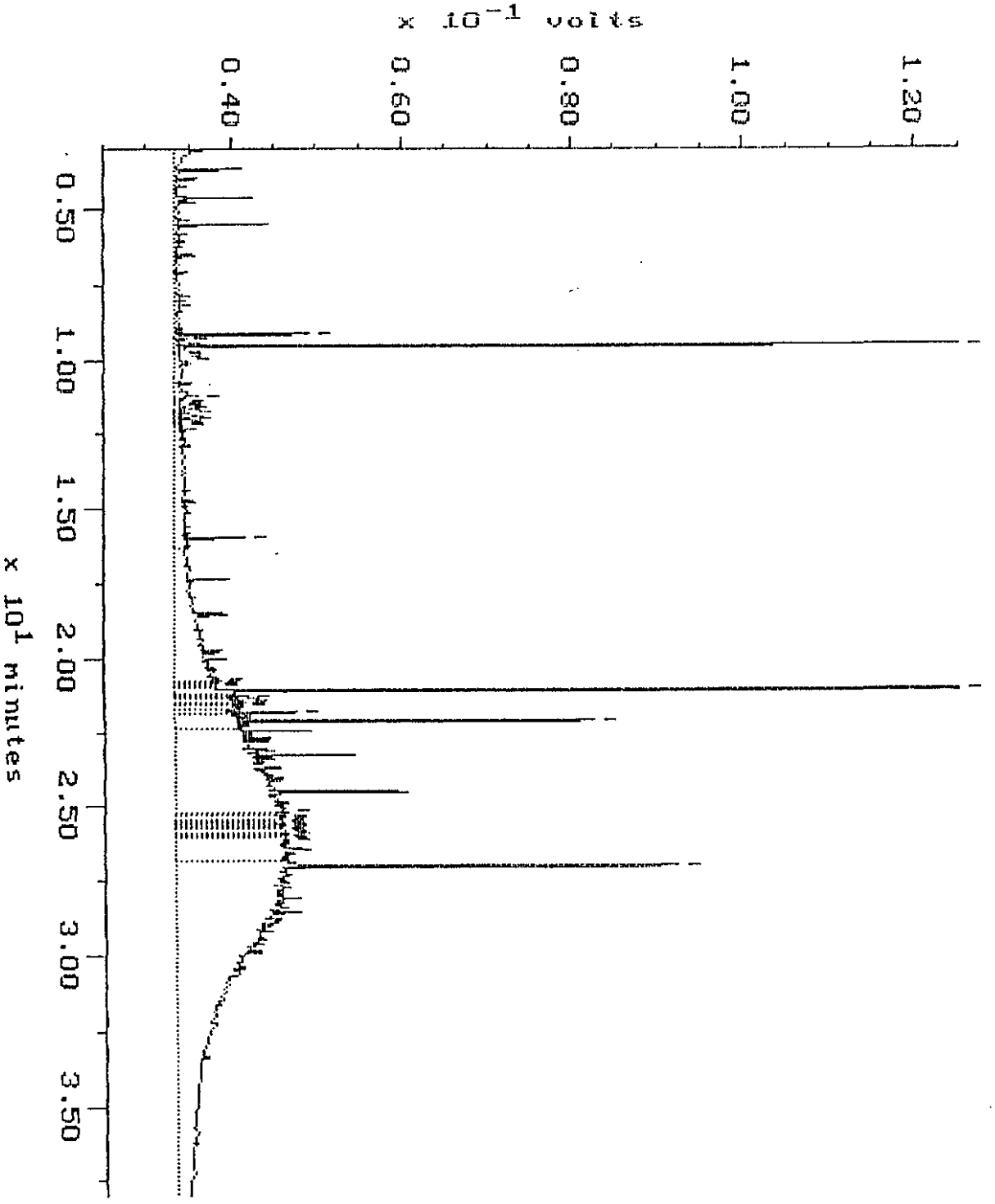
WA DOE WTPH-D

Sample: 9312-344-7 Channel: WILMA Filename: R1038W3E
Acquired: 04-JAN-94 15:35 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BKO



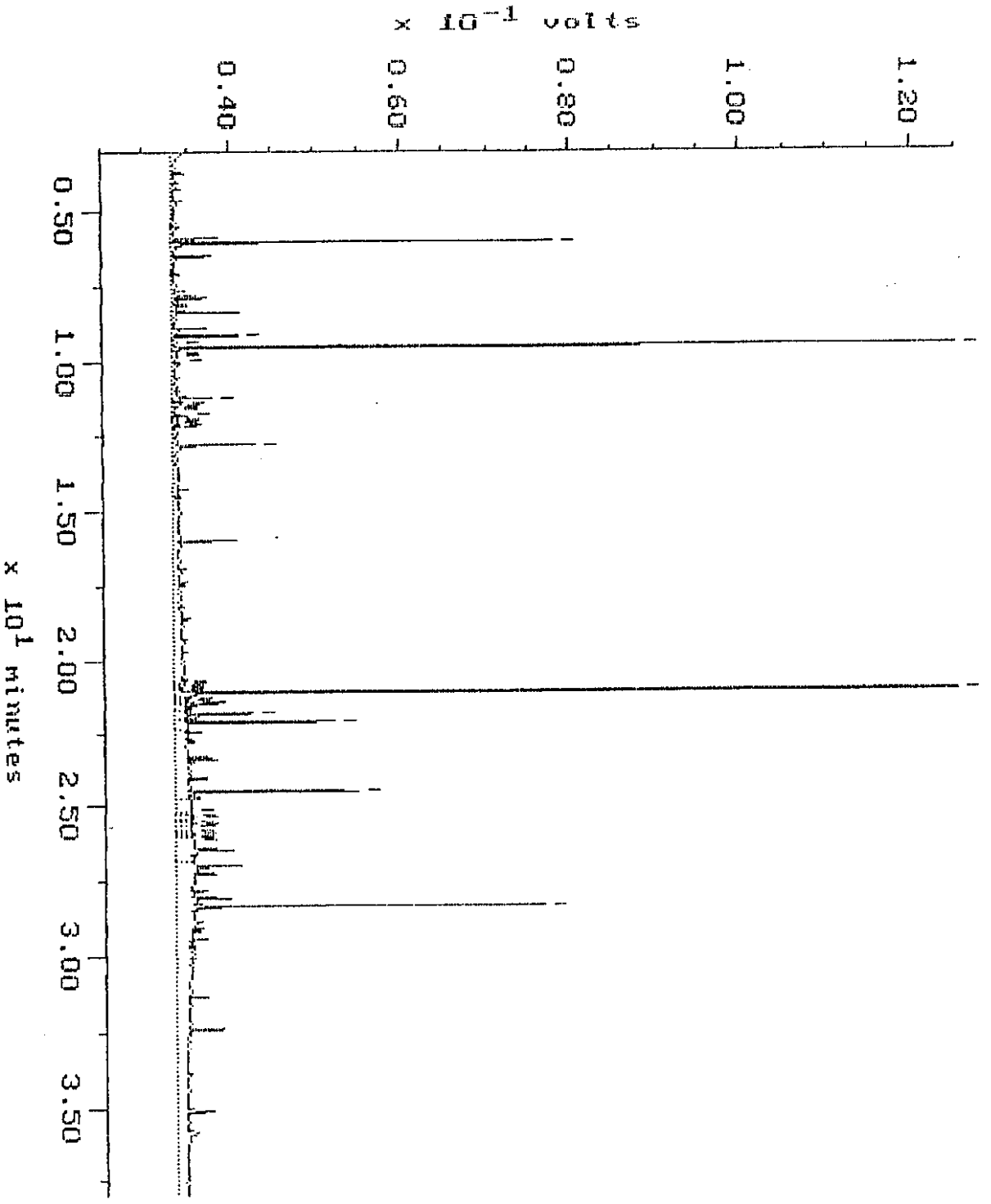
WA DOE WTPH-D

Sample: 9312-344-8 Channel: WILMA Filename: R1038WJ5
Acquired: 04-JAN-94 18:00 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BKO



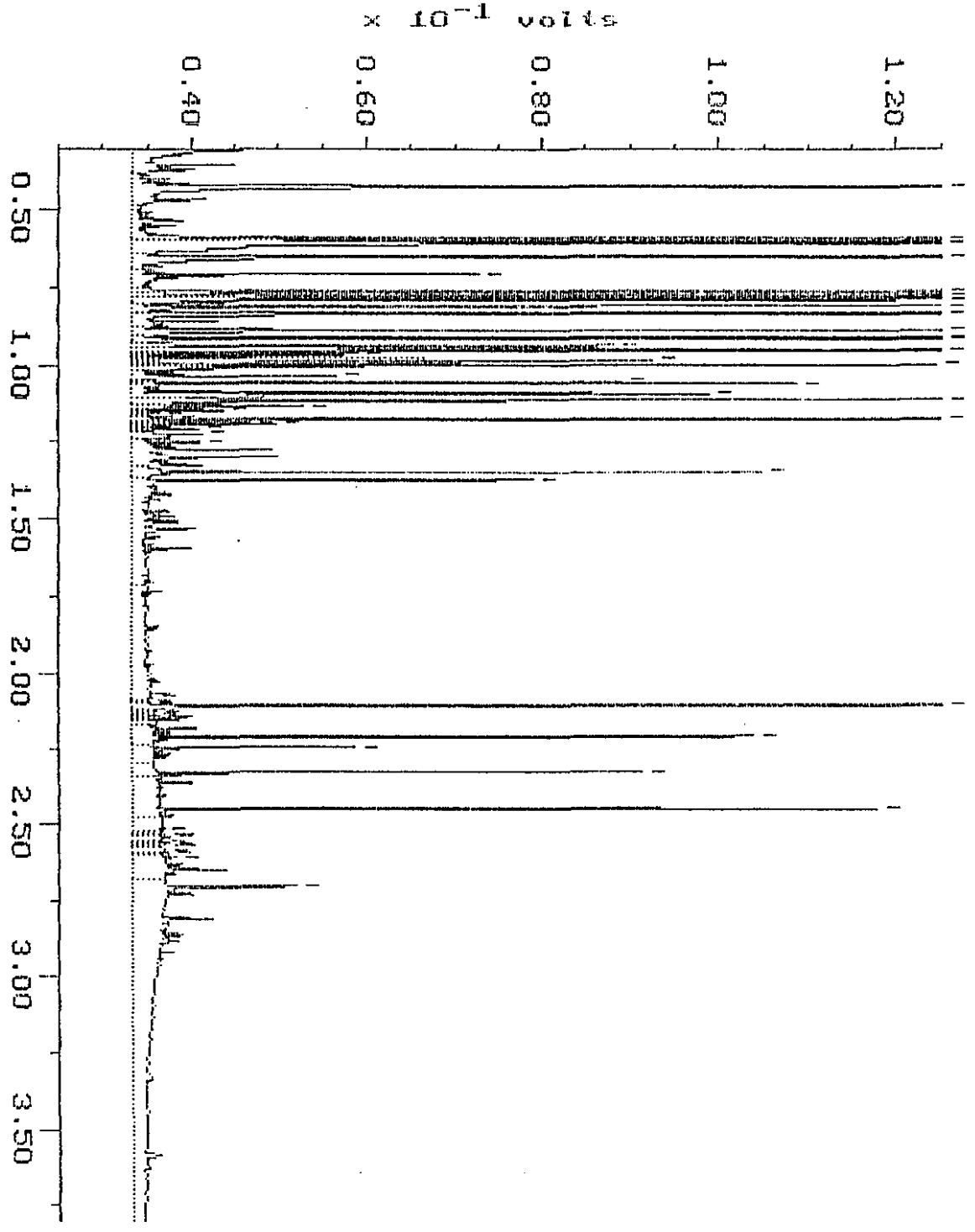
WA DOE WTPH-D

Sample: 9312-344-9 Channel: WILMA Filename: R1038W36
Acquired: 04-JAN-94 18:49 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BKO

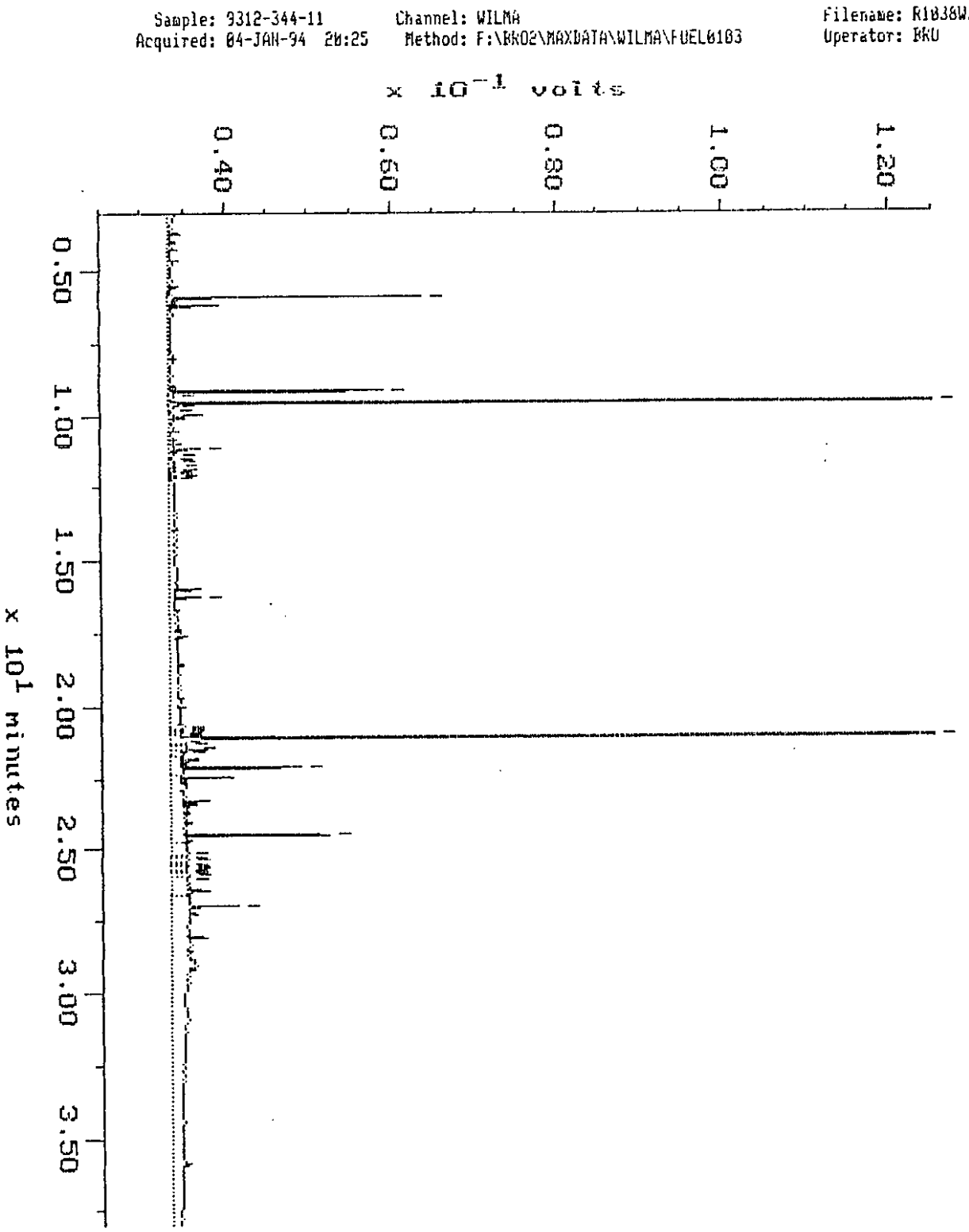


WA DOE WTPH-D

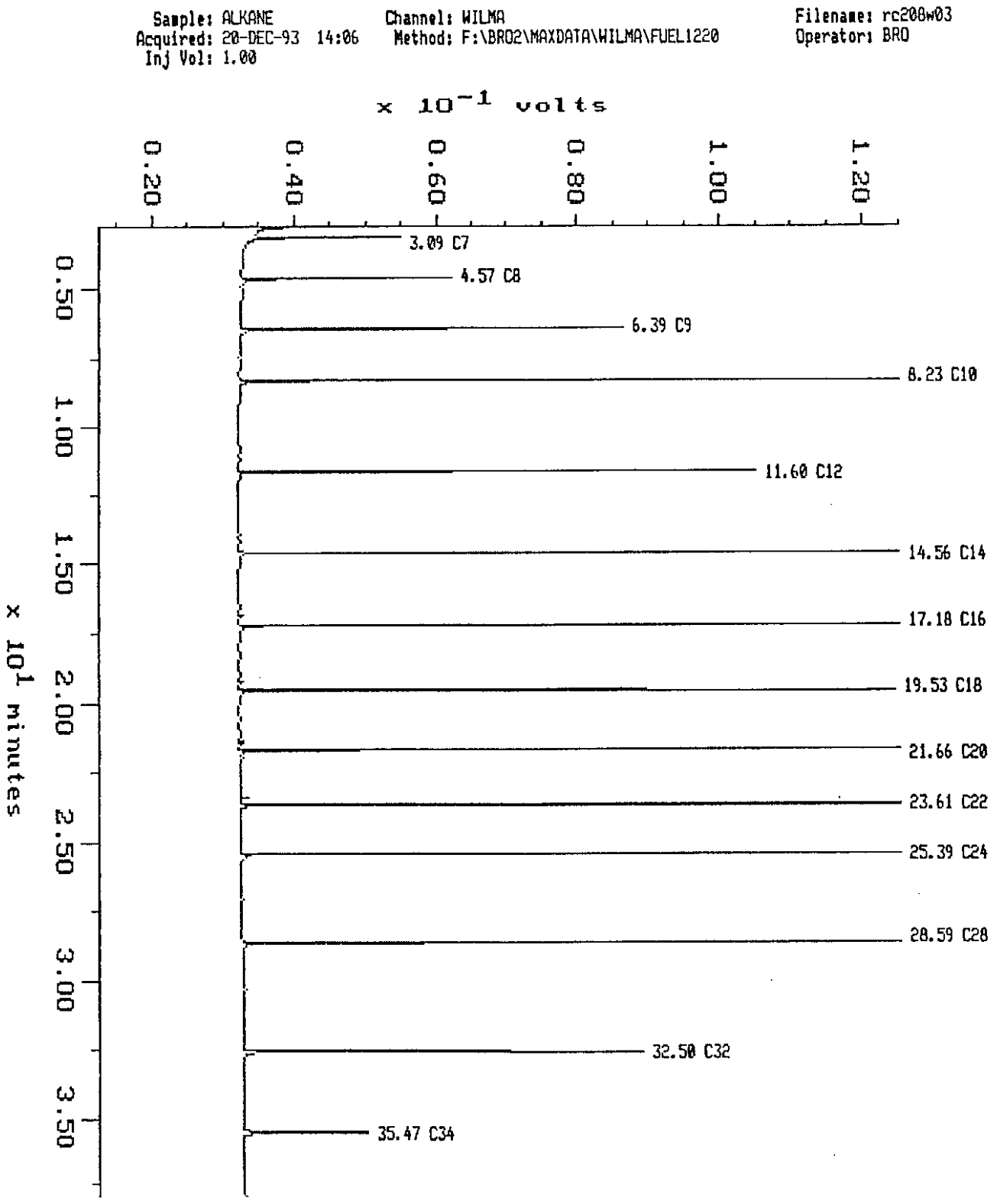
Sample: 9312-344-10 Channel: WILMA Filename: R1038W37
Acquired: 04-JAN-94 19:37 Method: F:\BRO2\MAXDATA\WILMA\FUEL0103 Operator: BRO



WA DOE WTPH-D

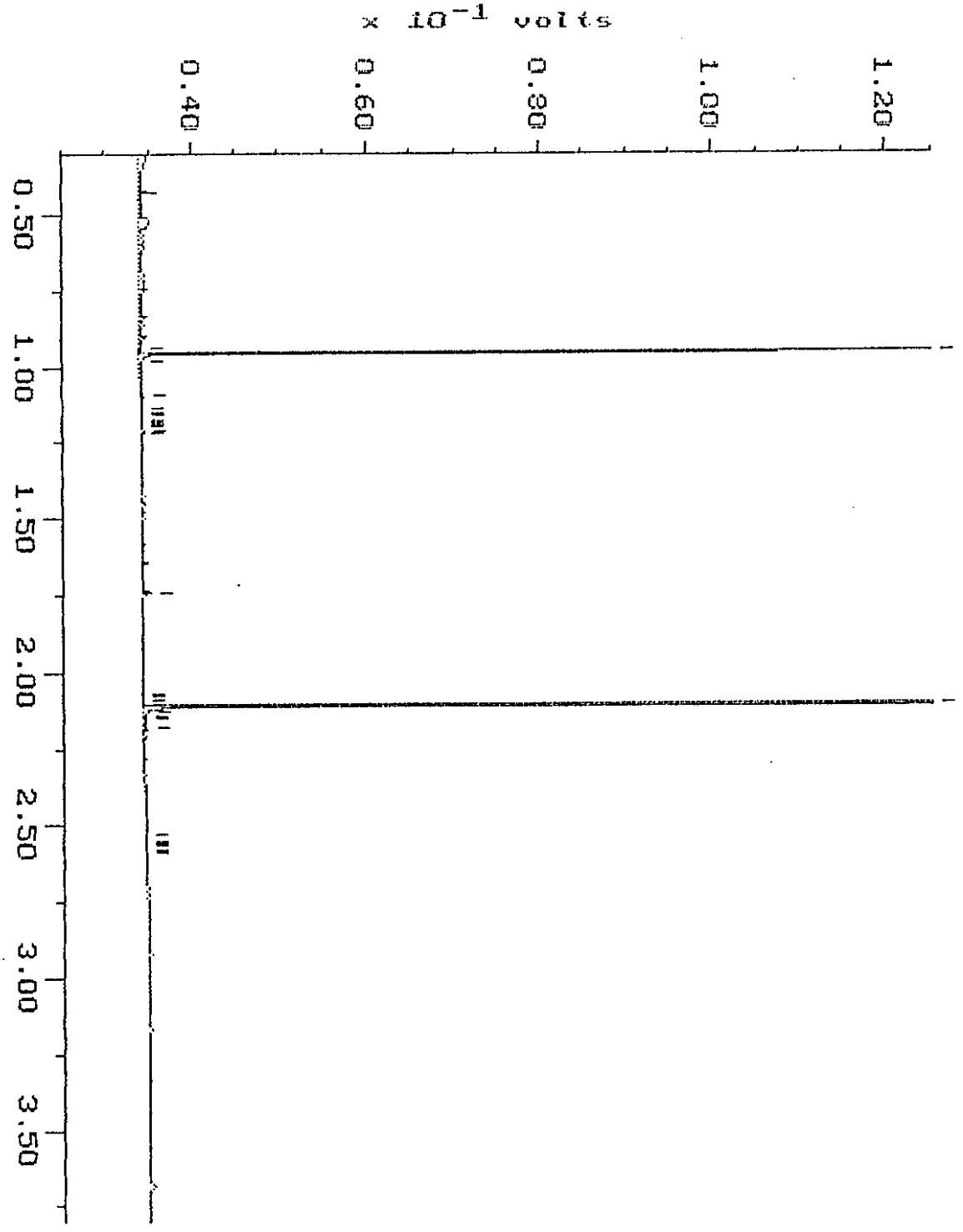

Sample: 9312-344-11
Acquired: 04-JAN-94 20:25
Channel: WILMA
Method: F:\BKO2\MAXDATA\WILMA\FUEL0103
Filename: R1038W38
Operator: BKU
x 10⁻¹ volts
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes

Alkane


Sample: ALKANE
Acquired: 20-DEC-93 14:06
Inj Vol: 1.00
Channel: WILMA
Method: F:\BRO2\MAXDATA\WILMA\FUEL1220
Filename: rc208w03
Operator: BRO
x 10⁻¹ volts
0.20
0.40
0.60
0.80
1.00
1.20
x 10¹ minutes
0.50
1.00
1.50
2.00
2.50
3.00
3.50
3.09 C7
4.57 C8
6.39 C9
8.23 C10
11.60 C12
14.56 C14
17.18 C16
19.53 C18
21.66 C20
23.61 C22
25.39 C24
28.59 C28
32.50 C32
35.47 C34

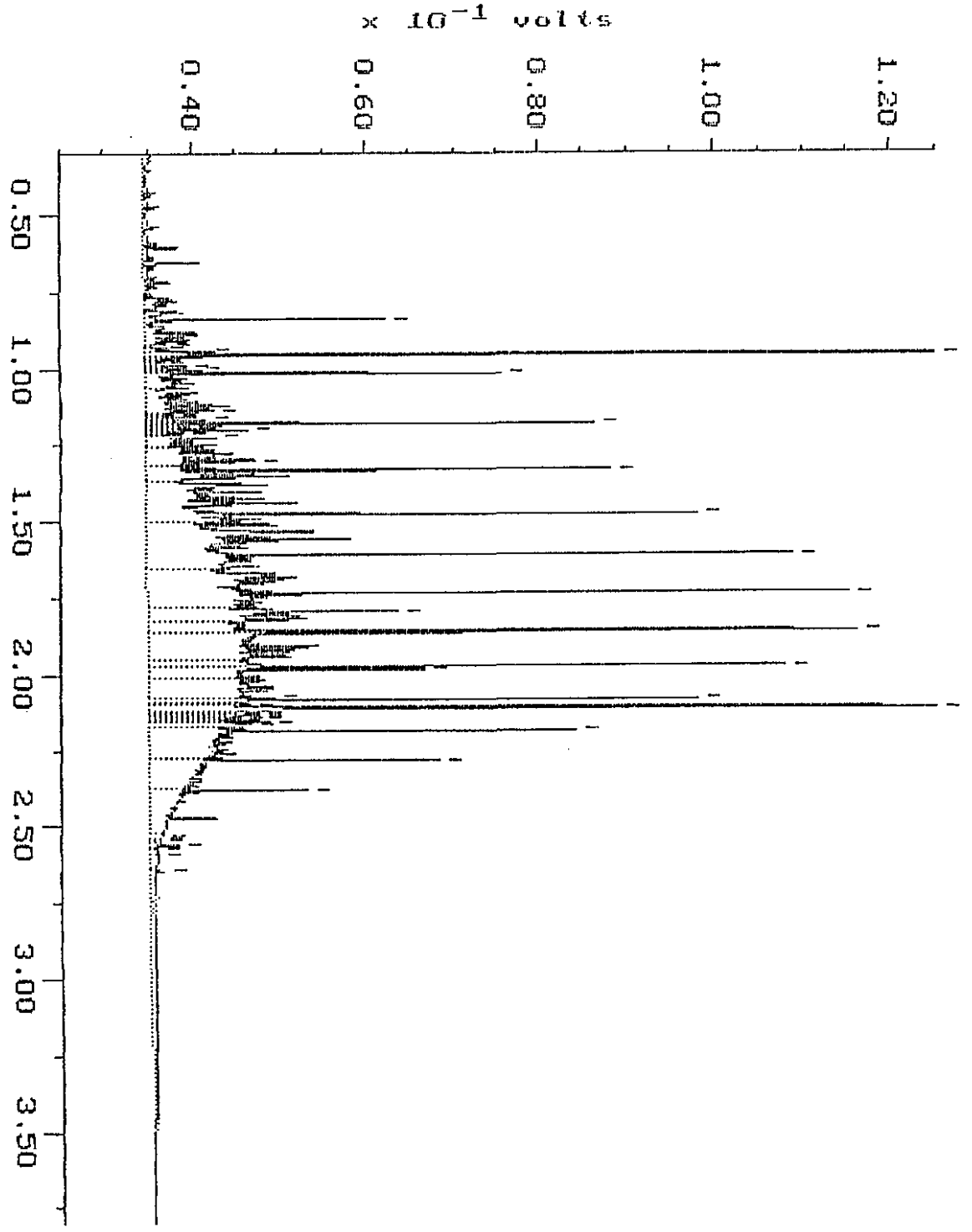
Blank

Sample: WRB 01-03 Channel: WILMA Filename: R10J8W10
Acquired: 03-JAN-94 22:02 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BKO

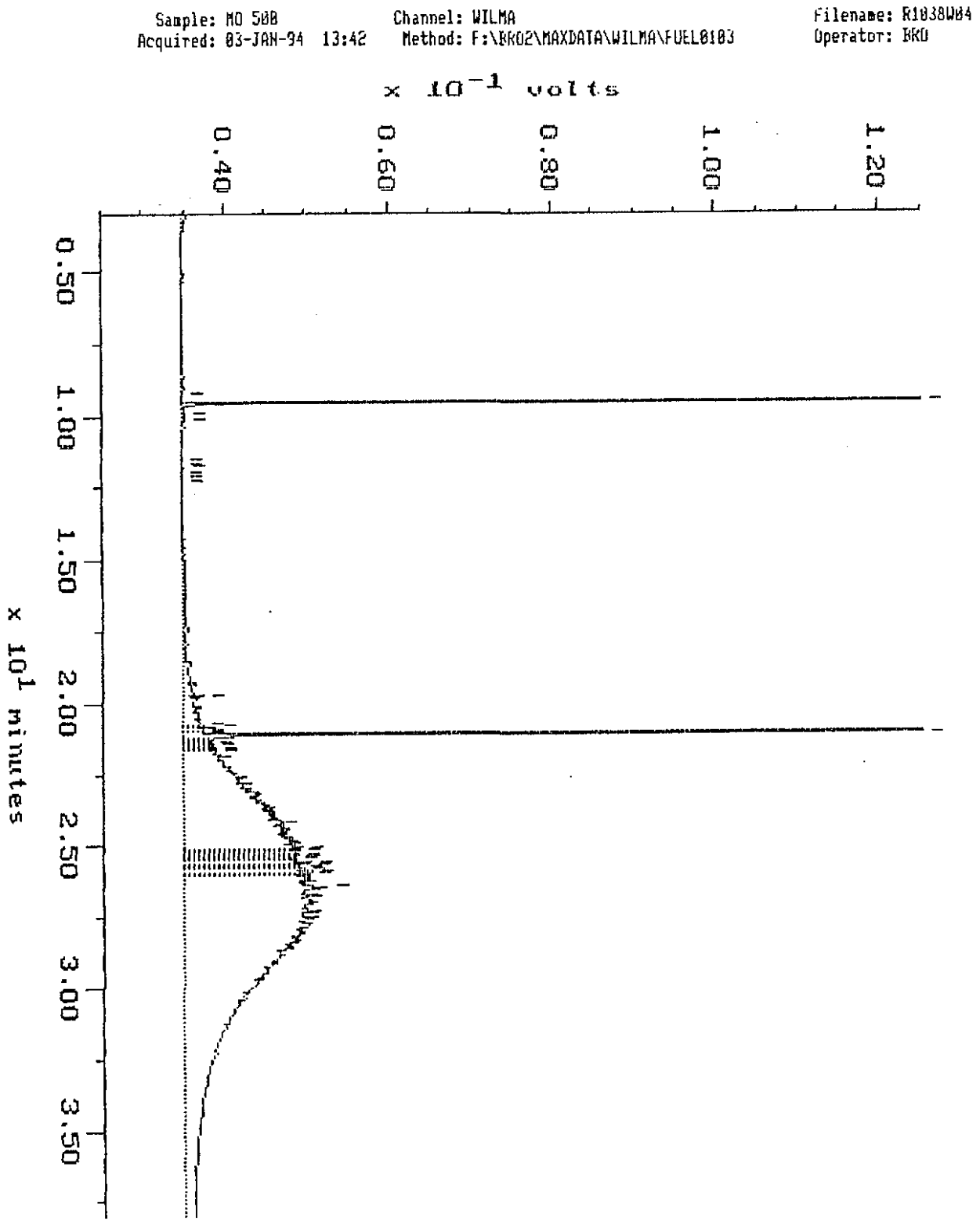


Continuing Calibration

Sample: D 508 Channel: WILMA Filename: R1030W03
Acquired: 03-JAN-94 12:54 Method: F:\BK02\MAXDATA\WILMA\FUEL0103 Operator: BK0



Continuing Calibration



Analytical Technologies, Inc.
500 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335

DATE: 12-28-93 Page 1 of 1 ATI ACCESSION # 9312-344

COMPANY: [illegible]
REPORT TO: Nora Bri
ADDRESS:
PHONE: ( ) 861-6000 FAX: ( ) -
PROJECT MANAGER: Nora Bri
PROJECT NUMBER: 0161-015-R09
PROJECT NAME: Unocal / Westlake & Mercer
ATI will DISPOSE / RETURN samples (circle one)

Sample ID	Date	Time	Matrix	LabID	FUELS: TPH-HCID WA/OR	BETX/TPH-G combo WA/OR	BETX (by 8020)	TPH-G WA/OR	TPH-D Extended WA/OR	8015 modified	418.1 WA/OR	413.2	AK-GRO	AK-DRO	ORGANIC COMPOUNDS: 8240 GCMS Volatiles	8270 GCMS Semivolatiles	8080 Pesticides/PCBs	PCB only (by 8080) STD/lo level	8010 Halogenated VOCs	8020 Aromatic VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	METALS: Metals (Indicate below *)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCLP: TCLP-Volatiles (ZHE-8240)	TCLP-Semivolatiles (8270)	TCLP-Pesticides (8080)	TCLP-Herbicides (8150)	TCLP-Metals (8 metals)	OTHER: % Moisture (please indicate)					Total # of Containers/sample
MW-32A	12-27-93	1025	Water	1		X			X																													4
MW-33	"	1115	"	2		X			X																													4
MW-34	"	1100	"	3		X			X																													4
MW-35	"	1020	"	4		X			X																													4
MW-36	12-28-93	0240	"	5		X			X																													4
MW-40	12-30-93	0250	"	6		X			X																													4
MW-41	12-29-93	1150	"	7		X			X																													4
MW-42	12-30-93	0145	"	8		X			X																													4
MW-43	12-30	0150	"	9		X			X																													4
MW-45	12-29	1145	"	10		X			X																													4
MW-47	12-30	0200	"	11		X			X																													4

Turnaround Time	
STANDARD TAT	X
1 WEEK TAT	
4 WORK DAY TAT	
3 WORK DAY TAT	
2 WORK DAY TAT	
24 HOUR TAT	

Sample Receipt	
TOTAL # CONTAINERS RECVD	52
COC SEALS PRESENT?	Y
COC SEALS INTACT?	Y
RECEIVED COLD?	Y
RECEIVED INTACT?	Y
RECEIVED VIA: COURIER	

Relinquished By: [illegible]
Kurt Harrington Date: 12-30-93
Kurt [illegible] Time: 1200

Relinquished By: Date: Time:

Relinquished By: Date: Time:

Received By:
[illegible] Date: 12/30/93
M. Postma Time: 1205

Received By: Date: Time:

Received By: Date: Time:

Special Instructions:

* Metals needed:

R - 163

Analytical Technologies, Inc.
560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
Karen L. Mixon, Laboratory Manager

ATI I.D. # 9401-066

January 20, 1994

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Attention : Norm Puri

Project Number : 0161-013-R69

Project Name : Unocal - West Lake & Mercer

Dear Mr. Puri:

On January 10, 1994, Analytical Technologies, Inc. (ATI), received one sample for analysis. The sample was analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Elaine M. Walker

Elaine M. Walker
Project Manager

EMW/hal/ff

Enclosure

Corporate Offices: 5550 Morehouse Drive, San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

ATI I.D. # 9401-066

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WEST LAKE & MERCER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9401-066-1	MW-37	01/06/94	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9401-066

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R69
PROJECT NAME : UNOCAL - WEST LAKE & MERCER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9401-066

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WEST LAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/11/94
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	105	52 - 116
TRIFLUOROTOLUENE	102	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9401-066-1

BETX - GASOLINE
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/06/94
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 01/10/94
PROJECT NAME	: UNOCAL - WEST LAKE & MERCER	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-37	DATE ANALYZED	: 01/11/94
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G/8020(BETX)	DILUTION FACTOR	: 200

COMPOUNDS	RESULTS
BENZENE	6200
ETHYLBENZENE	27000
TOLUENE	63000
TOTAL XYLENES	150000
FUEL HYDROCARBONS	1600000
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	108	52 - 116
TRIFLUOROTOLUENE	105	50 - 150

Analytical Technologies, Inc.

ATI I.D. # 9401-066

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 0161-013-R69	DATE RECEIVED	: N/A
PROJECT NAME	: UNOCAL - WEST LAKE & MERCER	DATE EXTRACTED	: 01/10/94
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 01/11/94
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<250
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	<1000
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

Analytical Technologies, Inc.

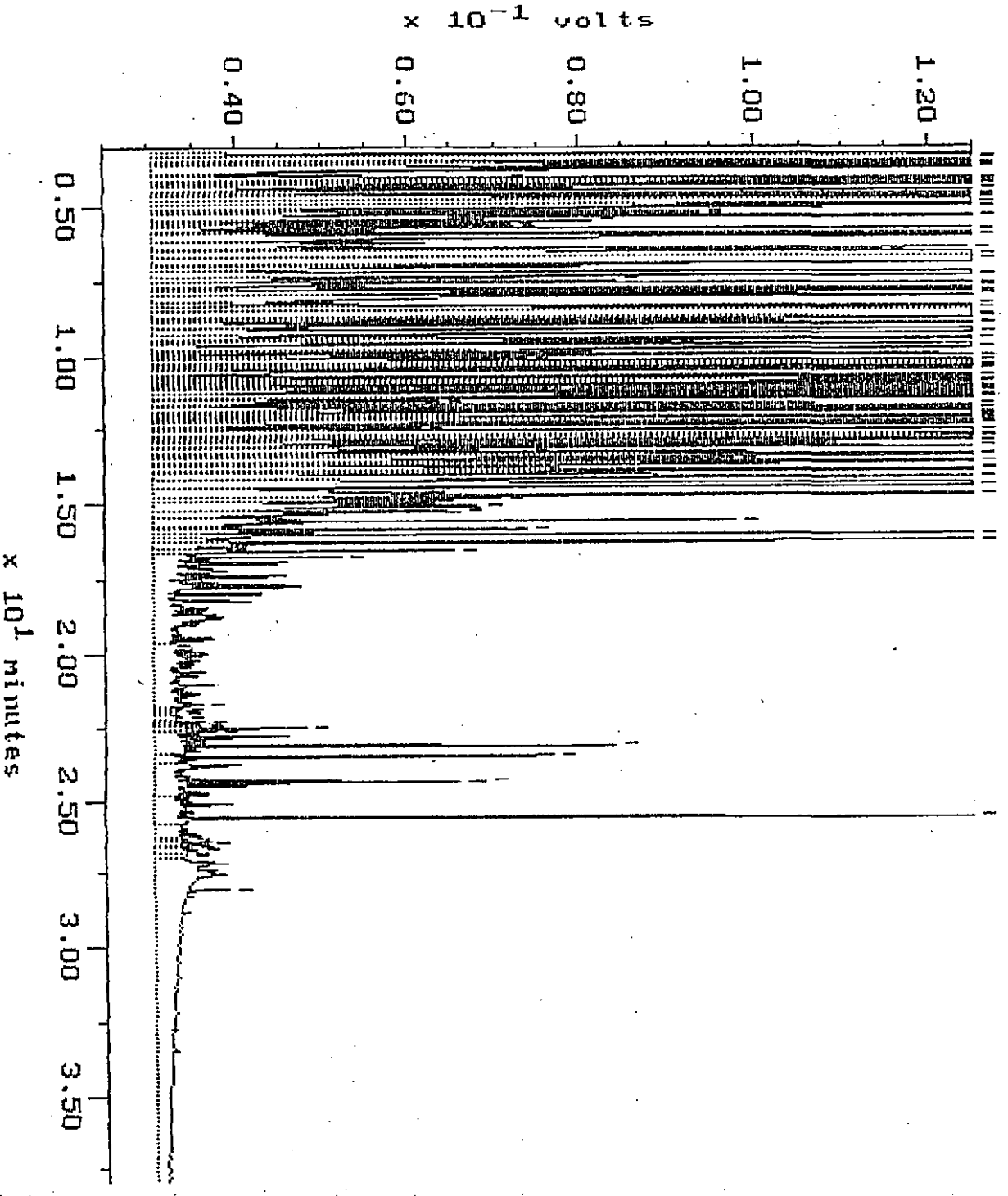
ATI I.D. # 9401-066-1

TOTAL PETROLEUM HYDROCARBONS
DATA SUMMARY

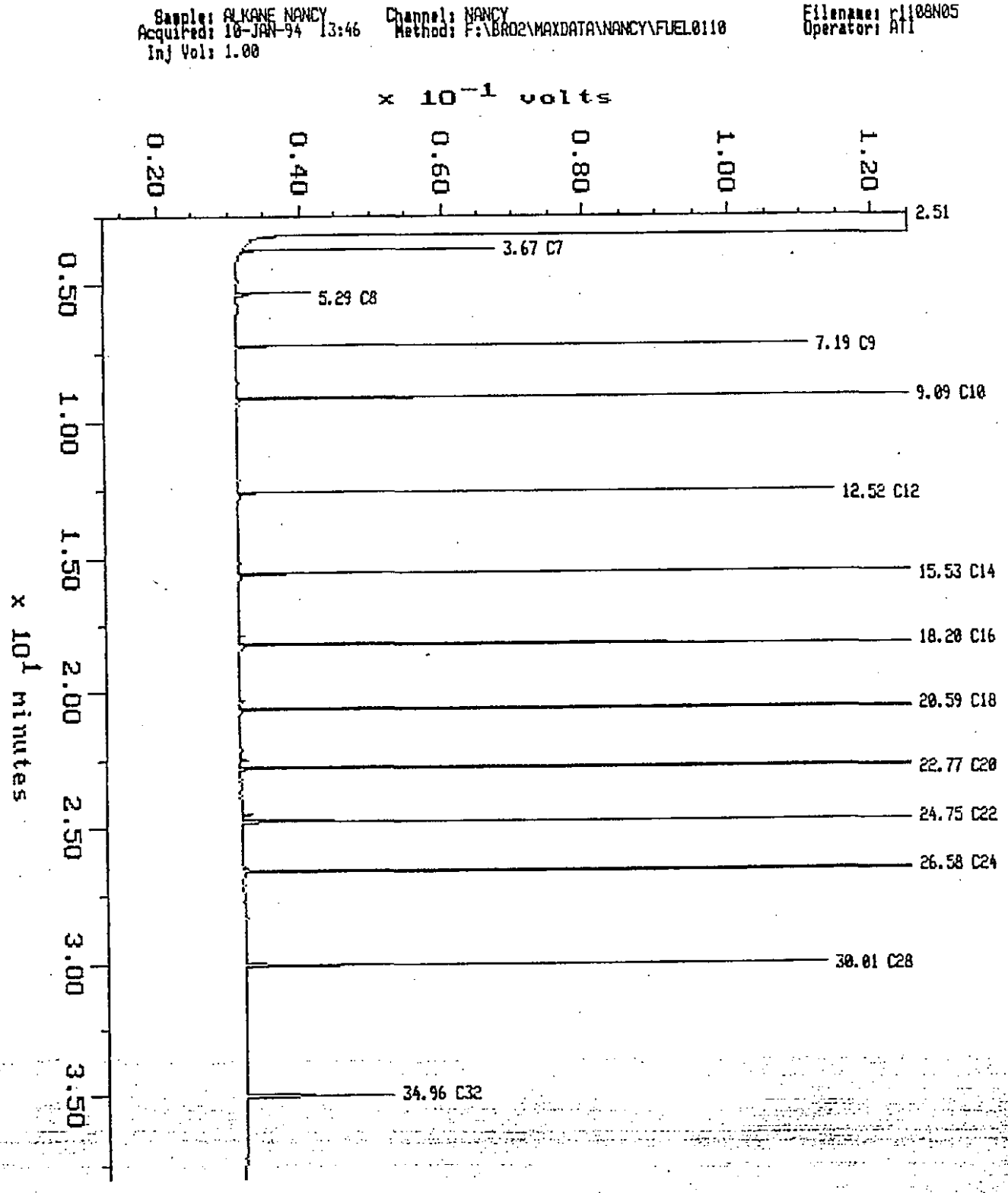
CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 01/06/94
PROJECT #	: 0161-013-R69	DATE RECEIVED	: 01/10/94
PROJECT NAME	: UNOCAL - WEST LAKE & MERCER	DATE EXTRACTED	: 01/10/94
CLIENT I.D.	: MW-37	DATE ANALYZED	: 01/11/94
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-D	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	90000
HYDROCARBON RANGE	C12 - C24
HYDROCARBON QUANTITATION USING	DIESEL
FUEL HYDROCARBONS	14000
HYDROCARBON RANGE	C24 - C34
HYDROCARBON QUANTITATION USING	MOTOR OIL

Sample: 9401-066-1 Channel: NANCY Filename: R1108N20
Acquired: 11-JAN-94 1:37 Method: F:\BRO2\MAXDATA\NANCY\FUEL0110 Operator: ATI
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE

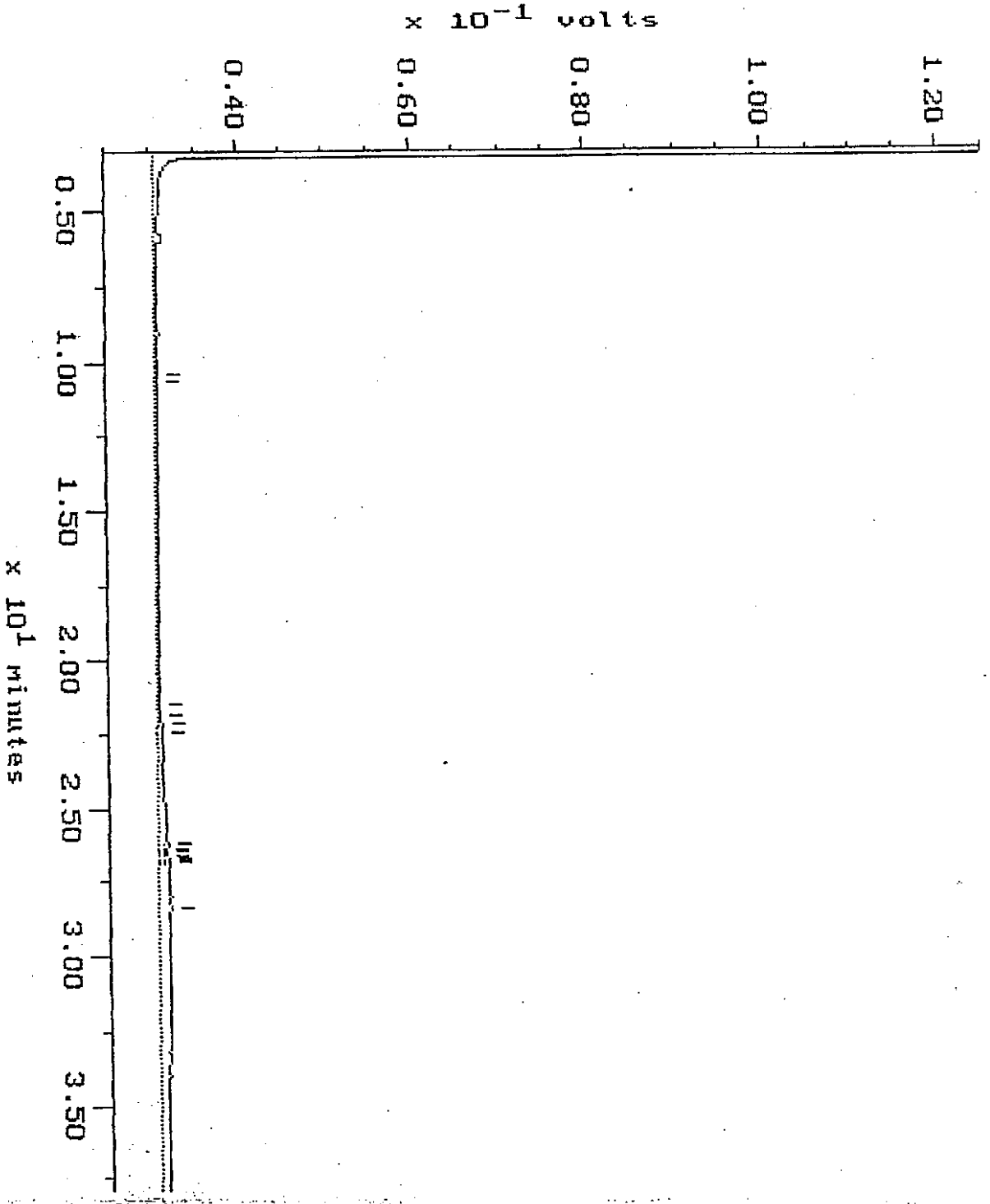


Alkane

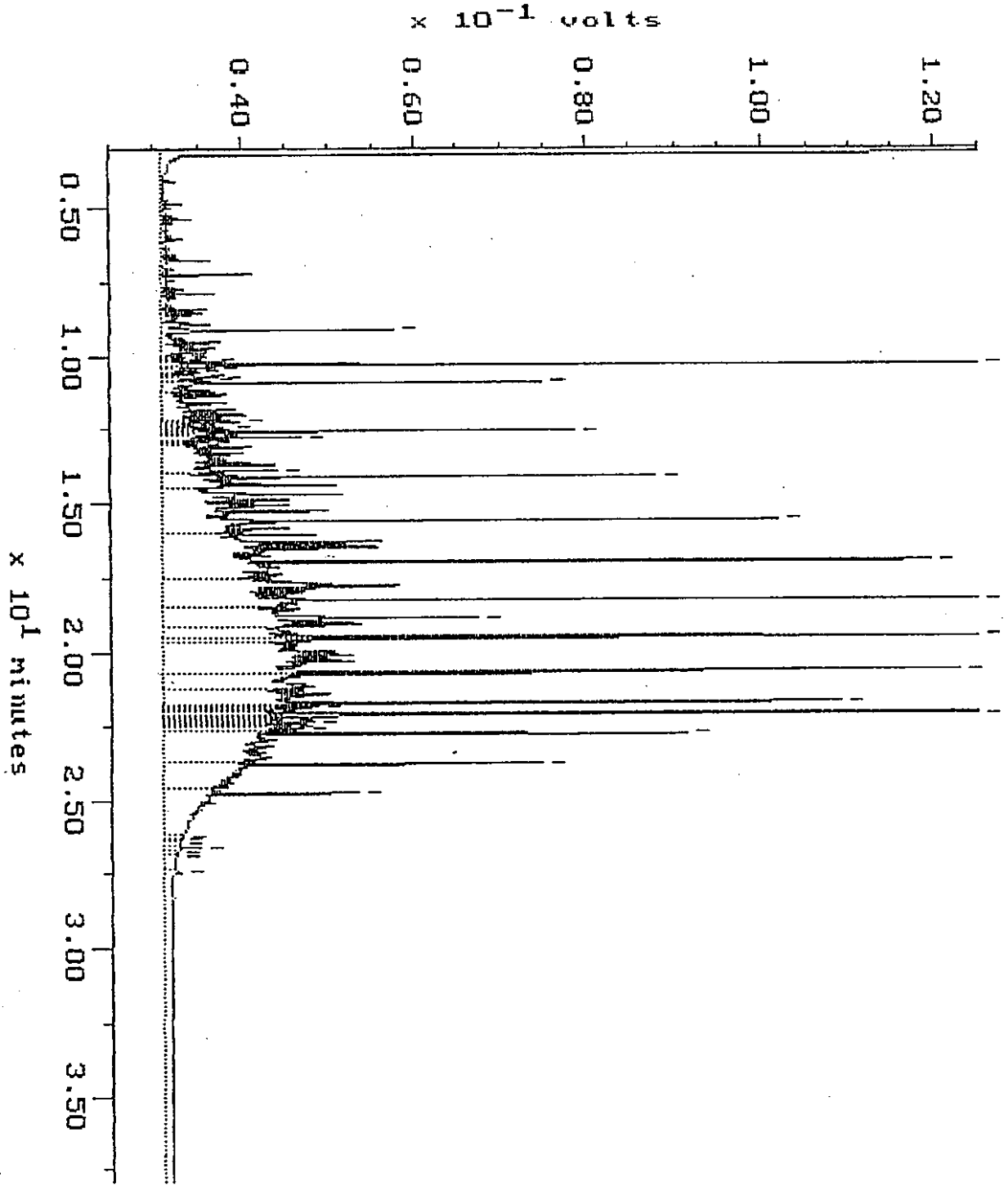

Sample: ALKANE NANCY
Acquired: 10-JAN-94 13:46
Inj Vol: 1.00
Channel: NANCY
Method: F:\BRO2\MAXDATA\NANCY\FUEL0110
Filename: r1108N05
Operator: ATI
x 10⁻¹ volts
0.20
0.40
0.60
0.80
1.00
1.20
x 10¹ minutes
0.50
1.00
1.50
2.00
2.50
3.00
3.50
2.51
3.67 C7
5.29 C8
7.19 C9
9.09 C10
12.52 C12
15.53 C14
18.20 C16
20.59 C18
22.77 C20
24.75 C22
26.58 C24
30.01 C28
34.96 C32

Blank

Sample: B0110-SRB Channel: NANCY Filename: R1108N18
Acquired: 11-JAN-94 0:02 Method: F:\BRO2\MAXDATA\NANCY\FUEL0110 Operator: ATI
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE

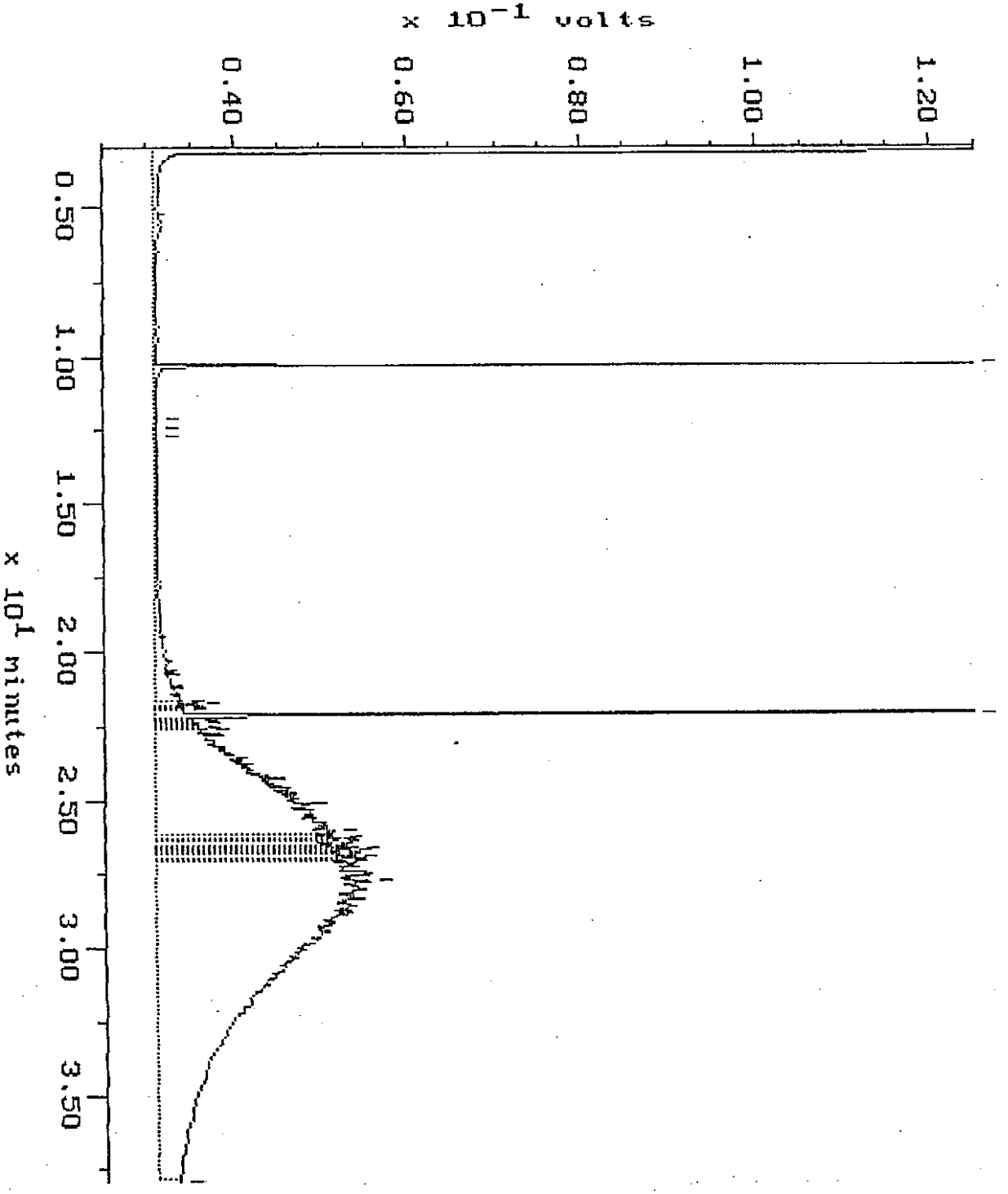


Sample: D 530 Channel: NANCY Filename: R1108N06
Acquired: 10-JAN-94 14:33 Method: F:\BRO2\MAXDATA\NANCY\FUEL0110 Operator: ATI
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE



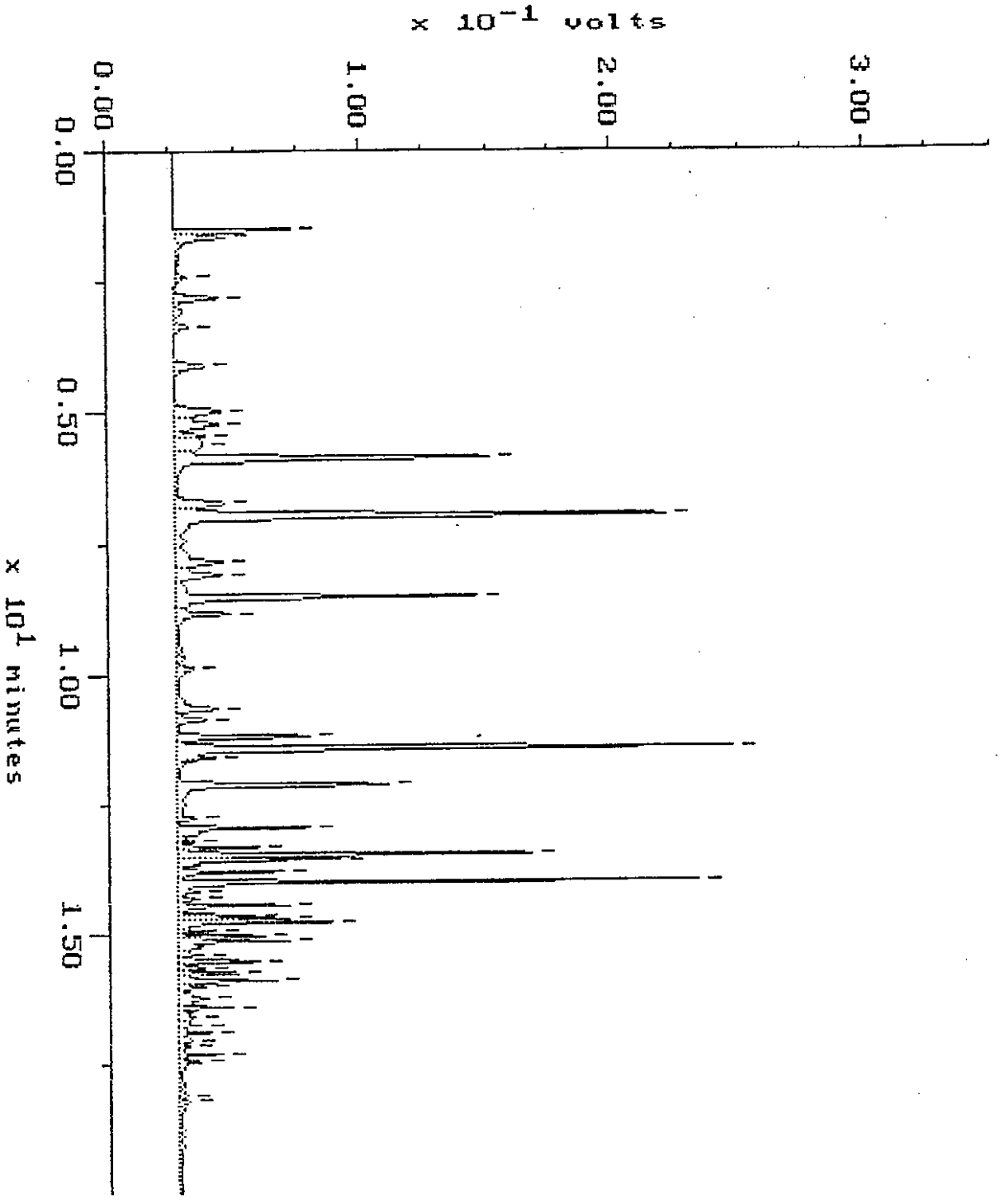
Continuing Calibration

Sample: MD 500 Channel: NANCY Filename: R1108M07
Acquired: 10-JAN-94 15:21 Method: F:\BRO2\MAXDATA\NANCY\FUEL0110 Operator: ATI
Comments: ATI RUSH FUELS:PROVIDERS OF EXCELLENCE AND QUALITY IN CLIENT SERVICE

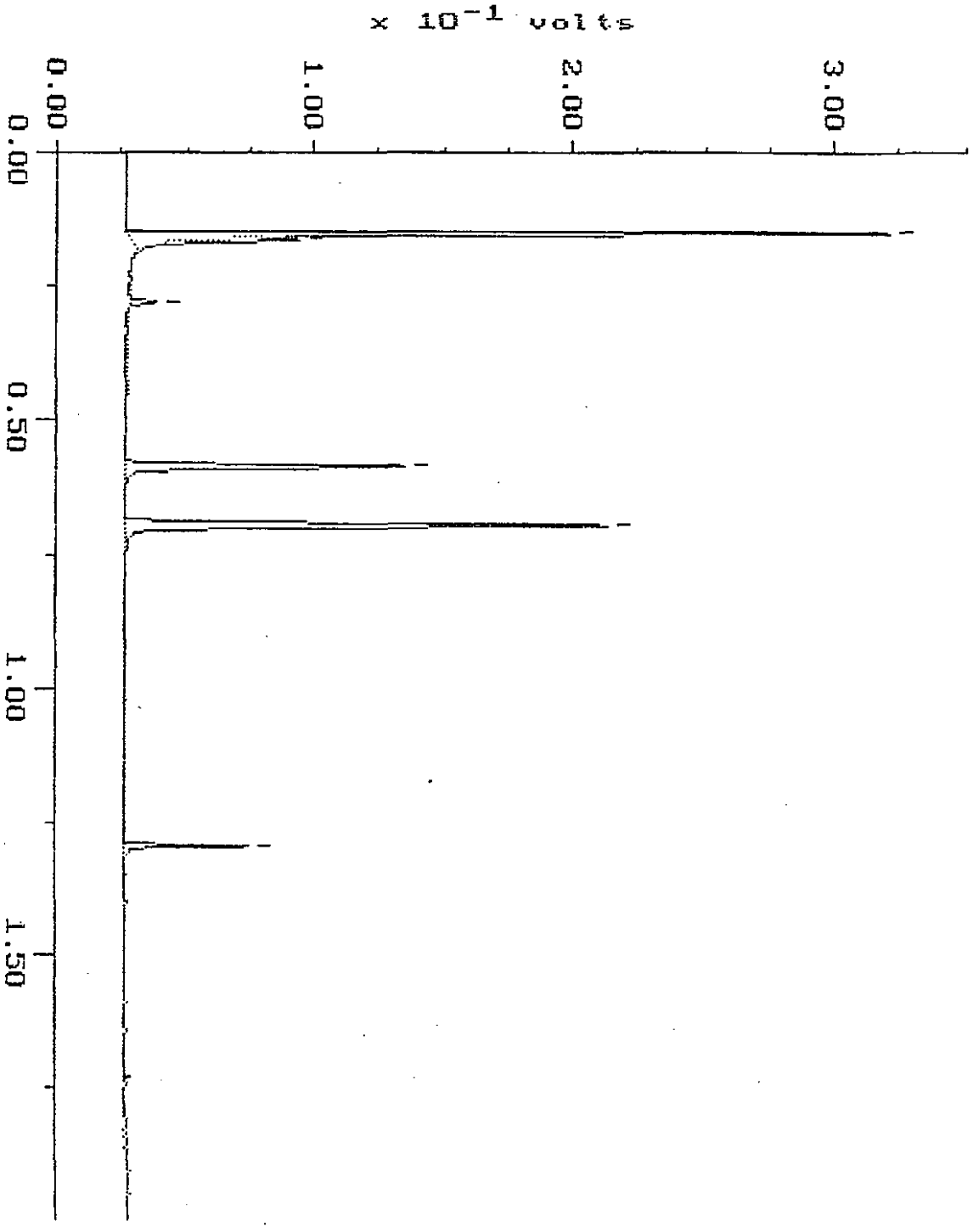


Blank

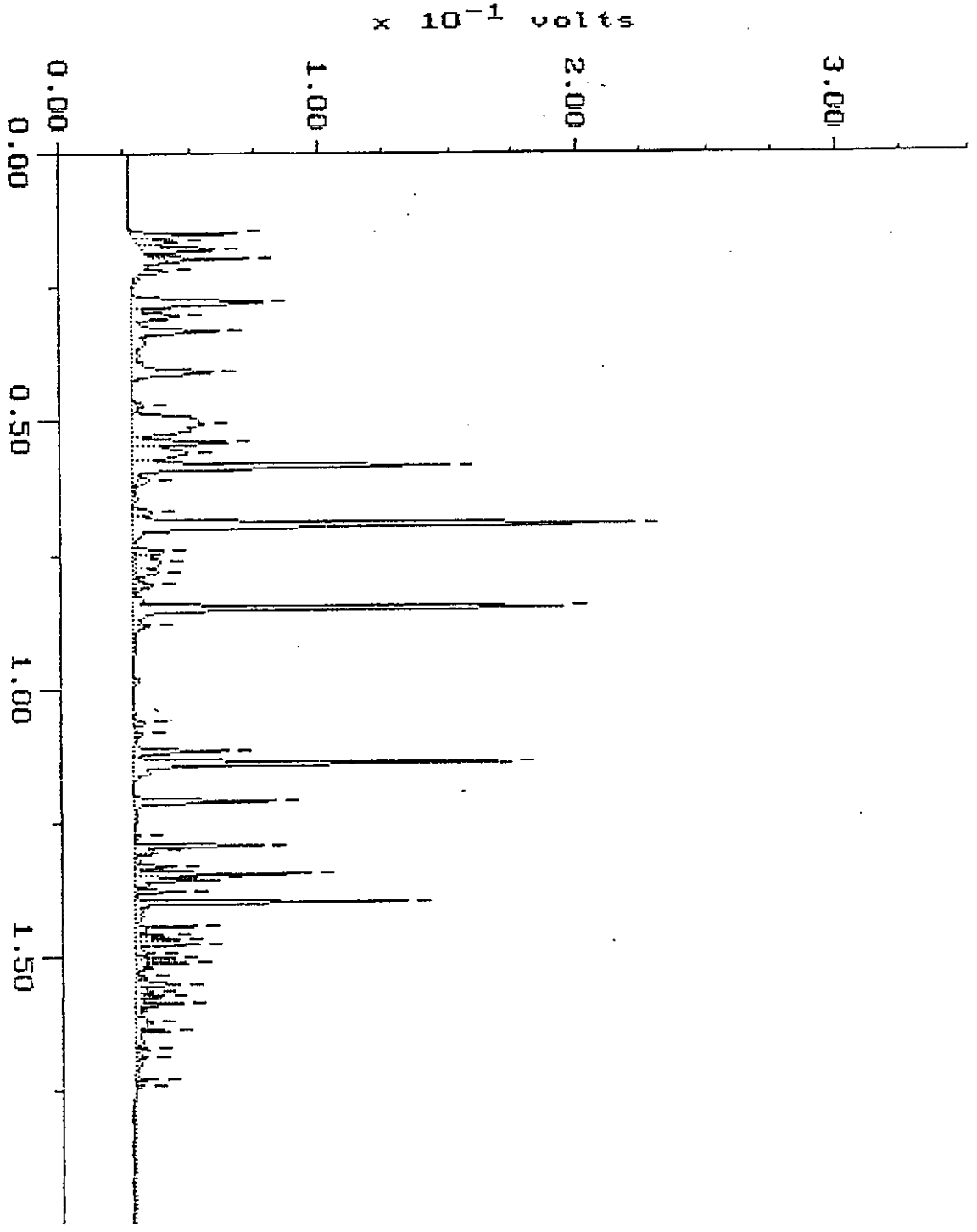
Sample: 9401-066-1 DIL Channel: FID Filename: R1109P33
Acquired: 11-JAN-94 2:13 Method: F:\BRO2\MAXDATA\PICARD\011094PC Operator: ATI
Dilution: 1 : 10000.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Sample: MEOH BLANK 1-10 Channel: FID Filename: R1109P34
Acquired: 11-JAN-94 2:44 Method: F:\BRO2\MAXDATA\PICARD\011094PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Sample: STD-C 6 Channel: FID Filename: R1109P01
Acquired: 10-JAN-94 8:20 Method: F:\BRO2\MAXDATA\PICARD\011094PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Analytical Technologies, Inc.
[redacted] Nachos Avenue, S.W., Suite 101, Renton, WA [redacted] (206) 2[redacted]

DATE: 1/7/93 Page 1 of 1 ATI ACCESSION # 9401066

COMPANY: GEOENGINEERS
REPORT TO: NORM PURI
ADDRESS: 5410 154th AVE NE
REDMOND WA 98052
PHONE: (206) 861-6000 FAX: (206) 861-6050
PROJECT MANAGER: NORM PURI
PROJECT NUMBER: 161-013-R6Y
PROJECT NAME: W. LAKE & MERCER
ATI will (DISPOSE) / RETURN samples (circle one)

Sample ID	Date	Time	Matrix	LabID	FUELS: TPH-HCID WA/OR	BETX/TPH-G combo WA/OR	BETX (by 8020) WA/OR	TPH-G WA/OR	TPH-D Extended	8015 modified WA/OR	418.1	413.2	AK-GRO	AK-DRO	ORGANIC COMPOUNDS: 8240 GCMS Volatiles	8270 GCMS Semivolatiles	8080 Pesticides/PCBs	PCB only (by 8080) STD/lo level	8010 Halogenated VOCs	8020 Aromatic VOCs	8310 HPLC PAHs	8040 Phenols	8140 OP Pesticides	8150 OC Herbicides	METALS: Metals (Indicate below *)	Total Lead	Priority Pollutant Metals (13)	TAL Metals (23)	TCLP: TCLP-Volatiles (ZHE-8240)	TCLP-Semivolatiles (8270)	TCLP-Pesticides (8080)	TCLP-Herbicides (8150)	TCLP-Metals (8 metals)	OTHER: % Moisture (please indicate)				Total # of Containers/sample
MW-37	1/6/93	0900	Filtered	-1		X	X		X	X																											2

Turnaround Time		Sample Receipt	
STANDARD TAT		TOTAL # CONTAINERS RECVD	2
1 WEEK TAT	X	COC SEALS PRESENT?	Y
4 WORK DAY TAT		COC SEALS INTACT?	Y
3 WORK DAY TAT		RECEIVED COLD?	Y
2 WORK DAY TAT		RECEIVED INTACT?	Y
24 HOUR TAT		RECEIVED VIA:	COURIER

Special Instructions:
* WATER & FATTY PRODUCT - SAMPLES
please use product color as sample
* Metals needed:

Relinquished By:	Relinquished By:	Relinquished By:
Date: 1/6/93	Date:	Date:
Time: 1700	Time:	Time:
Received By:	Received By:	Received By:
Date: 1/6/93	Date:	Date:
Time: 1720	Time:	Time:

Analytical**Technologies,** Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335

Karen L. Mixon, Laboratory Manager

ATI I.D. # 9404-075

April 20, 1994

GeoEngineers

APR 21 1994

Routing

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond WA 98052

Attention : Norm Puri

Project Number : 0161-013-R62

Project Name : Unocal #5353 - Seattle

Dear Mr. Puri:

On April 8, 1994, Analytical Technologies, Inc. (ATI), received nine samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Please note that this report has a summary report for the fuels analyses. If you have any questions, please call.

Sincerely,

Elaine M. Walker

Elaine M. Walker
Project Manager

EMW/hal/ff

Enclosure

5550 Morehouse Drive, San Diego, CA 92121 (619) 458-9141

Analytical Technologies, Inc.

ATI I.D. # 9404-075

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R62
PROJECT NAME : UNOCAL #5353 - SEATTLE

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9404-075-1	MW-32A	04/07/94	WATER
9404-075-2	MW-33	04/07/94	WATER
9404-075-3	MW-34	04/07/94	WATER
9404-075-4	MW-35	04/07/94	WATER
9404-075-5	MW-37	04/07/94	WATER
9404-075-6	MW-40	04/07/94	WATER
9404-075-7	MW-42	04/07/94	WATER
9404-075-8	MW-45	04/07/94	WATER
9404-075-9	MW-47	04/07/94	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	9

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ATI I.D. # 9404-075

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R62
PROJECT NAME : UNOCAL #5353 - SEATTLE

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-D	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

Analytical Technologies, Inc.

ATI I.D. # 9404-075

CASE NARRATIVE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 0161-013-R62
PROJECT NAME : UNOCAL #5353 - SEATTLE

CASE NARRATIVE: TOTAL PETROLEUM HYDROCARBONS (WA DOE WTPH-D) ANALYSIS

Nine water samples were received by ATI on April 8, 1994, for WA DOE WTPH-D extended analysis. These samples were analyzed in accordance with Washington state methodology.

The surrogate percent recovery for sample 9404-075-5 (MW-37) was out of ATI established control limits. There was insufficient sample for reextraction.

The relative percent difference (RPD) between sample 9404-086-1 and its duplicate was out of ATI established control limits. The surrogate percent recovery for the same sample was out of ATI established control limits due to matrix interference.

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L**

	ATI Sample #:	0		0		0		1		2		3	
	Client ID:	Method Blank		Method Blank		Method Blank		MW-32A		MW-33		MW-34	
	Date Sampled:	N/A		N/A		N/A		04/07/94		04/07/94		04/07/94	
	Date Extracted:	N/A		N/A		N/A		N/A		N/A		N/A	
	Date Analyzed:	04/08/94		04/11/94		04/12/94		04/09/94		04/12/94		04/09/94	
Benzene		<0.5		<0.5		<0.5		3900	D8	220	D5	4500	D8
Ethylbenzene		<0.5		<0.5		<0.5		490	D5	80	D1	260	D4
Toluene		<0.5		<0.5		<0.5		150	D5	1.5	D1	930	D4
Total Xylenes		<0.5		<0.5		<0.5		590	D5	190	D1	840	D4
Gasoline (Toluene to Dodecane)		<100		<100		<100		11000	D5	3500	D1	9800	D4
Surrogate Recoveries (%)													
Bromofluorobenzene		108		108		108		107	D5	105	D1	105	D4
Trifluorotoluene		108		107		110		106	D5	106	D1	105	D4

	ATI Sample #:	4		5		6		7		8		9	
	Client ID:	MW-35		MW-37		MW-40		MW-42		MW-45		MW-47	
	Date Sampled:	04/07/94		04/07/94		04/07/94		04/07/94		04/07/94		04/07/94	
	Date Extracted:	N/A		N/A		N/A		N/A		N/A		N/A	
	Date Analyzed:	04/09/94		04/09/94		04/12/94		04/12/94		04/12/94		04/11/94	
Benzene		480	D4	660	D7	29		620	D5	2500	D6	2.5	
Ethylbenzene		140	D4	1500	D7	6.9		<1.0	D1	580	D6	<0.5	
Toluene		51	D4	3600	D7	1.1		<1.0	D1	620	D6	<0.5	
Total Xylenes		550	D4	9500	D7	2.6		<1.0	D1	2500	D6	<0.5	
Gasoline (Toluene to Dodecane)		5300	D4	92000	D7	1200		<200	D1	16000	D6	<100	
Surrogate Recoveries (%)													
Bromofluorobenzene		107	D4	109	D7	109		104	D1	106	D6	107	
Trifluorotoluene		104	D4	103	D7	106		108	D1	106	D6	106	

Surrogate Limits: (BFB:76-120 TFT:50-150)

D1 Value from a two fold diluted analysis.
D4 Value from a ten fold diluted analysis.
D5 Value from a twenty fold diluted analysis.
D6 Value from a 50 fold diluted analysis.
D7 Value from a 100 fold diluted analysis.
D8 Value from a 250 fold diluted analysis.

Quality Control Summary Report

Client: GeoEngineers, Inc.

Project: Unocal #5353 - Seattle (0161-013-R62)

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L** **Blank Spike/Blank Spike Duplicate**

Extracted: N/A **Analyzed: 04/08/94** **Sample ID: Blank**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
BENZENE	<0.500	N/A	N/A	20.0	19.9	100	N/A	N/A	N/A	89-110	10
TOLUENE	<0.500	N/A	N/A	20.0	18.8	94	N/A	N/A	N/A	89-113	10
TOTAL XYLENES	<0.500	N/A	N/A	40.0	37.1	93	N/A	N/A	N/A	89-111	10
GASOLINE	<100	N/A	N/A	1000	999	100	N/A	N/A	N/A	78-116	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Spike	Spike Dup.	Limits
BROMOFLUOROBENZENE	108	108	N/A	76-120
TRIFLUOROTOLUENE	108	107	N/A	50-150

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L** **Blank Spike/Blank Spike Duplicate**

Extracted: N/A **Analyzed: 04/11/94** **Sample ID: Blank**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
BENZENE	<0.500	N/A	N/A	20.0	19.7	99	19.8	99	1	89-110	10
TOLUENE	<0.500	N/A	N/A	20.0	18.5	93	18.3	92	1	89-113	10
TOTAL XYLENES	<0.500	N/A	N/A	40.0	36.6	92	36.4	91	1	89-111	10
GASOLINE	<100	N/A	N/A	1000	933	93	950	95	2	78-116	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Spike	Spike Dup.	Limits
BROMOFLUOROBENZENE	108	108	106	76-120
TRIFLUOROTOLUENE	107	106	107	50-150

Quality Control Summary Report

Client: GeoEngineers, Inc.

Project: Unocal #5353 - Seattle (0161-013-R62)

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L** **Blank Spike/Blank Spike Duplicate**

Extracted: N/A **Analyzed: 04/12/94** **Sample ID: Blank**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
BENZENE	<0.500	N/A	N/A	20.0	19.8	99	N/A	N/A	N/A	89-110	10
TOLUENE	<0.500	N/A	N/A	20.0	18.6	93	N/A	N/A	N/A	89-113	10
TOTAL XYLENES	<0.500	N/A	N/A	40.0	36.9	92	N/A	N/A	N/A	89-111	10
GASOLINE	<100	N/A	N/A	1000	1010	101	N/A	N/A	N/A	78-116	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Spike	Spike Dup.	Limits
BROMOFLUOROBENZENE	108	107	N/A	76-120
TRIFLUOROTOLUENE	110	110	N/A	50-150

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L** **Matrix Spike/Matrix Spike Duplicate**

Extracted: N/A **Analyzed: 04/08/94** **Sample ID: 9404-073-1**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
GASOLINE	<100	<100	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Sample Dup.	Spike Dup.	Limits
TRIFLUOROTOLUENE	107	107	N/A	50-150

Analysis: WA DOE WTPH-G/8020(BETX) **Matrix: WATER** **Units: ug/L** **Matrix Spike/Matrix Spike Duplicate**

Extracted: N/A **Analyzed: 04/08/94** **Sample ID: 9404-063-1**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
BENZENE	<0.500	N/A	N/A	20.0	19.6	98	20.3	102	4	86-113	10
TOLUENE	<0.500	N/A	N/A	20.0	18.0	90	18.5	93	3	87-114	10
TOTAL XYLENES	<0.500	N/A	N/A	40.0	36.2	91	36.9	92	2	85-113	10
GASOLINE	<100	<100	NC	1000	955	96	939	94	2	80-113	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Spike	Spike Dup.	Limits
BROMOFLUOROBENZENE	109	107	107	76-120
TRIFLUOROTOLUENE	110	109	108	50-150

Analytical Summary Report

Client: GeoEngineers, Inc. **Project: Unocal #5353 - Seattle (0161-013-R62)**

Analysis: WA DOE WTPH-D **Matrix: WATER** **Units: mg/L**

ATI Sample #:	0	1	2	3	4	5	
Client ID:	Method Blank	MW-32A	MW-33	MW-34	MW-35	MW-37	
Date Sampled:	N/A	04/07/94	04/07/94	04/07/94	04/07/94	04/07/94	
Date Extracted:	04/11/94	04/11/94	04/11/94	04/11/94	04/11/94	04/11/94	
Date Analyzed:	04/12/94	04/13/94	04/12/94	04/13/94	04/13/94	04/13/94	
Diesel (C12-C24)	<0.25	2.1	1.0	1.4	0.87	18	D4
Motor Oil (C24-C34)	<0.75	1.3	1.1	<0.75	<0.75	<7.5	D4
Surrogate Recoveries (%)							
O-Terphenyl	106	96	95	103	88	49	HD4

ATI Sample #:	6	7	8	9
Client ID:	MW-40	MW-42	MW-45	MW-47
Date Sampled:	04/07/94	04/07/94	04/07/94	04/07/94
Date Extracted:	04/11/94	04/11/94	04/11/94	04/11/94
Date Analyzed:	04/13/94	04/13/94	04/13/94	04/12/94
Diesel (C12-C24)	2.2	0.84	0.83	0.30
Motor Oil (C24-C34)	2.0	1.1	<0.75	<0.75
Surrogate Recoveries (%)				
O-Terphenyl	70	96	61	87

Surrogate Limits: (O-T:50-150)

D4 Value from a ten fold diluted analysis.

H Out of limits.

AnalyticalTechnologies, Inc. ATI Reference: 9404-075

Quality Control Summary Report

Client: GeoEngineers, Inc.

Project: Unocal #5353 - Seattle (0161-013-R62)

Analysis: WA DOE WTPH-D **Matrix: WATER** **Units: mg/L** **Blank Spike/Blank Spike Duplicate**

Extracted: 04/11/94 **Analyzed: 04/12/94** **Sample ID: Blank**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
DIESEL	<0.250	N/A	N/A	2.50	2.54	102	2.33	93	9	70-114	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Spike	Spike Dup.	Limits
O-TERPHENYL	106	101	96	50-150

Analysis: WA DOE WTPH-D **Matrix: WATER** **Units: mg/L** **Matrix Spike/Matrix Spike Duplicate**

Extracted: 04/11/94 **Analyzed: 04/11/94** **Sample ID: 9404-086-1**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
DIESEL	147	96	42H	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20

Quality Control Surrogate Recoveries (%)

Compound	Sample	Sample Dup.	Spike Dup.	Limits
O-TERPHENYL	F	F	N/A	50-150

Analysis: WA DOE WTPH-D **Matrix: WATER** **Units: mg/L** **Matrix Spike/Matrix Spike Duplicate**

Extracted: 04/11/94 **Analyzed: 04/11/94** **Sample ID: 9404-090-1**

Compound	Sample Result	Duplicate Result	RPD	Spike Added	Spike Result	Spike %Rec	Spike Dup. Result	Spike Dup. %Rec	RPD	Limits %Rec	Limits RPD
DIESEL	<0.250	<0.250	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20

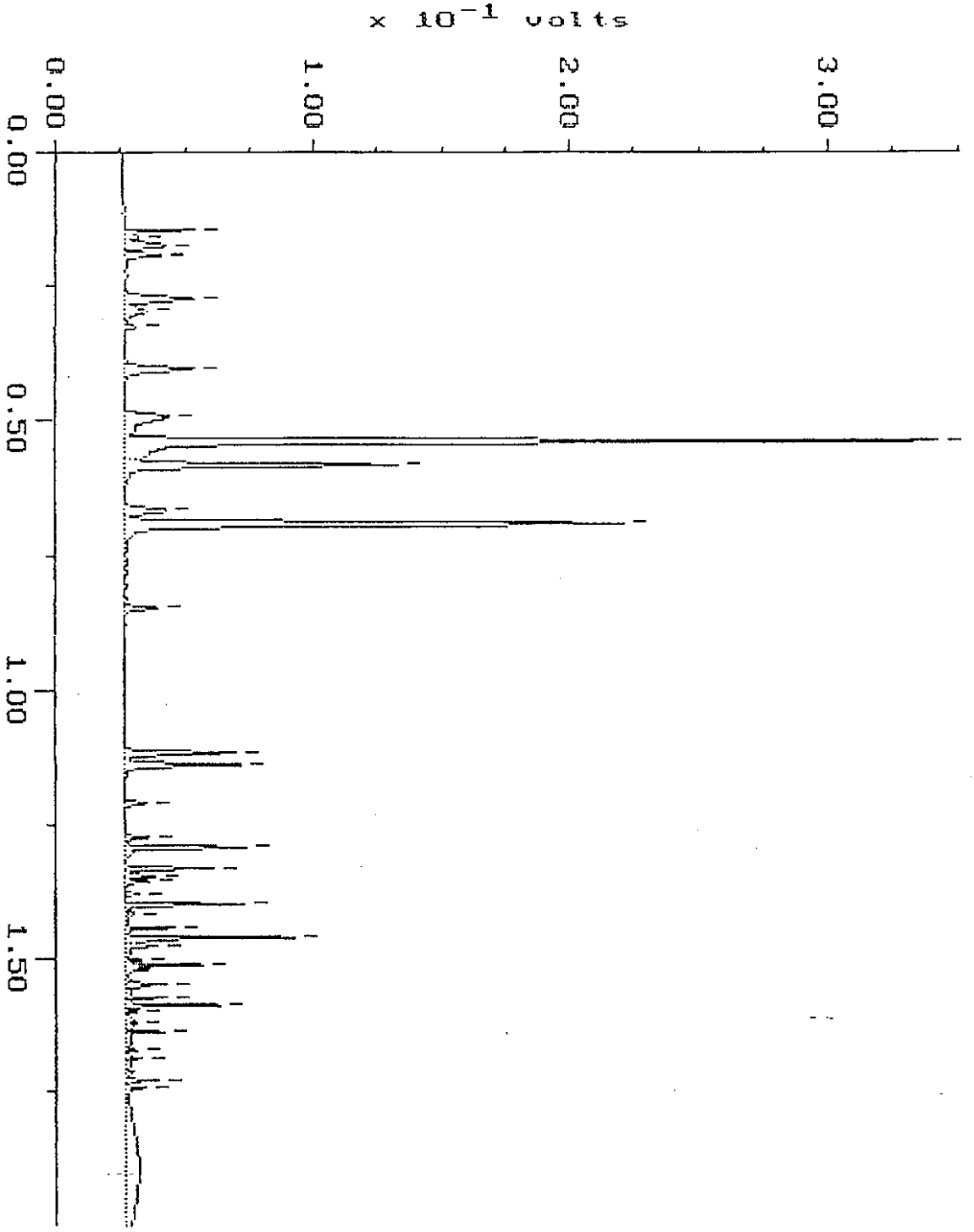
Quality Control Surrogate Recoveries (%)

Compound	Sample	Sample Dup.	Spike Dup.	Limits
O-TERPHENYL	77	83	N/A	50-150

F Out of limits due to matrix interference.
H Out of limits.

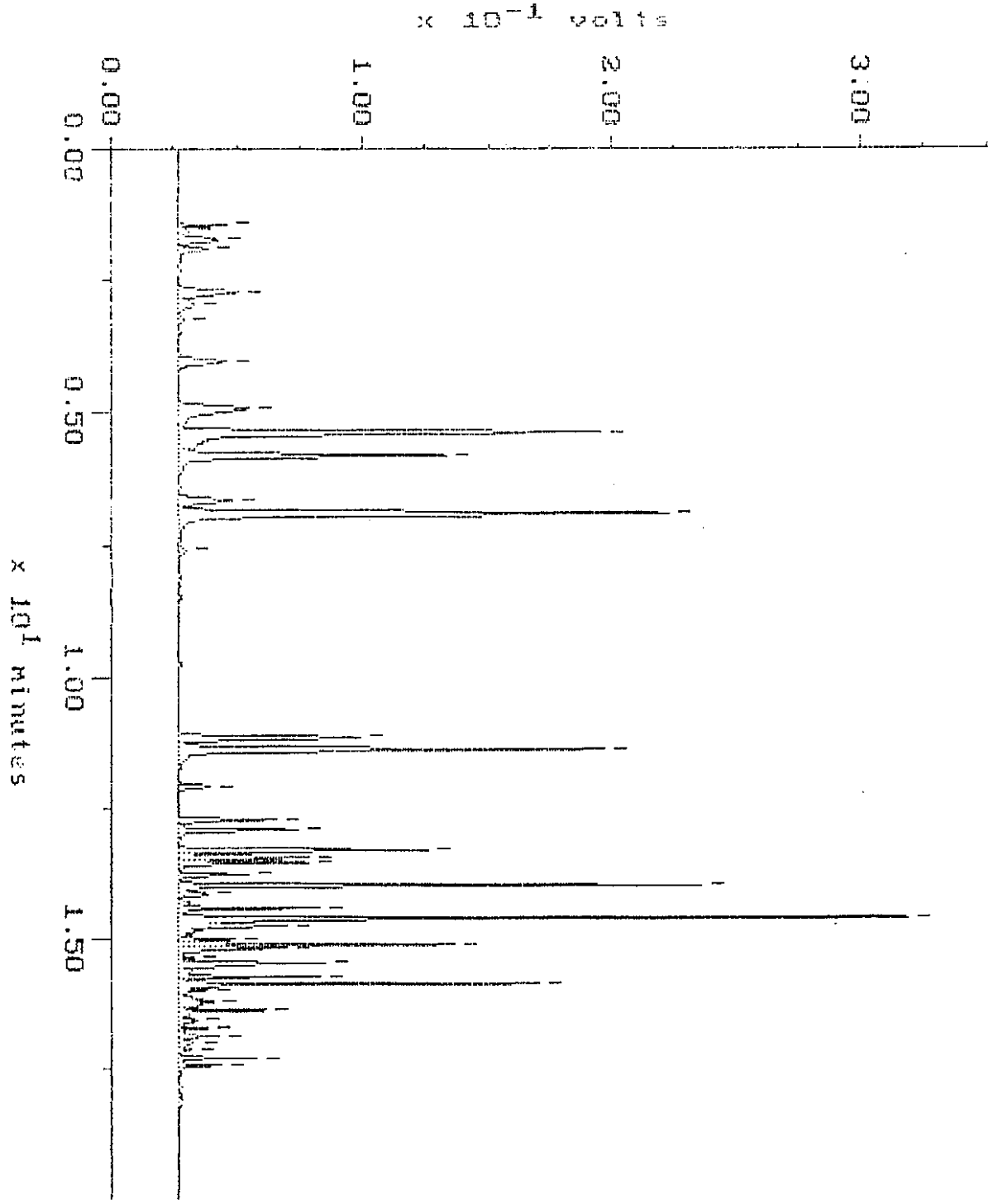
WA DOE WTPH-G

Sample: 9404-075-1 DIL Channel: FID Filename: R4089P33
Acquired: 09-APR-94 1:47 Method: F:\BRO2\MAXDATA\PICARD\040894PC Operator: ATI
Dilution: 1 : 20.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



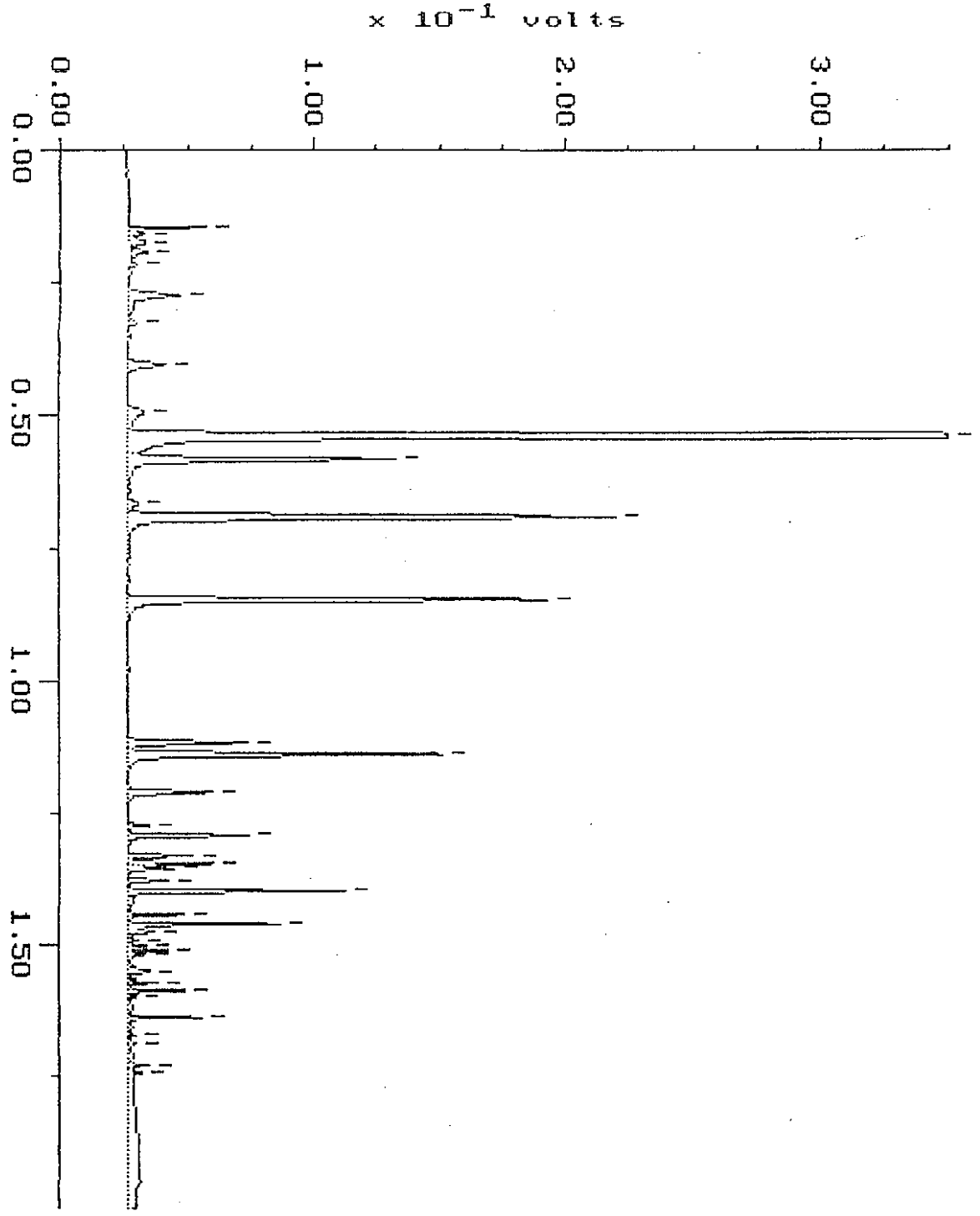
WA DOE WTPH-G

Sample: 9404-075-2 DIL Channel: FID Filename: R4119P03
Acquired: 12-APR-94 0:36 Method: F:\BRDE\WAXDATA\PICARD\041194PC Operator: ATI
Dilution: 1 : 2.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



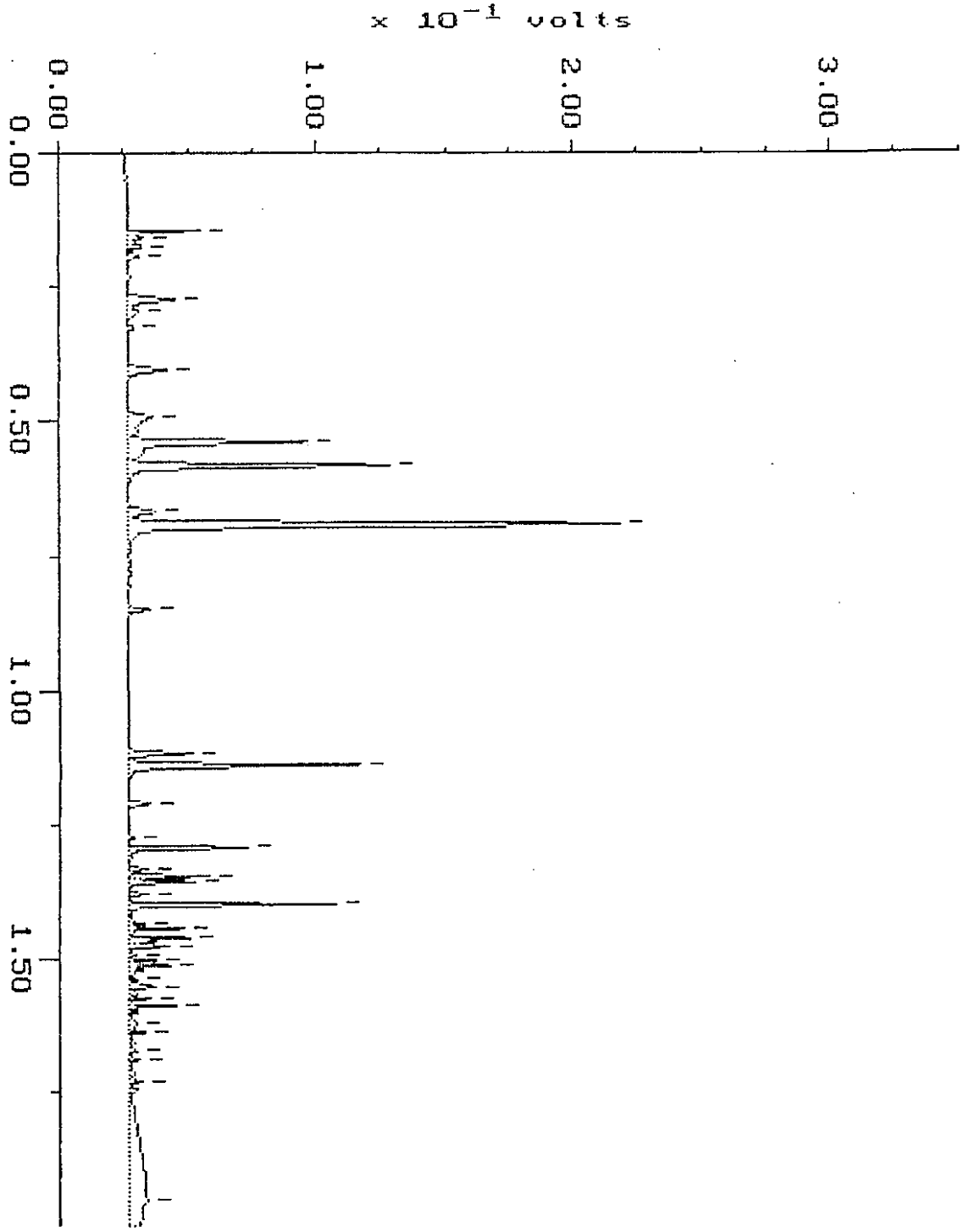
WA DOE WTPH-G

Sample: 9404-075-3 DIL Channel: FID Filename: R4089P39
Acquired: 09-APR-94 4:51 Method: F:\BRO2\MAXDATA\PICARD\040894PC Operator: ATI
Dilution: 1 : 10.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



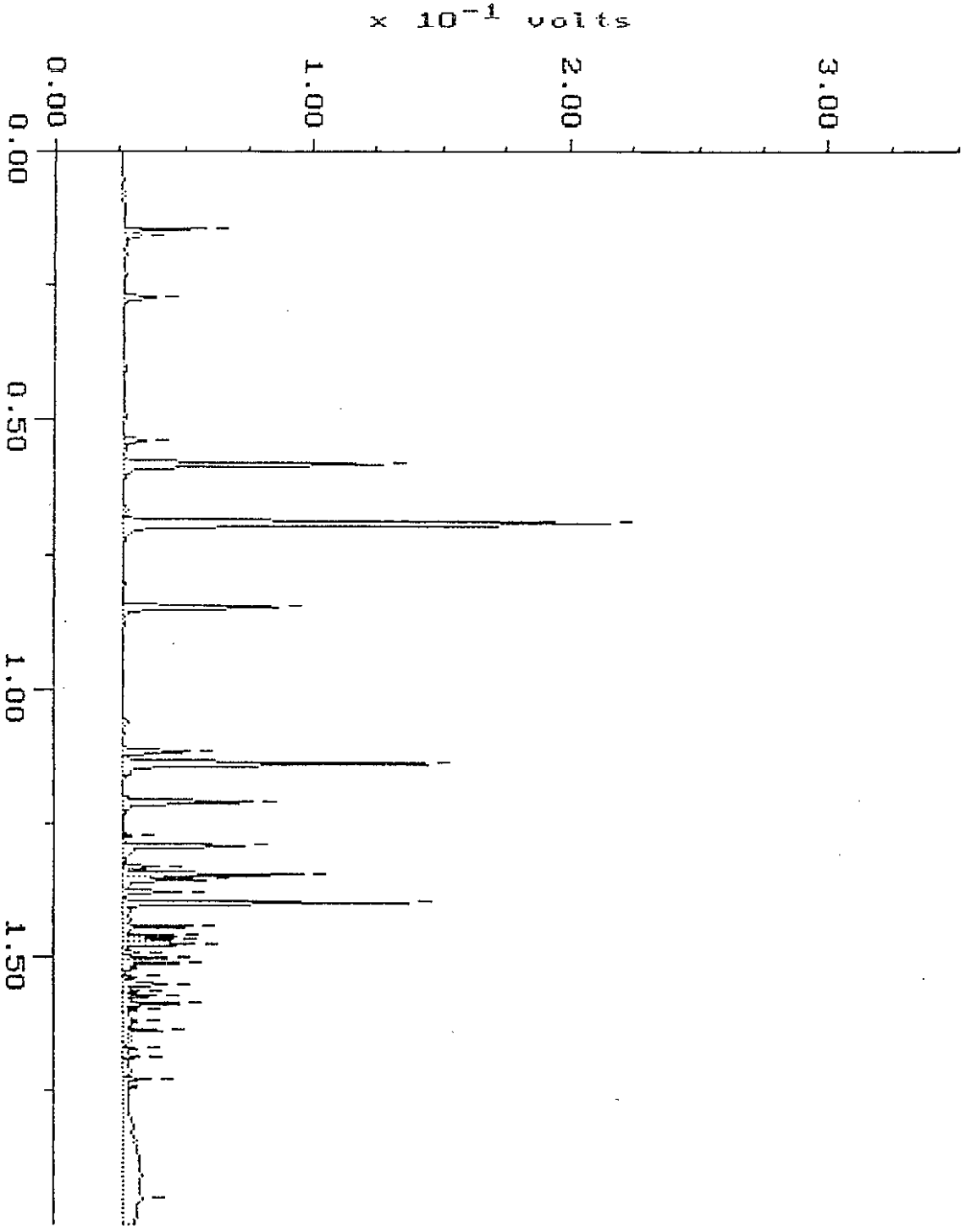
WA DOE WTPH-G

Sample: 9404-075-4 DIL Channel: FID Filename: R4089P38
Acquired: 09-APR-94 4:20 Method: F:\BRO2\MAXDATA\PICARD\040894PC Operator: ATI
Dilution: 1 : 10.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



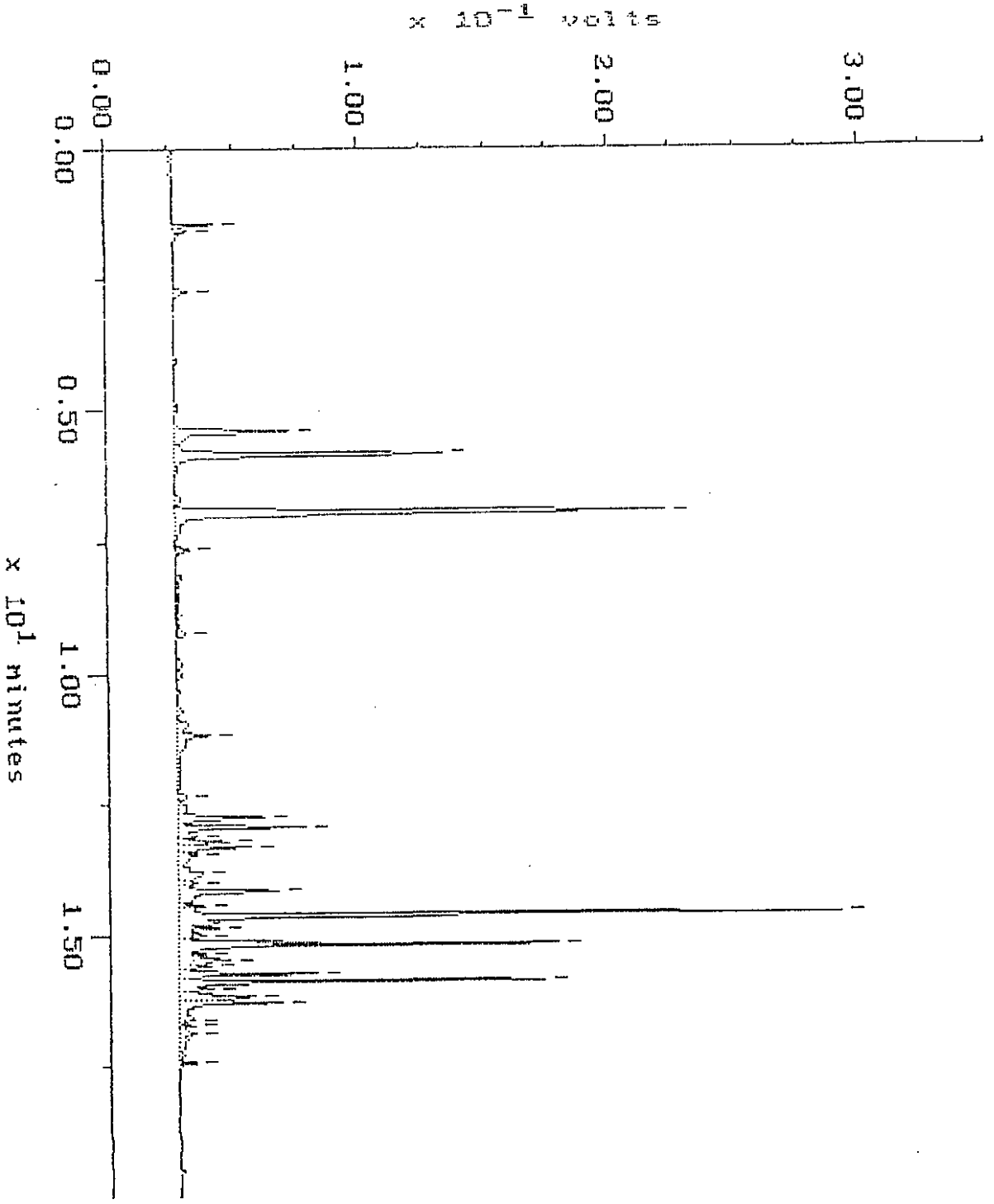
WA DOE WTPH-G

Sample: 9404-075-5 DIL Channel: FID Filename: R4089P37
Acquired: 09-APR-94 3:49 Method: F:\BRO2\MAXDATA\PICARD\040894PC Operator: ATI
Dilution: 1 : 100.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



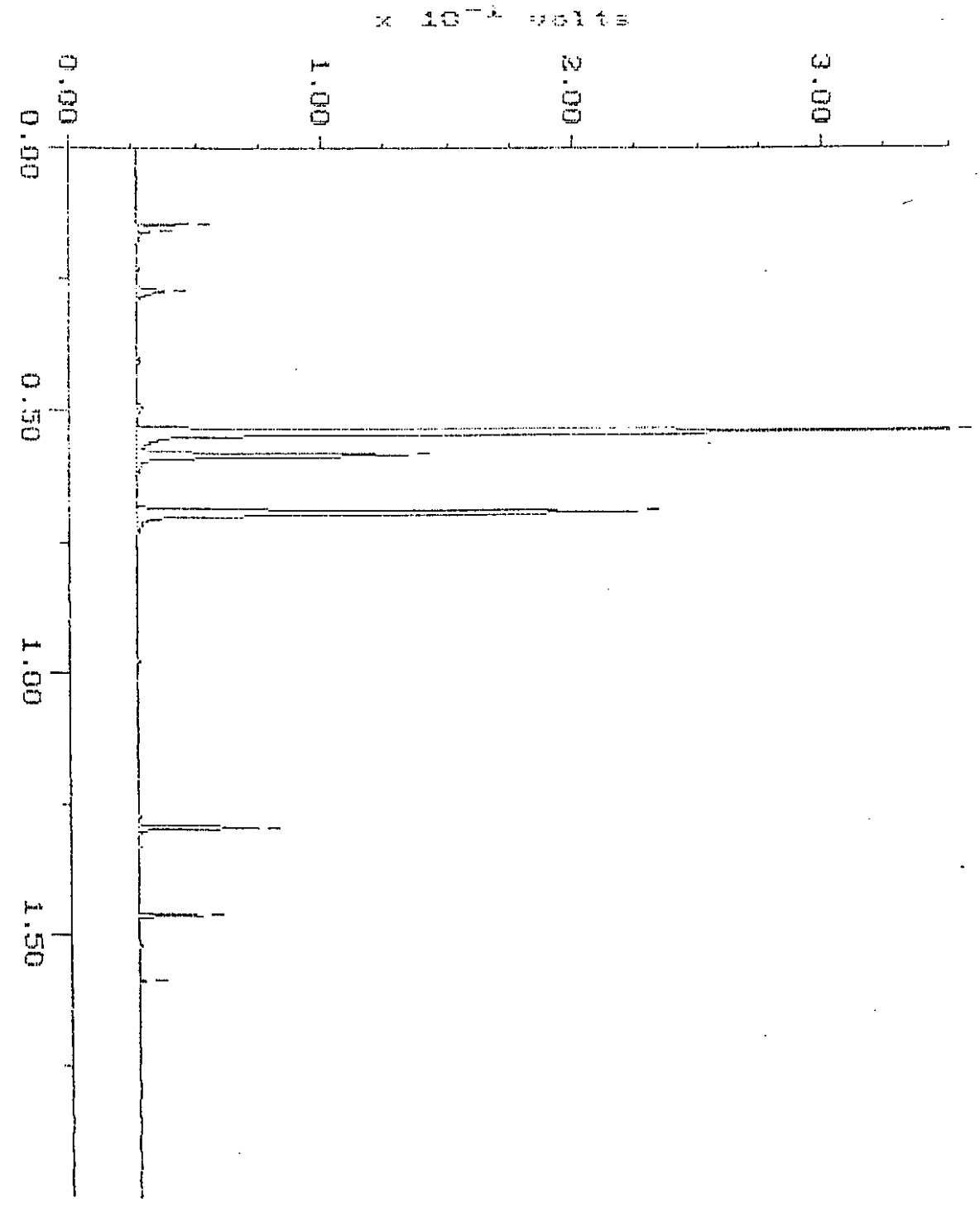
WA DOE WTPH-G

Sample: 9404-075-6 Channel: FID Filename: R4129P09
Acquired: 12-APR-94 16:49 Method: F:\BRD2\MAXDATA\PICARD\041294PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



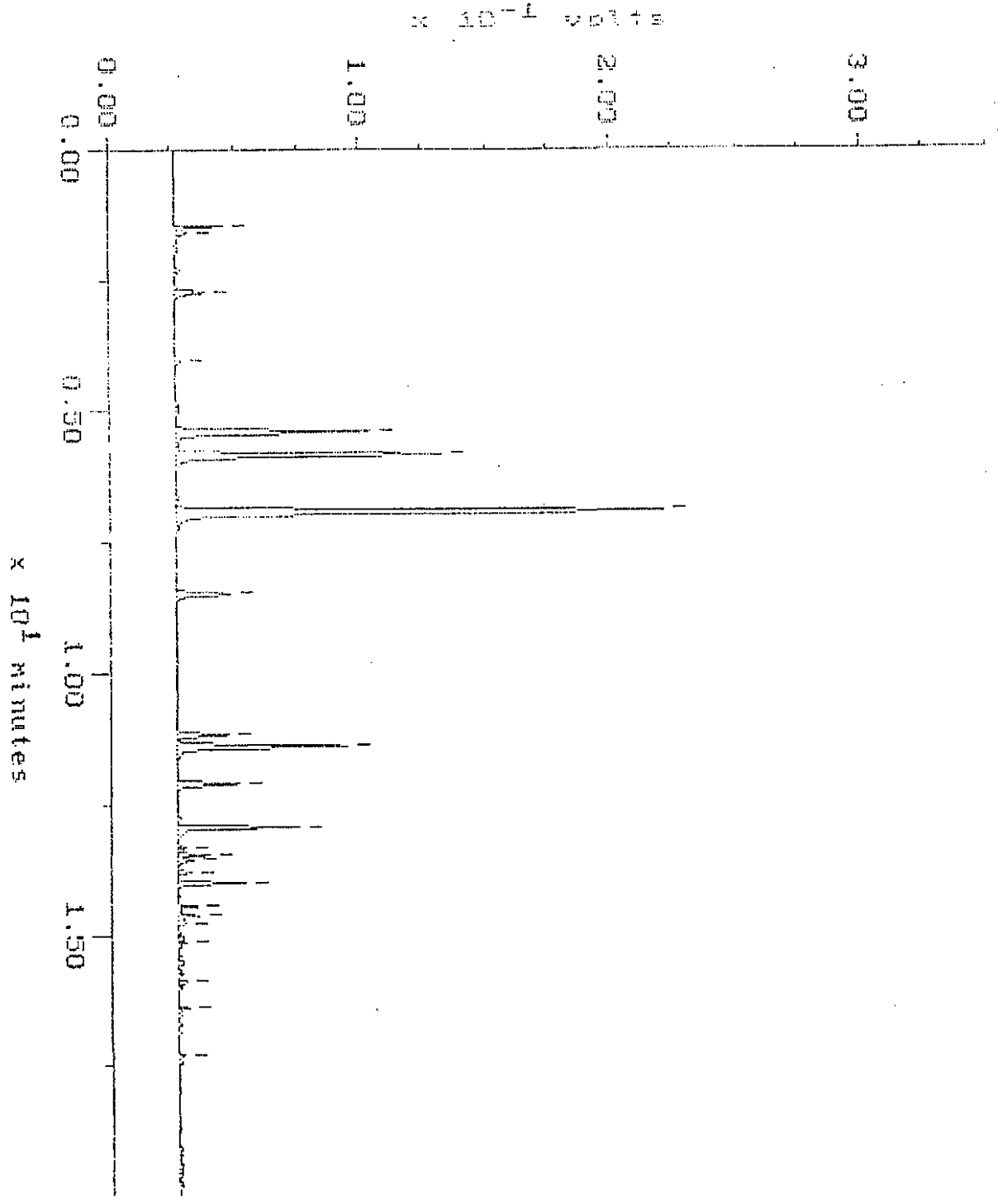
WA DOE WTPH-G

Sample: 9404-075-7 DIL Channel: FID Filename: R4123F17
Acquired: 12-APR-94 20:50 Method: F:\BRGE\MAXDATA\FIDARD\041294FC Operator: ATI
Dilution: 1 : 2.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



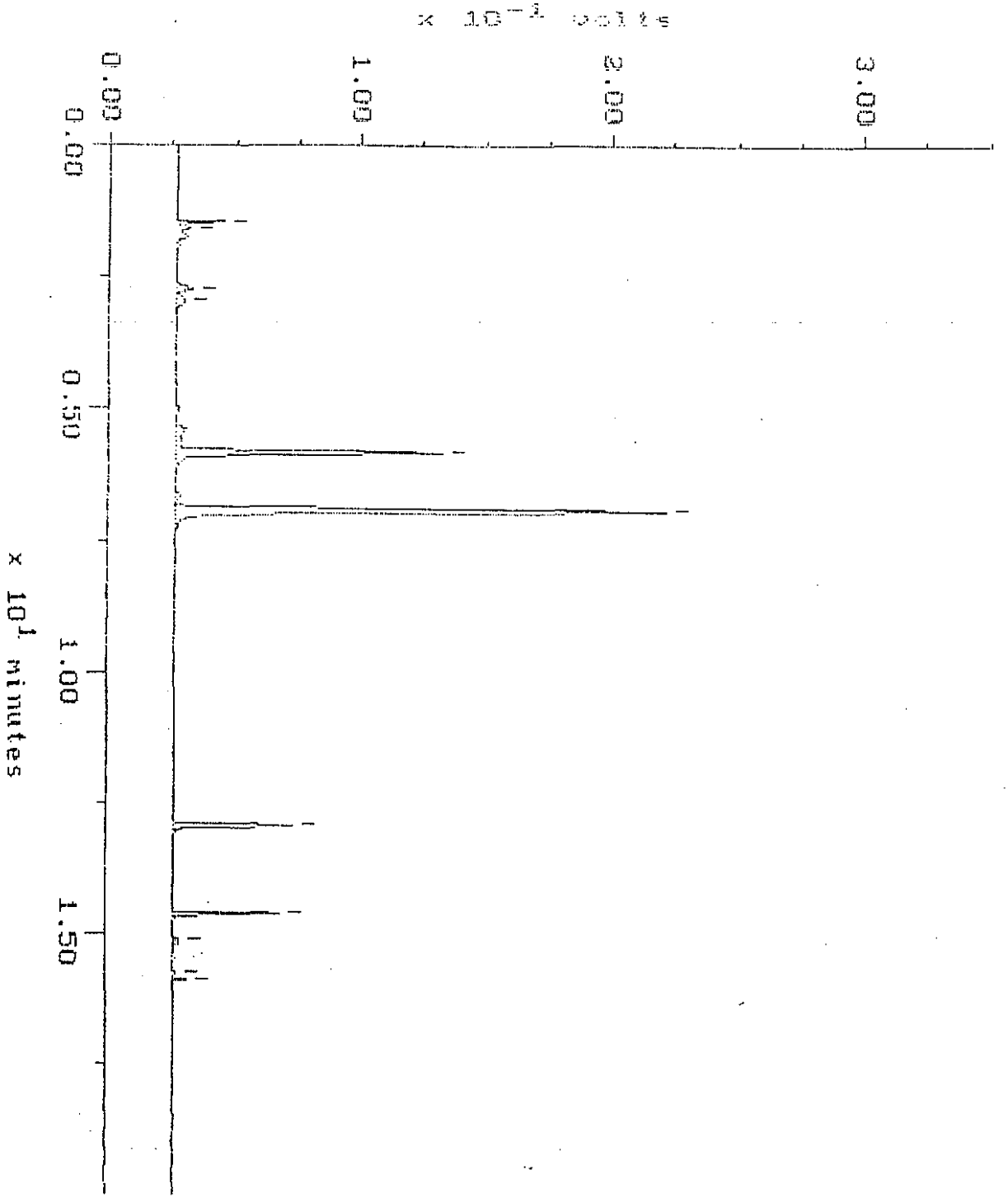
WA DOE WTPH-G

Sample: 9404-075-8 DIL Channel: FID Filename: R4129F28
Acquired: 12-APR-94 22:28 Method: F:\2RC2\HPCHEMDATA\FICHRD\041294FC Operator: ATI
Dilution: 1 : 50.000
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



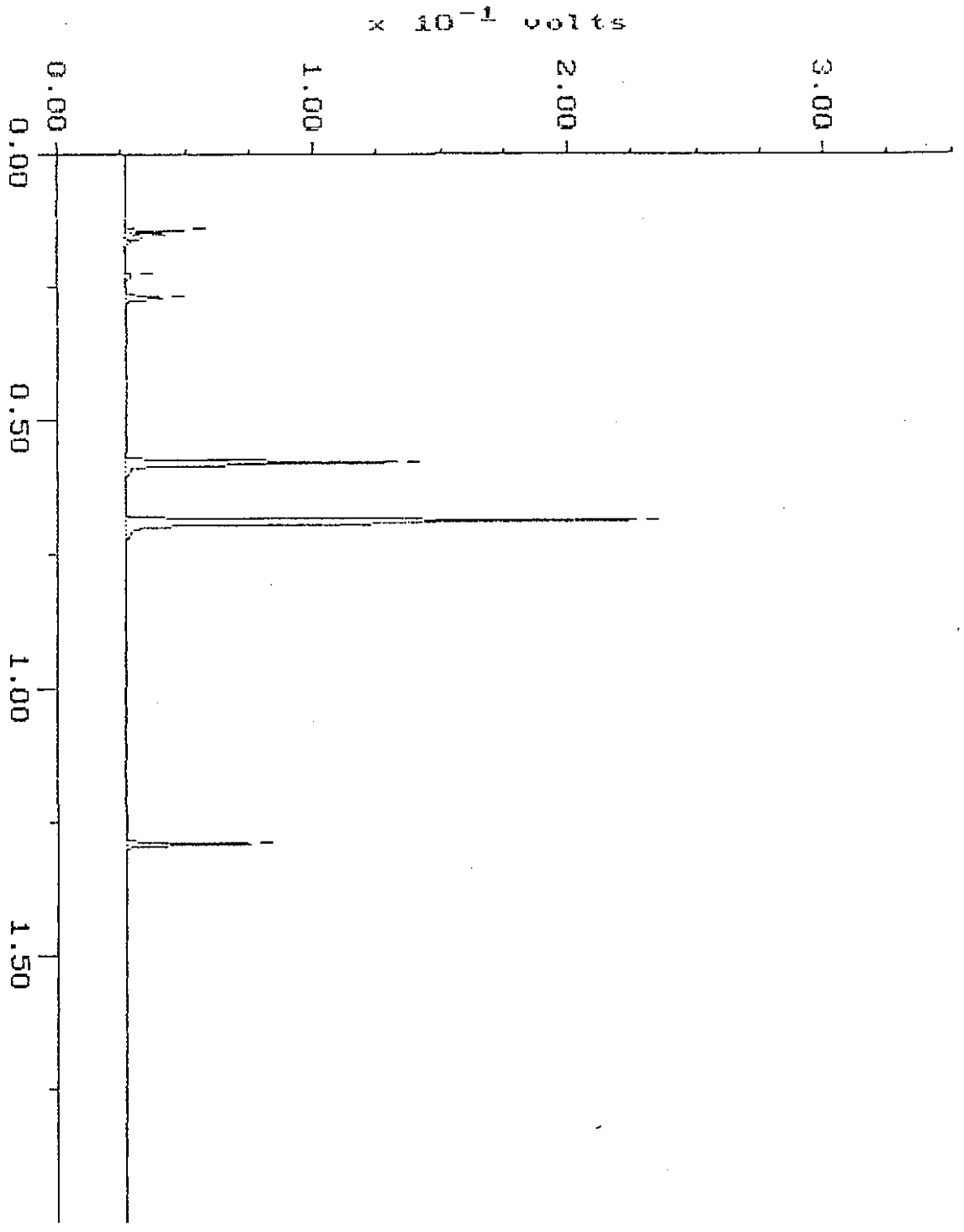
WA DOE WTPH-G

Sample: 9404-075-9 Channel: FID Filename: R4115P14
Acquired: 11-APR-94 17:38 Method: F:\EAS2\MAXDATA\PICARD\041194PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



WA DOE WTPH-G Blank

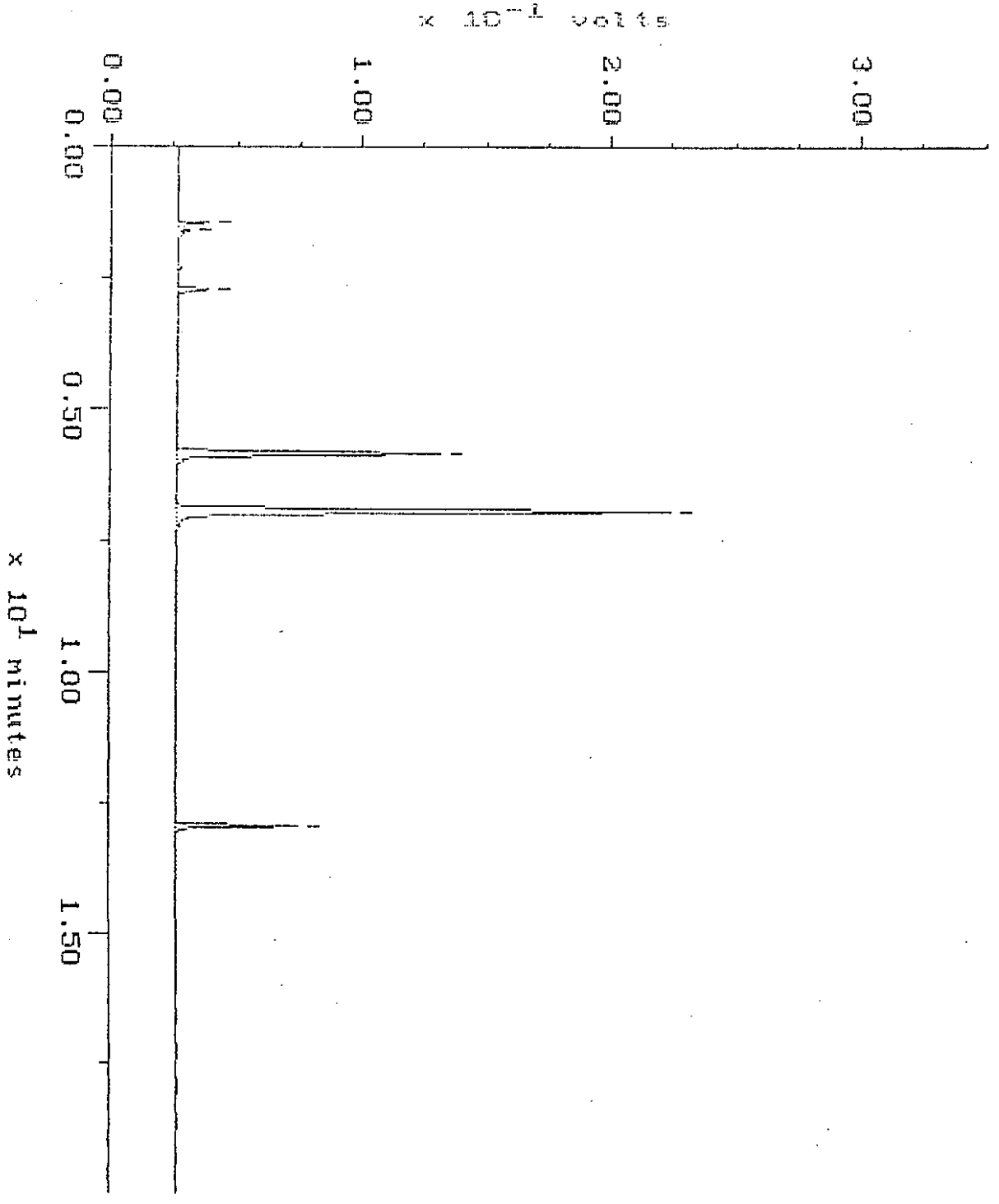
Sample: WRB 4-8 Channel: FID Filename: R4089P03
Acquired: 08-APR-94 9:20 Method: F:\BRD2\MAXDATA\PICARD\040894PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Blank

WA DOE WTPH-G

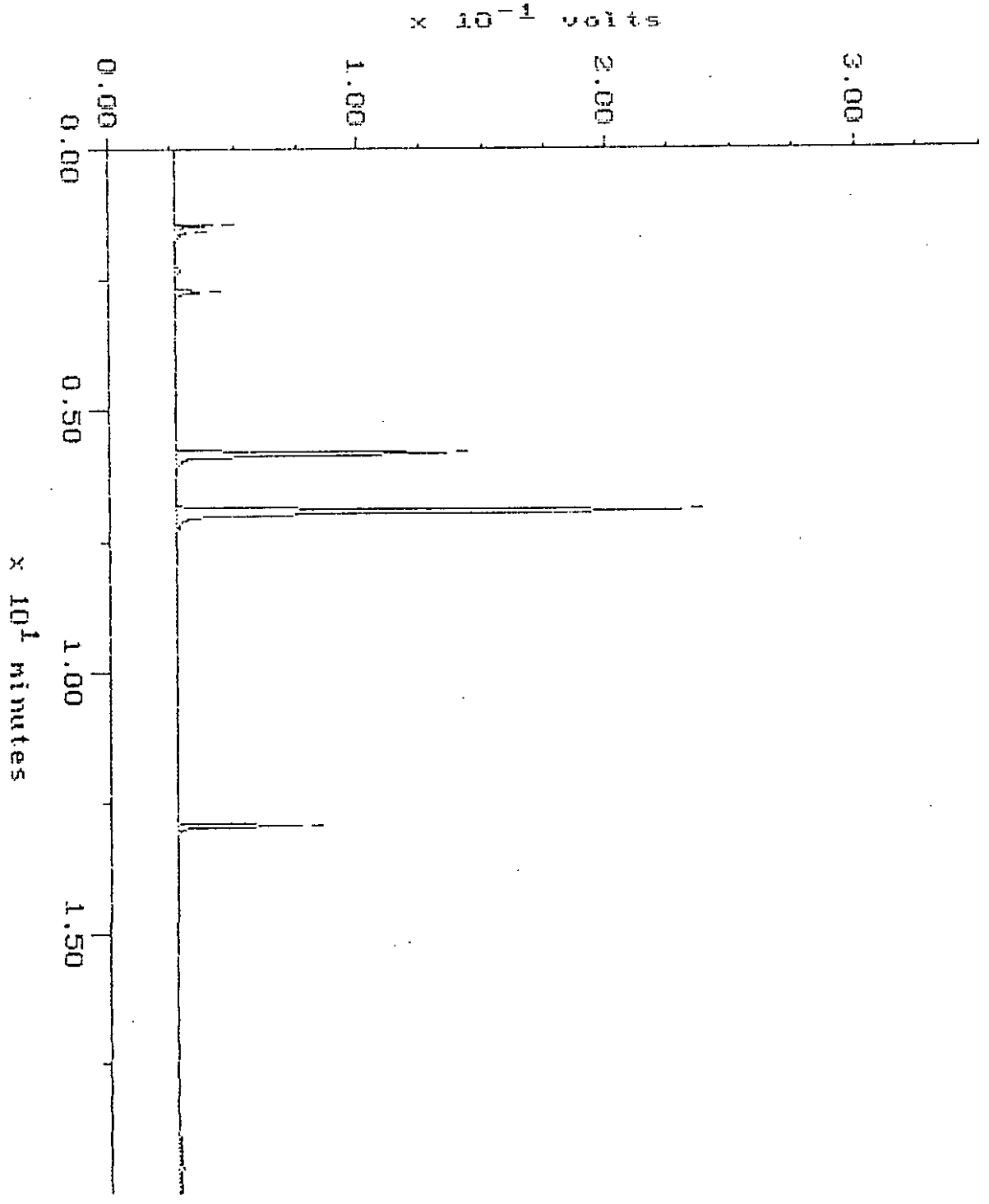
Sample: WRB 4-11 Channel: FID Filename: R4119F03
Acquired: 11-APR-94 11:15 Method: F:\BRD2\MAXDATA\PICARD\041194PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



WA DOE WTPH-G

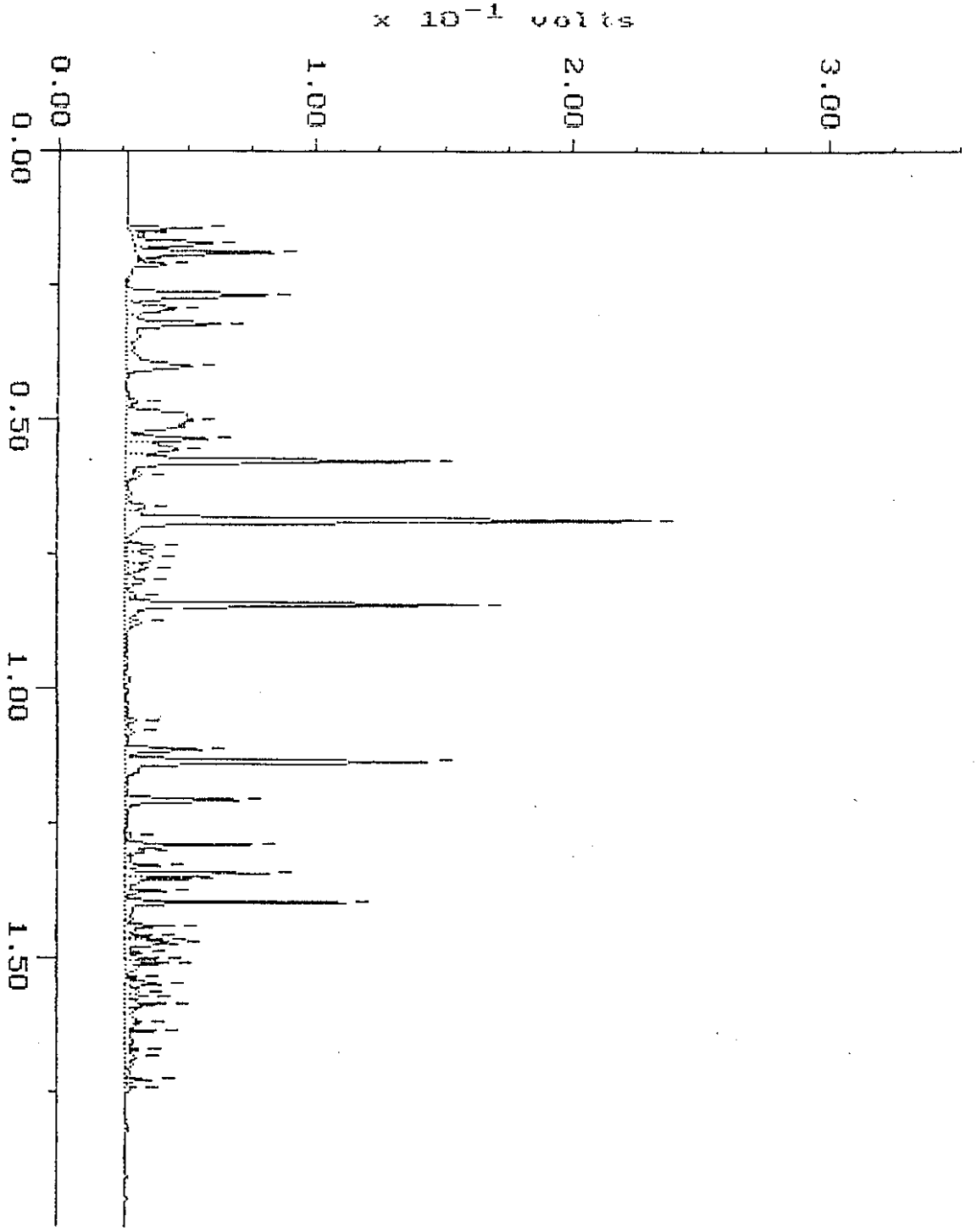
Blank

Sample: WR3 4-12 Channel: FID Filename: R4129P01
Acquired: 12-APR-94 8:38 Method: F:\BR02\MAXDATA\PICARD\041294PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



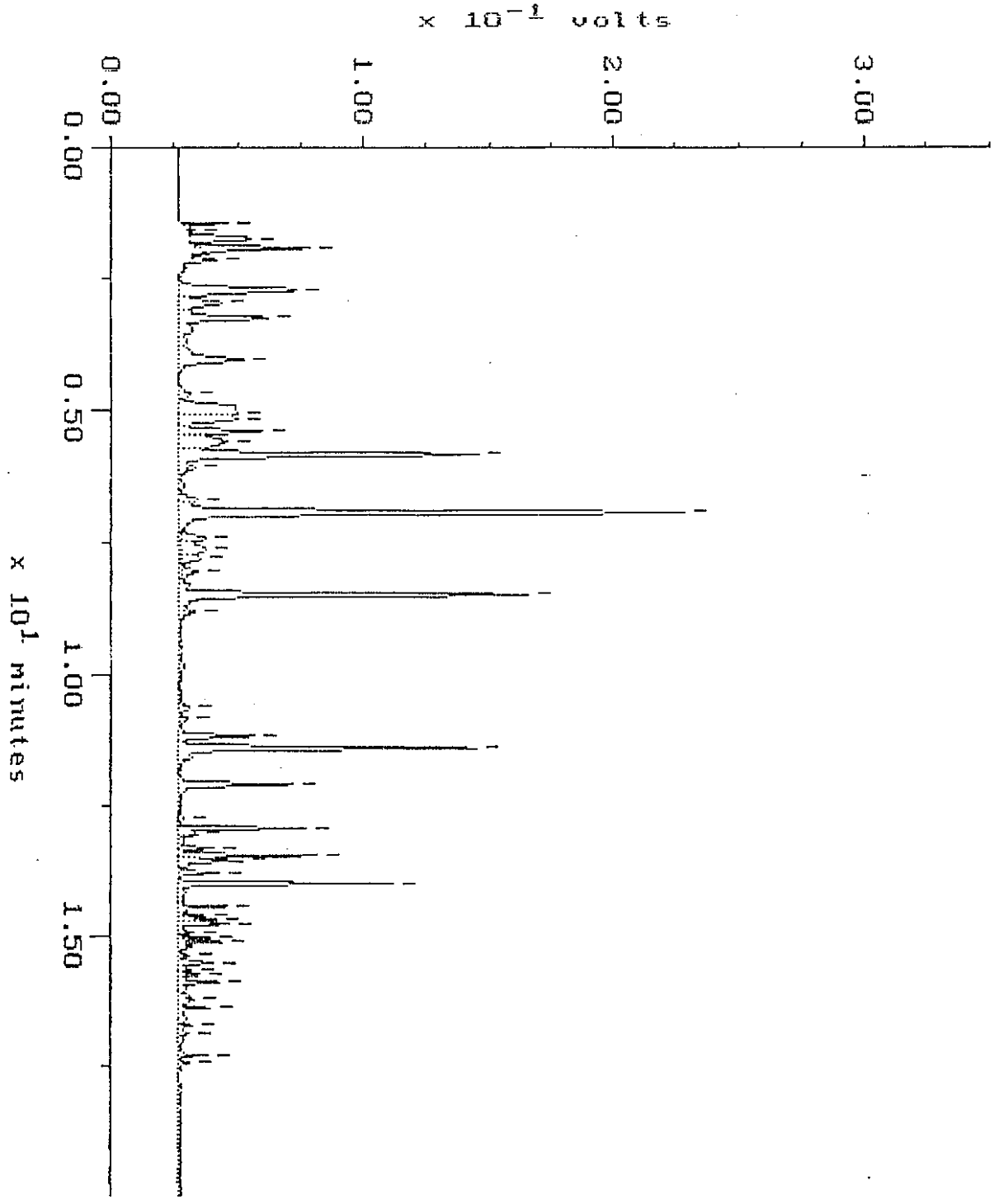
Continuing Calibration

Sample: STD-C G Channel: FID Filename: R40894P01
Acquired: 08-APR-94 7:48 Method: F:\BRD2\MAXDATA\PICARD\040894PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

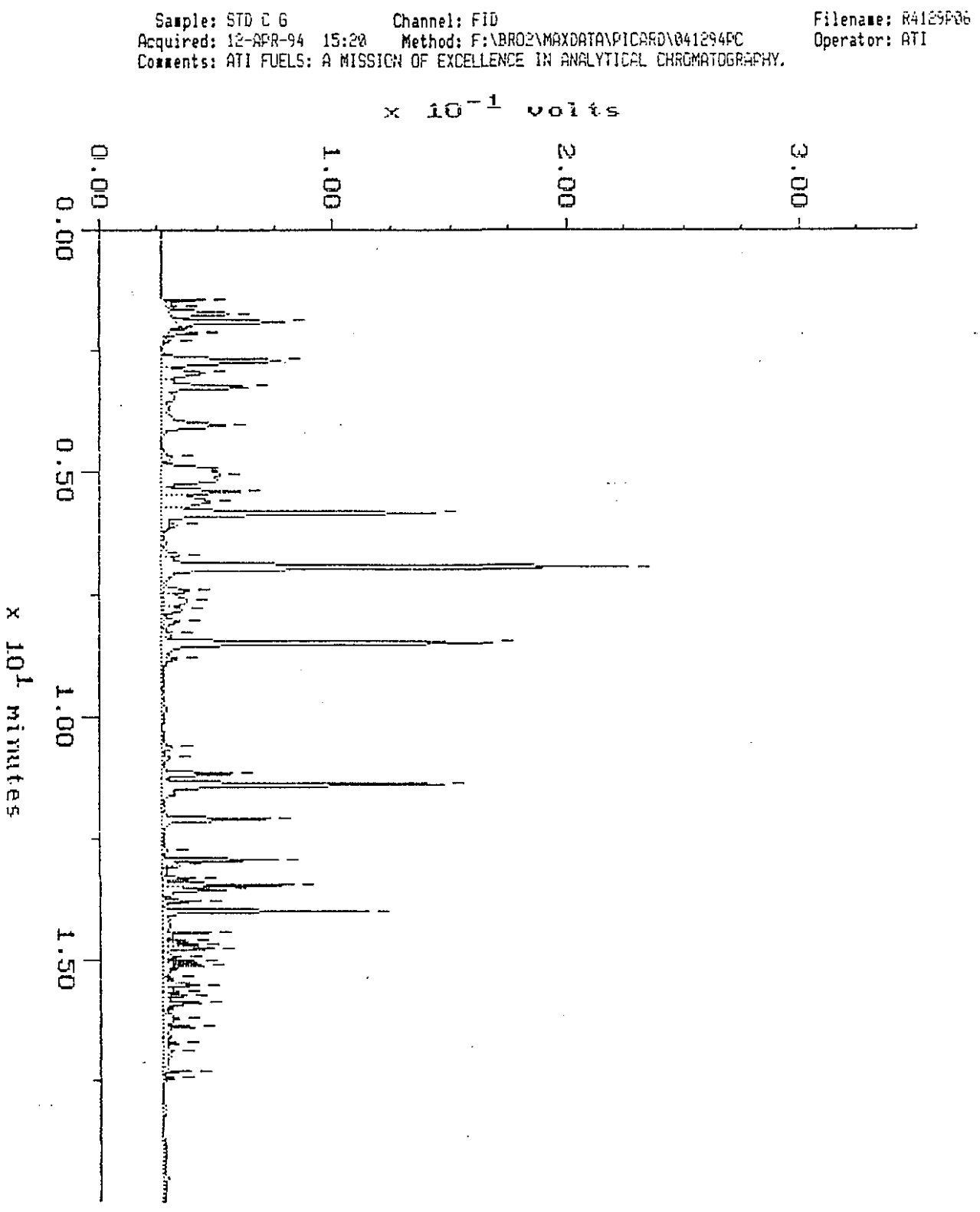


Continuing Calibration

Sample: STD-C G Channel: FID Filename: R4119P01
Acquired: 11-APR-94 9:52 Method: F:\BRO2\MAXDATA\PICARD\041194PC Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

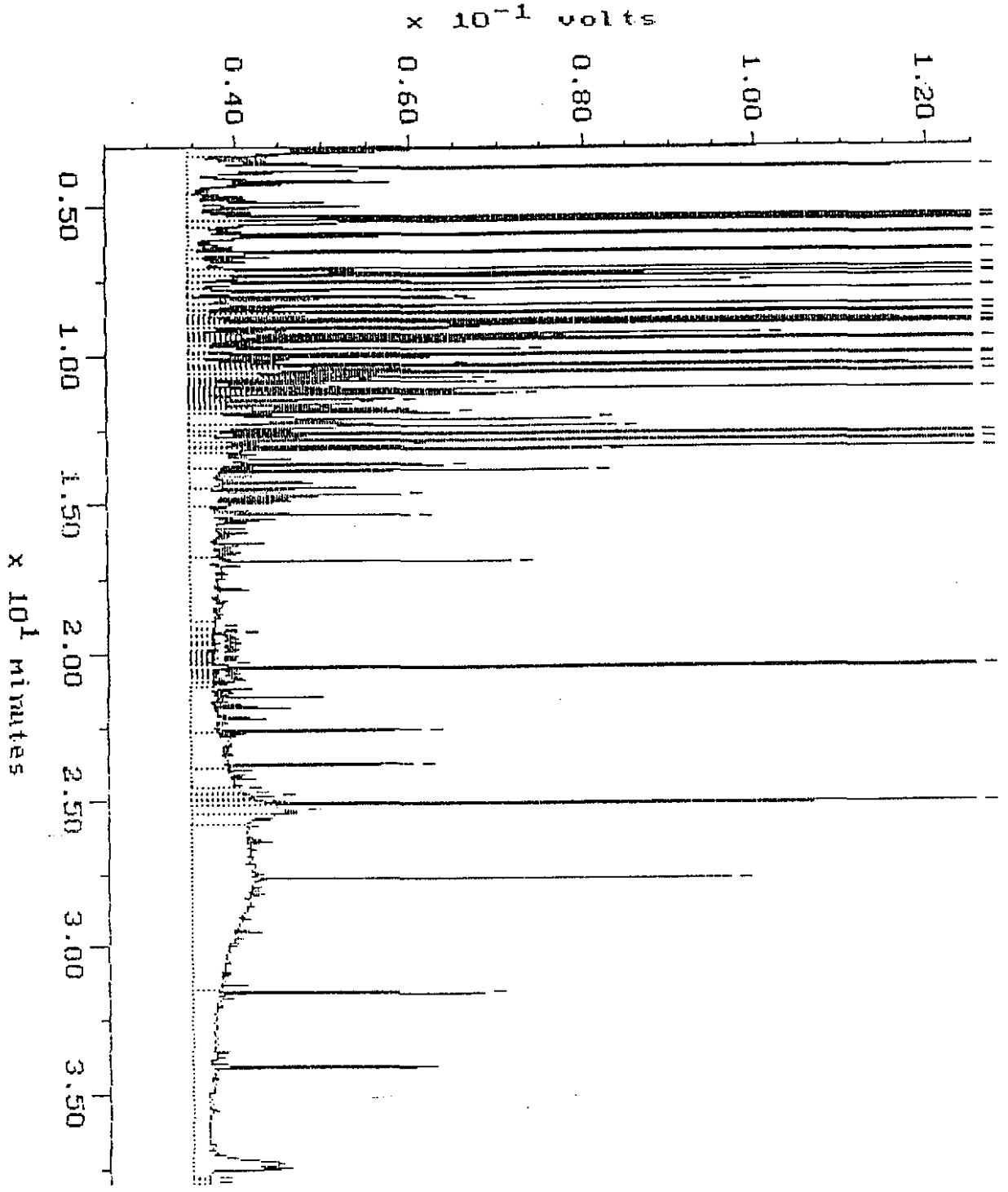


Continuing Calibration



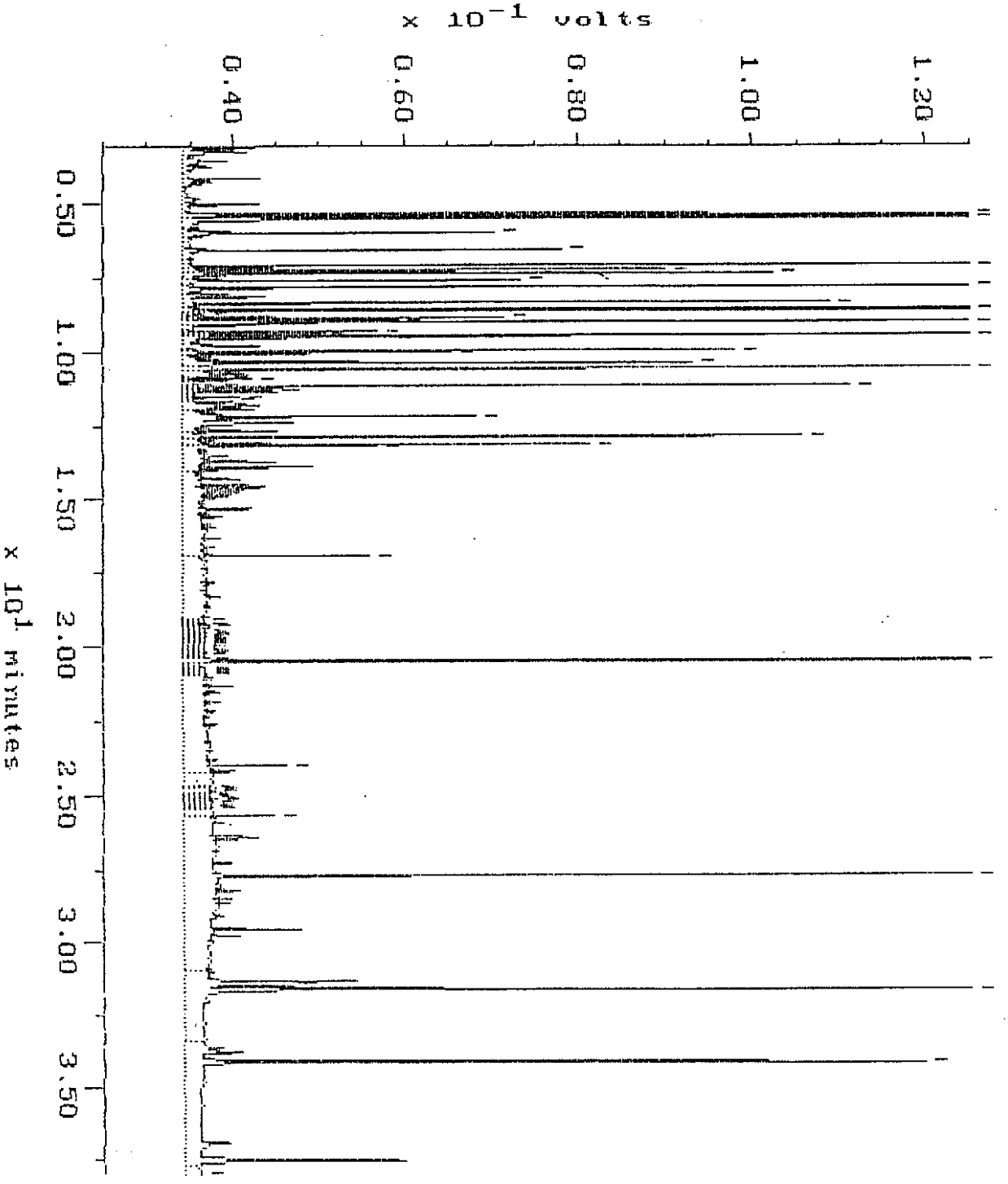
WA DOE WTPH-D

Sample: 9404-075-1 Channel: FRED Filename: R4126F13
Acquired: 13-APR-94 5:30 Method: F:\BRO2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



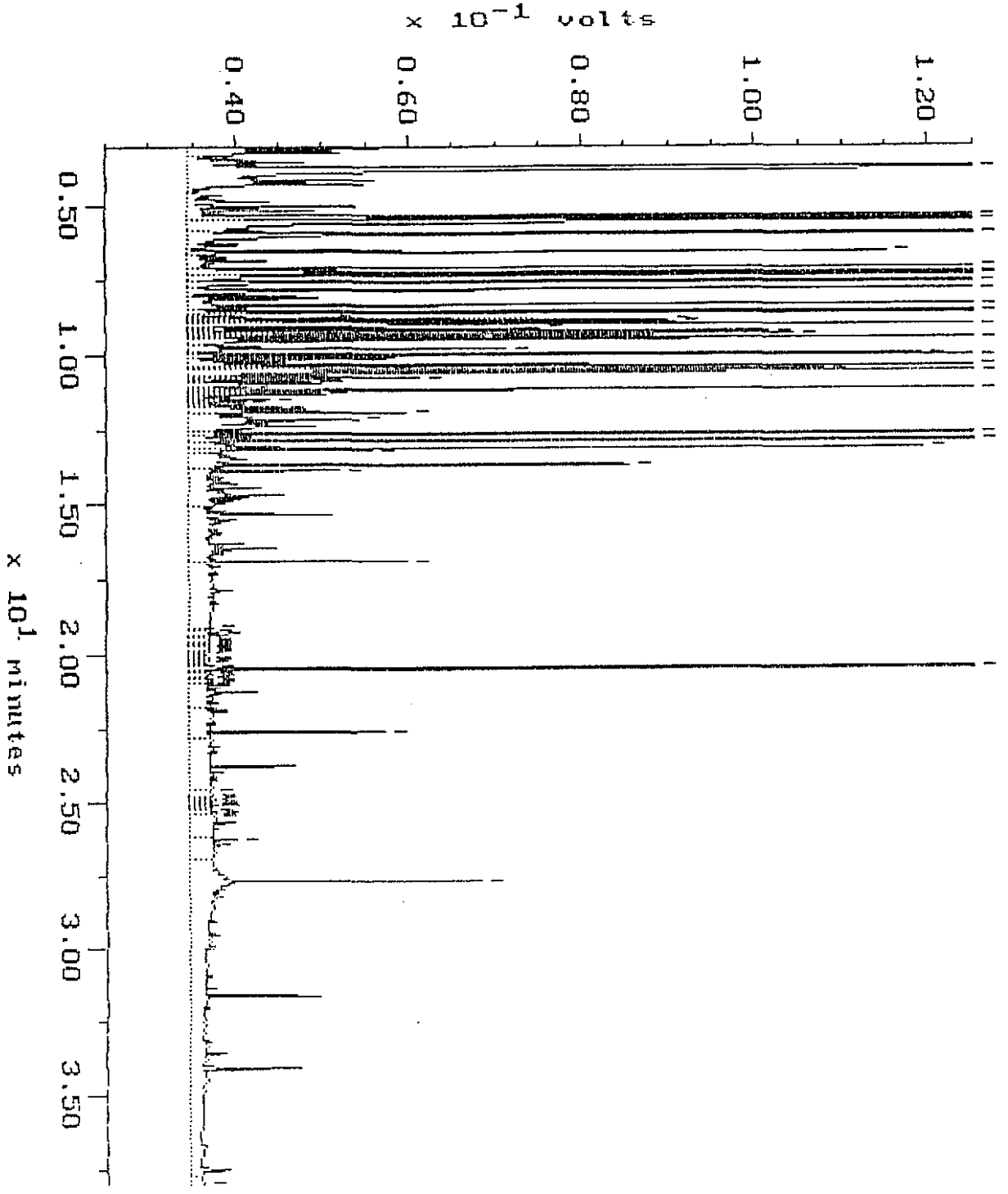
WA DOE WTPH-D

Sample: 94042754 Acquired: 12-APR-94 14:13 Created: FRED2\MAXDATA\FRED\FUEL6411 Operator: ATI 16F3E
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



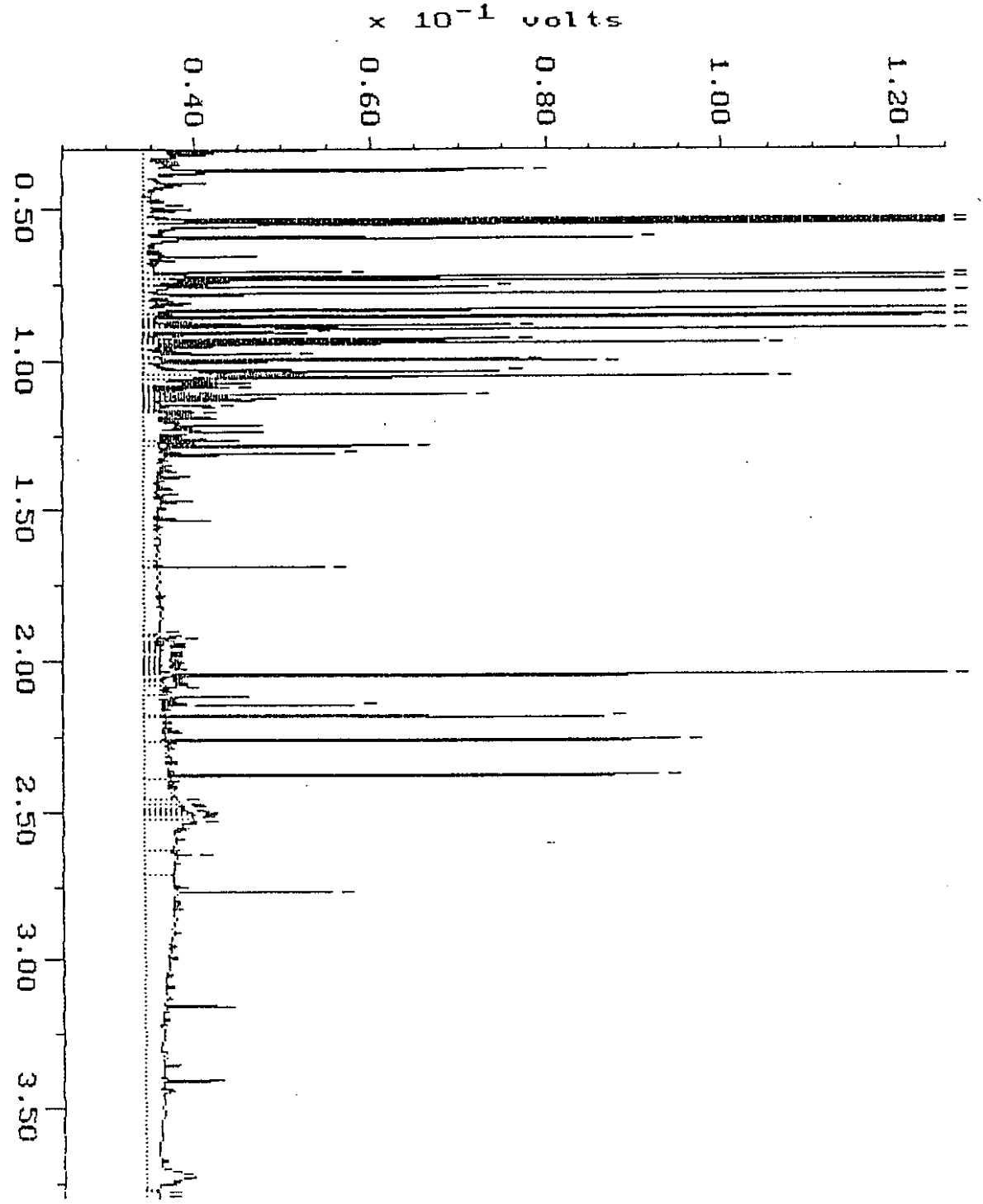
WA DOE WTPH-D

Sample: 9404-075-3 Channel: FRED Filename: R4126F17
Acquired: 13-APR-94 8:39 Method: F:\BRO2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



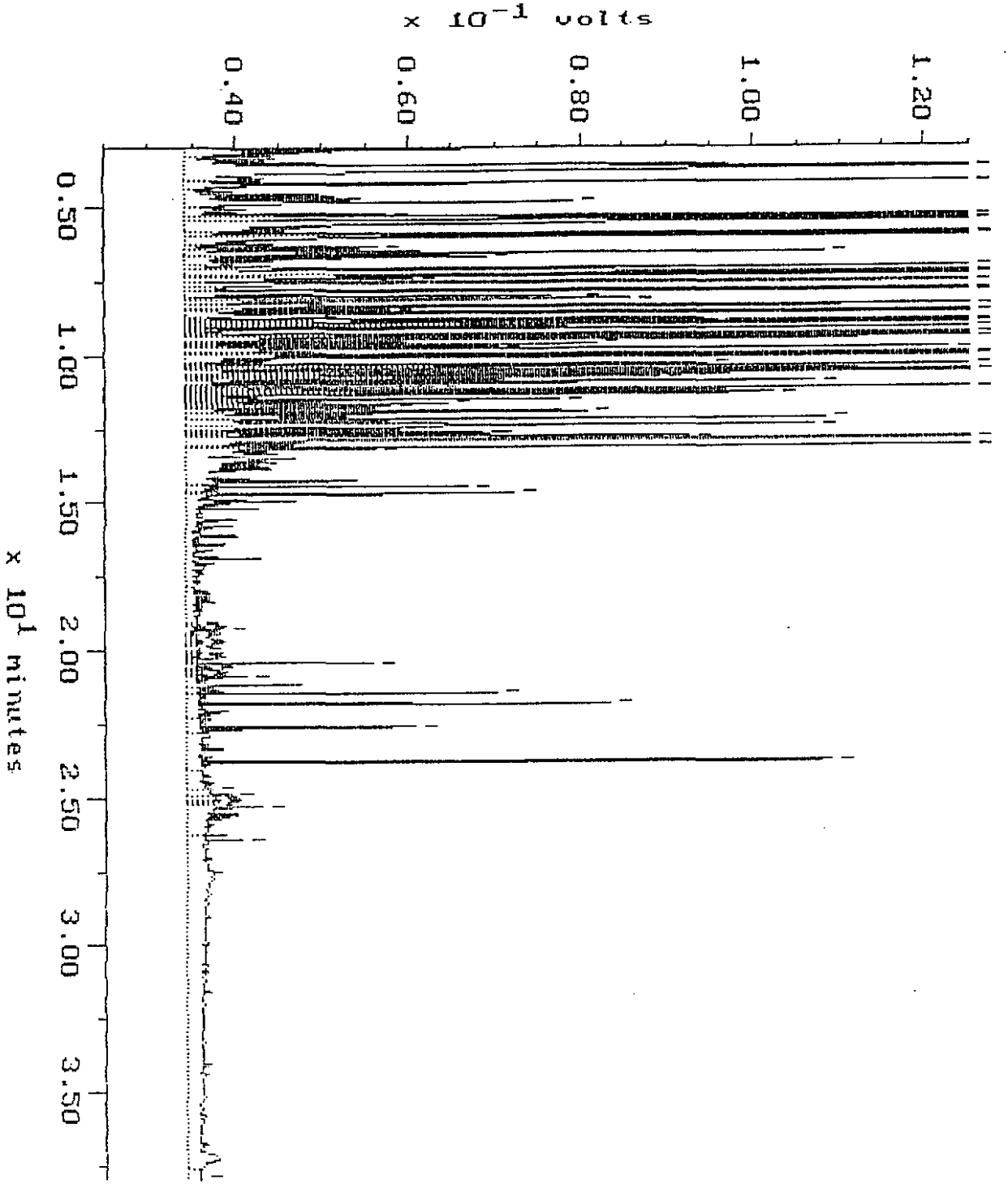
WA DOE WTPH-D

Sample: 9404-075-4 Channel: FRED Filename: R4126F19
Acquired: 13-APR-94 10:13 Method: F:\BRG2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



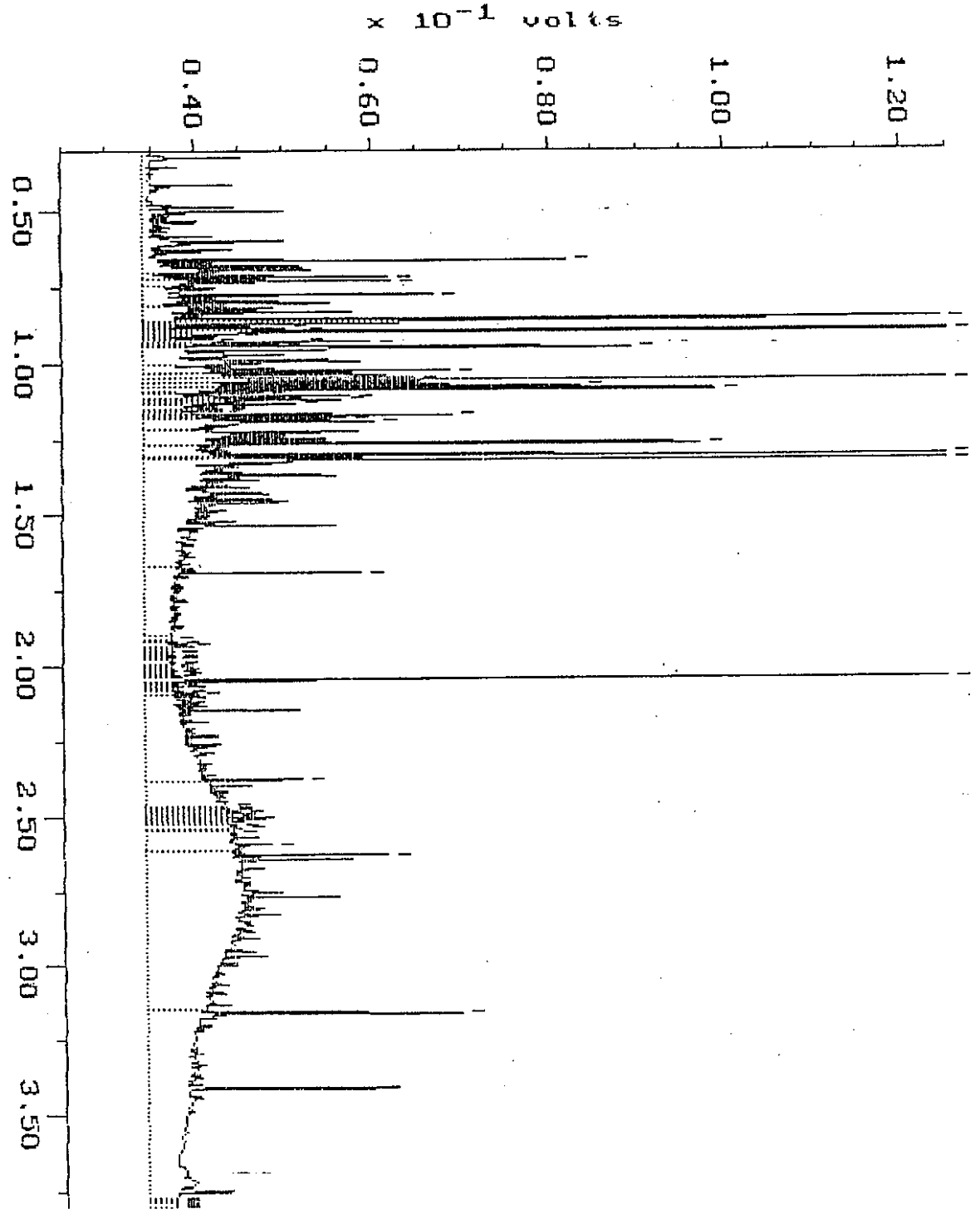
WA DOE WTPH-D

Sample: 9404-875-S DIL Channel: FRED Filename: R4128F21
Acquired: 13-APR-94 11:50 Method: F:\RRD2\MAXDATA\FRED\FUEL0412 Operator: ATI
Dilution: 1 : 10.000
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



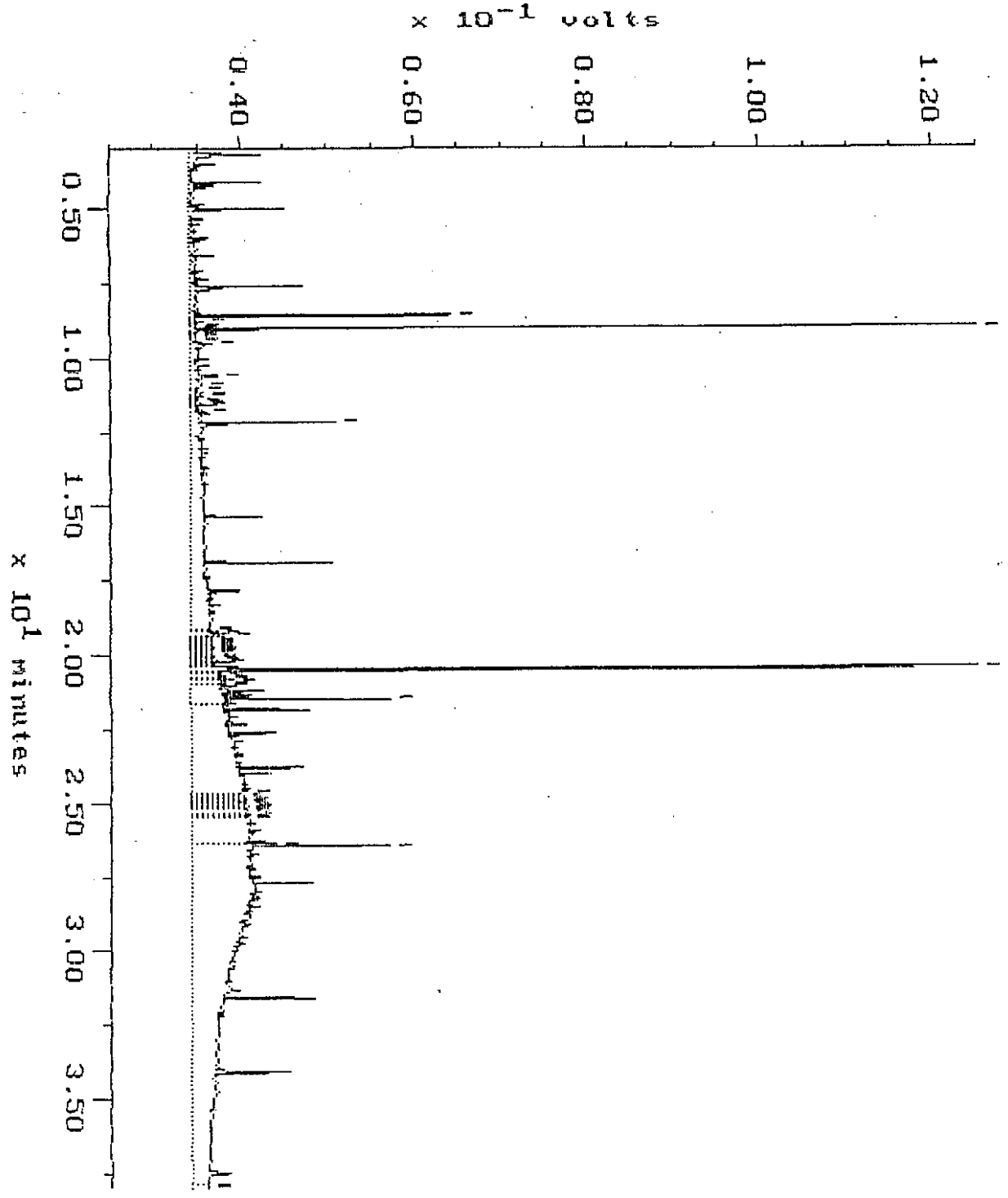
WA DOE WTPH-D

Sample: 9404-075-6 Channel: FRED Filename: R4128F11
Acquired: 13-APR-94 3:55 Method: F:\BRO2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



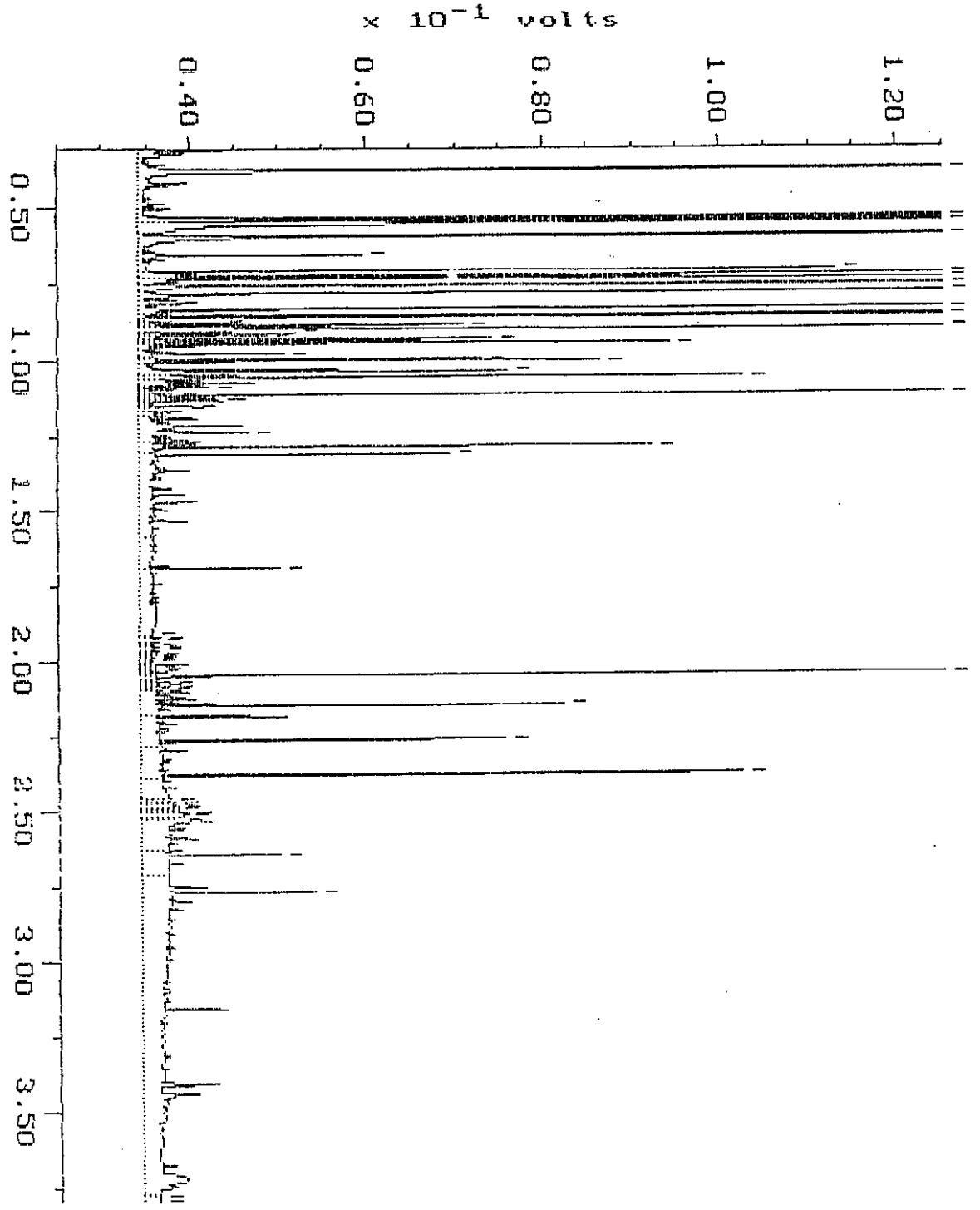
WA DOE WTPH-D

Sample: 9404-075-7 Channel: FRED Filename: R4128F07
Acquired: 13-APR-94 0:45 Method: F:\BRD2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



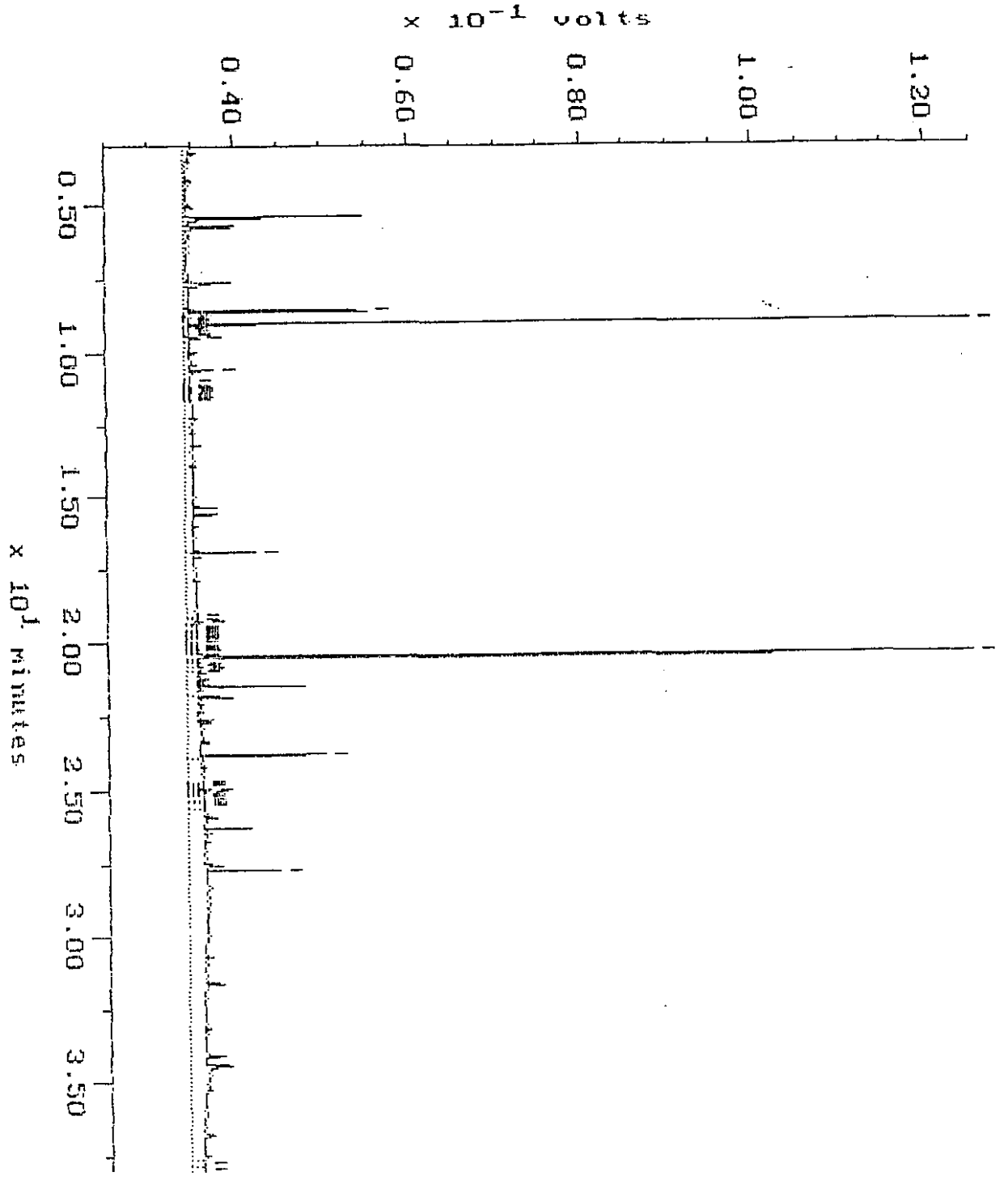
WA DOE WTPH-D

Sample: 9404-075-6 Channel: FRED Filename: R4128F09
Acquired: 13-APR-94 2:28 Method: F:\BRO2\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY

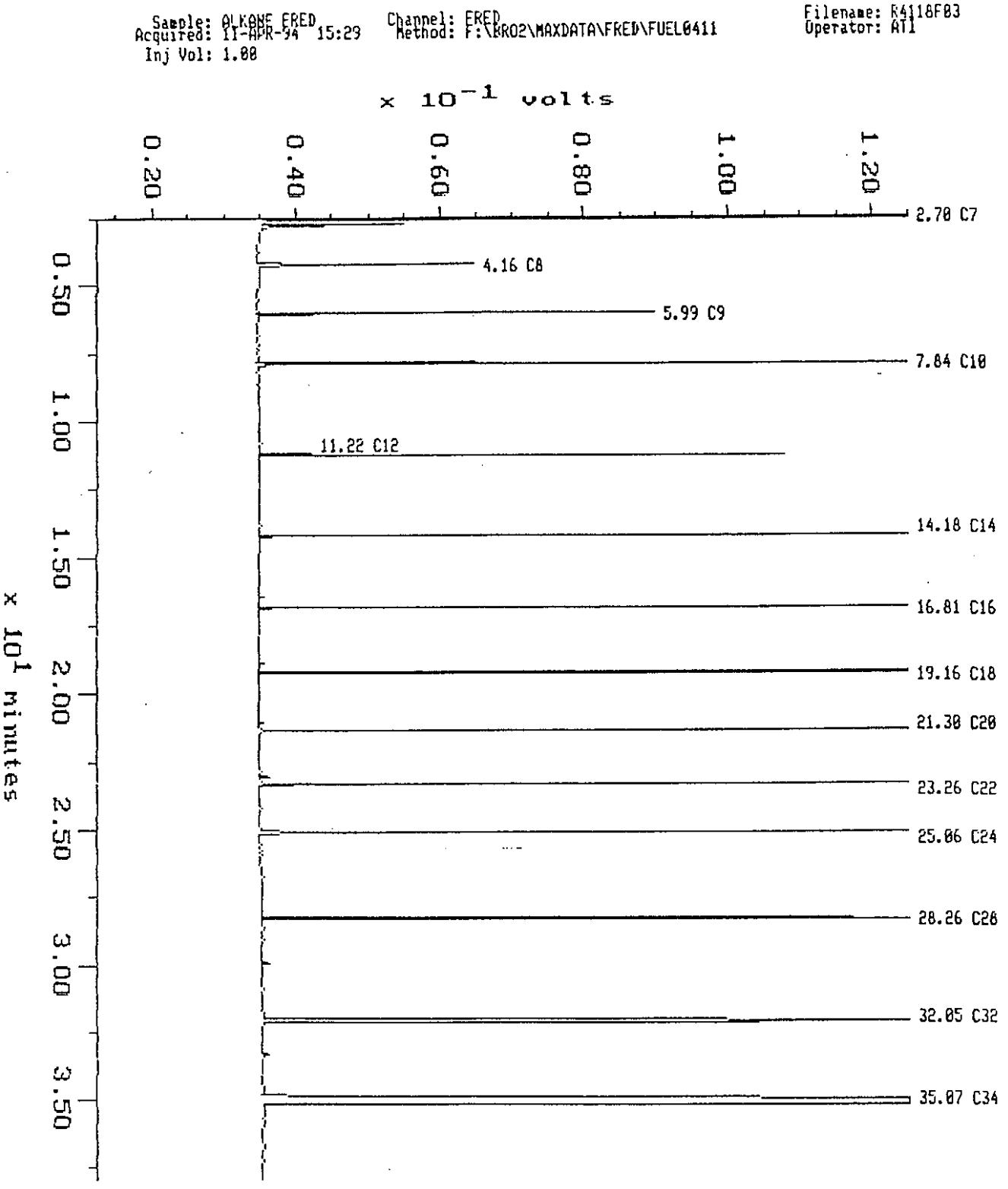


WA DOE WTPH-D

Sample: 9404-075-9 Channel: FRED Filename: R4126F06
Acquired: 12-APR-94 23:57 Method: F:\6K02\MAXDATA\FRED\FUEL0412 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Alkane


Sample: ALKANE FRED
Acquired: 11-APR-94 15:23
Inj Vol: 1.00
Channel: FRED
Method: F:\BRO2\MAXDATA\FRED\FUEL0411
Filename: R4118F03
Operator: ATI
x 10⁻¹ volts
0.20
0.40
0.60
0.80
1.00
1.20
0.50
1.00
1.50
2.00
2.50
3.00
3.50
x 10¹ minutes
2.70 C7
4.16 C8
5.99 C9
7.84 C10
11.22 C12
14.18 C14
16.81 C16
19.16 C18
21.30 C20
23.26 C22
25.06 C24
28.26 C28
32.05 C32
35.07 C34

WA DOE WTPH-D

Blank

Sample: WRB 4-11 Channel: FRED Filename: R4118F15
Acquired: 12-APR-94 2:21 Method: F:\BRO2\MAXDATA\FRED\FUEL0411 Operator: ATI
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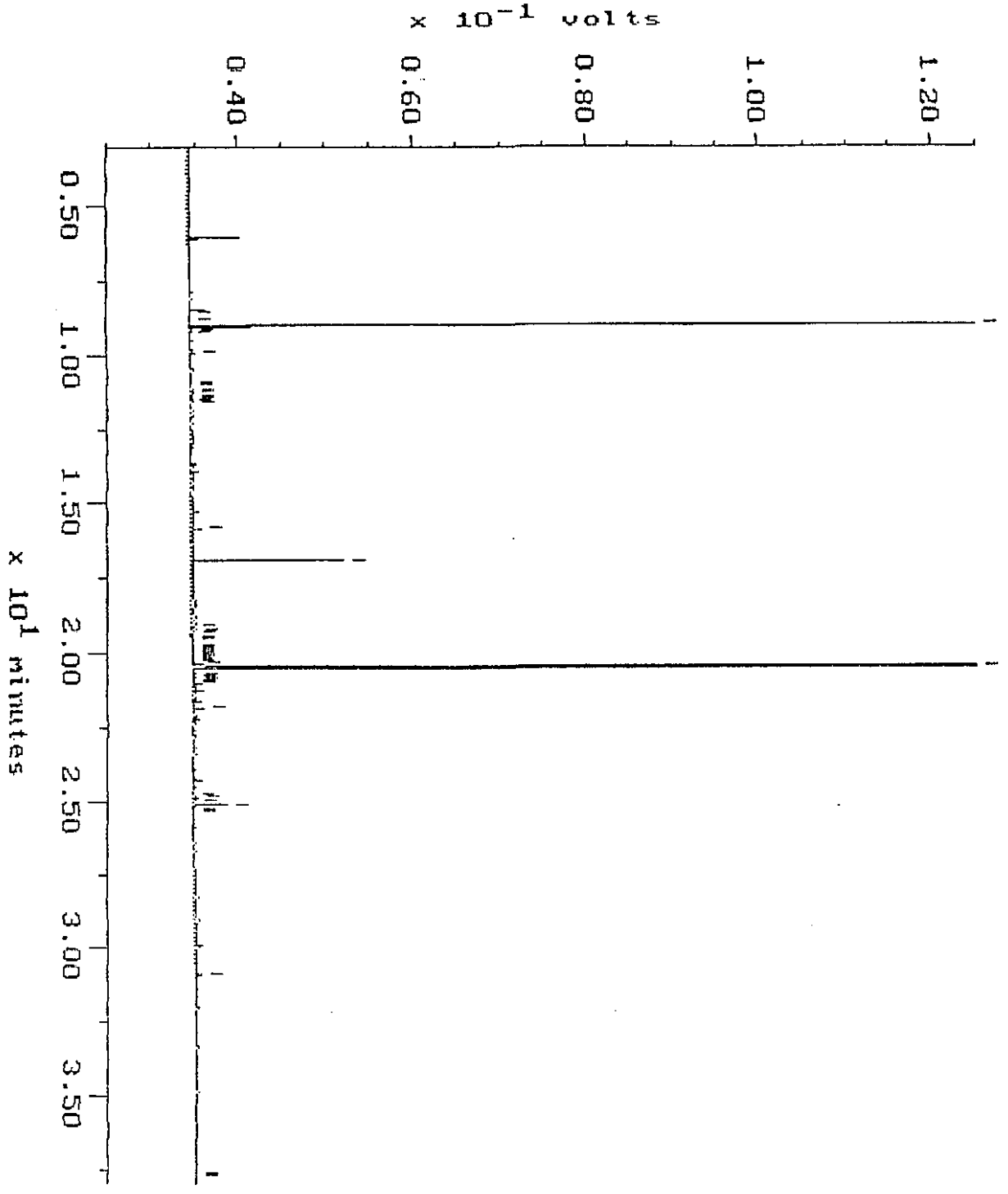

Continuing Calibration

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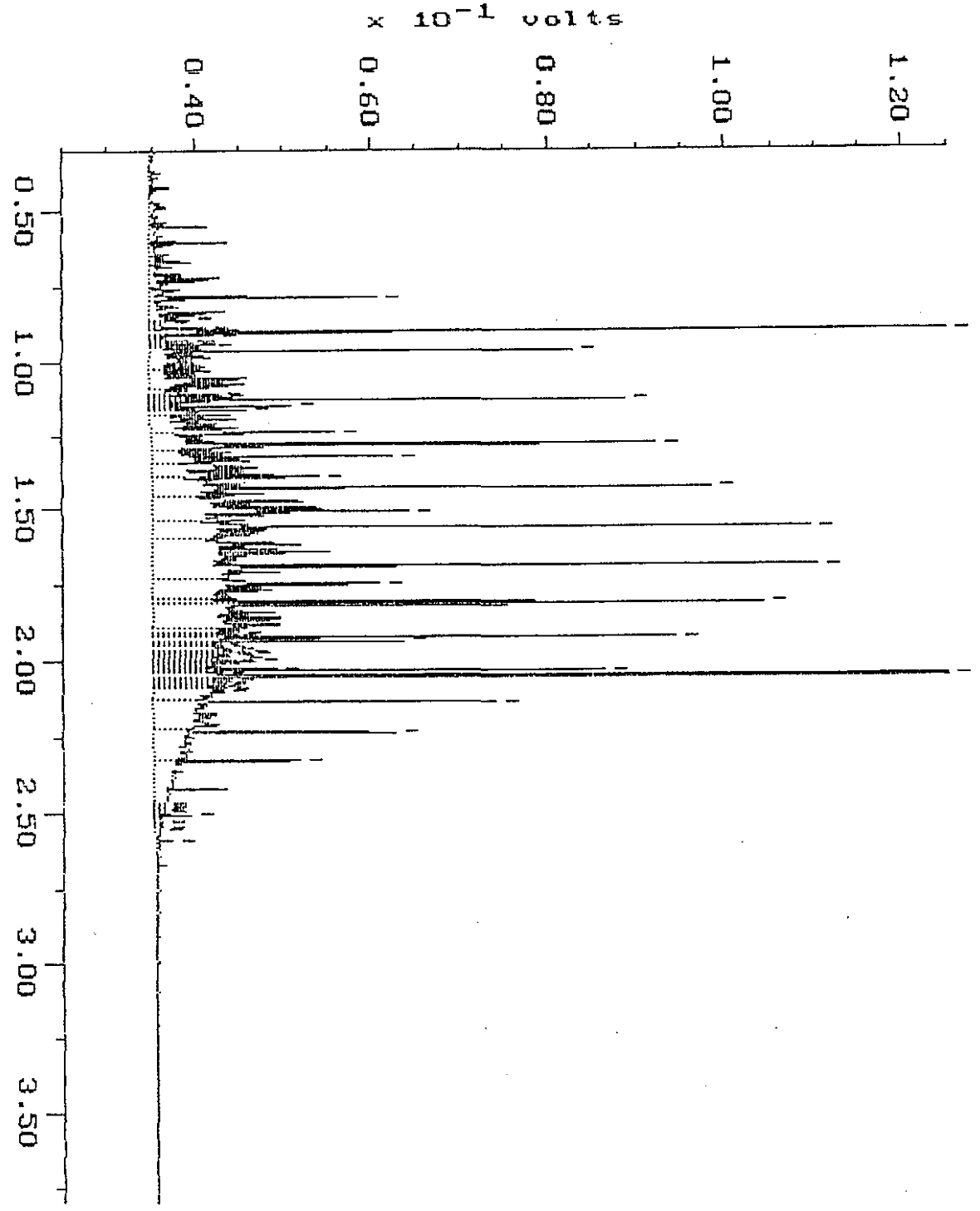
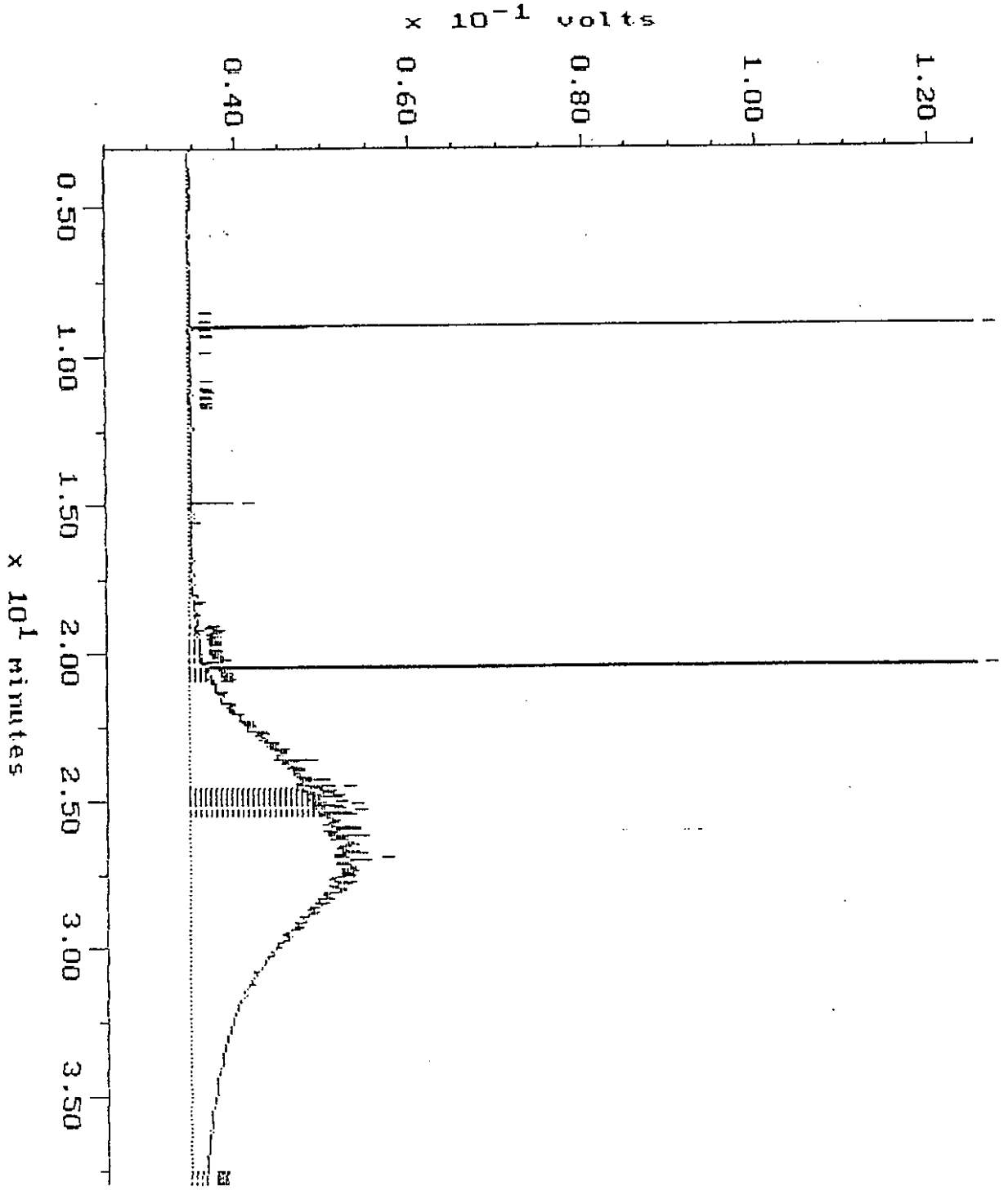


Continuing Calibration

Sample: MD 500 Channel: FRED Filename: R4118F13
Acquired: 12-APR-94 8:45 Method: F:\HRO2\MAXDATA\FRED\FUEL0411 Operator: ATI
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Continuing Calibration

Continuing Calibration

Sample: D 500 Channel: FRED Filename: R4128F02
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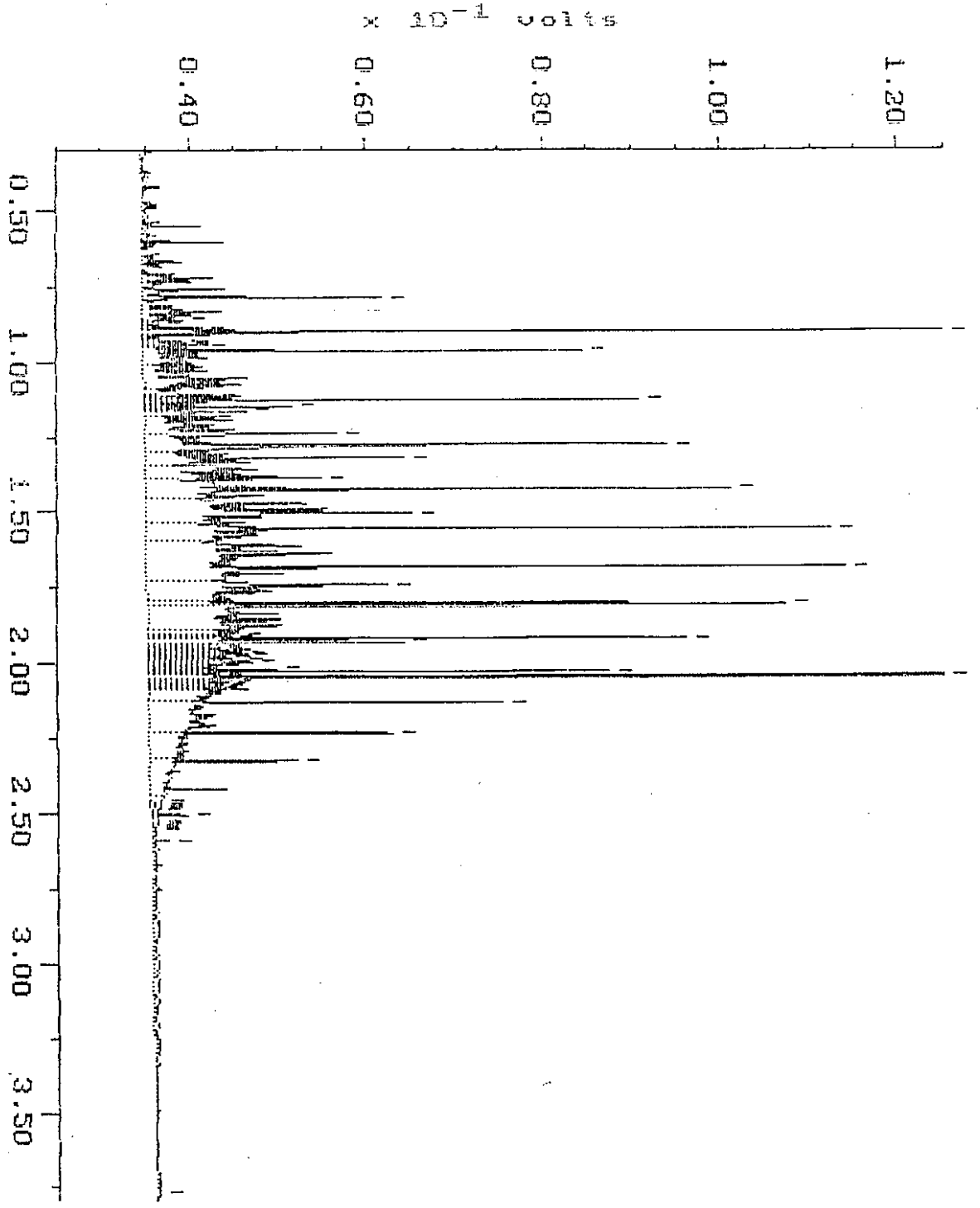

Continuing Calibration

Sample: M0 509 Channel: FRED Filename: R4126F03
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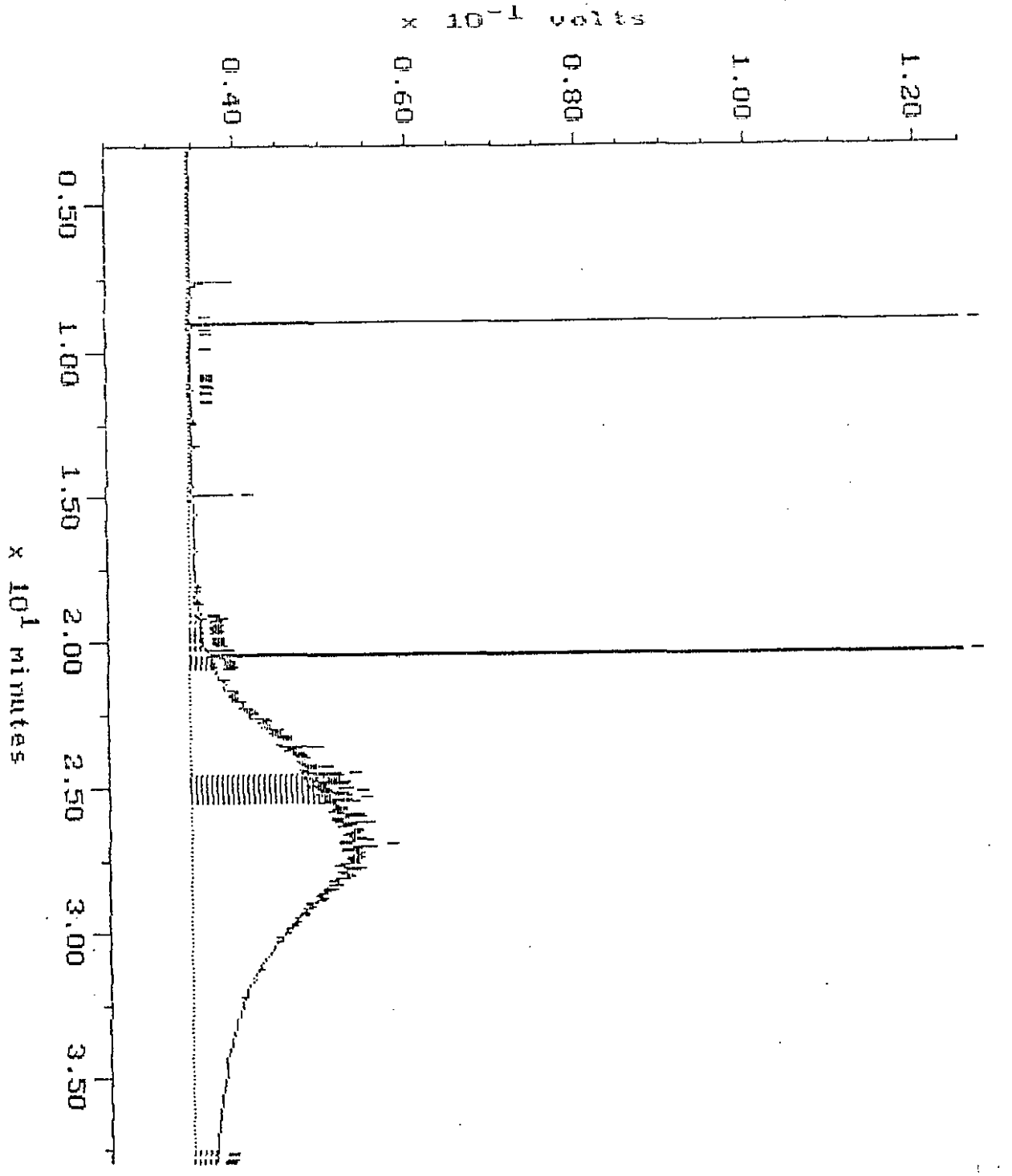
Comments: ATI RUSH FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY



Analytical Technologies, Inc.
OREGON / WASHINGTON

☐ YES
☒ NO

Page 1 of 1

Fax copy of Lab Report and COC to UNOCAL Contact:

Chain-of-Custody-Record#:

UNOCAL under contract with ATI RENTON: FAX: (206) 363-1742

Consultant Project Number: 01161-013-R6Z
Consultant Name: Cascade Engineers
Address: 8410 154th Ave NE
Project Contact: Norm Puri
(Phone): 861-6000
Samples Collected by (Name): DAVE COOK
Signature: Dave Cook

UNOCAL Contact (Name): Mark Brearley
(Phone): 640-7610
UNOCAL Facility #: SS 5353
Site Specific Release Number: MXB282
TASK #: 09.1

Sample Number	Lab Sample ID	# of Containers	Matrix	Date	Time – All times are PM	BETX / TPH-G Combo (WA) State: OR	BETX (8020)	TPH-HCID State: OR WA	TPH-G State: OR WA	TPH-D – EXTENDED (WA) State: OR	TPH-418.1M State: OR WA	EPA 418.1	Fuel Fingerprint EPA 8015M	Purgeable Halocarbons (8010)	Purgeable Aromatics (8020)	PCBs Only (8080M)	PCB / Pesticides (8080)	HPLC PAHs (8310)	Lead Total / Dissolved	TCLP Metals (8)	Purgeable Organics (8240) GC/MS	Extractable Organics (8270) GC/MS					RUSH Y / (N) *	Remarks
MW-32A	-1	3	Water	4/7/94	1010	X				X																		
MW-33	-2	3			1100	X				X																		* RUN WITPH-D Extended
MW-34	-3	3			1040	X				X																		
MW-35	-4	3			1015	X				X																		
MW-37	-5	3			1150	X				X																		* All samples on STD TAT.
MW-40	-6	3			1210	X				X																		
MW-42	-7	3			1120	X				X																		
MW-45	-8	3			1230	X				X																		
MW-47	-9	3	↓	↓	1045	X				X																		

QC Data:
☒ UNOCAL Summary Report
☒ Expanded QC Report

Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Orgainzation	Date/Time
Dave Cook	GE1	4/8/94		ATI	4/8/94 13:00
Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Orgainzation	Date/Time
Relinquished By (Signature)	Organization	Date/Time	Received By Laboratory		Date/Time

* Please Schedule Rush TATs with ATI Project Manager

To be completed upon receipt of report:
1) Were the analyses requested on the Chain of Custody reported: ☒ Yes ☐ No. If no, what analyses are still needed? _____
2) Was the report issued within the requested turnaround time: ☒ Yes ☐ No. If no, what was the turnaround time? _____
Approved by: _____ Signature: _____ Company: _____ Date: _____

APPENDIX C

EcoChem, Inc.

GeoEngineers

Environmental Science and Chemistry

MAY 05 1994

Routing NLP

File

MEMORANDUM

DATE: May 3, 1994

TO: Norm Puri, P.E.
GeoEngineers, Inc.

FROM: Teri Floyd, EcoChem, Inc. Teri A. Floyd

SUBJECT: **CHEMICAL EVALUATION OF SOIL AND GROUNDWATER CONTAMINATION AT THE UNOCAL AND ROSEN SITES ON MERCER STREET ECOCHEM PROJECT NO. 2202-01**

This memorandum report presents EcoChem, Inc.'s (EcoChem) evaluation of the soil and groundwater contamination at the Rosen site on Mercer and Terry streets, and the Unocal site diagonally across Mercer Street.

Our evaluation is based on information contained in the following documents and on our professional judgment based on our experiences with related projects in the past. Specific documents reviewed included:

- Draft letter to Mr. Herb Rosen from Enviros, Inc. dated November 4, 1993, regarding "Groundwater gasoline contamination at the Rosen property at the Corner of Mercer and Terry Streets.

- Fax transmittal from Kathleen Goodman of Enviros to Steve Perrigo of GeoEngineers, dated October 4, 1993, containing information on sample R-EXW-2.

- Letter to Mr. Herb Rosen from Enviros, Inc., dated November 13, 1993, regarding "Summary of a Partial Review of the Data Concerning Possible Off-site Sources for the Gasoline Contamination at the Mercer-Terry Street Property.

- Letter to EcoChem from you, dated November 16, 1993, summarizing the problem and requesting a chemical evaluation of the products at the two sites. The letter includes attached maps and laboratory reports for GeoEngineer's fall 1993 sampling at both the Rosen and Unocal sites.

1401 Norton Building • 801 Second Avenue • Seattle WA 98104 • (206) 233-9332 • Fax (206) 233-0114

- A submittal from Analytical Technologies Inc. of the laboratory reports corresponding to GeoEngineers January 1994 groundwater sampling at the Unocal site.

- Chromatographic library from Analytical Technologies, Inc. for 1992 and 1993, showing the expected chromatograms for a large number of petroleum products using methods WTPH-G and WTPH-D.

PROJECT OBJECTIVE

The first objective of EcoChem's task was to identify the products at the two sites. Our second objective was to evaluate the potential for contamination at the Rosen site being due to the Unocal spill, based a knowledge of the chemical properties of the products involved. GeoEngineers would then combine this evaluation with other site information to confirm or dispute the conclusion in the Enviros report that the Rosen site is impacted by the release at the Unocal site.

CHEMICAL IDENTIFICATION OF PRODUCTS AT THE ROSEN SITE

A review of the chromatograms collected by GeoEngineers from the Rosen site reveals the presence of the following products:

- **Diesel No. 2 or a closely related product with a more narrow hydrocarbons range.** This product is present most clearly in wall samples W-3, W-4, and W-10. These samples contain no detectable benzene or toluene, present a typical diesel chromatographic pattern in WTPH-D, and a typical "diesel-tail" in the chromatogram for WTPH-G. Diesel was also reported as present at concentrations up to 800 mg/kg in excavated and vadose zone soils by Enviros.

- **Motor and hydraulic-range oils.** These oils are present in the majority of samples across the site. These heavy oils do not contain detectable benzene, toluene, or ethylbenzene; nor do they have a chromatographic response using method WTPH-G. The WTPH-D chromatographic shape for motor oil is characterized by a broad symmetric hump between C-18 and the end of the range. Hydraulic fluid is typically an asymmetric shape with significant fine structure in the same area. Numerous other petroleum oils also have chromatographic responses in this area, but motor oil and hydraulic fluid are generally the most common. Oil range hydrocarbons were also reported as ubiquitous across the site by Enviros; the highest concentration in their samples was 36,000 mg/kg.

- **A gasoline-range product, probably very old gasoline.** This product was detected in the three bottom samples from the center of the site and in several wall samples,

especially W-7, W-8, W-11, and W-12. Assuming that the product was originally gasoline, the WTPH-G chromatograms show a nearly complete loss of BETX and n-alkane components, followed by additional weathering so that the usual valley in gasoline, around 10 minutes in the chromatogram, is no longer present due to weathering of the components on either side of the valley. The WTPH-D chromatograms also show a marked loss of low hydrocarbon components, but retain the sharp decrease in concentration beyond C-13 or -14. This again is consistent with a very old gasoline. Specific markers of this material include (1) the benzene to WTPH-G ratio is generally less than 1 to 1000; (2) the toluene, ethylbenzene, and xylene concentrations are also low; (3) the WTPH-G chromatogram has lost low-end components, n-alkanes, and the valley around 10 minutes and appears continuously "hilly" from about 6 though 20 minutes; (4) the estimated concentrations by WTPH-G and WTPH-D are similar with a ratio between 0.5 and 2.0; (5) the WTPH-D chromatogram is much more symmetric than for fresher gasoline due to a significant loss of volatile components.

The gasoline-range product on the Rosen site is extensively weathered. Given its dispersion on the site and the weather in Western Washington, it is probably more than 30 years old. Throughout the remainder of this submittal, this product is referred to as "aged gasoline."

Although comparable chromatograms are not available for Enviros's work on-site, an aged gasoline component would be quite consistent with their findings of extensive gasoline contamination, with little or no BETX contamination.

Representative chromatograms of these products are shown in Figures 1 for WTPH-G analysis and 2 for WTPH-D analysis. A summary of the chemical results are presented in Table 1.

CHEMICAL IDENTIFICATION OF PRODUCTS AT THE UNOCAL SITE ON MERCER STREET

A review of chromatograms from GeoEngineer's Fall 1993 and Winter 1994 groundwater sampling at the Unocal site reveals the presence of significant gasoline contamination, centered in the area around MW-37 and MW-34. Free product is still measurable in MW-37. Table 2 lists chemical concentrations. Figure 3 shows the WTPH-G chromatogram of the product versus a fresh gasoline standard. Figure 4 shows the WTPH-D chromatogram of the product versus fresh gasoline and diesel standards. Note that the product in MW-37 contains a motor oil fraction in addition to the gasoline. This is a common occurrence on older gas station sites with ubiquitous motor oil contamination. The gasoline, which is an excellent solvent for motor oil, appears to extract the residual motor oil in surrounding soils and hold it in the free product phase.

A very similar pattern exists in adjacent wells, MW-34, MW-32A, MW-35, and MW-33. The chromatographic shape is very similar, but the benzene to xylene ratios are higher in the water samples than in the product sample. This is a direct consequence of the higher solubility in water

for benzene than for xylenes. The benzene to xylene ratios in these samples are a good indication that at least some of the contamination in these wells is due to current groundwater transport (which would favor benzene over xylenes) rather than purely residual contamination from the spill.

The gasoline product present on the Unocal site is significantly different from, and newer than, the aged gasoline present on the Rosen Site. The product is probably residual from the 1980 Unocal release. Throughout the remainder of this submittal, this product will be referred to as the "fresher" gasoline.

The patterns in upgradient wells MW-41, MW-42, and MW-43, and in downgradient MW-40 are different. The differences in MW-40 are the most significant, since the well is apparently downgradient of the Rosen site. Figures 5 and 6 show the WTPH-G and WTPH-D chromatograms for groundwater samples MW-40 and MW-33, product sample MW-37, and soil samples W-8 and W-10. Recall that the groundwater samples should contain more light-end components than the soil due to increased solubility. Note the strong similarities between the product sample MW-37, and well sample MW-33, approximately 120 feet downgradient. Note the strong similarities between W-8 and MW-40 located approximately 20 feet apart. MW-40 is located slightly closer to the product well MW-37, than is MW-33; yet the clear chromatogram of gasoline in the MW-33 and MW-37, is replaced in MW-40 with the pattern of the very old gasoline found at the Rosen site. The MW-40 WTPH-D chromatogram also shows a small amount of diesel contamination. From a chemical standpoint, the contamination in MW-40 is almost surely coming from the Rosen site and not from the Unocal spill. Since the nearness of MW-40 to MW-37 would argue for a more significant impact than the chemistry indicates, it would be interesting to find out if a utility corridor or other underground feature along Mercer Street is limiting groundwater flow from the Unocal site, or whether there is a very strong northward groundwater gradient across the Rosen site.

DISTRIBUTION AND MIGRATION POTENTIAL OF CONTAMINANTS AT THE ROSEN SITE

Samples from the bottom of the excavation pit at the Rosen site contain significant concentrations of the aged gasoline component discussed above. The sample from furthest south, B-12, is essentially clean. According to Enviros's report this location should be upgradient of on-site contamination. Samples B-6 and B-9 from the center of the site show almost identical levels of aged gasoline. These samples also contain spiky, asymmetric oil-range hydrocarbons visible in the WTPH-D chromatogram. Sample B-3, taken from the northwest section of the site, nearest the Unocal station, shows the same aged gasoline pattern as in the other samples, but the concentrations are an order of magnitude less than those in the center of the site.

Four samples were collected from the west section of the north wall, at the closest point of approach to the Unocal spill; these samples are designated W-1 (~3-feet bgs), W-2 (~7-feet bgs),

W-3 (~11 feet bgs at the water table), and W-4 (~12-feet bgs, at or just below the water table). The vadose zone samples were essentially clean; while W-3 contained 7,800 mg/kg of diesel. W-4, a foot deeper, contain diesel at 210 mg/kg. No gasoline was present in any of these samples. The "gasoline" concentrations found using WTPH-G are clearly due to the light-weight components of diesel which elute in the WTPH-G method. The WTPH-G chromatogram is unambiguously due to Diesel No. 2, not gasoline.

Four more wall samples were collected in the central portion of the north wall. Again, the vadose zone samples (W-5 and W-6) show only low levels of contamination. However, the contamination is aged gasoline, rather than diesel. The two samples from near the water table (W-7 and W-8) show significant concentrations of aged gasoline. The WTPH-G and WTPH-D chromatograms of these two samples best represent the aged gasoline found on this site. As discussed above and shown in Figures 5 and 6, they are very dissimilar to the chromatograms of fresher gasoline at the Unocal site.

The last four samples were collected from the eastern section of the north wall. The northeast section of the site was found by Enviros to be the most contaminated. Again the upper most sample (W-9) was clean. The other vadose zone sample was slightly contaminated, but with diesel no. 2, not gasoline. The two samples from near the water table (W-11 and W-12) were most contaminated, with 2,300 to 3,400 mg/kg of aged gasoline. The product found in these samples strongly resembles the product in the bottom samples (B-6 and B-9) and in the wall samples W-7 and W-8; while it does not resemble the fresher gasoline free-product found in MW-37.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on field observations contained in the Enviros reports, potentiometric data from the GeoEngineers letter to me, and chemical data from both sites:

- The oil and diesel contamination on the Rosen site was wide-spread, and due to historical on-site sources. The contamination was likely migrating northward and has contaminated the north wall of the excavation.

- The gasoline contamination on the Rosen site is very old, probably more than 30 years. The contamination in 1993 was apparently heaviest near the water table and in the wood debris layer. This observation is consistent with an old source of contamination, where the vadose zone has significantly remediated itself due to gravity flow of the gasoline toward to the water table, volatilization of the light-end hydrocarbons during the dry season, volatilization and biodegradation during the wetter seasons, and rainwater leaching of the residual soil component into the groundwater. These processes leave the highest residual contamination at the water

table. Here, the water table coincides with a layer of wood debris which acts as an effective sponge to the residual gasoline as it ages.

- The pattern of aged gasoline contamination at the Rosen site, which is highest in the central and northeastern sections of the site, is consistent with the known locations of the central portions of the service station overlying sampling points B-6 and B-9; while the pump islands were located further to the northeast. Over time the highest residual contamination would be at the water table beneath the original source area and downgradient of the source area (presumably to the north).

- The aged gasoline is continuing to leave the site in groundwater, and appears to have contaminated the groundwater at MW-40. Diesel from the Rosen site also appears to be impacting MW-40.

- Chemical concentrations and chromatographic patterns of groundwater samples from the Unocal site are consistent in interpretation. A major spill of gasoline occurred that has left free product in MW-37, and significant concentrations in adjacent wells, MW-32A, MW-33, MW-34, and MW-35. The product in MW-37 appears to be an essentially unweathered gasoline ("fresher gasoline"), containing between 0.5 and 1.0% benzene, and even higher percentages of the other BETX components. Groundwater contamination in the adjacent wells, approximately 100 to 150 feet away is chemically and chromatographically very similar, although some aging has occurred in the samples further from the source area. The fresher gasoline product does not appear related to the aged gasoline at the Rosen site.

- The chromatographic fingerprint of MW-40 is much more consistent with aged gasoline and diesel contamination coming from the Rosen site, than with fresher gasoline from the Unocal site. GeoEngineers potentiometric surfaces for the area indicate that MW-40 is probably downgradient from the Rosen. However, it is possible that underground utilities corridors may limit or facilitate groundwater flow along Mercer street.

I hope that this memorandum report is sufficiently detailed to meet your project needs. If you have any questions, please feel free to call me.

Table 1

Summary of GeoEngineers Data from 960 Republican Street Excavation

Data Collected Oct. 11, 1993; Data Analyzed at ATI-Renton using WA Methods

	Western Group				Central Group			
	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8
Benzene	<0.028	<.031	<0.16	<0.03	0.12	<0.027	1.6	1.1
Ethylbenzene	<0.028	<.031	0.19	<0.03	0.098	<0.027	5.2	1.3
Toluene	<0.028	0.046	<0.16	<0.03	0.11	<0.027	4.4	1.4
Xylenes	<0.028	0.14	0.87	0.063	0.062	0.036	22	11
WTPH-G	<6	12	470	44	37	6	2300 d	1200 a
WTPH-D	21	54	7800	210	220 a	<11	970 b	2300 c
WTPH-MO	45	120	280	<49	980 a	<42	3500 b	7000 c
Identity	DZ, MO	AG?, MO	D2, MO	D2, MO	aG, MO	aG?	aG, MO	aG, MO

	Eastern Group				Bottom Samples			
	W-9	W-10	W-11	W-12	B-3	B-6	B-9	B-12
Benzene	<0.028	<0.027	0.69	4.8	0.12	<1.6	1.3	<0.069
Ethylbenzene	<0.028	<0.027	6.7	19	0.27	21	14	<0.069
Toluene	<0.028	<0.027	2.8	8	0.3	6.4	5.6	0.12
Xylenes	<0.028	0.076	19	40	1.2	110	55	<0.069
WTPH-G	<6	35	2300 c	3400 d	250	5400 b	3800 a	<14
WTPH-D	<11	42	280	1900 a	490	2900	3700	73
WTPH-MO	<44	<43	<49	1900	1700	2200	3400	270
Identity		D2, MO	aG, H	aG, H	aG, H	aG, H	aG, H	aG?, H?

Notes:

1. Chromatograms were evaluated relative to ATI's chromatographic library and based on professional judgement.
2. Chromatogram ID codes: G - gasoline, aG - aged gasoline, D2 - diesel, MO - motor oil, H - hydraulic fluid.
   All identifications are tenative and are based on c-range and c-gram shape.
   Closely related products are not eliminated based on this classification; but may be eliminated based on other information or a more detailed anaylsis of the data.
3. Units for BETX , WTPH-G, WTPH-D, and WTPH-MO are mg/kg, dry wt.

a - Reporting limit is elevated 5X due to dilution.

b - Reporting limit is elevated 10X due to dilution.

c - Reporting limit is elevated 20X due to dilution.

d - Reporting limit is elevated 50X due to dilution.

Table 2

Summary of Groundwater and Free Product Chemical Analytical Data

Data Collected Oct. and Dec., 1993, and Jan., 1994; Data analyzed at ATI-Renton using WA Methods.

	MW-37 (Product)		MW-32A		MW-33		MW-34	
	Oct. 93	Jan. 94	Oct.93	Dec. 94	Oct.93	Dec. 94	Oct.93	Dec. 94
Benzene	7,500	6,200 d	–	6,300 a	–	560 b	1,400	15,000 a
Ethylbenzene	28,000	27,000 d	–	940 b	–	250 b	120	1,500 a
Toluene	69,000	63,000	–	990 b	–	100 b	480	11,000 a
Xylenes	170,000	150,000	–	1,700 a	–	1,100 b	440	7,000 a
WTPH - G	2,000,000	1,600,000	–	19,000 b	–	7,200	4,200	52,000 a
WTPH - D	82,000	90,000	–	3,000	–	1,000	1,600	2,200
WTPH - MO	<94000	14,000	–	1,000	–	<750	970	<750
Identity	G	G		G		G	G	G

	MW-35		MW-40		GW-1	GW-2
	Oct.93	Dec. 94	Oct. 93	Dec. 94	Oct. 93	Oct. 93
Benzene	–	580 b	36	34 c	2	<25
Ethylbenzene	–	200 b	2	11 c	2	200
Toluene	–	40 b	2	1 c	2	44
Xylenes	–	720 b	5	7 c	12	520
WTPH - G	–	4,200 b	930	1,500 c	1	28
WTPH - D	–	1,000	1,800	5,400	–	–
WTPH - MO	–	<750	1,900	4,200	–	–
Identity		G	aG,MO	aG,MO	ND	ND

	MW-41		MW-42		MW-43		MTCA Method A
	Oct. 93	Dec. 94	Oct. 93	Dec. 94	Oct. 93	Dec. 94	GW Cleanup Level
Benzene	–	5	–	570 b	–	82	5
Ethylbenzene	–	<0.5	–	<0.5	–	11	30
Toluene	–	<0.5	–	1	–	1	40
Xylenes	–	<0.5	–	1	–	100	20
WTPH - G	–	<100	–	<100	–	340	1,000
WTPH - D	–	<0.25	–	1,300	–	320	1,000
WTPH - MO	–	<0.75	–	2,400	–	<750	1,000
Identity				G, MO		G	

Notes:

1. Units for BETX, WTPH-G, WTPH-D, and WTPH-MO are ug/L.
   Units for MW-37, product, are mg/Kg.
2. Chromatogram ID codes: G - gasoline, aG - aged gasoline, D2 - diesel, MO - motor oil, H - hydraulic fluid.
   All identifications are tenative and are based on c-range and c-gram shape.
   Closely related products are not eliminated based on this classification; but may be eliminated based on other information or a more detailed anaylsis of the data.

a - Reporting limit is elevated 250X due to dilution.
b - Reporting limit is elevated 10X due to dilution.
c - Reporting limit is elevated 2X due to dilution.
d - Reporting limit is elevated 200X due to dilution.

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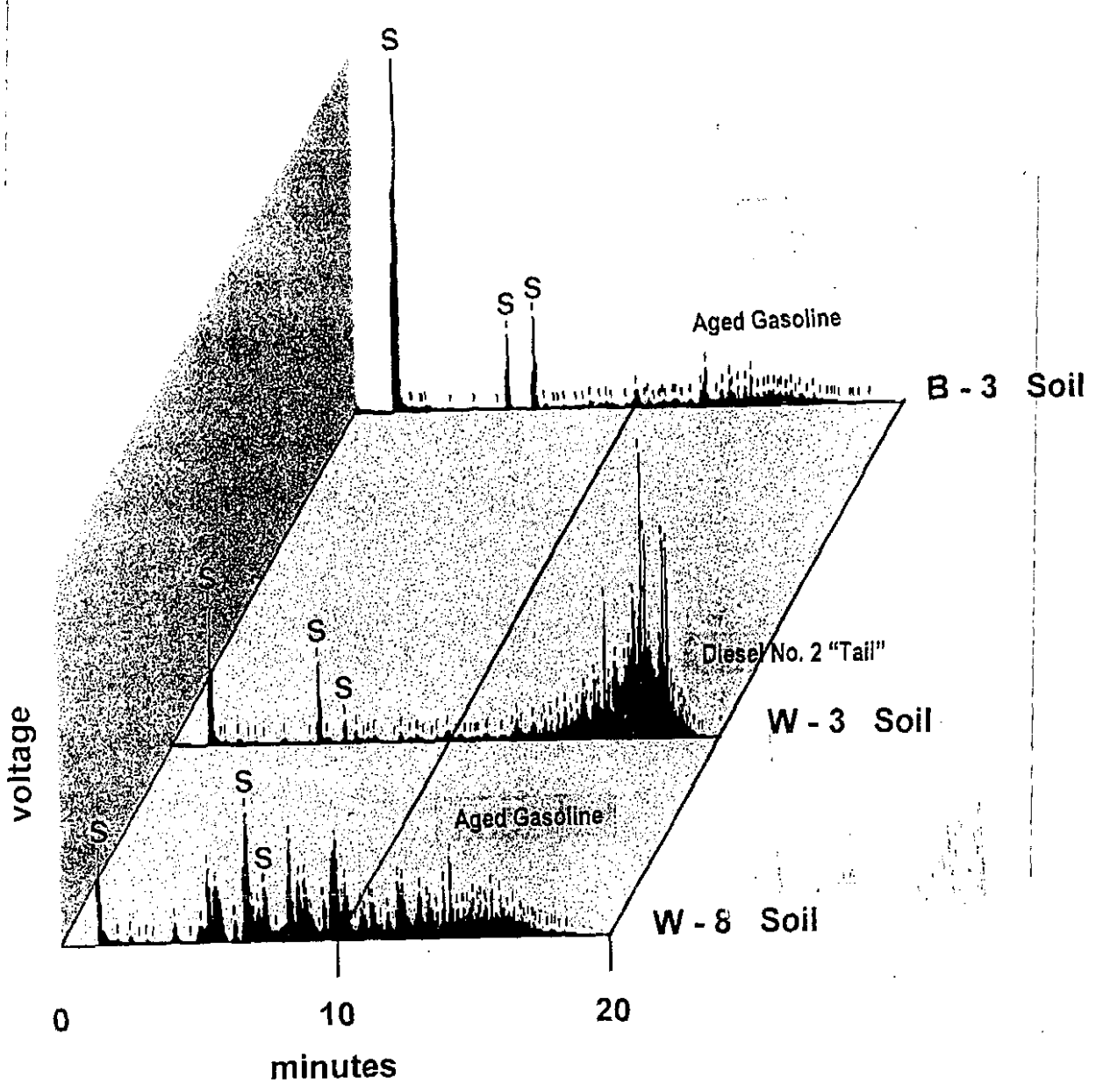
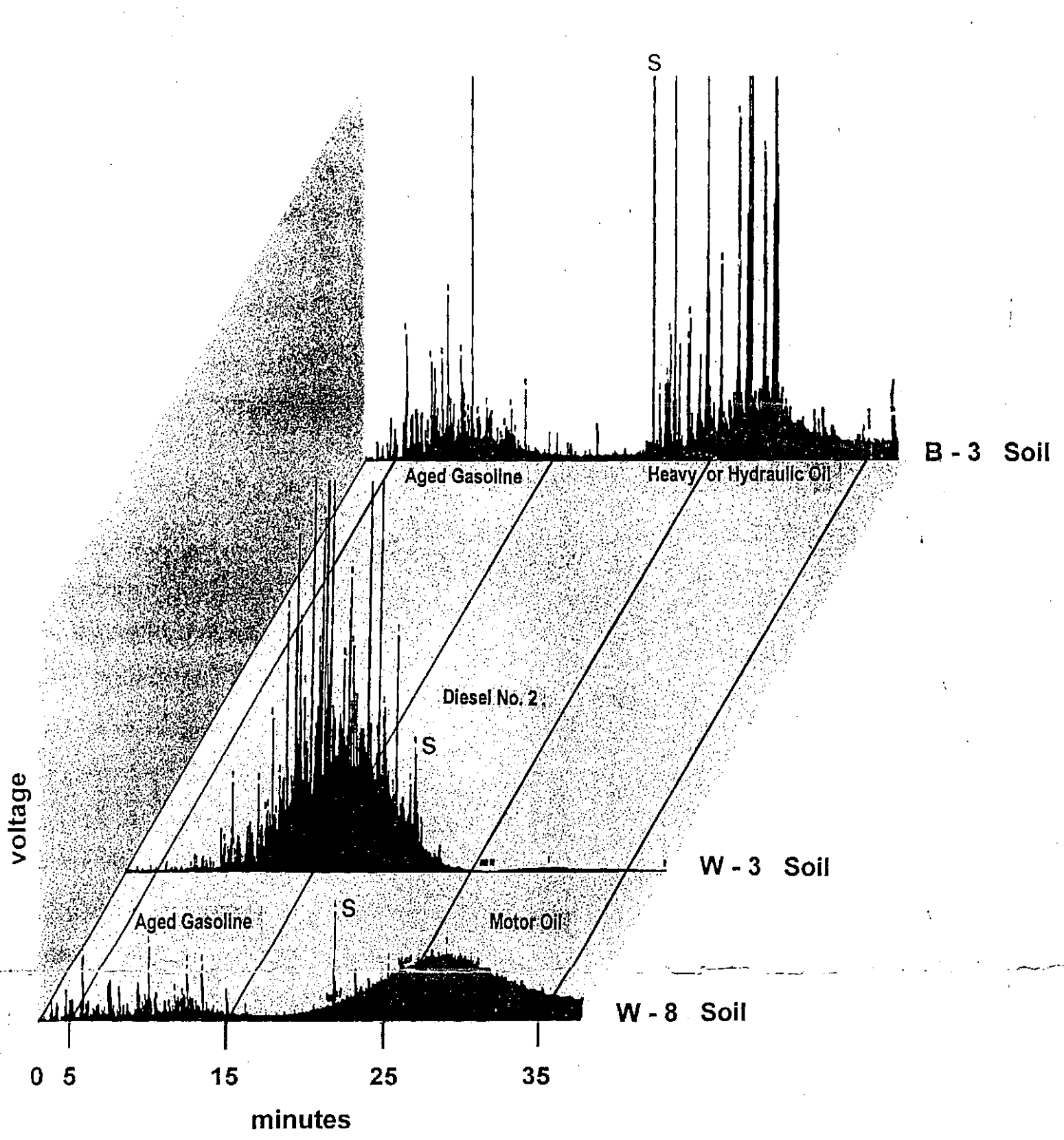


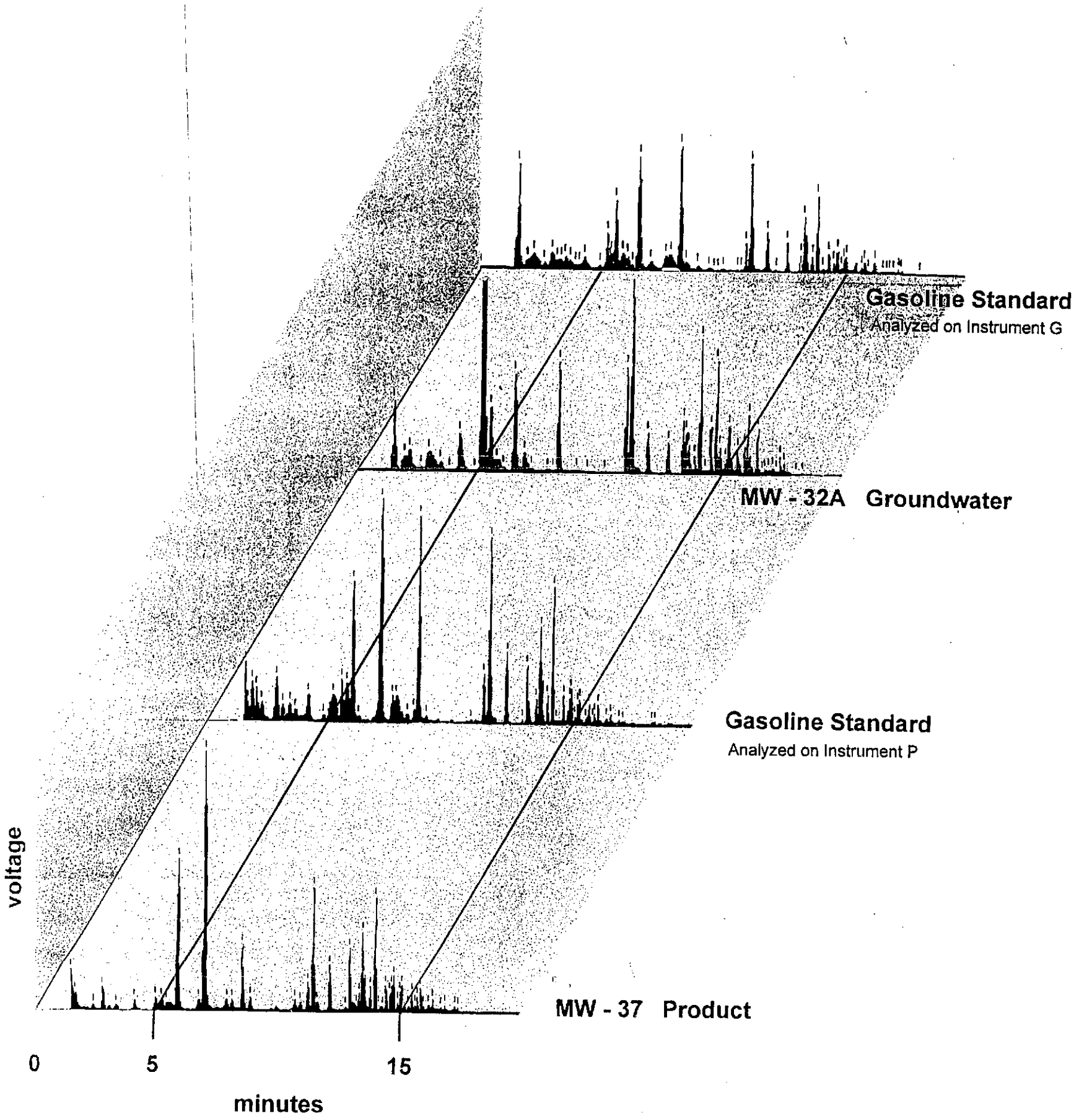
WTPH - G Representative Chromatograms of Product at Rosen Site

Figure 1



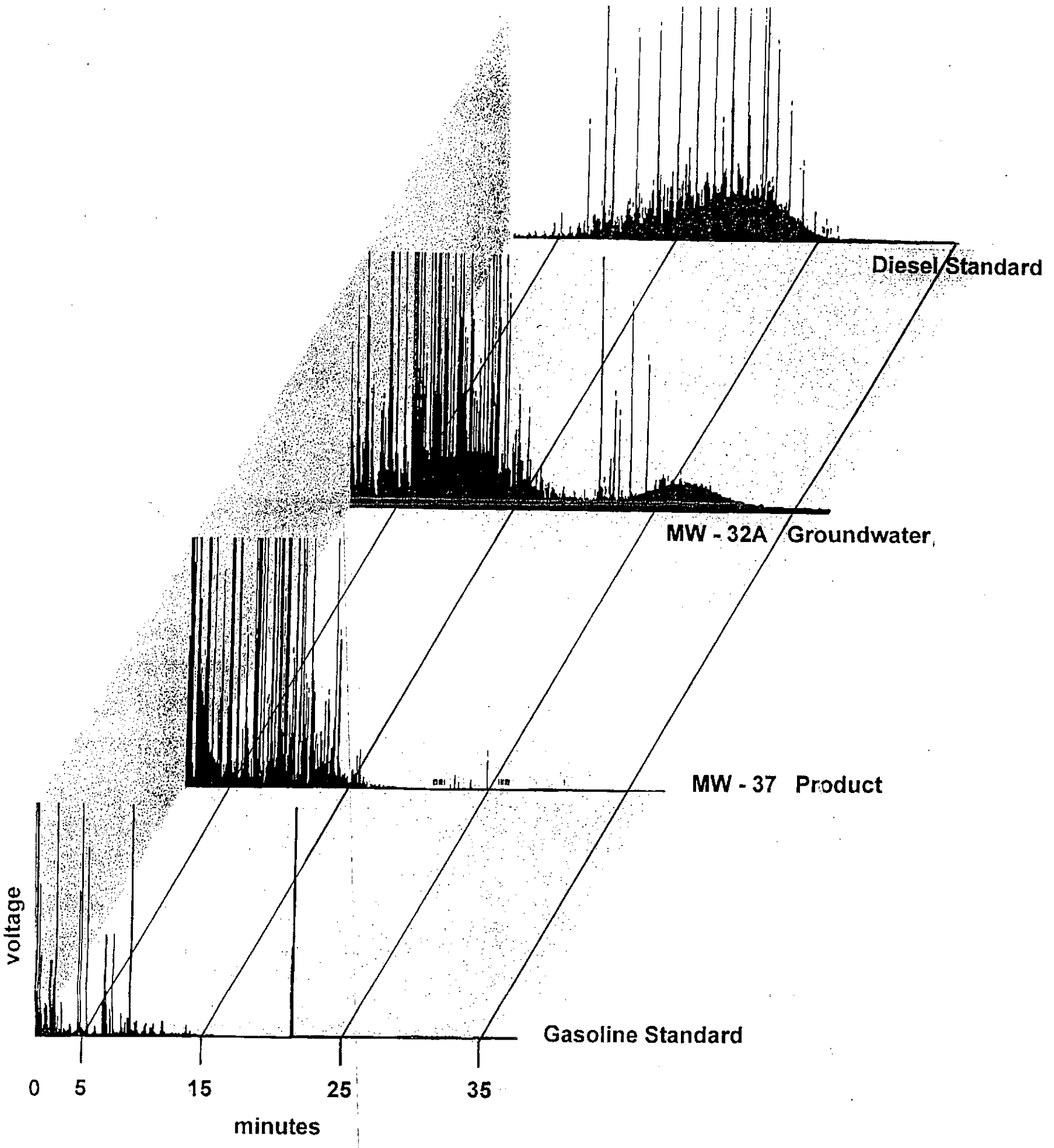
WTPH - D Representative Chromatograms of Product at Rosen Site

Figure 2



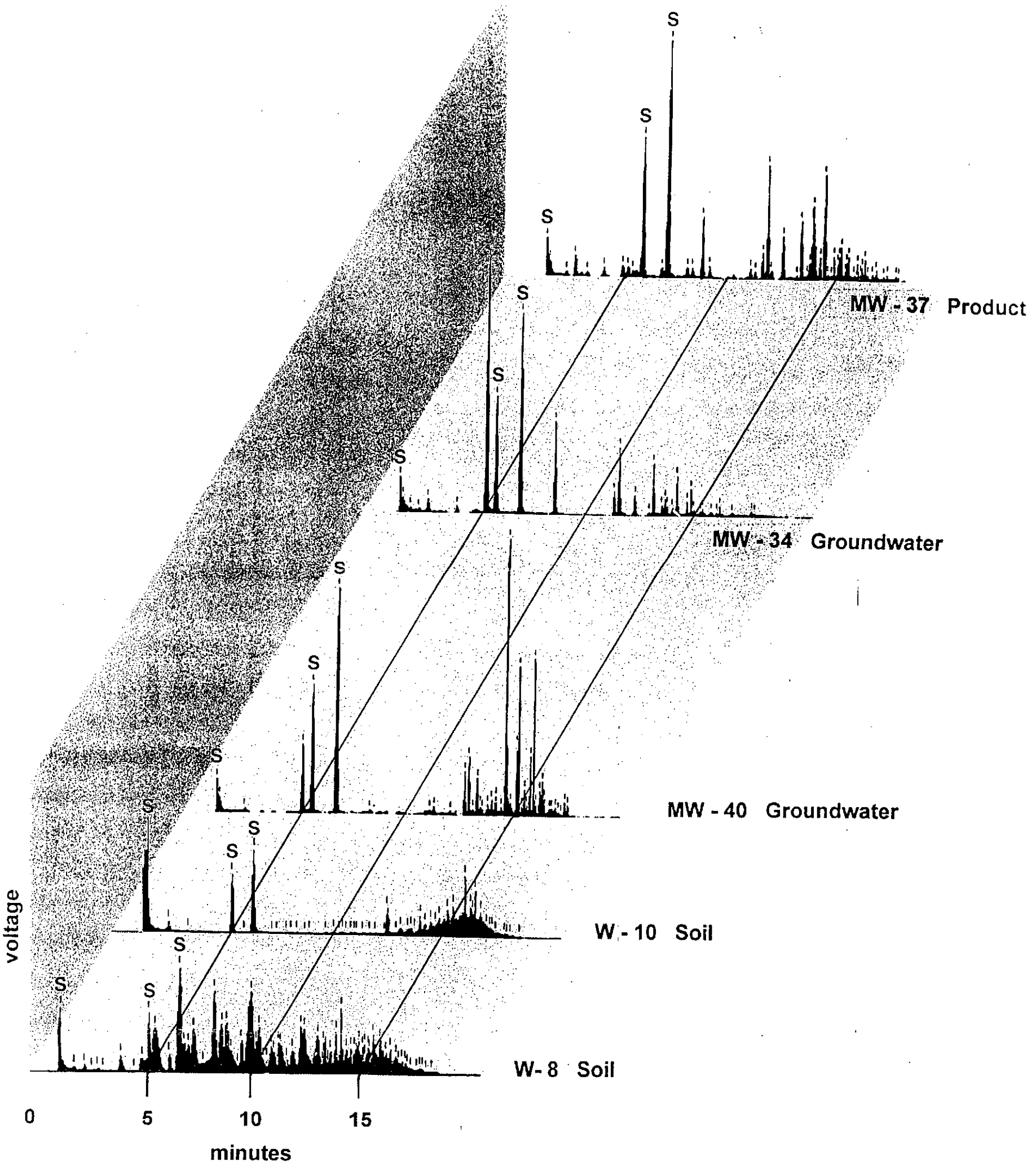
WTPH - G Chromatograms of Product & Groundwater Contamination at Unocal Site

Figure 3



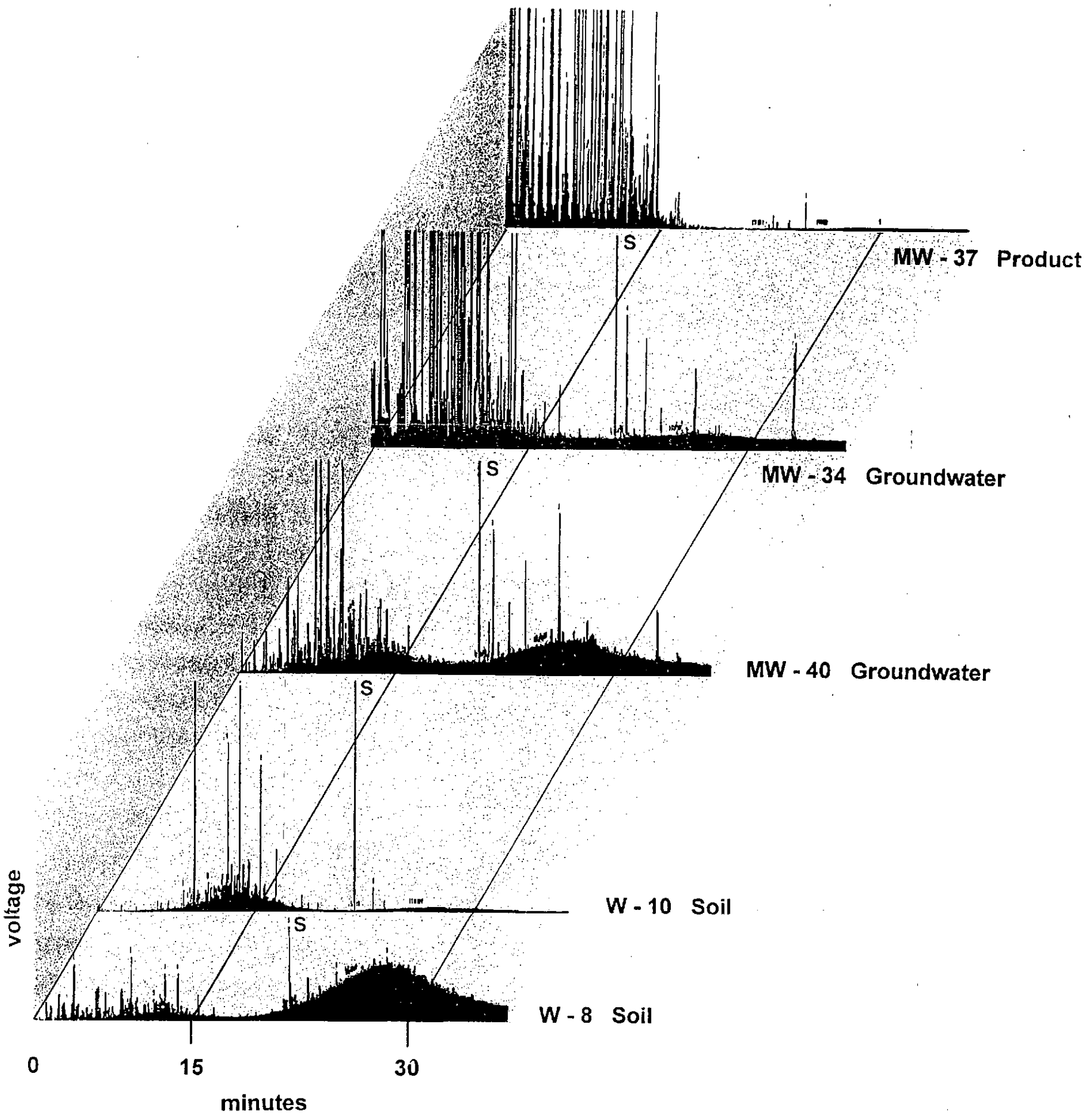
WTPH - D Chromatograms of Product & Groundwater Contamination at Unocal Site

Figure 4



WTPH - G Chromatograms Comparing Products at Rosen & Unocal Sites

Figure 5



WTPH - D Chromatograms Comparing Products at Rosen & Unocal Sites

Figure 6