GAS CHROMATOGRAPHY ANALYSES OF SITE CONTAMINANTS

OWENS-CORNING FIBERGLAS
2001 MARINA BOULEVARD
SAN LEANDRO, CALIFORNIA

Discussion of Contaminant Analyses

During initial treatment of soils from the site, products other than gasoline and diesel were noticed in the soil. Informal laboratory results from the treatment cell reported higher than expected levels of diesel after soil treatment. Based on these observations, closer examination of the soil and laboratory results indicated that the soil contained asphaltic concrete, unmixed asphalt (also referred to as tar or bitumen), asphalt shingles, and a material known as blow-down oil.

In an attempt to characterize the material in the soil, six samples were sent to Friedman & Bruya, Inc. of Seattle, Washington. This organization is well known for their work on fingerprinting organic compounds during environmental investigations. The following samples were sent to Friedman & Bruya:

- Contaminated soil from the soil stockpile
- Blow-down oil from another Owens-Corning facility in Martinez
- Asphaltic concrete from the site
- Tar (unmixed asphalt) from the site
- Asphalt shingles from the site
- Asphaltic concrete pieces from the site

Gas chromatography with flame ionization detection (GC-FID) was used to develop characteristic chromatograph fingerprints for each sample as received and as a water soluble fraction for each sample. The chromatograms of these analyses are included in this appendix.

The asphaltic concrete at the site is most likely from site paving. It is a mixture of asphalt and aggregate. This asphalt contains high boiling point compounds, such as those found in refined petroleum products. The gas chromatograph peaks range from approximately C-18[1] to greater than C-35, with a maximum near C-23.

The asphaltic concrete pieces are also likely from site paving. This asphalt contains high boiling point compounds, such as those found in tars and asphalts. The chromatograph is a relatively smooth envelope from approximately C-19 to greater than C-35, with a maximum near C-30. The material appears to be highly weathered,

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1 The designation C-18 refers to the elusion time where the unbranched alkane octadecane ($C_{18}H_{38}$) exits a gas chromatograph.

as indicated by the loss of sharpness of the peaks present. This indicates the formulation of polar compounds associated with weathering processes. Also, the shift of the maximum from C-23 to C-30 indicates breakdown of lighter compounds indicative of aging.

The unmixed asphalt contains high boiling point compounds, such as those found in unrefined petroleum products. The gas chromatograph peaks range from approximately C-19 to greater than C-35, with a maximum near C-30. It appears to be different than the asphalt in the asphaltic concrete.

The asphalt shingles contain high boiling point compounds, such as those found in tars and asphalts. The gas chromatograph peaks range from approximately C-19 to greater than C-35, with a maximum near C-30. Thus, it appears to be related to the asphalt in the unmixed asphalt.

The blow-down oil contains medium to high boiling point compounds, such as those found in heavier liquid fuels such as No. 4 fuel oil. The gas chromatograph peaks range from approximately C-12 to C-33, with a maximum near C-22.

Blow-down oil is formed when air is blown through asphalt flux. The resulting vapors condense as a mixture of water and blow-down oil. Blow-down oil contains more saturated hydrocarbons than the unblown asphalt, but still contains significant amounts of unsaturated hydrocarbons. Approximately half of blow-down oil is saturated compounds and half is divided among aromatic, resin, and asphaltene fractions. Blow-down oil is somewhat oxidized and contains significant amounts of carbonyl groups (C=O). It contains from 1.3% to 2.4% sulfur. The water associated with the blow-down oil has a low pH and may contain iron, sulfates, chlorides, zinc, aluminum and silica.

A review of the chromatographs for blow-down oil, unmixed asphalt, and asphalt shingles suggests that the unmixed asphalt has not been air-blown. It contains more of the lighter fractions which are seen in the blow-down oil chromatograph. The asphalt chromatograph contains peaks at and just beyond the C-30 maximum, which correspond to the peaks in the asphalt shingle chromatograph.

The chromatographs for each soluble fraction show detection of some soluble compounds, even though these compounds are considered insoluble. An explanation is that the detected compounds are adsorbed onto fine clay or glass fiber particles which pass through the 2 micron filter used to remove bulk solids prior to analysis.

APPENDIX C-1

CHROMATOGRAPHIC ANALYSES

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

March 31, 1992

John Lynch, Project Manager
RESNA, Inc.
42501 Albrae Street
Fremont, CA 94538

Dear Mr. Lynch:

Enclosed are the results of the analyses of the samples submitted on March 19, 1992 from Project Remediation Project, Owens-Corning, 4751.

As you will see in the enclosed descriptions, the contaminated soil does not contain material consistent with the presence of diesel fuel or cutter stocks that were expected. It is possible that whatever was there has been remediated, but it is unlikely,, since I would still expect to find material associated with the heavier petroleum fractions still present.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman, Chemist

AJF

Enclosures

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
Date Submitted: March 19, 1992
Project: Remediation Project, Owens-Corning, 4751

RESULTS OF ANALYSES OF THE SOIL SAMPLE FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Contaminated Soil	The gas chromatographic trace showed the presence of medium and high boiling compounds, most closely resembling those found in the tar and asphalt samples (below). This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{12} to *n*-C_{32} with a maximum near *n*-C_{28}. The material appeared to be relatively unweathered weathered as indicated by the sharp delineation of the peaks showing few polar components that are formed during weathering.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
Date Submitted: March 19, 1992
Project: Remediation Project, Owens-Corning, 4751

RESULTS OF ANALYSES OF THE WATER SOLUBLE FRACTION OF THE SOIL SAMPLE FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Contaminated Soil (Water soluble fraction)	The gas chromatographic trace showed the presence of low levels of medium to high boiling compounds, such as those found in the contaminated soil sample analyzed for total solvent extractable material (above). This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{16} to *n*-C_{28} with a maximum near *n*-C_{25}. The material appeared to be relatively unweathered as indicated by the sharp delineation of the peaks showing few polar components that are formed during weathering. The shift to slightly lower boiling components is typical of water soluble fractions. The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
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Project: Remediation Project, Owens-Corning, 4751

RESULTS OF ANALYSES OF THE PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Blow-Down Oil	The gas chromatographic trace showed the presence of medium to high boiling compounds, such as those found in heavier diesel fuels such as a No. 4 Fuel oil. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{12} to *n*-C_{33} with a maximum near *n*-C_{22}. The material appeared to be unweathered, as indicated by the even distribution of the *n*-alkanes, the high proportions of *n*-C_{17} to Pristane and *n*-C_{18} to Phytane, and the sharp nature of the peaks present, indicating little formation of polar compounds associated with degradative weathering processes.
Asphalt	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in refined petroleum products such as motor oils and asphalts. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{18} to >*n*-C_{35} with a maximum near *n*-C_{23}. The material appeared to be unweathered, as indicated by the sharp nature of the peaks present showing little sign of degradative weathering.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
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RESULTS OF ANALYSES OF THE PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Asphalt Shingle	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in tars and asphalts. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{19} to >*n*-C_{35} with a maximum near *n*-C_{30}. The material appeared to be somewhat weathered, as indicated by the loss of the sharp nature of the peaks present, indicating some formation of polar compounds associated with degradative weathering processes. The fact that the maximum abundance appears so far out in the chromatogram suggests that a considerable portion of this material may not be represented in the chromatogram, being higher boiling than is suitable for these parameters.
Tar	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in unrefined petroleum products such as heavy tars. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{19} to >*n*-C_{35} with a maximum near *n*-C_{30}. The material appeared to be unweathered, as indicated by the sharp nature of the peaks present showing little sign of degradative weathering. Again, the fact that the maximum abundance appears so far out in the chromatogram suggests that a considerable portion of this material may not be represented in the chromatogram, being higher boiling than is suitable for these parameters.

FRIEDMAN & BRUYA, INC.

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RESULTS OF ANALYSES OF THE PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Asphalt Pieces	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in tars and asphalts. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{19} to >*n*-C_{35} with a maximum near *n*-C_{30}. The material appeared to be highly weathered, as indicated by the loss of the sharp nature of the peaks present, indicating formation of polar compounds associated with degradative weathering processes. The fact that the maximum abundance appears so far out in the chromatogram suggests that a considerable portion of this material may not be represented in the chromatogram, being higher boiling than is suitable for these parameters.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
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RESULTS OF ANALYSES OF THE WATER SOLUBLE FRACTION OF PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Blow-Down Oil	The gas chromatographic trace showed the presence of medium boiling compounds, such as those found in the water soluble fractions of heavier petroleum products. such as a No. 4 Fuel oil or Bunker Oil. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_8 to *n*-C_{22} with a maximum near *n*-C_{15}. The major peaks present appear to be polynuclear aromatic hydrocarbons centered around phenanthrene. The material appeared to be unweathered, as indicated by the sharp nature of the peaks present, indicating little formation of polar compounds associated with degradative weathering processes.
3 rings	The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
Date Submitted: March 19, 1992
Project: Remediation Project, Owens-Corning, 4751

RESULTS OF ANALYSES OF THE WATER SOLUBLE FRACTION OF PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Asphalt	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in refined petroleum products such as motor oils and asphalts. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{15} to *n*-C_{32} with a maximum near *n*-C_{22}. The material appeared to be unweathered, as indicated by the sharp nature of the peaks present showing little sign of degradative weathering. Little definition of individual compounds is seen in this sample, which is unusual in water soluble fractions, suggesting that we may be seeing entrained material associated with fine particles that passed through the glass-fiber filters. The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: March 31, 1992
Date Submitted: March 19, 1992
Project: Remediation Project, Owens-Corning, 4751

RESULTS OF ANALYSES OF THE WATER SOLUBLE FRACTION OF THE PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Asphalt Shingle	The gas chromatographic trace showed the presence of high boiling compounds, such as those found in tars and asphalts. This characterization is based on the presence of a relatively smooth envelope of peaks present from ca *n*-C_{19} to >*n*-C_{35} with a maximum near *n*-C_{30}. The material appeared to be somewhat weathered, as indicated by the loss of the sharp nature of the peaks present, indicating some formation of polar compounds associated with degradative weathering processes. The fact that the maximum abundance appears so far out in the chromatogram suggests that a considerable portion of this material may not be represented in the chromatogram, being higher boiling than is suitable for these parameters. Little definition of individual compounds is seen in this sample, which is unusual in water soluble fractions, suggesting that we may be seeing entrained material associated with fine particles that passed through the glass-fiber filters. The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.

FRIEDMAN & BRUYA, INC.

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RESULTS OF ANALYSES OF THE WATER SOLUBLE FRACTION OF THE PRODUCT SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING FLAME IONIZATION DETECTION (FID)

Sample #	GC Characterization
Tar	The gas chromatographic trace showed an absence of significant levels of volatile or semi-volatile compounds. The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.

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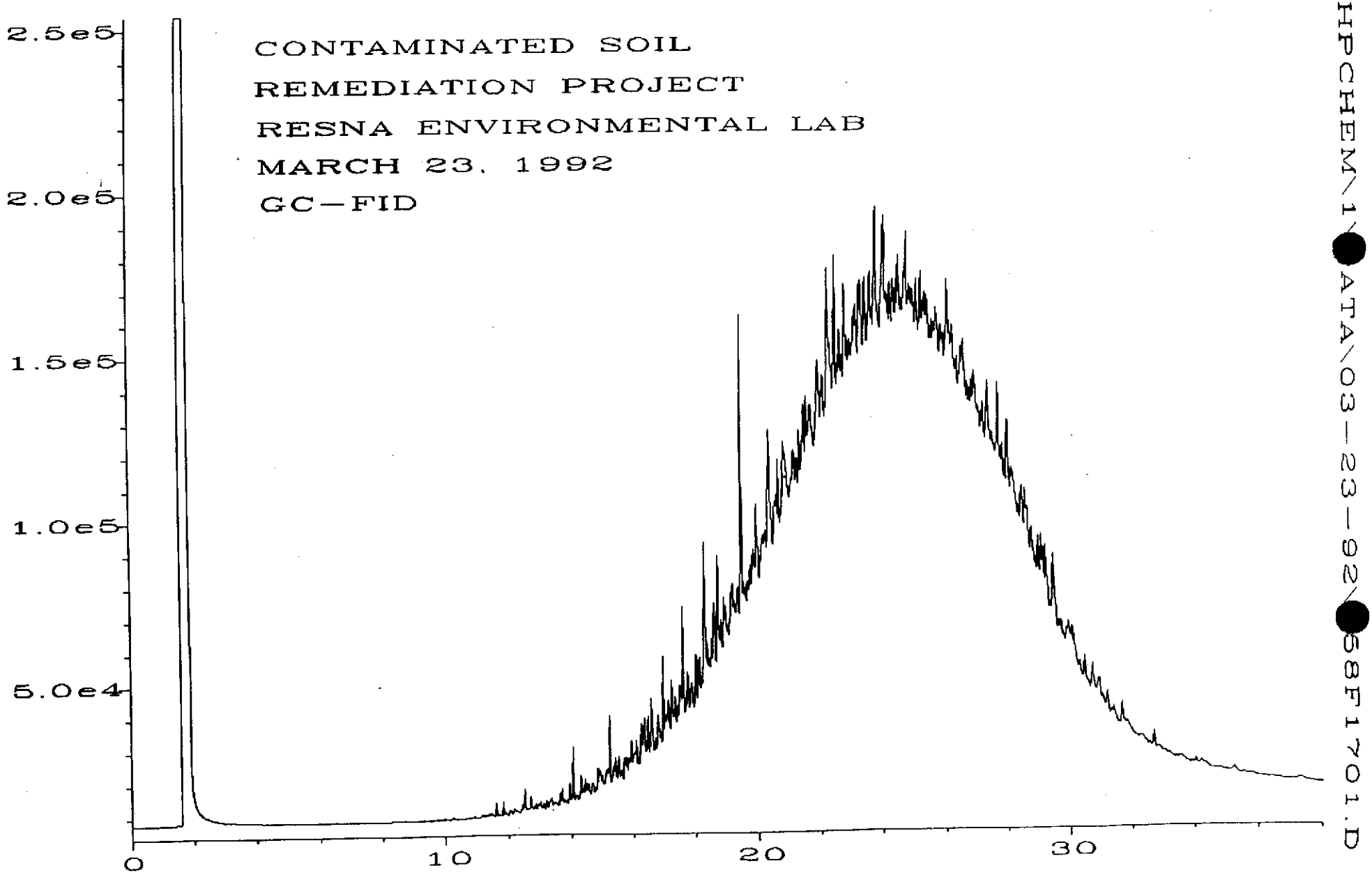
Sample #	GC Characterization
Asphalt Pieces	The gas chromatographic trace showed the presence of low, medium and high boiling compounds, such as those found in the water soluble fractions of gasoline, aged diesels and higher boiling products such as asphalt or tar. This characterization is based on the presence of a relatively low level of toluene, and xylenes in the front end of the chromatogram, followed by somewhat higher levels of what appear to be naphthalene and methyl-naphthalenes, and then a smooth envelope of peaks present from ca *n*-C_{16} to >*n*-C_{35} with a maximum near *n*-C_{30}, punctuated by higher levels of individual components in a pattern typical of the water soluble fractions of petroleum products. The material appeared to be somewhat weathered, as indicated by the loss of the alkylated polynuclear aromatic hydrocarbons that are somewhat more available for biodegradation than their less alkylated homologues. The fact that the maximum abundance appears so far out in the chromatogram suggests that a considerable portion of this material may not be represented in the chromatogram, being higher boiling than is suitable for these parameters. The unresolved nature of much of the later eluting material suggests that we may be looking at particulate associated material that passed through the glass-fiber filters. The large peak seen at 24 minutes is tert-phenyl, a compound that we add as a QA/QC check.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REMEDIATION PROJECT
RESNA ENVIRONMENTAL LAB
MARCH 23, 1992
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10
20
30
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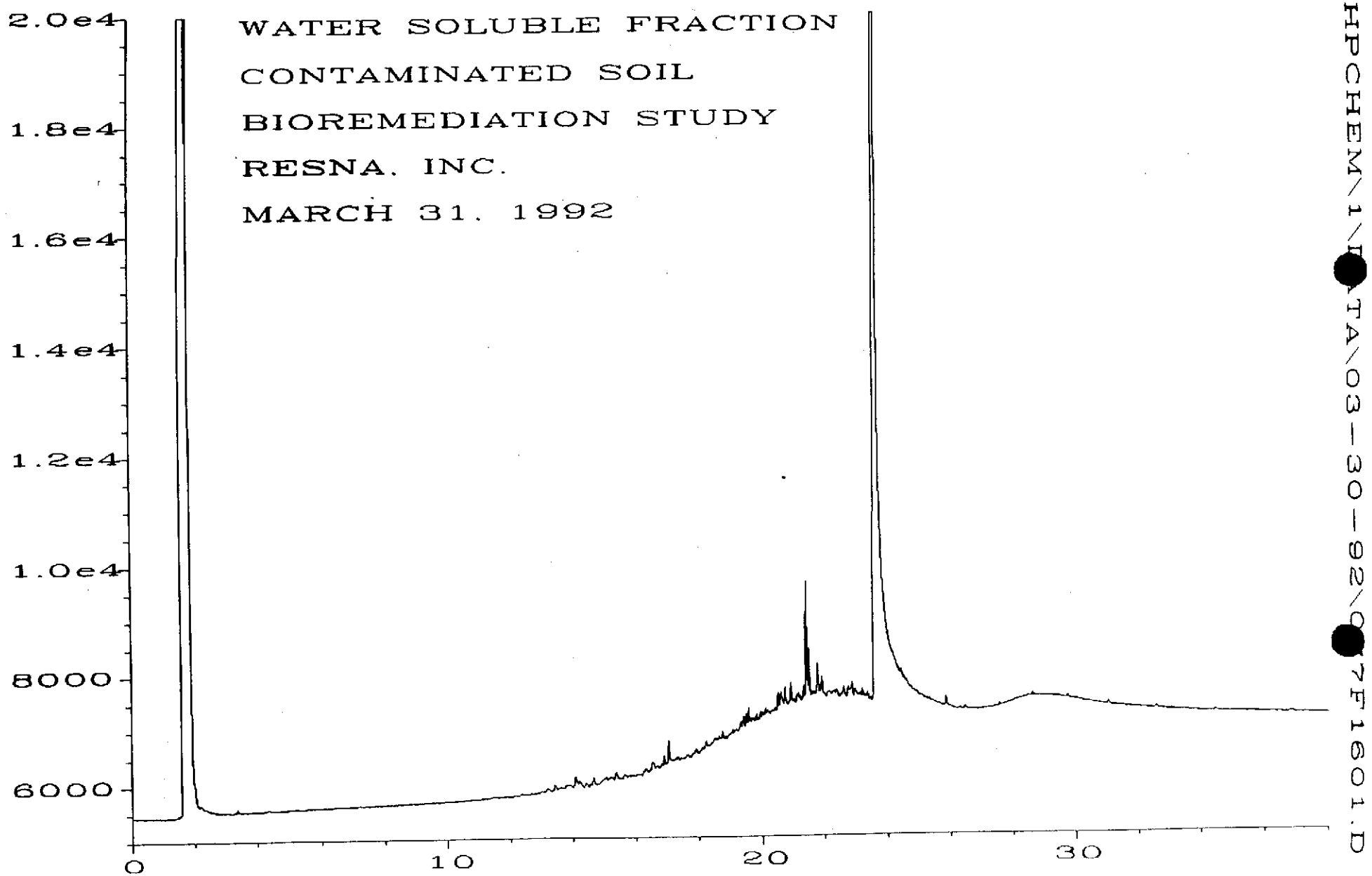
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BIOREMEDIATION STUDY
RESNA. INC.
MARCH 31. 1992
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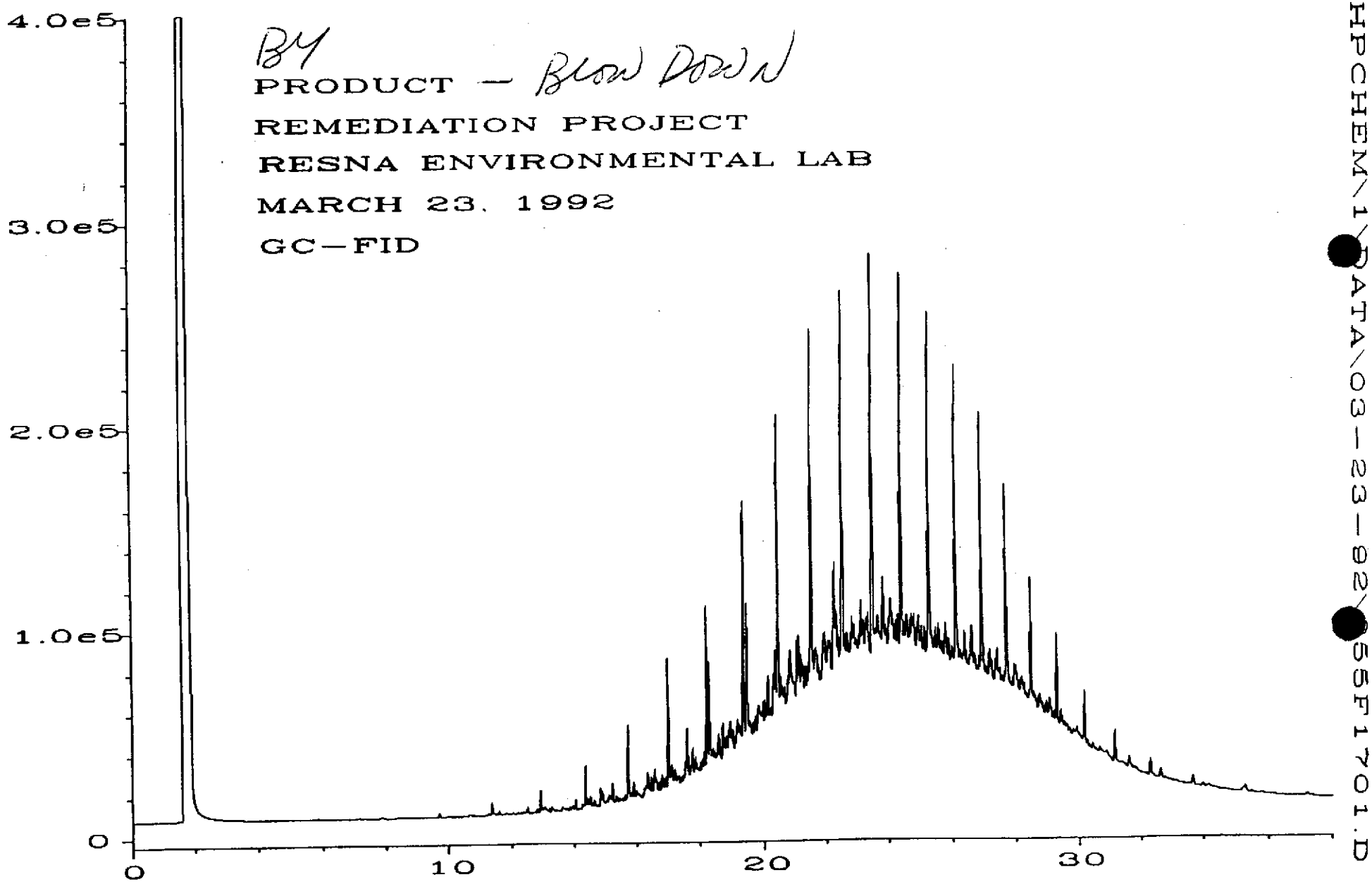
BY
PRODUCT — Blow Down
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RESNA ENVIRONMENTAL LAB
MARCH 23, 1992
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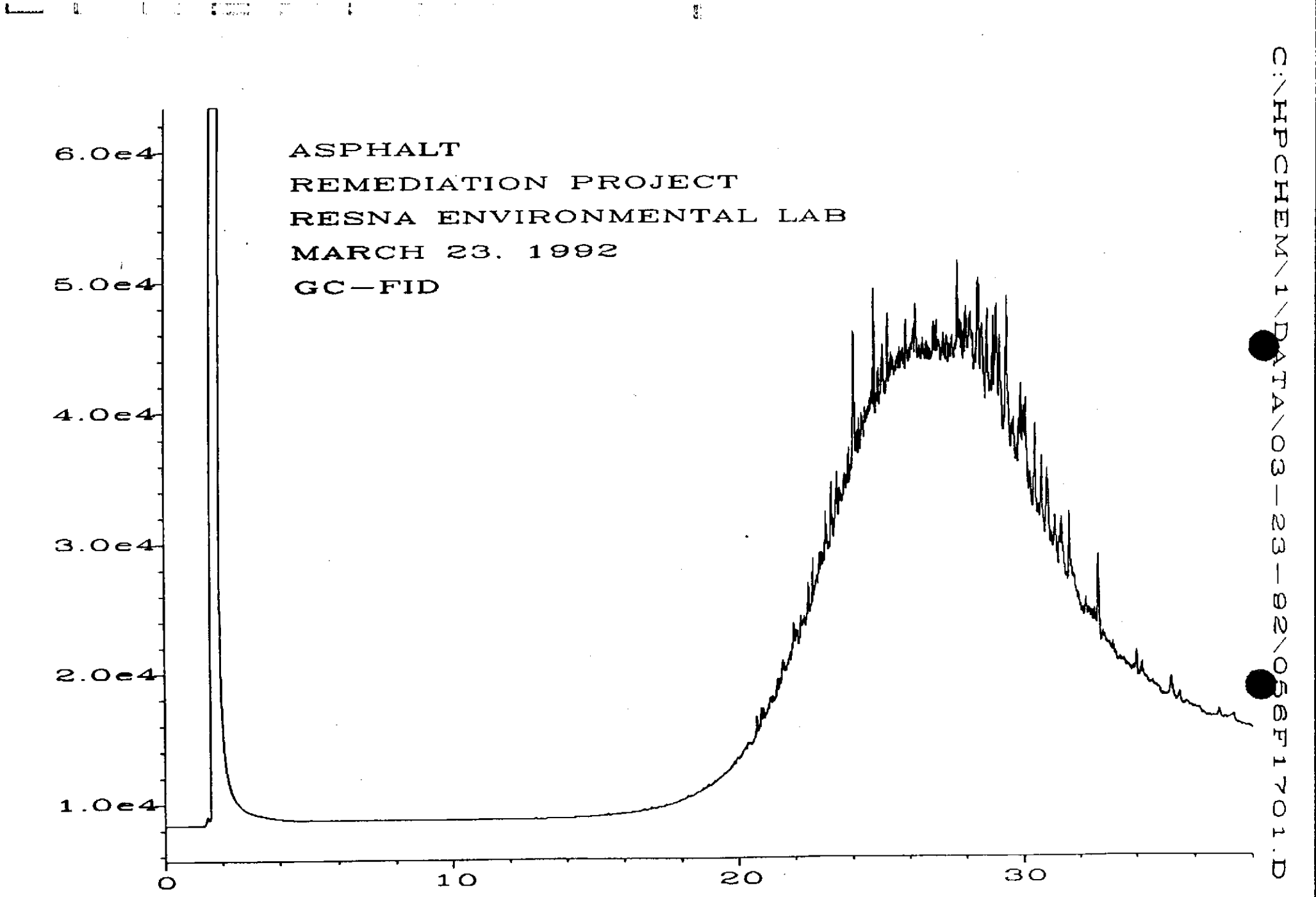
ASPHALT
REMEDIATION PROJECT
RESNA ENVIRONMENTAL LAB
MARCH 23. 1992
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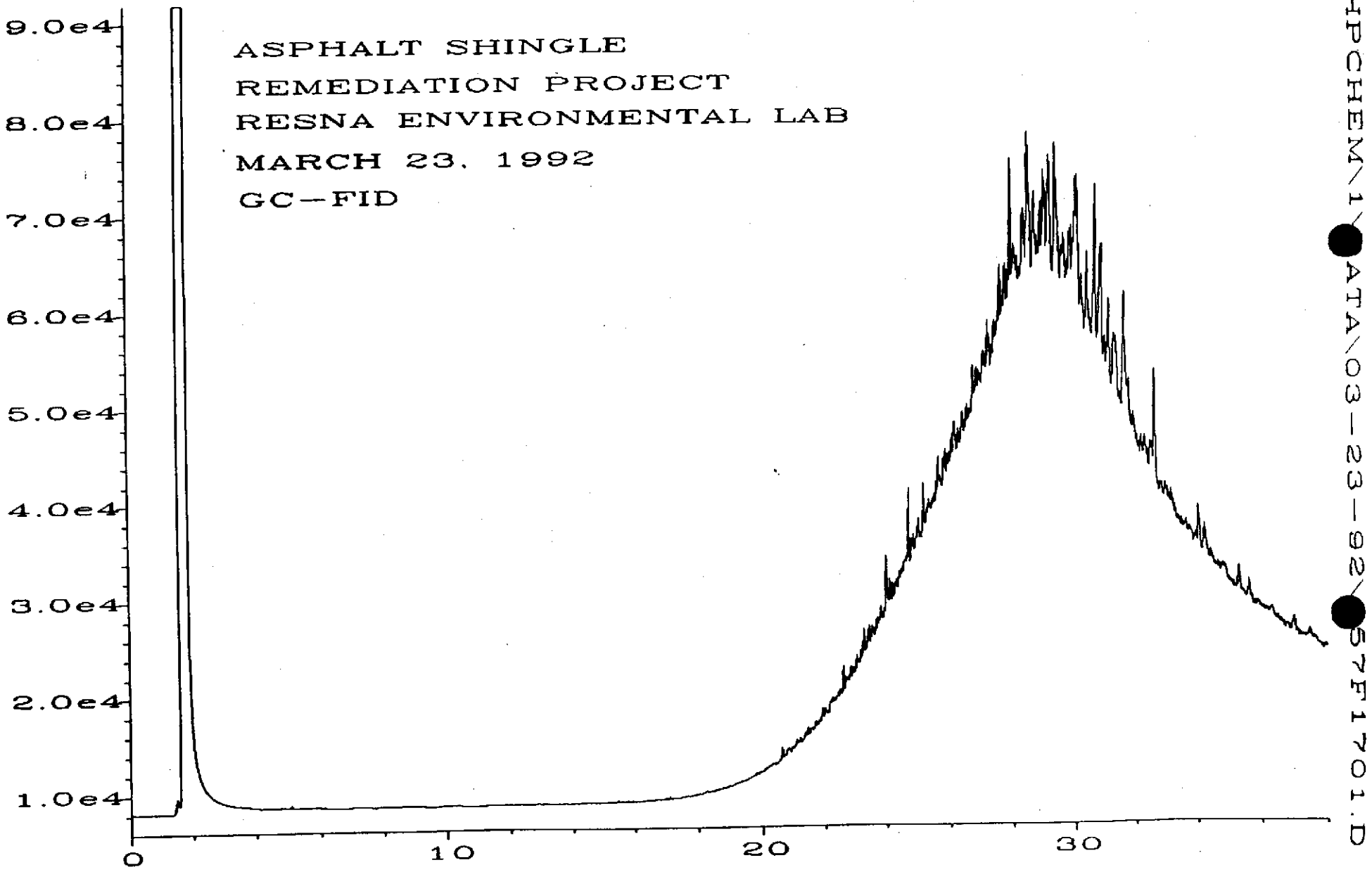
ASPHALT SHINGLE
REMEDIATION PROJECT
RESNA ENVIRONMENTAL LAB
MARCH 23, 1992
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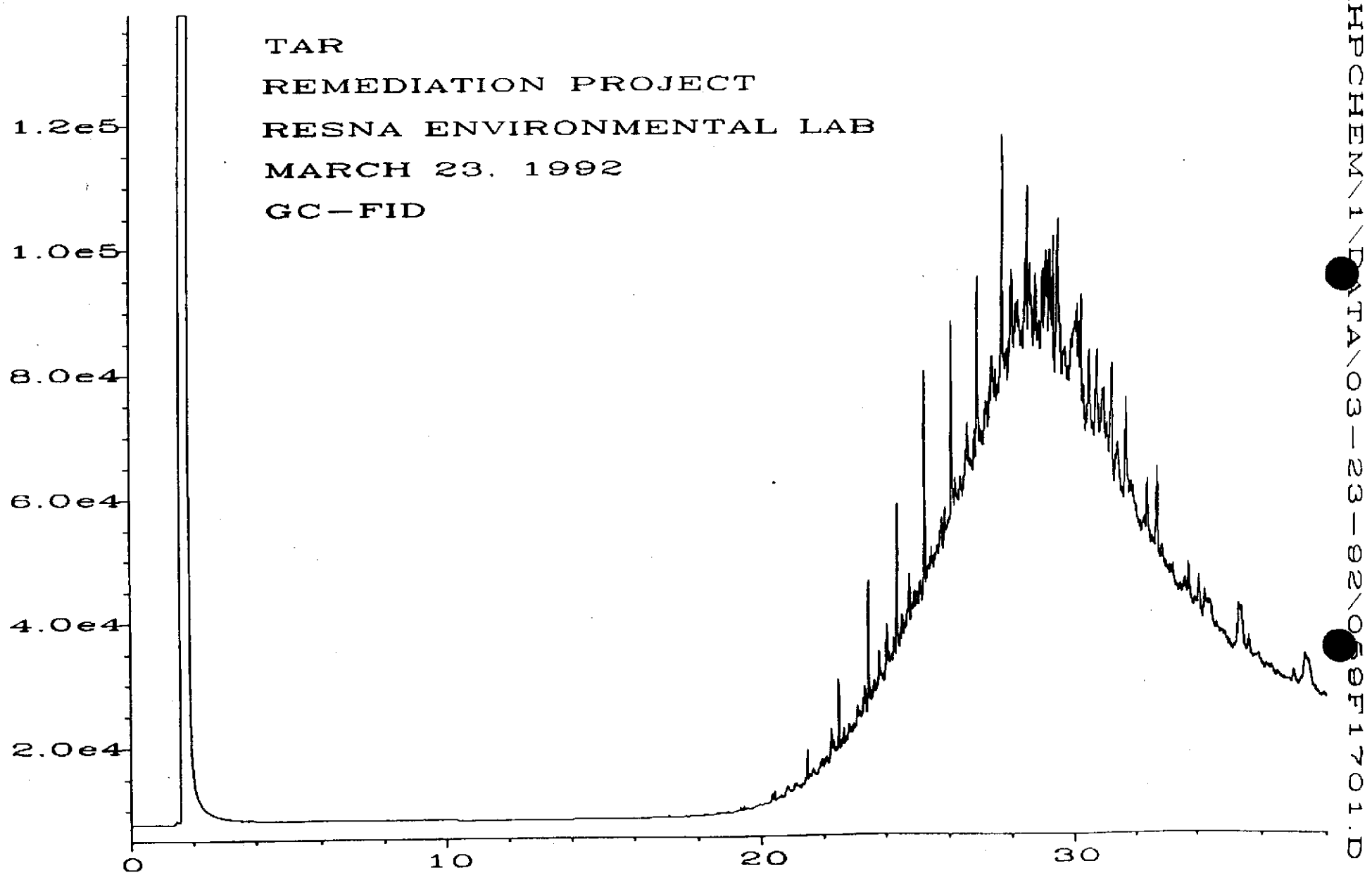
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REMEDIATION PROJECT
RESNA ENVIRONMENTAL LAB
MARCH 23. 1992
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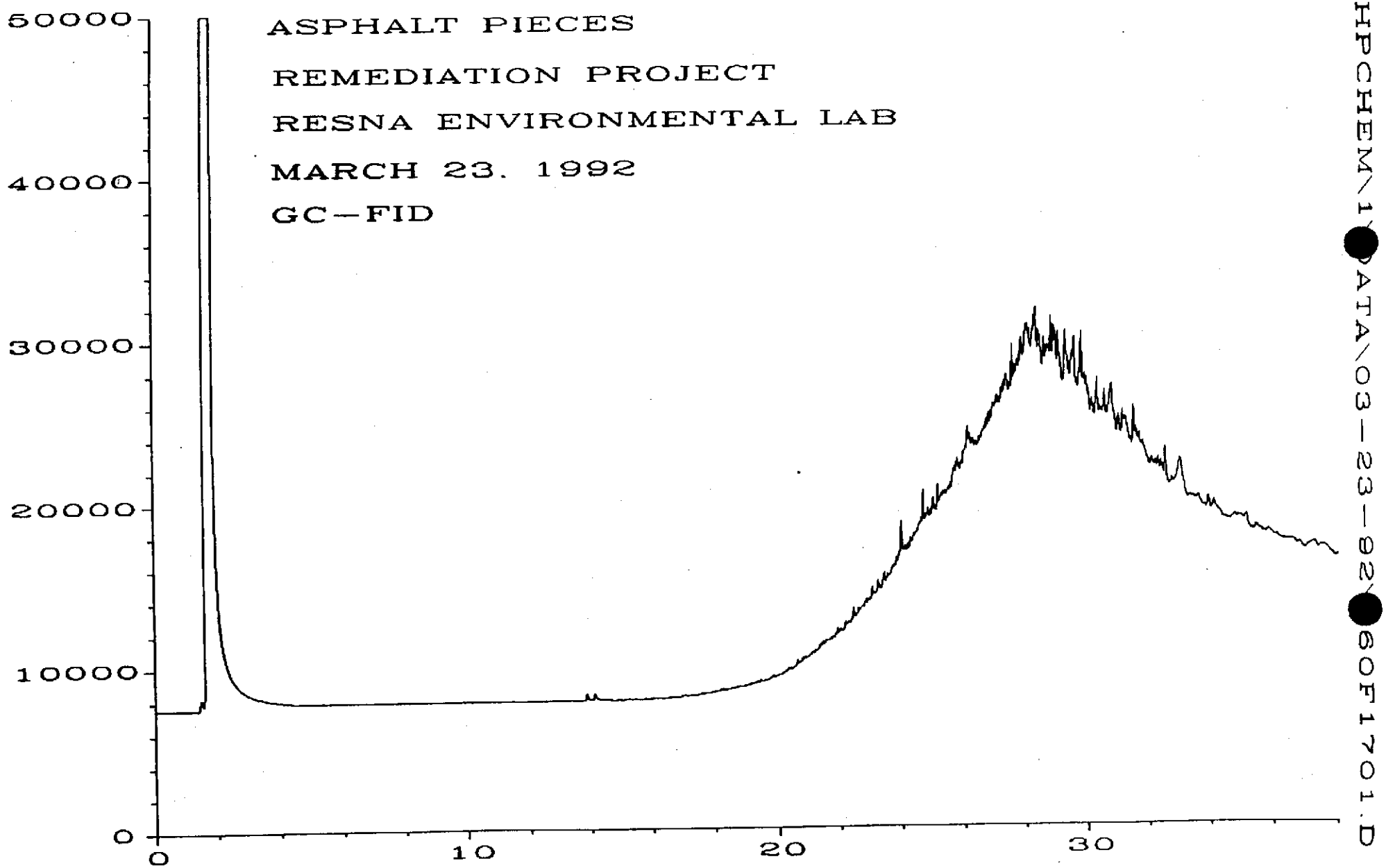
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REMEDIATION PROJECT
RESNA ENVIRONMENTAL LAB
MARCH 23. 1992
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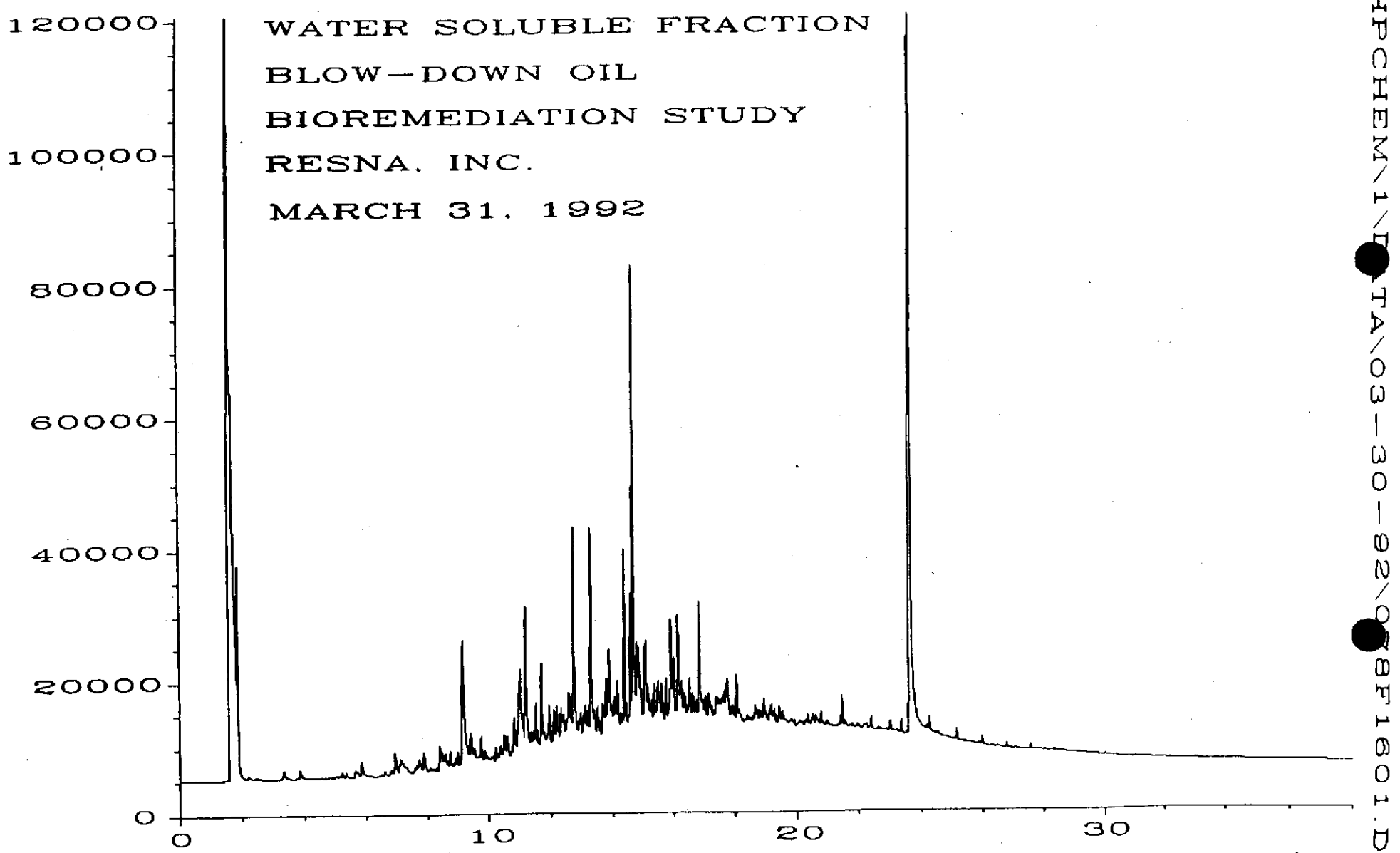
WATER SOLUBLE FRACTION
BLOW-DOWN OIL
BIOREMEDIATION STUDY
RESNA. INC.
MARCH 31. 1992
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40000
20000
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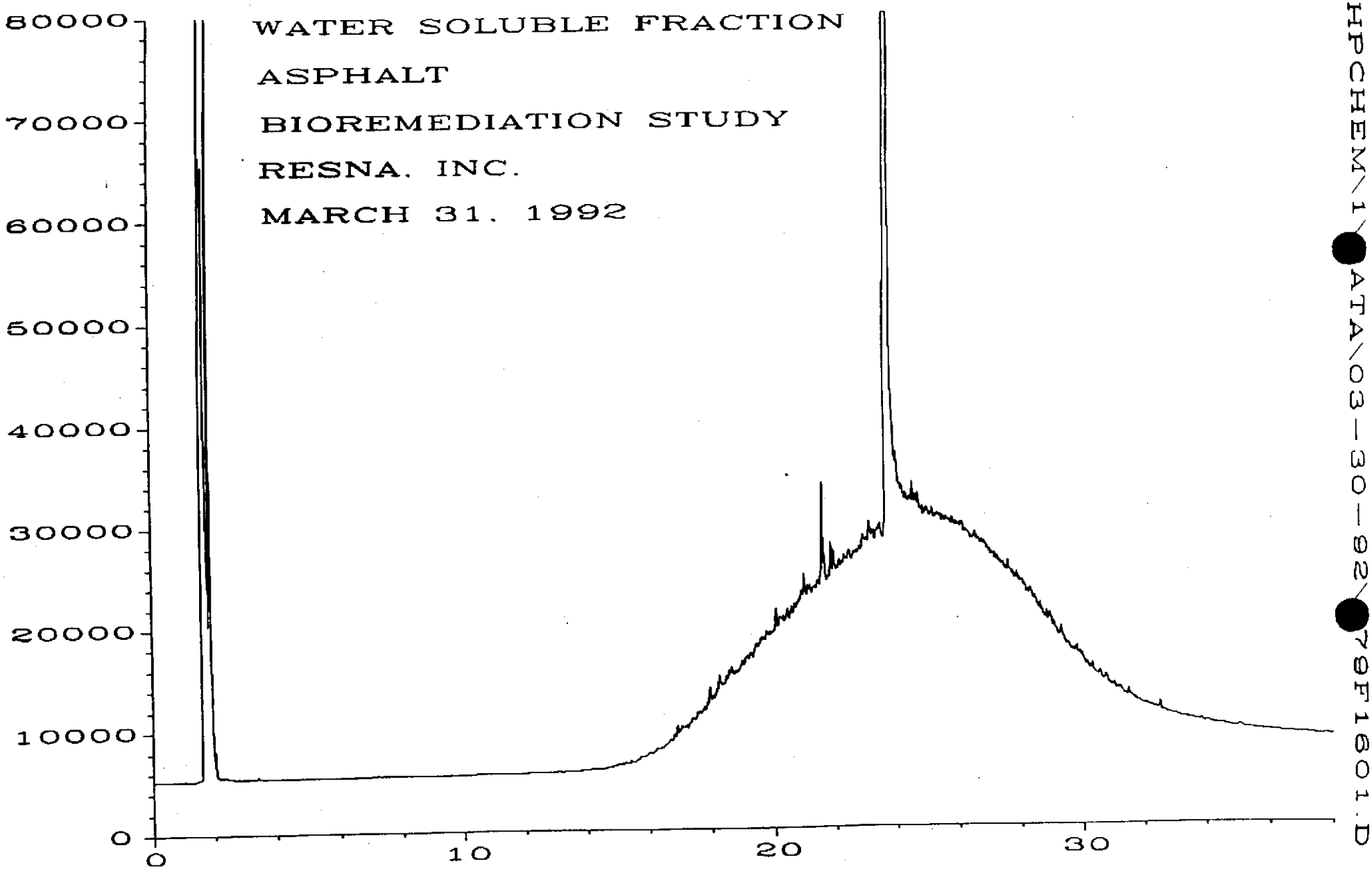
WATER SOLUBLE FRACTION
ASPHALT
BIOREMEDIATION STUDY
RESNA. INC.
MARCH 31. 1992
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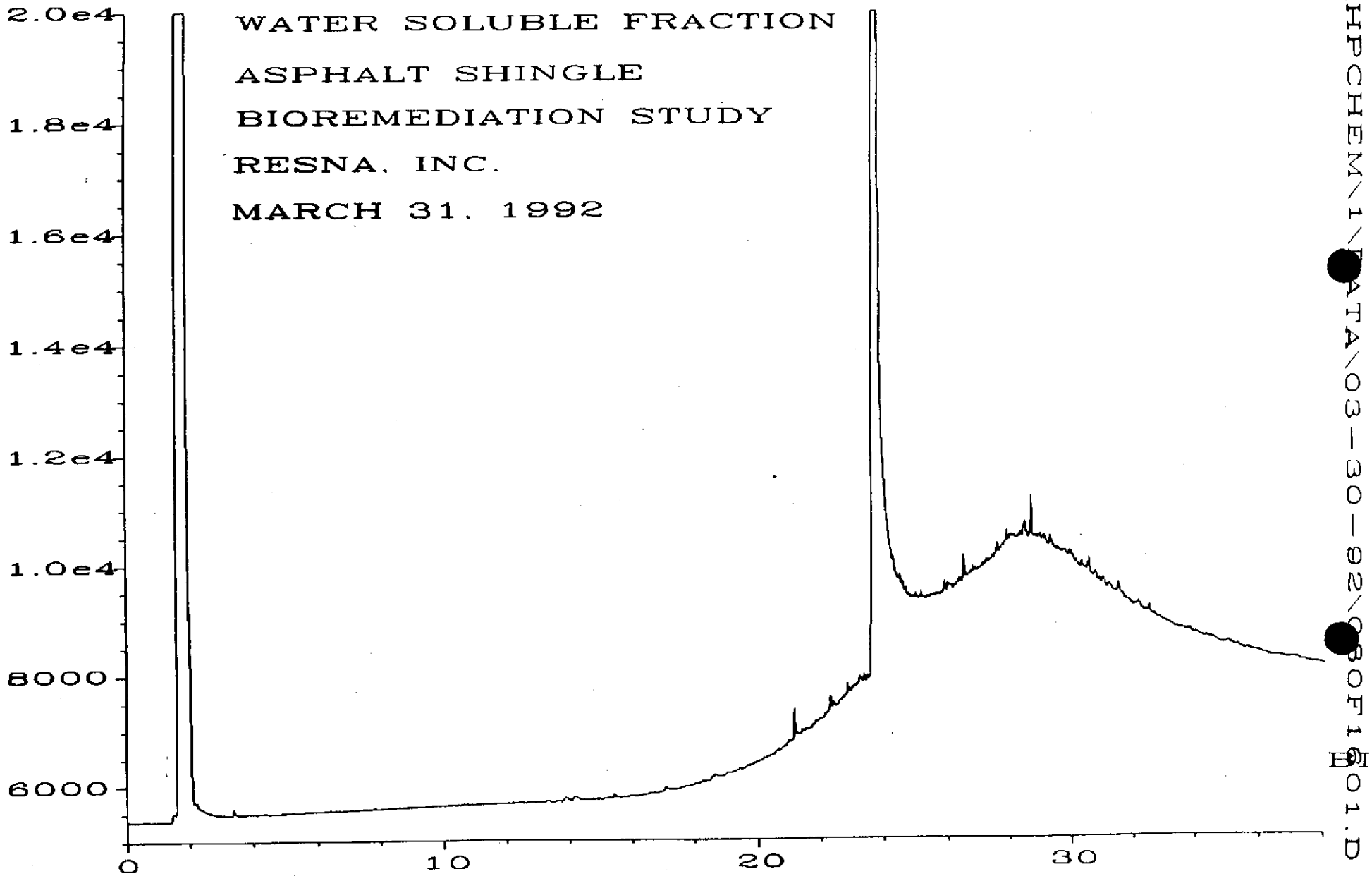
WATER SOLUBLE FRACTION
ASPHALT SHINGLE
BIOREMEDIATION STUDY
RESNA. INC.
MARCH 31. 1992
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1.4e4
1.2e4
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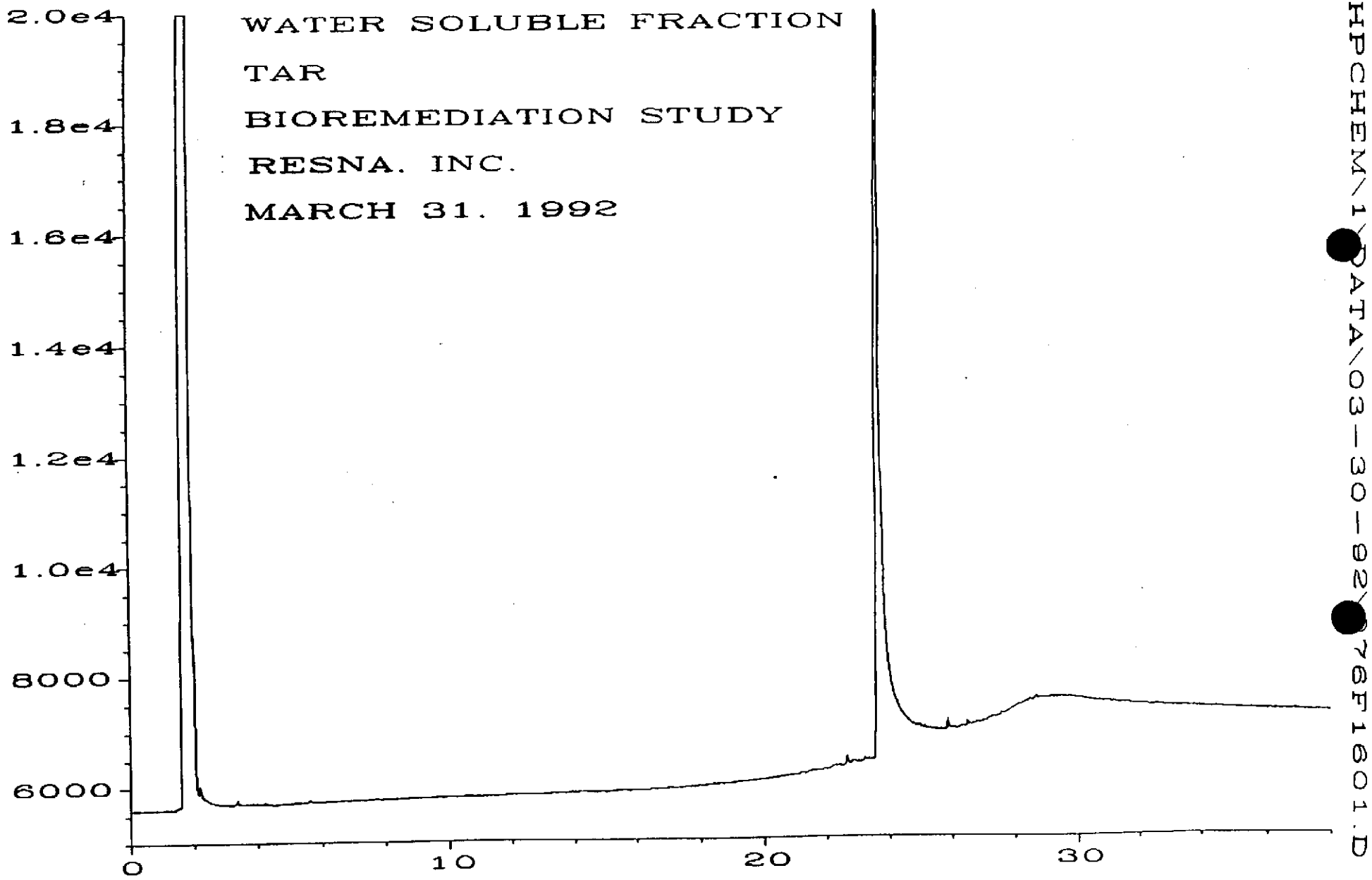
WATER SOLUBLE FRACTION
TAR
BIOREMEDIATION STUDY
RESNA. INC.
MARCH 31. 1992
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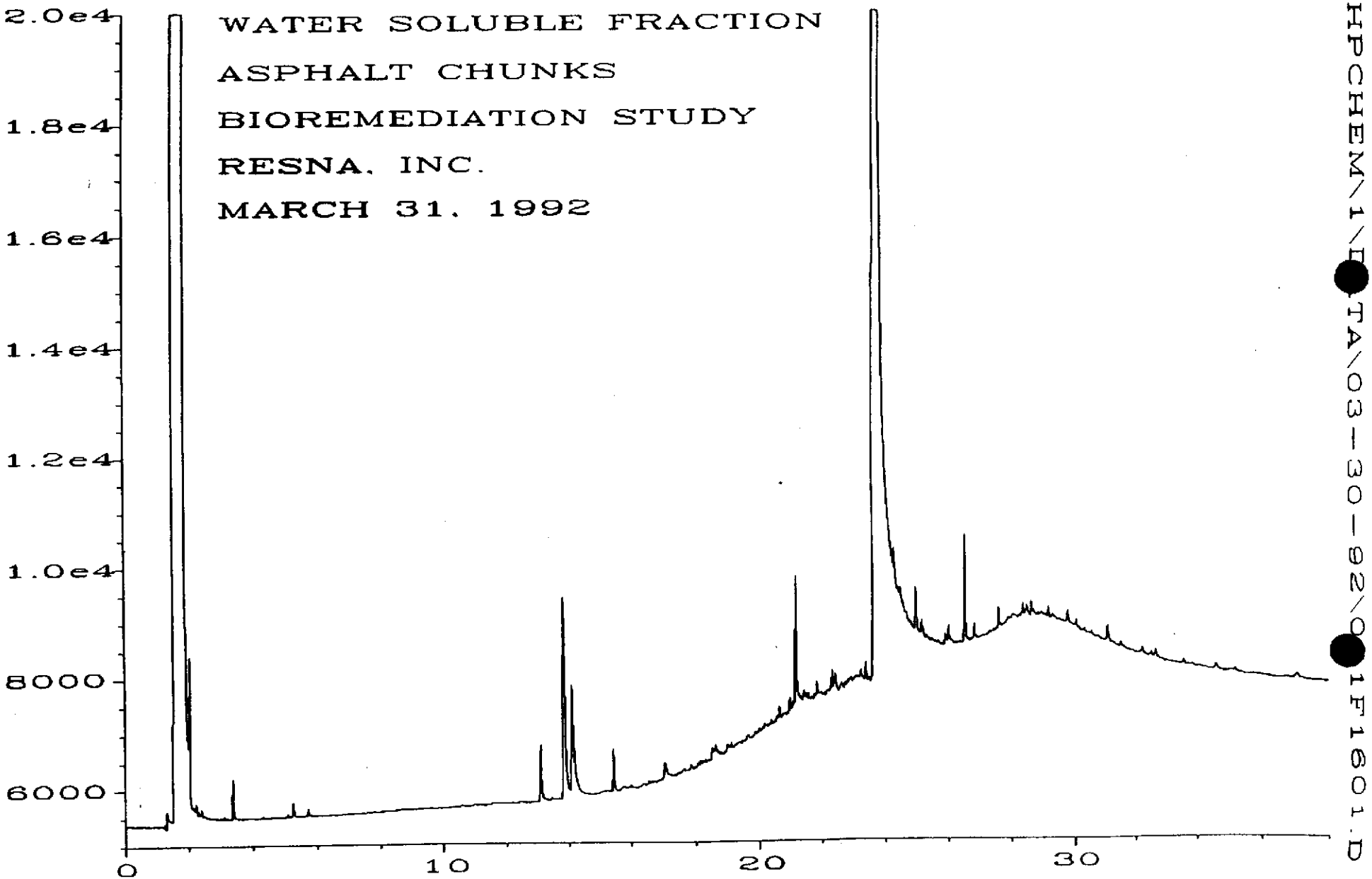
WATER SOLUBLE FRACTION
ASPHALT CHUNKS
BIOREMEDIATION STUDY
RESNA, INC.
MARCH 31, 1992
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1.4e4
1.2e4
1.0e4
8000
6000
0
10
20
30
C:\HPCHEM\1\DATA\03-30-92\01F1601.D

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

April 1, 1992

John Lynch, Project Manager
RESNA, Inc.
42501 Albrae Street
Fremont, CA 94538

Dear Mr. Lynch:

In further investigation of the levels of contamination at your Owens-Corning bioremediation site, I am forwarding chromatograms for gasoline and diesel standards run on the same gas chromatographic method as your samples. In comparing those generated from your samples, please note that the water soluble fractions are concentrated 250-fold.

The physical examination of the sample for particulates indicates that the material present is almost all quite small in nature and easily passes a 20 mesh screen, suggesting that the material present is not large pieces of asphalt, but material much more finely divided. It appears to be viscous material like the tar mixed with firm sand.

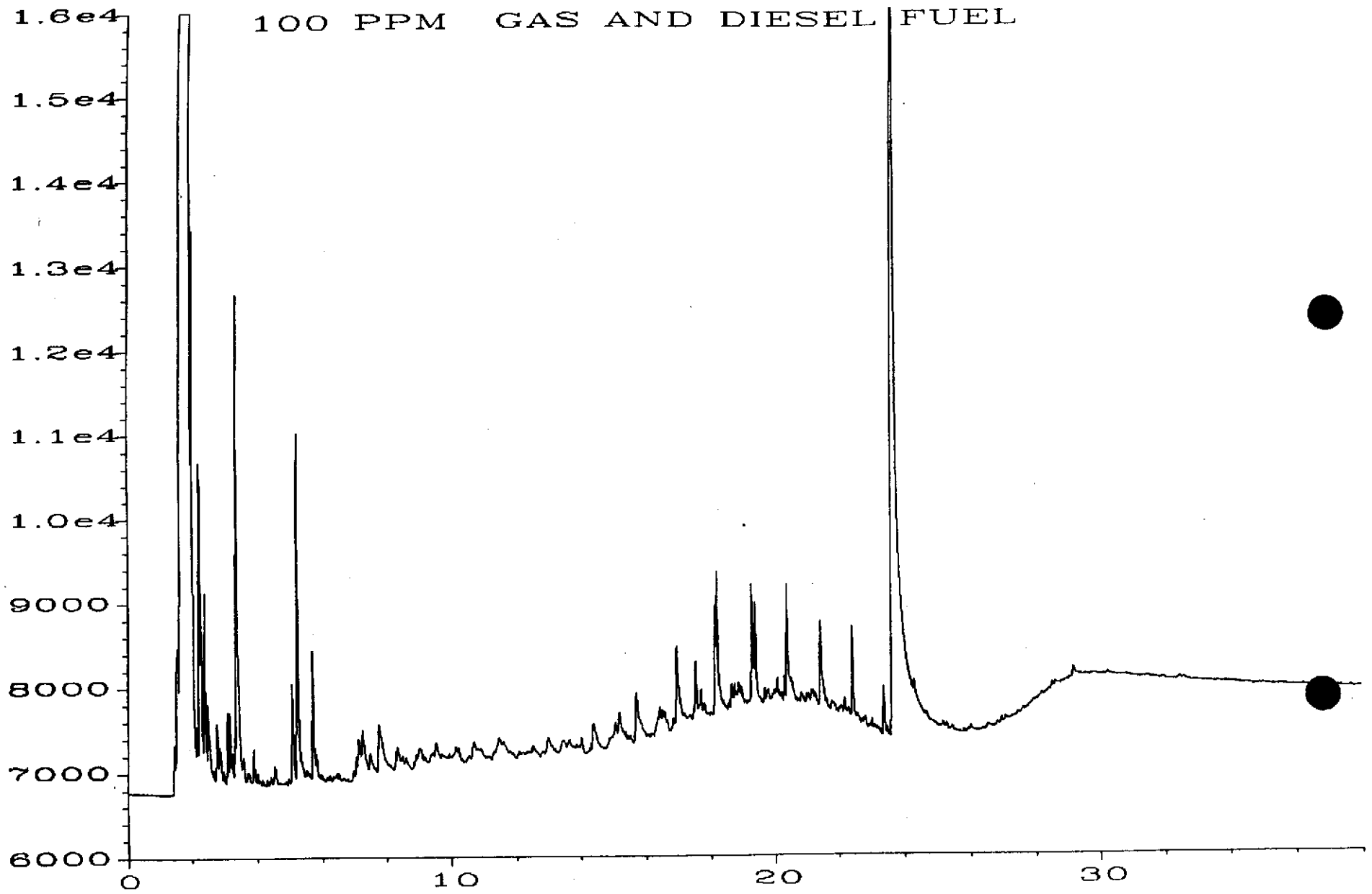
We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman
Chemist

AJF/dp

Enclosures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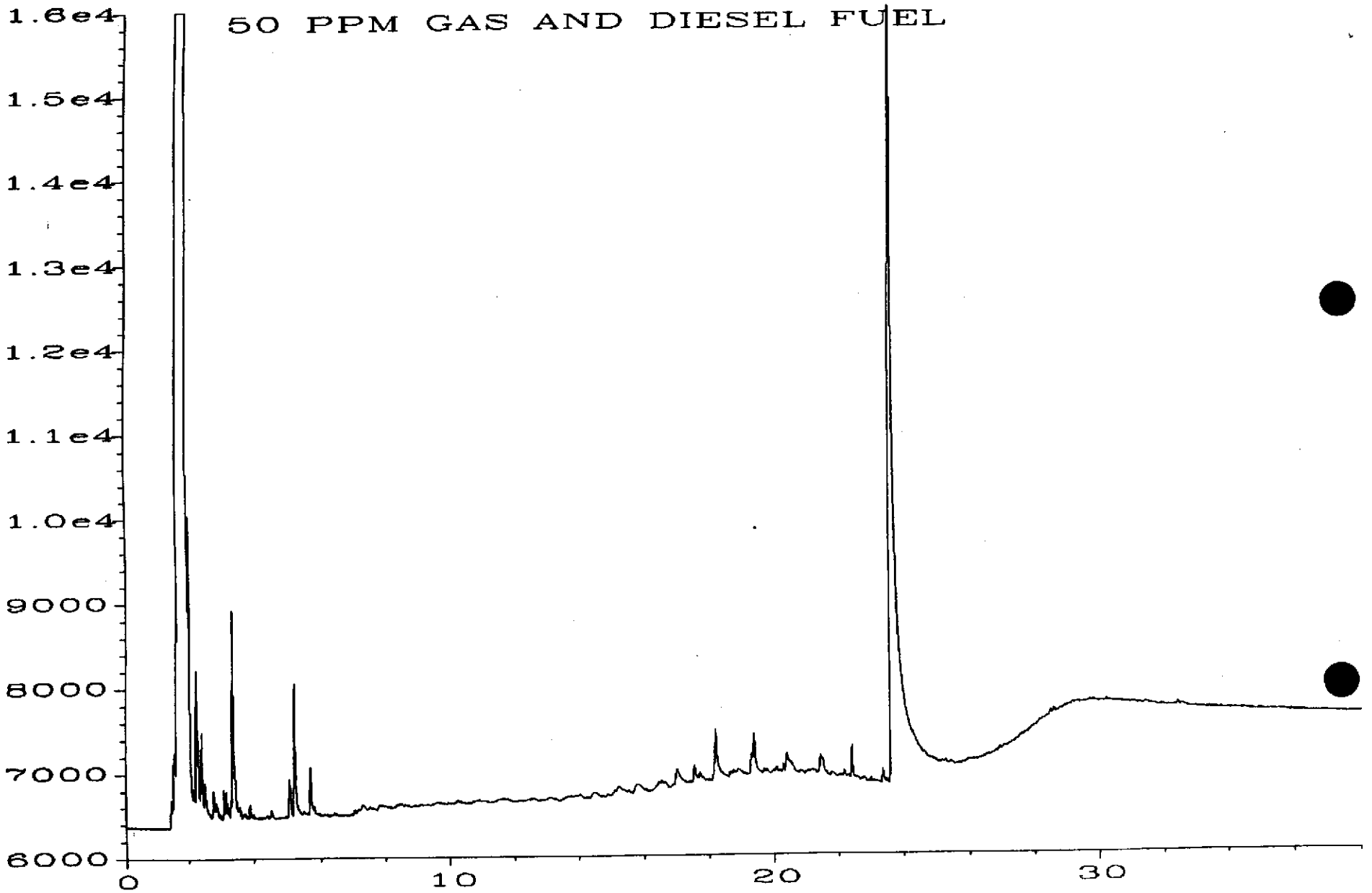
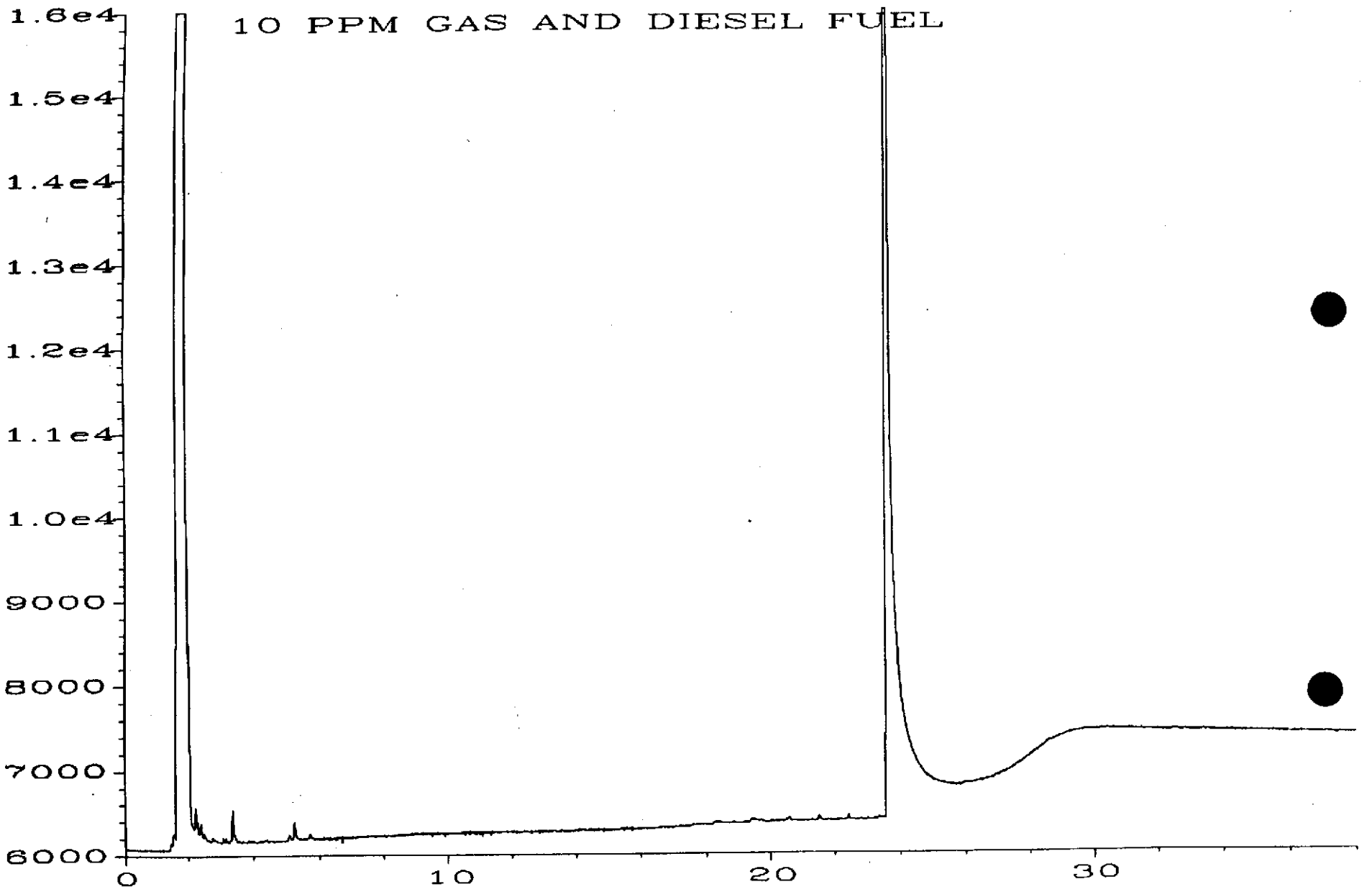
1.5e4
1.4e4
1.3e4
1.2e4
1.1e4
1.0e4
9000
8000
7000
6000
0
10
20
30


50 PPM GAS AND DIESEL FUEL
1.6e4
1.5e4
1.4e4
1.3e4
1.2e4
1.1e4
1.0e4
9000
8000
7000
6000
0
10
20
30


10 PPM GAS AND DIESEL FUEL
1.6e4
1.5e4
1.4e4
1.3e4
1.2e4
1.1e4
1.0e4
9000
8000
7000
6000
0
10
20
30