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September 9, 2003

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DELIVERY ORDER: 01
SUBMITTAL OF DELIVERABLES – Letter Data Report, Task RI-8, Petroleum Hydrocarbon Assessment of Centredale Sediment Cores, Centredale Manor Restoration Project Superfund Site

Dear Ms. Borochaner:

Enclosed please find two (2) copies of the Letter Data Report for the Centredale Manor Restoration Project Superfund Site for your review. This letter summarizes the results of analytical work performed by Battelle on five sediment core samples collected at the site in May 2003. The primary purpose of this investigation is to characterize selected sediment core samples from Allendale and Lyman Mill Ponds. Briefly, sediment core samples were collected at Allendale and Lyman Mill Ponds from May 6 to May 9, 2003. Sediment cores were processed and sub-samples from various depth intervals were removed for radiodating, dioxin and geotechnical testing; results from these analyses will be reported separately. Core processing showed that many cores collected at Lyman Mill Pond were noticeably different from Allendale Pond cores. Specifically, the top layer (1 to 2 ½ ft) of sediment in many of the Lyman Mill Pond cores consisted of an unconsolidated, black, oily material with a petroleum smell. Core logs for all sediment samples were reviewed and five samples were selected for petroleum hydrocarbon assessment to determine whether the sediment material in this top layer was natural or man-made.

Samples

Samples selected for petroleum hydrocarbon characterization are presented in Table 1, and sample locations are presented in Figures 1a and 1b. Samples were analyzed in the laboratory for total petroleum hydrocarbon (TPH) content, alkanes, and isoprenoids, polycyclic aromatic hydrocarbons (PAH) and biomarkers. Sample analysis methods are described below.

Methods

The five sediment samples were extracted in one analytical batch according to Battelle SOP 5-307, *Soil/Sediment Extraction for Petroleum Contaminant Analysis Using the Accelerated Solvent Extractor*. A high-resolution fingerprint (nC8-nC40) of all samples was generated using a gas chromatograph equipped with a flame ionization detector (GC/FID). All extracts were also analyzed for parent and alkylated PAHs (Table 2) and biomarker signatures using gas chromatography/mass spectrometry operated in the selected ion monitoring mode (GC/MS/SIM).

Results and Discussion

The high-resolution hydrocarbon fingerprints (GC/FID) indicated the presence of three hydrocarbon types in the five samples from the Allendale and Lyman Mill Pond sediments (Figure 2).

- Plant waxes constituted the largest peaks. These compounds included normal alkanes containing 27 to 35 carbons per compound and a pronounced enrichment of odd over even carbon chain lengths (see the profile of peaks 27 to 35 in Figures 2a to 2d). The differences in the profile of the waxes likely indicated the presence of varying plant species and environmental degradation.

- The unresolved complex mixture (UCM) indicated the presence of weathered residual petroleum, motor oil drippings, asphalt, or a combination of these materials. The UCM contour of CMS-SD-4223 (boring ID 120b) was superimposed on the other field and reference samples to illustrate the subtle differences in the UCM composition. These small differences suggested the presence of varying levels of asphalt, motor oil, and residual petroleum. The UCM profiles resembled common urban background signatures (compare Figures 2a to 2d with 2e).

- Low levels of recalcitrant PAH compounds, like fluoranthene (F) and pyrene (P), originated from sources of partially combusted organic material; for example, building fires, vehicular exhaust, tar products and others. The relative abundances of these analytes resembled the urban sediment reference material (compare Figures 2a to 2d with 2e). The similar relative abundance of fluoranthene and pyrene in the study samples suggested a shared anthropogenic PAH origin.

The detailed PAH data complemented the high-resolution hydrocarbon fingerprints in several respects.

- The most abundant PAH were fluoranthene and pyrene in all field and urban sediment reference samples. In part, this PAH maximum typically results from the environmental weathering of 2- and 3-ring PAH as illustrated in Figure 3a.

- Similarly, the field and reference samples shared a pyrogenic[1] PAH profile. Notice the downwardly sloping contour of the alkylation series for phenanthrene/anthracene, fluoranthene/pyrene, and benz(a)anthracene/chrysene. This downwardly sloping contour illustrated a declining relative abundance with increasing alkylation level as illustrated in Figure 3b.

- Also, the field and reference samples contained relatively high levels of pyrogenic 5- and 6-ring PAH as illustrated in Figure 3c.

[1] The term, "pyrogenic," refers to the formation of PAH during the partial combustion or pyrolysis of organic matter (Emsbo-Mattingly et al., 2002). A pyrogenic PAH pattern exhibits a high abundance of parent relative to alkylated PAH; e.g., in the absence of weathering, PAH homologues with no alkyl groups are more abundant than those containing one alkyl group. In turn, the PAH with increasing alkyl groups progressively decline in relative abundance. By contrast, the term "petrogenic" refers to the formation of PAH during petroleum or coal generation (Stout, et al., 2002). A petrogenic PAH pattern exhibits low parent abundance relative to its alkylated homologues; e.g., PAH homologues with no alkyl groups are less abundant than PAH with one to three alkyl groups. The homologues with 2 or 3 alkyl groups are often the most abundant in a petrogenic PAH profile.

- However, the pyrogenic PAH in CMS-SD-4223 (boring ID 120b) differed slightly in the low abundance of benzo(a)pyrene relative to benzo(e)pyrene (compare Figures 3a to 3b through 3d). This subtle difference may indicate a slightly different source of pyrogenic PAH. Additional samples would help determine if this difference was localized to this sample or generally applicable to Allendale Pond.

- The higher abundance of perylene (PER) relative to dibenz(a,h)anthracene (DA) in LPX-SD-4203 (boring ID 188c) suggested slightly higher diagenetic rates of plant material in the southern reaches of Lyman Mill Pond (Figure 3d).

The triterpane biomarker fingerprints exhibited a high degree of similarity as well (Figure 4).

- The field samples possessed a wide range of triterpanes (tricyclics through homohopanes). The relative abundances of source specific analytes (e.g., Ts to Tm and NH to H) remained fairly constant in the field samples.

- The relative abundance of oleanane to moretane was slightly higher in CMS-SD-4223 (boring ID 120b) (compare Figure 4a to 4b through 4d). However, it was not possible with the few number of samples analyzed to determine if this difference indicated unique sources of high molecular weight petroleum in each pond.

A summary of the quantitative data helped evaluate the significance of the hydrocarbon patterns (Figure 5). The sum of the 16 EPA Priority Pollutant PAH (EPA 16 PAH) correlated very well with the sum of the 43 PAH (Total PAH) measured in this study (Figure 5a, $R^2 = 0.9975$). This tight correlation indicated that a similar pyrogenic PAH assemblage existed in all study samples (Figure 3) and registered little evidence of localized influence from petroleum products (e.g., petrogenic PAH). In addition, low concentrations of EPA 16 PAH were measured in the southern end of Allendale Pond, northern end of Lyman Mill Pond, and southern end of Lyman Mill Pond. By contrast the maximum levels of EPA 16 PAH were measured in the middle of Lyman Mill Pond. These elevated levels suggested increased inputs of partially combusted material in the middle of Lyman Mill Pond and were consistent with the receipt of runoff from more urbanized areas.

Similarly, the high abundance of hopane relative to the sum of EPA 16 PAH fell in the middle to lower reaches of Lyman Mill Pond (Figure 5b). This hopane trend may indicate higher inputs of residual petroleum products (e.g. motor oil drippings and abraded asphalt) in middle and lower sections of Lyman Mill Pond.

High levels of total organic carbon (TOC[2]) failed to correlate with PAH concentration (Figure 5c). This poor correlation demonstrated that the TOC and PAH originated from different sources; e.g., the organic content of the field samples was not predominantly petrogenic or pyrogenic. It is likely that the organic material in these samples was predominantly degraded vegetation.

In general, the levels of PAH (EPA 16 PAH from 2,000 ug/kg dry to 100,000 ug/kg dry) measured in Allendale and Lyman Mill Ponds (Figure 6a) were comparable to levels also

[2] TOC results discussed here are from the analysis of geotechnical samples conducted in support of the Centredale Task RI-8 Sediment Investigation. The TOC results are not final through third party validation at the time this letter was written.

measured in down stream locations (Figure 6b) and regional reference locations (Figure 6c)[3]. The regionally consistent PAH in the study area suggested the absence of a clearly identifiable point source for these compounds. Rather, the PAH loading was widespread and characteristic of local background conditions with two exceptions: Dyerville and Assapumpset. It was not possible to determine the cause for lower PAH levels in Dyerville and Assapumpset from the available data. Possible explanations included different stormwater flow pathways or low numbers of representative samples. Nevertheless, the regional PAH concentrations measured throughout this project (Figure 6a to 6c) fell within the range of urban background sediments published by Stout, et al., 2003 (Figure 6d).

Conclusion

The field samples likely contained combustion byproducts (soot) and residual petroleum (asphalt, motor oil, and possibly other residual petroleum products) consistent with an urban background. They contained low levels of PAH and exhibited similar hydrocarbon fingerprints. The signature of urban runoff increased slightly in the middle of Lyman Mill Pond and likely corresponded to a greater density of human settlement, incidental hydrocarbon releases from vehicular traffic, and commercial activity in adjacent upland locations. Nevertheless, the sediments from Allendale and Lyman Mill Ponds were generally similar. The absence of pronounced localized signatures of petroleum and tar products indicated a lack of significant point sources of PAH detectable in the sampling locations. The low levels of soot and residual petroleum failed to explain the relatively high levels of organic carbon (7.9% to 15%[4]) present in the pond sediments. Consequently, we attributed the bulk of the organic material to degraded vegetation.

If you have any questions regarding this report, please contact Mr. William Steinhauer at (781) 952-5319 or Mr. Stephen Emsbo-Mattingly at (781) 952-5246.

Sincerely,

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Karen Foster
Program Manager

encl.

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Attachments:

Attachment A: Total Petroleum Hydrocarbons Results (GC/FID)
Attachment B: High-Resolution Hydrocarbon Fingerprints (GC/FID)
Attachment C: Quantitative PAH Results (GC/MS/SIM)
Attachment D: Detailed PAH Histograms (GC/MS/SIM)
Attachment E: Triterpane Fingerprints (GC/MS/SIM)
Attachment F: Total Organic Carbon

[3] EPA 16 PAH levels were determined using sediment and soil data from the Centredale database.
[4] Range in TOC values reported correspond to samples analyzed for petroleum hydrocarbons (Table 1), using pre-validated data.

Table 1. Study Samples from Allendale and Lyman Mill Ponds, North Providence, RI.

Sample ID	Boring ID	Laboratory ID	Date Collected
CMS-SD-4223-0004-01 (a)	120b	T2360	5/8/2003
LPX-SD-4208-0011-01 (a)	223a	T2361	5/7/2003
LPX-SD-4207-0009-01 (a)	217a	T2364	5/7/2003
LPX-SD-4205-0015-01	199a	T2334	5/8/2003
LPX-SD-4203-0012-01	188c	T2385	5/8/2003

(a) Samples received slightly outside of temperature specifications (8.8°C vs. 6°C)

Table 2. Analyte Abbreviations.

PAH Analyte	Abbreviation	Ring Number
Naphthalene	NO	2
C1-Naphthalenes	N1	2
C2-Naphthalenes	N2	2
C3-Naphthalenes	N3	2
C4-Naphthalenes	N4	2
Biphenyl	B	2
Acenaphthylene	AY	3
Acenaphthene	AE	3
Dibenzofuran	DF	3
Fluorene	FO	3
C1-Fluorenes	F1	3
C2-Fluorenes	F2	3
C3-Fluorenes	F3	3
Dibenzothiophene	DBT0	3
C1-Dibenzothiophenes	DBT1	3
C2-Dibenzothiophenes	DBT2	3
C3-Dibenzothiophenes	DBT3	3
C4-Dibenzothiophenes	DBT4	3
Anthracene	A0	3
Phenanthrene	P0	3
C1-Phenanthrenes/Anthracenes	PA1	3
C2-Phenanthrenes/Anthracenes	PA2	3
C3-Phenanthrenes/Anthracenes	PA3	3
C4-Phenanthrenes/Anthracenes	PA4	3
Fluoranthene	FL0	4
Pyrene	PY0	4
C1-Fluoranthenes/Pyrenes	FP1	4
C2-Fluoranthenes/Pyrenes	FP2	4
C3-Fluoranthenes/Pyrenes	FP3	4
Benzo(a)anthracene	BA0	4
Chrysene	C0	4
C1-Chrysenes	BC1	4
C2-Chrysenes	BC2	4
C3-Chrysenes	BC3	4
C4-Chrysenes	BC4	4
Benzo(b)fluoranthene	BB	5
Benzo(j/k)fluoranthene	BJK	5
Benzo(a)fluoranthene	BAF	5
Benzo(e)pyrene	BEP	5
Benzo(a)pyrene	BAP	5
Perylene	PER	5
Indeno(1,2,3-c,d)pyrene	IND	6
Dibenz(a,h)anthracene	DA	5
Benzo(g,h,i)perylene	GHI	6

Figure 1a. Sample Locations in Allendale Pond. Forensic sample locations circled.

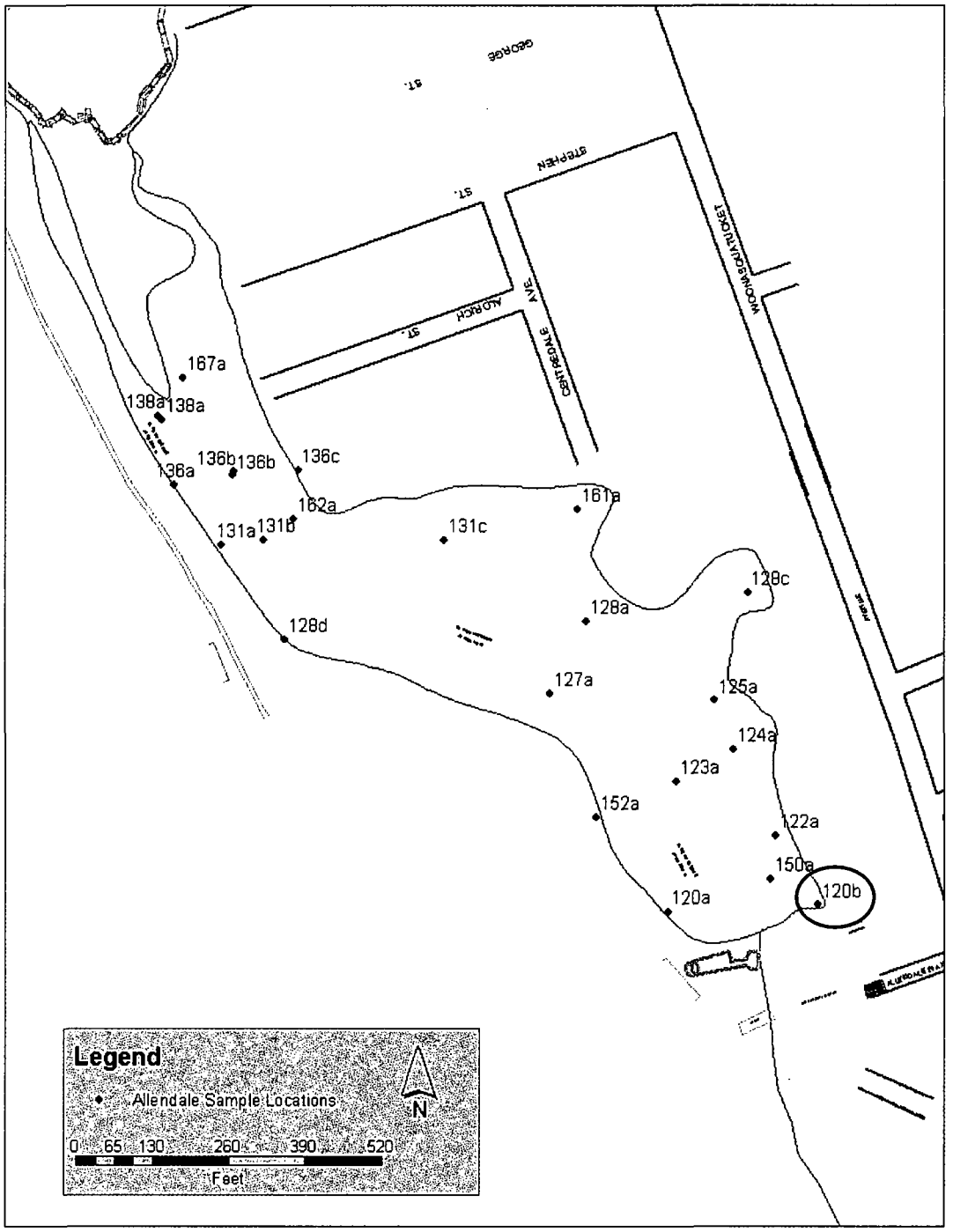


Figure 1b. Sample Locations in Lyman Mill Pond. Forensic sample locations circled.

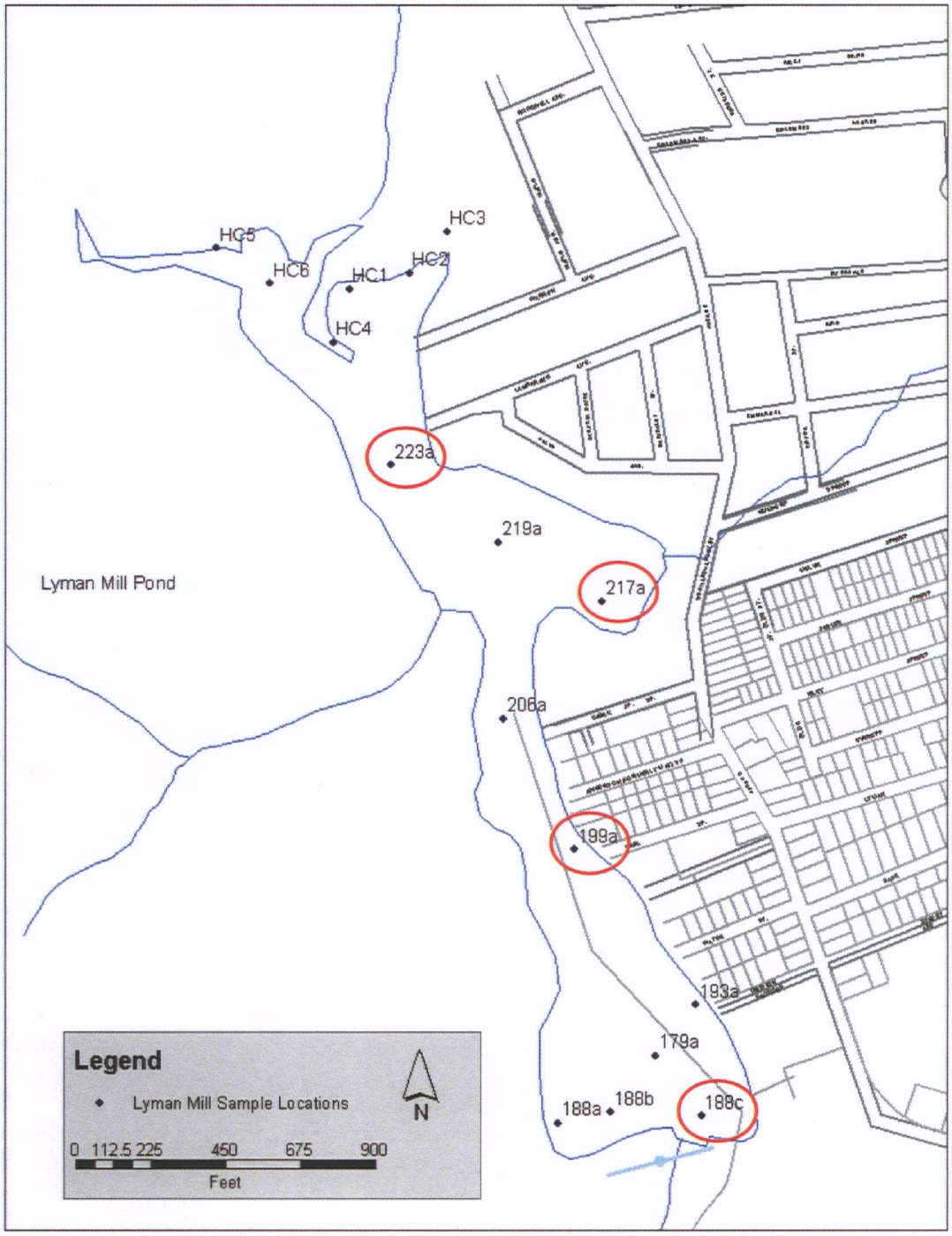
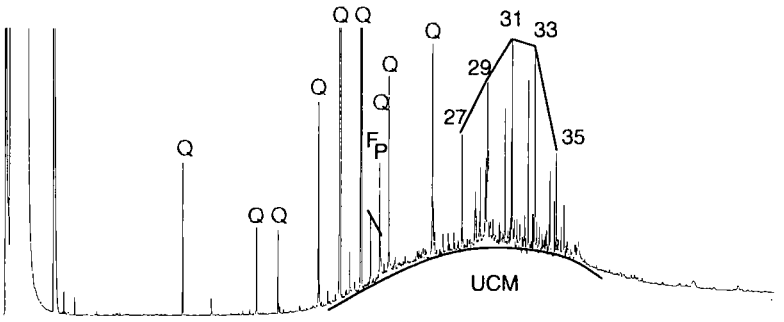
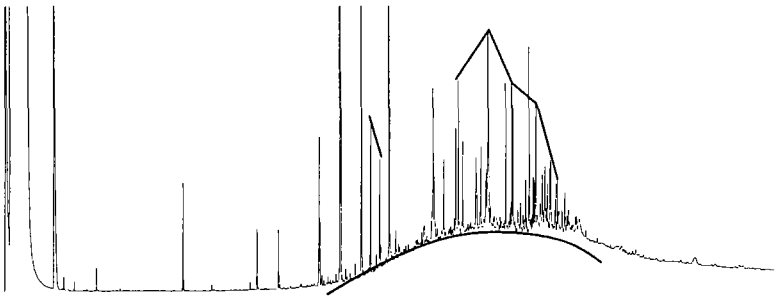


Figure 2. High-Resolution Hydrocarbon Fingerprints (GC/FID).

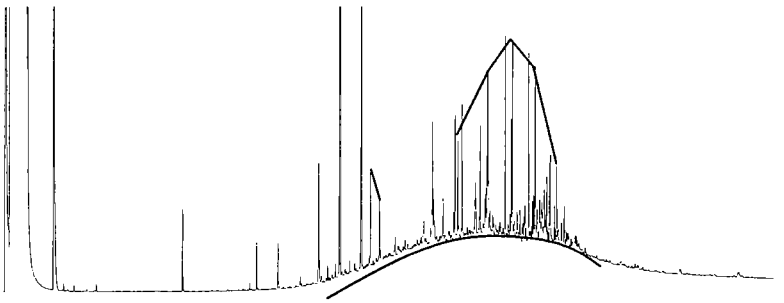
a. South Allendale Pond
CMS-SD-4223-0004-01 (120b)



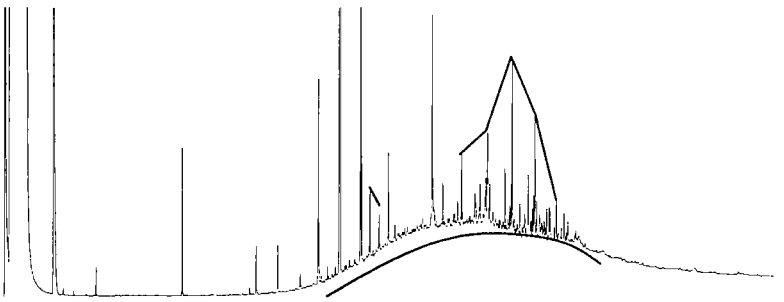
b. Middle Cove Lyman Mill Pond
LPX-SD-4207-0009-01 (217a)



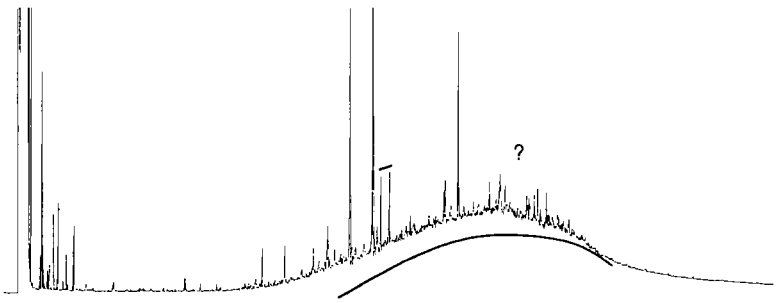
c. Middle Lyman Mill Pond
LPX-SD-4205-0015-01 (199a)
Similar to sample
LPX-SD-4208 (223a)



d. South Lyman Mill Pond
LPX-SD-4203-0012-01 (188c)



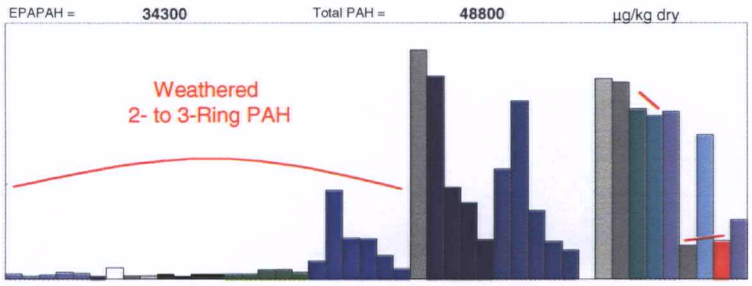
e. Urban Sediment
NIST SRM 1944



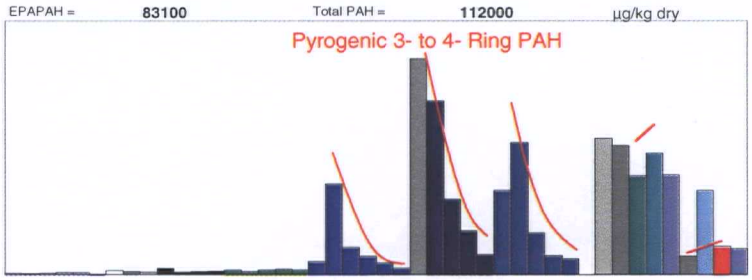
Q = QC compounds F = Fluoranthene P = Pyrene ## = normal alkane carbon number

Figure 3. Detailed PAH Histograms (GC/MS/SIM).

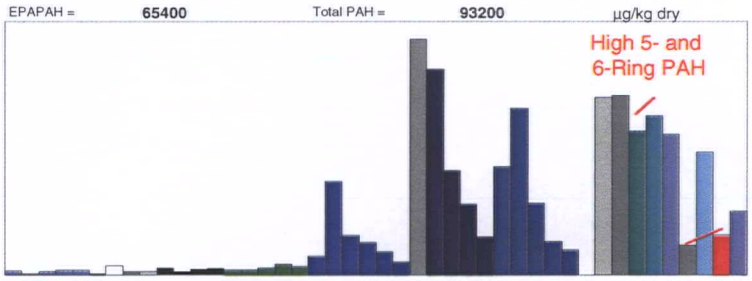
a. South Allendale Pond
CMS-SD-4223-0004-01 (120b)



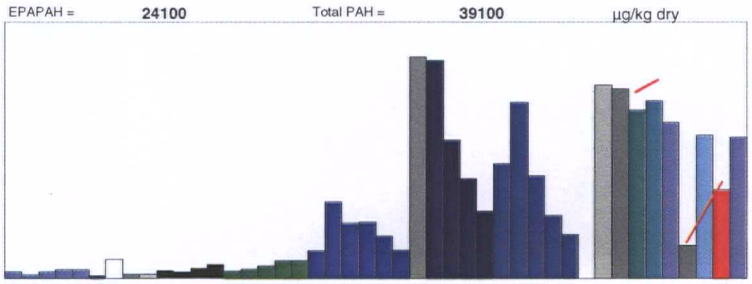
b. Middle Cove Lyman Mill Pond
LPX-SD-4207-0009-01 (217a)



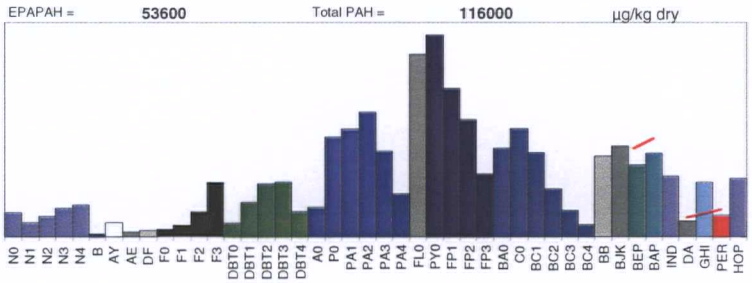
c. Middle Lyman Mill Pond
LPX-SD-4205-0015-01 (199a)
Similar to sample
LPX-SD-4208 (223a)



d. South Lyman Mill Pond
LPX-SD-4203-0012-01 (188c)



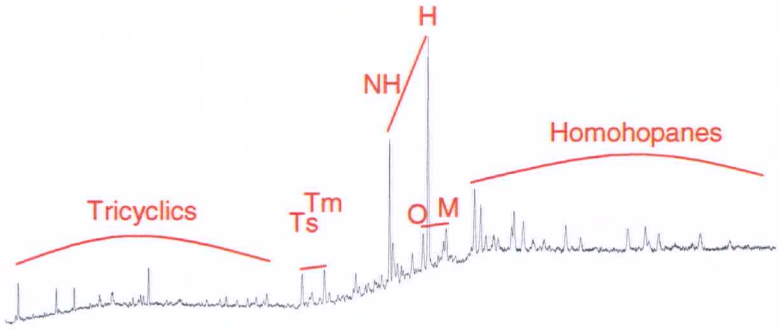
e. Urban Sediment
NIST SRM 1944



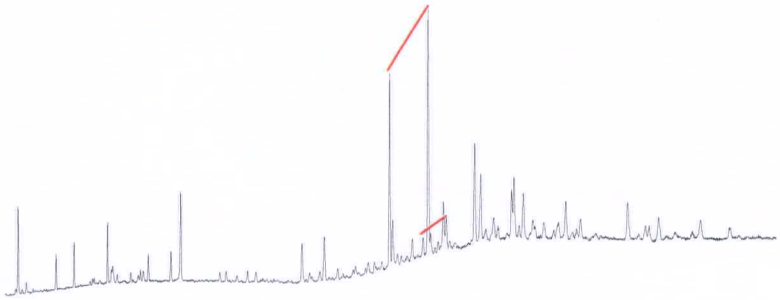
Analyte abbreviations (Table 2)

Figure 4. Triterpane Fingerprints (GC/MS/SIM).

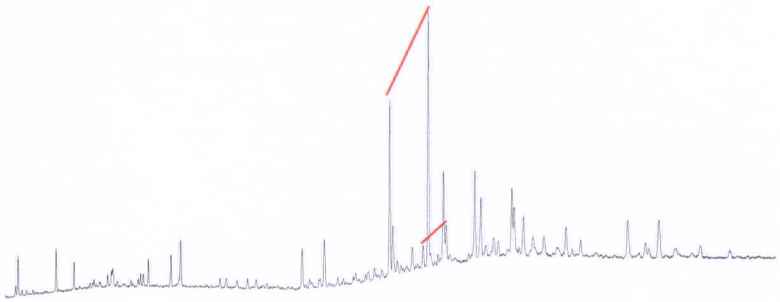
a. South Allendale Pond
CMS-SD-4223-0004-01 (120b)



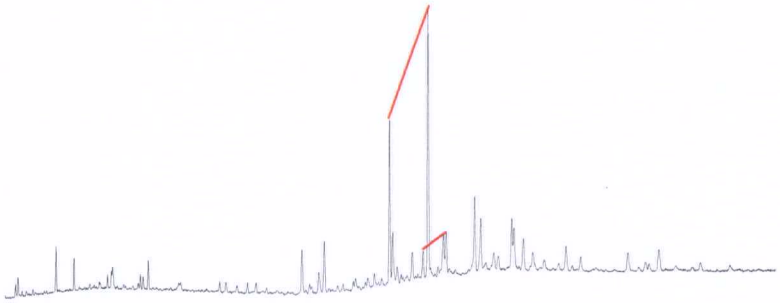
b. Middle Cove Lyman Mill Pond
LPX-SD-4207-0009-01 (217a)



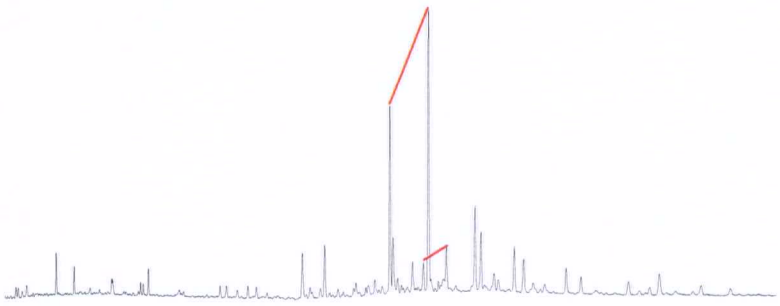
c. Middle Lyman Mill Pond
LPX-SD-4205-0015-01 (199a)
Similar to sample
LPX-SD-4208 (223a)



d. South Lyman Mill Pond
LPX-SD-4203-0012-01 (188c)



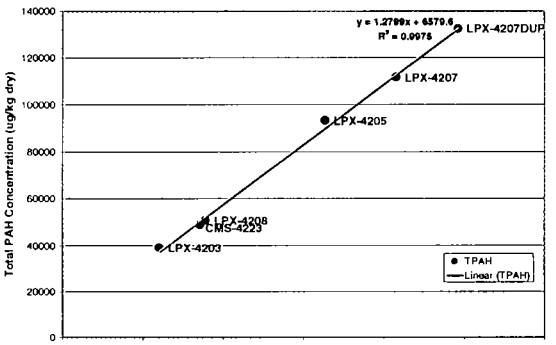
e. Urban Sediment
NIST SRM 1944



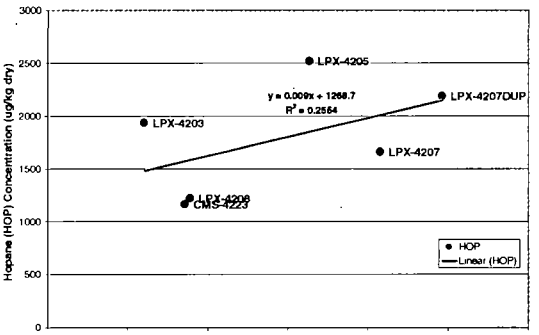
Ts	18a(H)-22,29,30-Trinorneohopane	NH	30-Norhopane	O	Oleanane
Tm	17a(H)-22,29,30-Trinorhopane	H	Hopane	M	Moretane

Figure 5. Summary of Quantitative PAH and TOC Data.

a. Very good correlation between the sums of EPA 16 PAH and the total PAH concentrations suggests a common PAH origin at varying levels of dilution.



b. Poor correlation between the sum of EPA 16 PAH and the heavy petroleum marker hopane (HOP). Relatively high levels of HOP in LPX-4203, LPX-4205, and LPX-4207 suggest higher residual petroleum or asphalt in the middle to lower Lyman Pond sediments.



c. Very poor correlation between EPA 16 PAH and Total Organic Carbon (TOC) indicates that the bulk of the organic material is not sourced to the PAH origin.

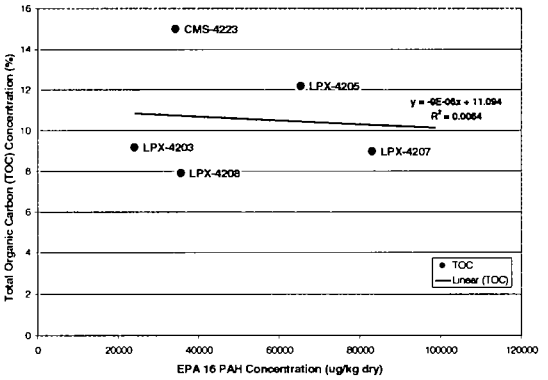
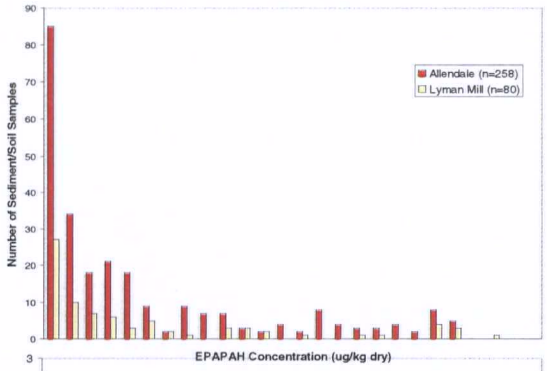
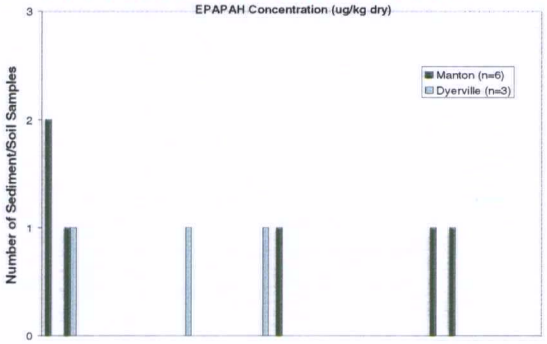


Figure 6. Frequency Histograms of Total EPA 16 PAH Concentration by Location. Data drawn from larger Centredale project database and published values for urban background.

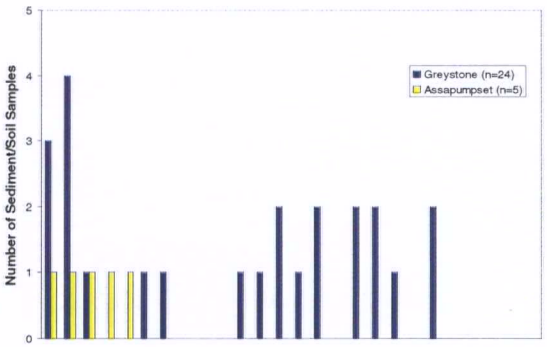
a. Forensic Study Area. A wide range of PAH concentrations exist throughout Allendale and Lyman Mill Ponds.



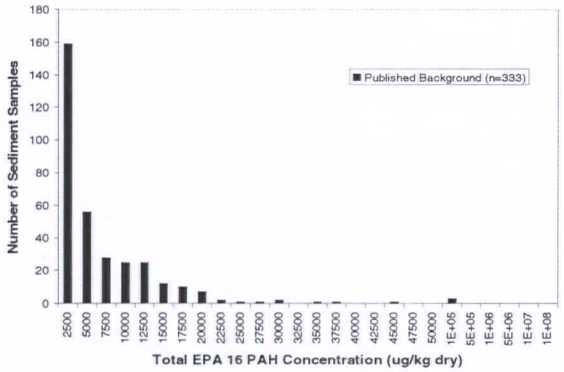
b. Down Stream Study Area. Despite fewer samples, the range of PAH concentrations in the Allendale/Lyman Mill Ponds continued downstream.



c. Regional Reference Areas. The frequency of high PAH concentrations in the Greystone sediments resembled the Allendale and Lyman Mill Ponds. The Assapumpset sediments spanned a more narrow PAH concentration range.



d. Published PAH Concentrations in Urban Background Sediments (Stout, et al., 2003). The concentration of total EPA 16 PAH in the study areas fell within the same order of magnitude (2 to 100 ppm) as urban sediments measured throughout the United States.



References

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US ARMY CORPS
OF ENGINEERS
New England District

Contract No. DACW33-01-D-0004
Delivery Order No. 01
September 2003

PETROLEUM HYDROCARBON ASSESSMENT OF CENTREDALE SEDIMENT CORES

Centredale Manor Restoration Project Superfund Site North Providence, Rhode Island

Attachment A

Total Petroleum Hydrocarbons Results (GC/FID)

TPH/ALKANES/ISOPRENOIDS QA/QC SUMMARY
QC Batch 03-0619

PROJECT: USACE NAE Delivery Order #01 Centredale, Task RI-8

PARAMETER: TPH, alkanes and isoprenoids

LABORATORY: Battelle, Duxbury, MA

MATRIX: Sediment

SAMPLE CUSTODY: Sediment samples were collected in the field between May 6-9, 2003. Samples arrived at Battelle Duxbury in one shipment and cooler temperatures ranged from 2.9 to 8.8 °C. Receipt cooler temperatures for the five sediment samples selected for analysis were:

T2360, T2361, and T2364 were received at 8.8 °C;
T2334 was received at 3.0 °C;
T2385 was received at 4.0 °C.

All samples were received in good condition.

QA/QC MEASUREMENT PERFORMANCE CRITERIA*:

	Reference Method	Blank	Surrogate Recovery	LCS/MS Recovery	Duplicate Precision
TPH, alkanes, isoprenoids	Battelle SOP 5-307	<ssRL[a]	40-125% Recovery	40-120% Recovery [b]	≤30% RPD [c]

[a] ssRL = sample-specific reporting limit; Associated sample concentrations should be >5× blank values.
[b] For 90% of analytes; Analyte concentration in MS must be >5× background to be used for data quality assessment
[c] For 90% of analytes; Analyte concentration in sample replicates must be >ssRL to be used for data quality assessment

* Please note that the petroleum hydrocarbon assessment of selected sediment cores collected in May 2003 is outside the scope of Centredale Quality Assurance Project Plan (QAPP), therefore no project specific QA/QC criteria available. The laboratory default QA/QC criteria are used in this task.

METHOD: Sediment samples were prepared and analyzed for TPH, alkanes, isoprenoids, PAHs and hopane following Battelle's Standard Operating Procedures (SOP). Briefly,

Sediment Sample Preparation – Sediment samples were extracted for TPH, alkanes, isoprenoids, PAHs and hopane following Battelle Duxbury SOP 5-307, *Soil/Sediment Extraction for Petroleum Contaminant Analysis Using the Accelerated Solvent Extractor*. Briefly, approximately 10 g of well-mixed, wet sediment material was weighed into an extraction vessel and spiked with the surrogate internal standard (SIS) compounds. Next, the sample was extracted with dichloromethane (DCM) using Dionex™ ASE 200 Accelerated Solvent Extractor (1500 psi, 100°C). The extract was dried over hydromatrix diatomaceous earth or sodium sulfate, concentrated to approximately 2 to 3 mL using Kuderna-Danish and nitrogen evaporation techniques. Sample extracts were treated with activated copper to remove elemental sulfur. The extract was then processed through an alumina cleanup column. Gravimetric analysis was performed for both pre-column and post-column extracts to estimate the dilution factor for the sample extracts. The extract was concentrated under nitrogen to approximately 1 mL, fortified with recovery internal standard (RIS) compounds that are used for quantification, and split for TPH/alkanes/isoprenoids and PAHs/hopane analyses by GC/FID and GC/MS, respectively.

GC/FID Analysis – TPH/alkanes/isoprenoids were analyzed by GC/FID (Hewlett Packard 6890) using a 30-m DB5 column and hydrogen as the carrier gas. A minimum of a five-point calibration curve was used for TPH/alkanes/isoprenoids analysis, ranging

METHOD (CONT): from approximately 1 to 200 µg/mL. Concentrations of TPH/alkanes/isoprenoids were determined by the method of internal standards, using the RIS. All sediment results were reported in a milligram per kilogram dry-weight concentration basis (mg/kg).

HOLDING TIMES: Samples were prepared for analysis in one analytical batch. Samples were extracted and analyzed within holding times. Sediment samples were held frozen and in the dark until extraction.

Batch	Extraction Date	Analysis Date
03-0619	07/16/2003	07/25/2003

DETECTION LIMITS: TPH/alkanes/isoprenoids results are reported relative to sample-specific reporting limits (ssRL) for that compound, as follows:

- Non-detects are reported as "null" and U flagged.
- Compounds detected at a concentration below the ssRL are reported and J flagged.

Note that the ssRL is based on the low calibration standard and adjusted for sample specific processing factors and volumes.

BLANKS: A laboratory procedural blank (PB) was prepared with the analytical batch. Blanks are analyzed to ensure that the sample extraction and analysis methods were free of contamination.

03-0619 – No exceedances.

LABORATORY CONTROL SAMPLE One laboratory control sample (LCS) was prepared with each analytical batch. The LCS was fortified with representative alkanes to monitor data quality in terms of accuracy.

03-0619 – No exceedances.

LCS recoveries ranged from:

	alkanes
BC924LCS	47 – 97%

MATRIX SPIKES: One matrix spike (MS) sample was prepared with the sediment batch to measure data quality in terms of accuracy and precision. The MS was fortified with representative alkanes to monitor data quality in terms of accuracy.

03-0619 – No exceedances.

Recoveries ranged from:

	alkanes
T2360MS-D	41 – 104%

SURROGATES: One surrogate compound, o-Terphenyl, was added to each sample prior to extraction. Recovery data were calculated to measure data quality in terms of accuracy (extraction efficiency).

03-0619 – No exceedances.

TPH/ALKANES/ISOPRENOIDS QA/QC SUMMARY
QC Batch 03-0619

DUPLICATES: A laboratory duplicate was prepared with the batch. The relative percent difference (RPDs) between laboratory duplicate analyses for TPH/alkanes/isoprenoids were calculated to measure data quality in terms of precision.

03-0619 – No exceedances.

RPDs ranged from 4.0 to 30.0%.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	Procedural Blank
Battelle Sample ID	BC923PB
Matrix	Sediment
Batch ID	03-0619
Analytical Method	8100M
Sequence	SQFA003.S
Data File	FA0061.D
Collection Date	NA
Receipt Date	NA
Extraction Date	07/16/03
Analysis Date	07/25/03
Sample Weight (g)	4.00
Percent Moisture	62.64
Primary Dilution Factor	1.00
Secondary Dilution Factor	NA
PIV (µl)	1000
Min Reporting Limit	0.25
Concentration Units	mg/kg
n-C8	U
n-C9	U
n-C10	U
n-C11	U
n-C12	U
n-C13	U
Isoprenoid 1380	U
n-C14	U
Isoprenoid 1470	U
n-C15	U
n-C16	U
Isoprenoid 1650	U
n-C17	U
Pristane	U
n-C18	U
Phytane	U
n-C19	U
n-C20	U
n-C21	U
n-C22	U
n-C23	U
n-C24	U
n-C25	U
n-C26	U
n-C27	U
n-C28	U
n-C29	U
n-C30	U
n-C31	U
n-C32	U
n-C33	U
n-C34	U
n-C35	U
n-C36	U
n-C37	U
n-C38	U
n-C39	U
n-C40	U
TPH	5.37
Surrogate Recoveries (%)	
o-Terphenyl	86

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID		Laboratory control Sample		
Battelle Sample ID		BC924LCS		
Matrix		Sediment		
Batch ID		03-0619		
Analytical Method		8100M		
Sequence		SQFA003.S		
Data File		FA0063.D		
Collection Date		*NA*		
Receipt Date		NA		
Extraction Date		07/16/03		
Analysis Date		07/25/03		
Sample Weight (g)		NA		
Percent Moisture		NA		
Primary Dilution Factor		1.00		
Secondary Dilution Factor		NA		
PIV (µl)		1000		
Min Reporting Limit		1.00		
Concentration Units	FZ46	µg	% Recovery	Q
n-C8		U		
n-C9	10.0	4.66	47	
n-C10	10.0	5.97	60	
n-C11		U		
n-C12	10.0	7.86	79	
n-C13		U		
Isoprenoid 1380		U		
n-C14	10.0	7.42	74	
Isoprenoid 1470		U		
n-C15		U		
n-C16	10.0	8.02	80	
Isoprenoid 1650		U		
n-C17		U		
Pristane	10.0	8.59	86	
n-C18	10.0	8.93	89	
Phytane	10.0	8.84	88	
n-C19	10.0	8.04	80	
n-C20	10.0	8.70	87	
n-C21		U		
n-C22	10.0	8.64	86	
n-C23		U		
n-C24	10.0	9.66	97	
n-C25		U		
n-C26	10.0	8.49	85	
n-C27		U		
n-C28	10.0	9.67	97	
n-C29		U		
n-C30	10.0	8.67	87	
n-C31		U		
n-C32		U		
n-C33		U		
n-C34		U		
n-C35		U		
n-C36	10.0	8.64	86	
n-C37		U		
n-C38		U		
n-C39		U		
n-C40		U		

Surrogate Recoveries (%)
o-Terphenyl 92

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID		CMS-SD-4223-0004-01	CMS-SD-4223-0004-01		
Battelle Sample ID		T2360-D	T2360MS-D		
Matrix		Sediment	Sediment		
Batch ID		03-0619	03-0619		
Analytical Method		8100M	8100M		
Sequence		SQFA003.S	SQFA003.S		
Data File		FA0067.D	FA0069.D		
Collection Date		05/08/03	05/08/03		
Receipt Date		05/12/03	05/12/03		
Extraction Date		07/16/03	07/16/03		
Analysis Date		07/25/03	07/25/03		
Sample Weight (g)		3.70	1.88		
Percent Moisture		63.12	63.12		
Primary Dilution Factor		10.53	5.26		
Secondary Dilution Factor		NA	NA		
PIV (µl)		1000	1000		
Min Reporting Limit		2.85	2.80		
Concentration Units	FZ46	mg/kg	mg/kg	% Recovery	Q
n-C8		U	U		
n-C9	100	U	21.95	41	
n-C10	100	U	23.09	43	
n-C11		U	U		
n-C12	100	U	31.14	59	
n-C13		U	U		
Isoprenoid 1380		U	U		
n-C14	100	U	36.97	70	
Isoprenoid 1470		U	U		
n-C15		U	U		
n-C16	100	U	45.67	86	
Isoprenoid 1650		U	U		
n-C17		U	U		
Pristane	100	U	49.26	93	
n-C18	100	U	51.17	96	
Phytane	100	U	49.70	93	
n-C19	100	U	48.62	91	
n-C20	100	U	47.12	89	
n-C21		U	U		
n-C22	100	U	45.71	86	
n-C23		0.60 J	0.76 J		
n-C24	100	U	50.60	95	
n-C25		1.39 J	1.55 J		
n-C26	100	U	46.58	88	
n-C27		7.22	7.89		
n-C28	100	U	55.38	104	
n-C29		9.31	8.54		
n-C30	100	U	45.45	85	
n-C31		6.69	6.54		
n-C32		U	U		
n-C33		2.21 J	2.12 J		
n-C34		U	U		
n-C35		4.12	4.87		
n-C36	100	U	41.14	77	
n-C37		1.38 J	1.56 J		
n-C38		U	U		
n-C39		0.35 J	0.31 J		
n-C40		U	U		
TPH		2035.19	3324.61		
Surrogate Recoveries (%)					
o-Terphenyl		91	90		

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.

Not Surrogate Corrected
MS Data

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	LPX-SD-4207-0009-01	LPX-SD-4207-0009-01		
Battelle Sample ID	T2364-D	T2364DUP-D		
Matrix	Sediment	Sediment		
Batch ID	03-0619	03-0619		
Analytical Method	8100M	8100M		
Sequence	SQFA003.S	SQFA003.S		
Data File	FA0073.D	FA0075.D		
Collection Date	05/07/03	05/07/03		
Receipt Date	05/12/03	05/12/03		
Extraction Date	07/16/03	07/16/03		
Analysis Date	07/25/03	07/25/03		
Sample Weight (g)	3.83	3.72		
Percent Moisture	63.16	63.16		
Primary Dilution Factor	10.53	10.53		
Secondary Dilution Factor	NA	NA		
PIV (µl)	1000	1000		
Min Reporting Limit	2.75	2.83		
Concentration Units	mg/kg	mg/kg	RPD	Q
n-C8	U	U		
n-C9	U	U		
n-C10	U	U		
n-C11	U	U		
n-C12	U	U		
n-C13	U	U		
Isoprenoid 1380	U	U		
n-C14	U	U		
Isoprenoid 1470	U	U		
n-C15	U	U		
n-C16	U	U		
Isoprenoid 1650	U	U		
n-C17	U	U		
Pristane	U	U		
n-C18	U	U		
Phytane	U	U		
n-C19	U	U		
n-C20	U	U		
n-C21	U	U		
n-C22	U	U		
n-C23	0.59 J	0.76 J	25.1	
n-C24	U	U		
n-C25	2.22 J	2.31 J	4.0	
n-C26	U	U		
n-C27	8.24	10.58	24.9	
n-C28	U	U		
n-C29	16.26	14.96	8.3	
n-C30	U	U		
n-C31	10.97	11.72	6.6	
n-C32	U	U		
n-C33	4.00	4.75	17.2	
n-C34	U	U		
n-C35	4.11	4.93	18.0	
n-C36	U	U		
n-C37	2.19 J	2.69 J	20.4	
n-C38	U	U		
n-C39	0.56 J	0.73 J	26.2	
n-C40	U	U		
TPH	2687.07	3634.53	30.0	
Surrogate Recoveries (%)				
o-Terphenyl	91	90	0.1	

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

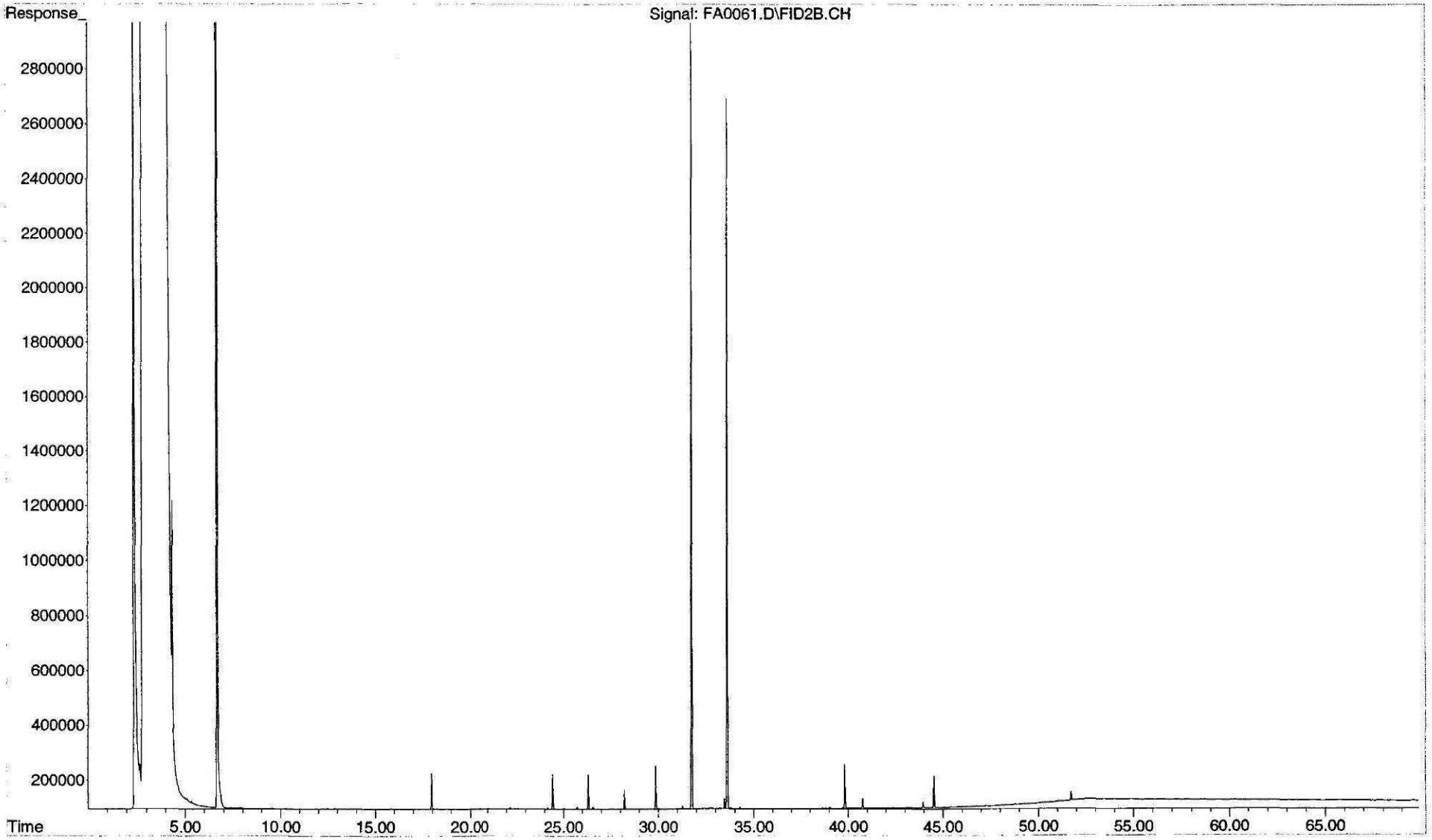
Client Sample ID	LPX-SD-4205-0015-01	CMS-SD-4223-0004-01	LPX-SD-4208-0011-01	LPX-SD-4207-0009-01	LPX-SD-4203-0012-01
Battelle Sample ID	T2334-D	T2360-D	T2361-D	T2364-D	T2385-D
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment
Batch ID	03-0619	03-0619	03-0619	03-0619	03-0619
Analytical Method	8100M	8100M	8100M	8100M	8100M
Sequence	SQFA003.S	SQFA003.S	SQFA003.S	SQFA003.S	SQFA003.S
Data File	FA0065.D	FA0067.D	FA0071.D	FA0073.D	FA0077.D
Collection Date	05/08/03	05/08/03	05/07/03	05/07/03	05/08/03
Receipt Date	05/12/03	05/12/03	05/12/03	05/12/03	05/12/03
Extraction Date	07/16/03	07/16/03	07/16/03	07/16/03	07/16/03
Analysis Date	07/25/03	07/25/03	07/25/03	07/25/03	07/25/03
Sample Weight (g)	3.66	3.70	4.48	3.83	3.25
Percent Moisture	63.52	63.12	55.21	63.16	68.20
Primary Dilution Factor	10.53	10.53	7.02	10.53	5.85
Secondary Dilution Factor	NA	NA	NA	NA	NA
PIV (µl)	1000	1000	1000	1000	1000
Min Reporting Limit	2.88	2.85	1.57	2.75	1.80
Concentration Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
n-C8	U	U	U	U	U
n-C9	U	U	U	U	U
n-C10	U	U	U	U	U
n-C11	U	U	U	U	U
n-C12	U	U	U	U	U
n-C13	U	U	U	U	U
Isoprenoid 1380	U	U	U	U	U
n-C14	U	U	U	U	U
Isoprenoid 1470	U	U	U	U	U
n-C15	U	U	U	U	U
n-C16	U	U	U	U	U
Isoprenoid 1650	U	U	U	U	U
n-C17	U	U	U	U	U
Pristane	U	U	U	U	U
n-C18	U	U	U	U	U
Phytane	U	U	U	U	U
n-C19	U	U	U	U	U
n-C20	U	U	U	U	U
n-C21	U	U	U	U	U
n-C22	U	U	U	U	U
n-C23	1.03 J	0.60 J	0.65 J	0.59 J	0.52 J
n-C24	U	U	U	U	U
n-C25	2.48 J	1.39 J	1.43 J	2.22 J	0.97 J
n-C26	U	U	U	U	U
n-C27	15.05	7.22	7.69	8.24	5.07
n-C28	U	U	U	U	U
n-C29	15.81	9.31	8.75	16.26	3.70
n-C30	U	U	U	U	U
n-C31	11.98	6.69	5.65	10.97	2.65
n-C32	U	U	U	U	U
n-C33	5.16	2.21 J	2.46	4.00	2.91
n-C34	U	U	U	U	U
n-C35	5.42	4.12	2.67	4.11	1.27 J
n-C36	U	U	U	U	U
n-C37	2.26 J	1.38 J	1.29 J	2.19 J	0.99 J
n-C38	U	U	U	U	U
n-C39	0.50 J	0.35 J	0.31 J	0.56 J	0.26 J
n-C40	U	U	U	U	U
TPH	3177.36	2035.19	1640.95	2687.07	2369.15
Surrogate Recoveries (%)					
o-Terphenyl	94	91	92	93	87

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.

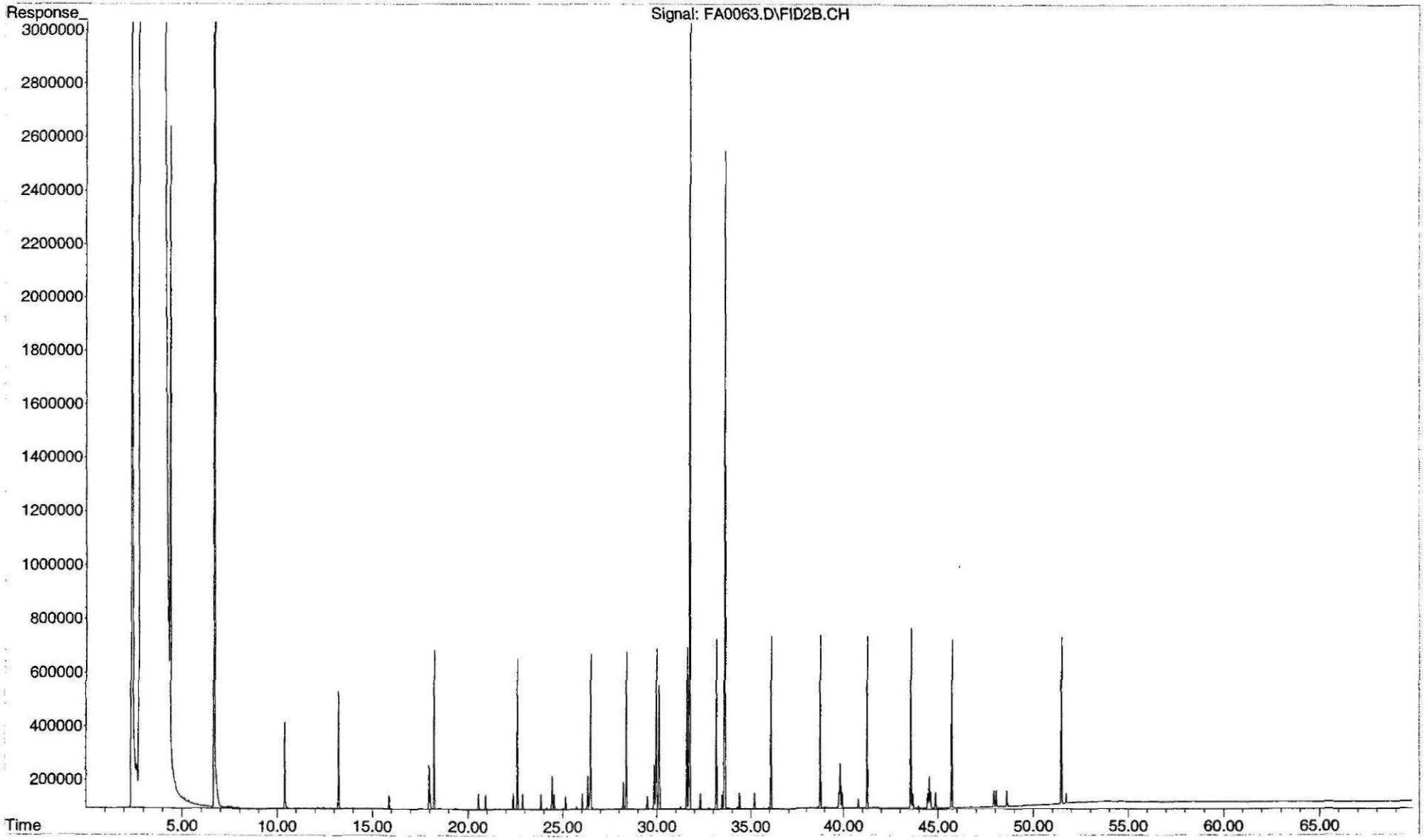
Attachment B

High-Resolution Hydrocarbon Fingerprints (GC/FID)

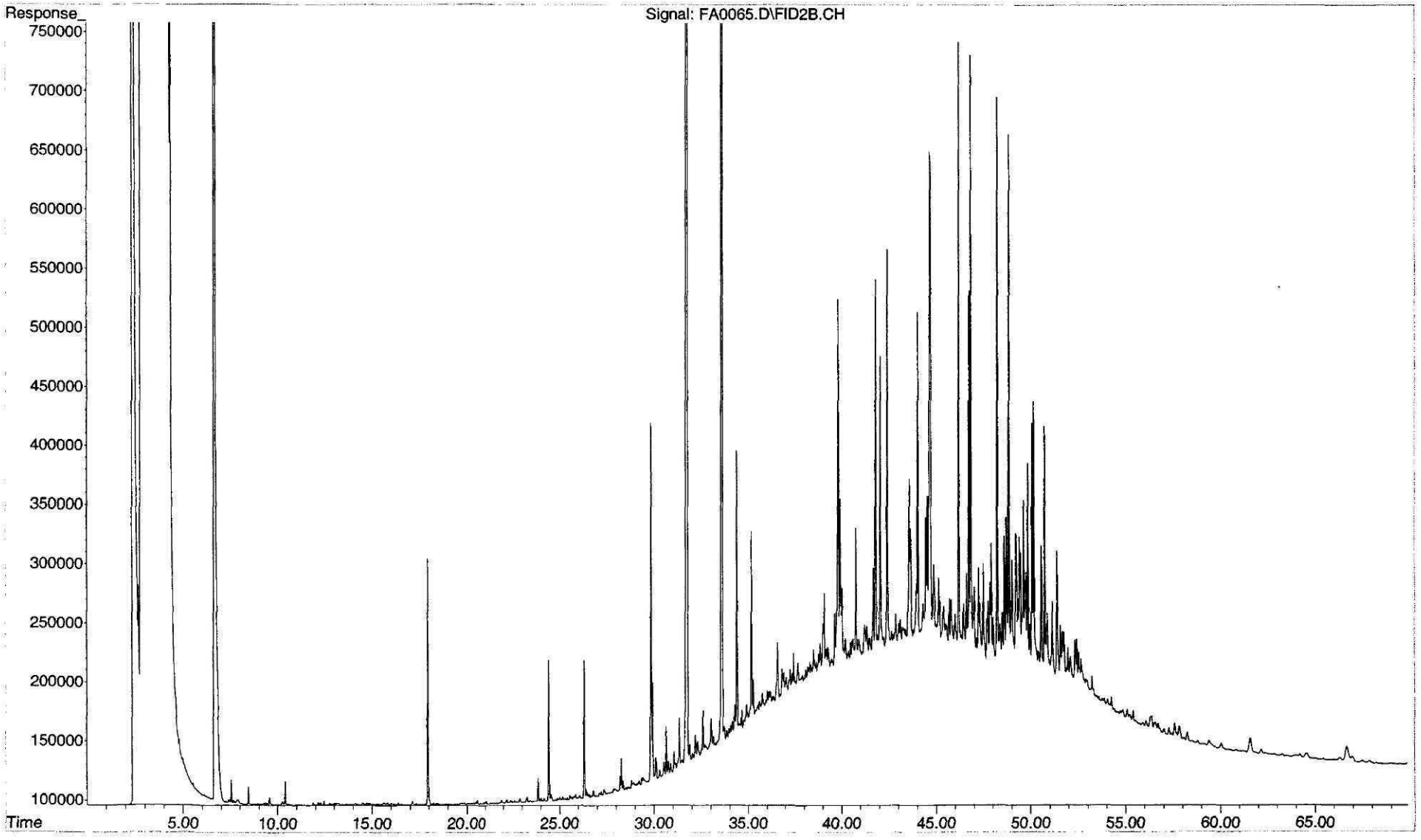
File : F:\A\DATA\SQFA003.SEC\FA0061.D
Operator : JAR
Acquired : 25 Jul 2003 12:04 pm using AcqMethod
Instrument : FID 1
Sample Name: BC923PB
Misc Info : Procedural Blank
Vial Number: 14



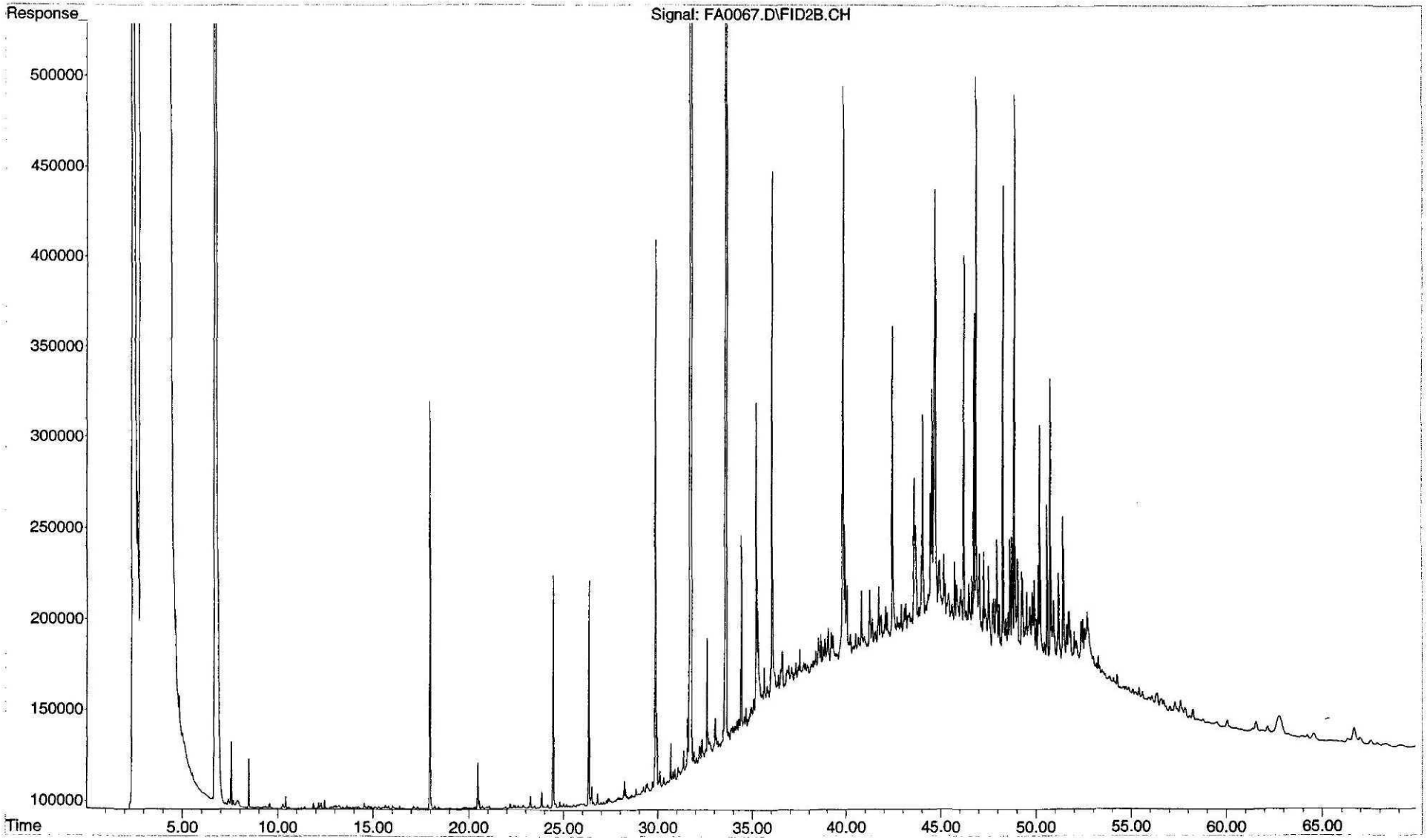
File : F:\A\DATA\SQFA003.SEC\FA0063.D
Operator : JAR
Acquired : 7-25-2003 01:25:02 PM using AcqMethod
Instrument : FID 1
Sample Name: BC924LCS
Misc Info : Laboratory Control Sample
Vial Number: 15



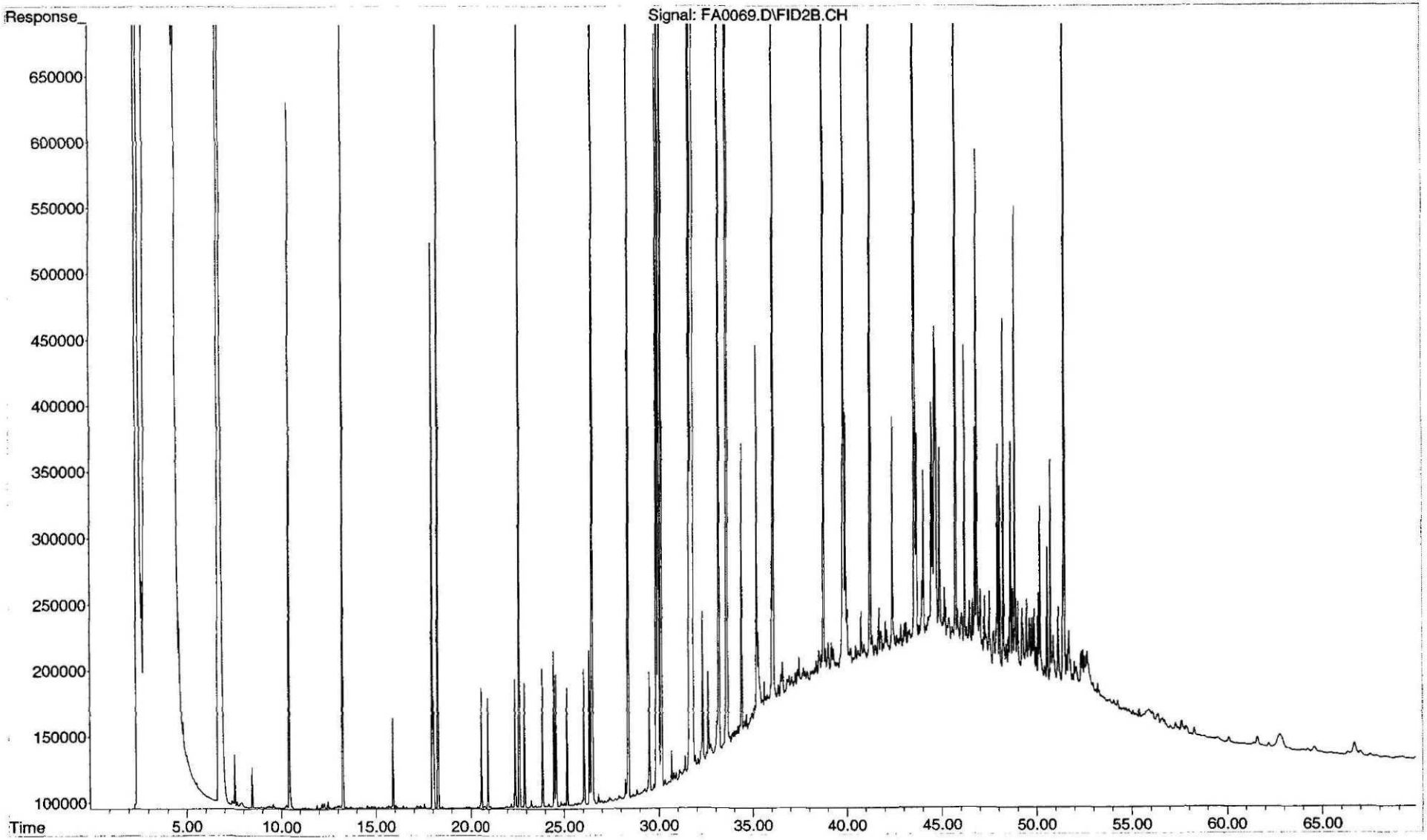
File : F:\A\DATA\SQFA003.SEC\FA0065.D
Operator : JAR
Acquired : 7-25-2003 02:45:23 PM using AcqMethod
Instrument : FID 1
Sample Name: T2334-D
Misc Info : LPX-SD-4205-0015-01
Vial Number: 16



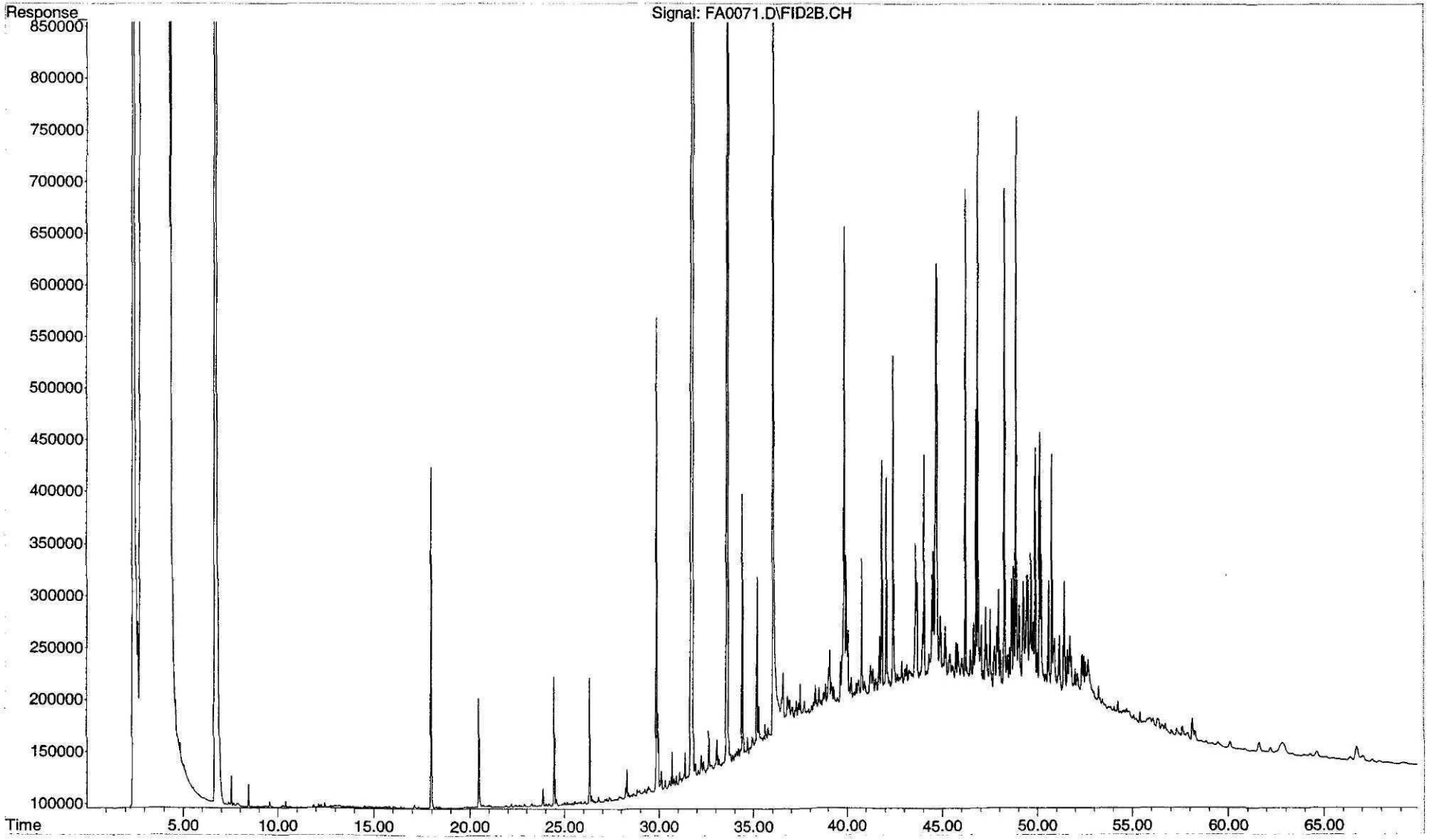
File : F:\A\DATA\SQFA003.SEC\FA0067.D
Operator : JAR
Acquired : 7-25-2003 04:05:37 PM using AcqMethod
Instrument : FID 1
Sample Name: T2360-D
Misc Info : CMS-SD-4223-0004-01
Vial Number: 17



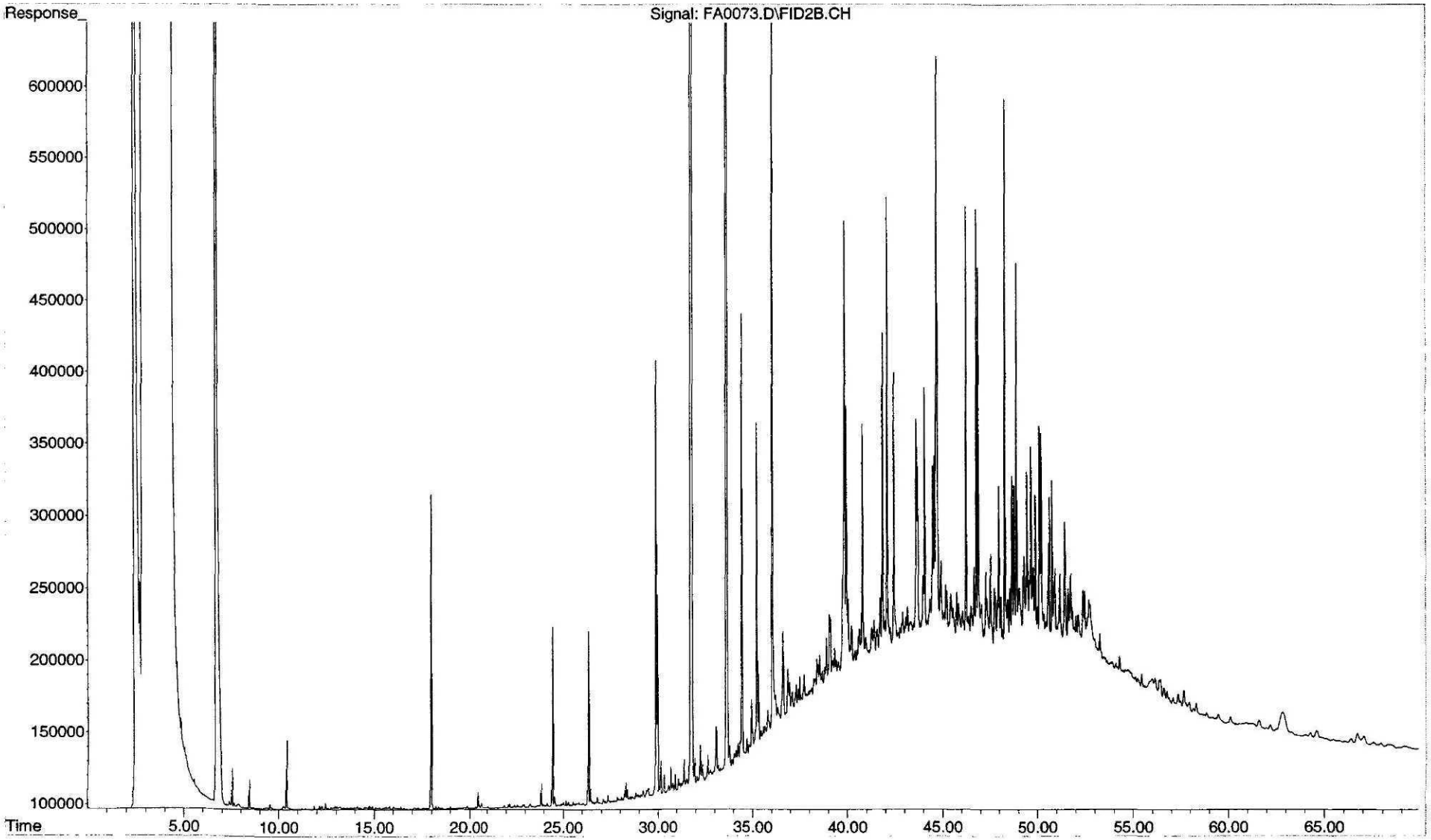
File : F:\A\DATA\SQFA003.SEC\FA0069.D
Operator : JAR
Acquired : 7-25-2003 05:25:36 PM using AcqMethod
Instrument : FID 1
Sample Name: T2360MS-D
Misc Info : CMS-SD-4223-0004-01
Vial Number: 18



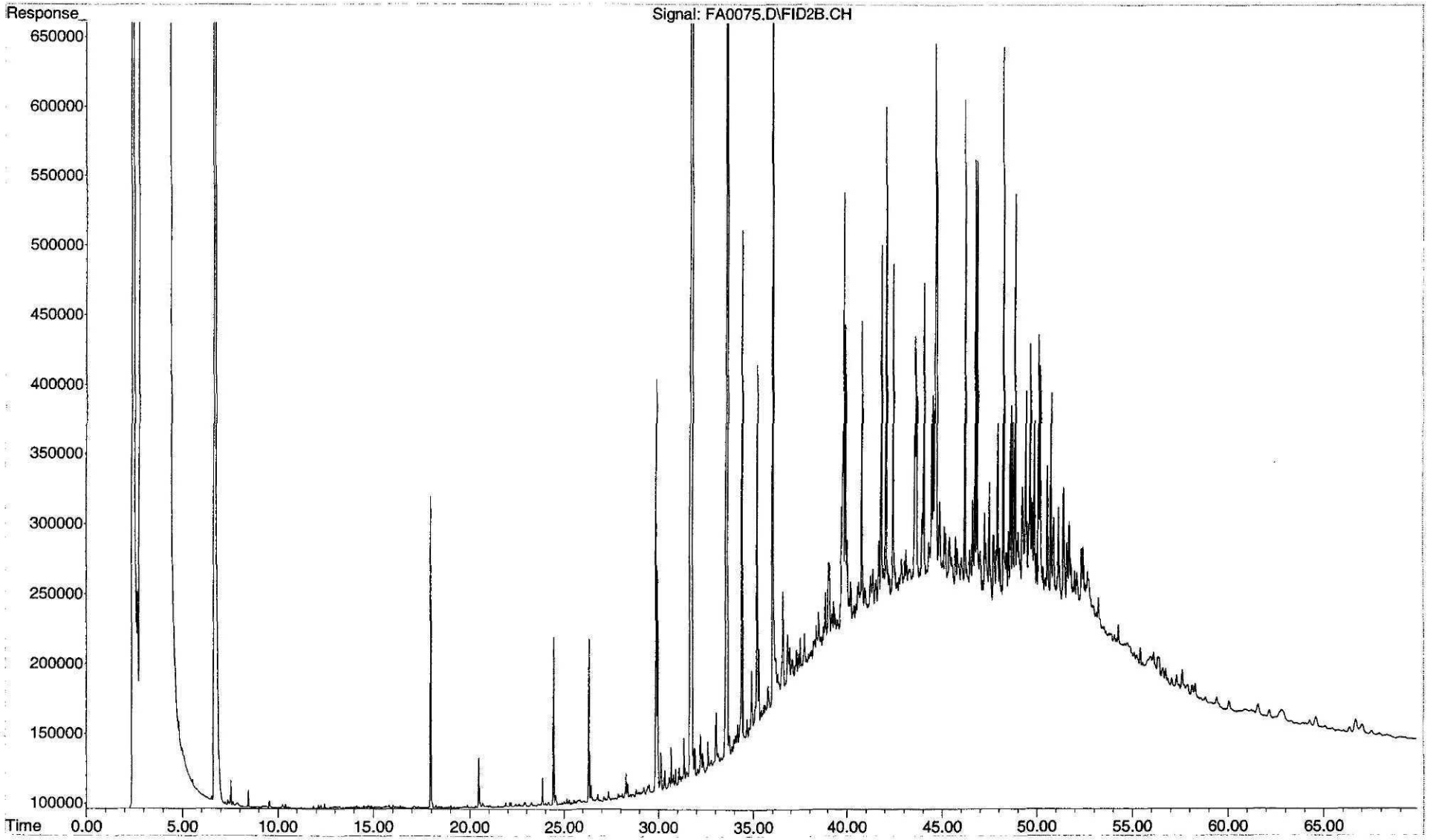
File : F:\A\DATA\SQFA003.SEC\FA0071.D
Operator : JAR
Acquired : 7-25-2003 06:45:45 PM using AcqMethod
Instrument : FID 1
Sample Name: T2361-D
Misc Info : LPX-SD-4208-0011-01
Vial Number: 19



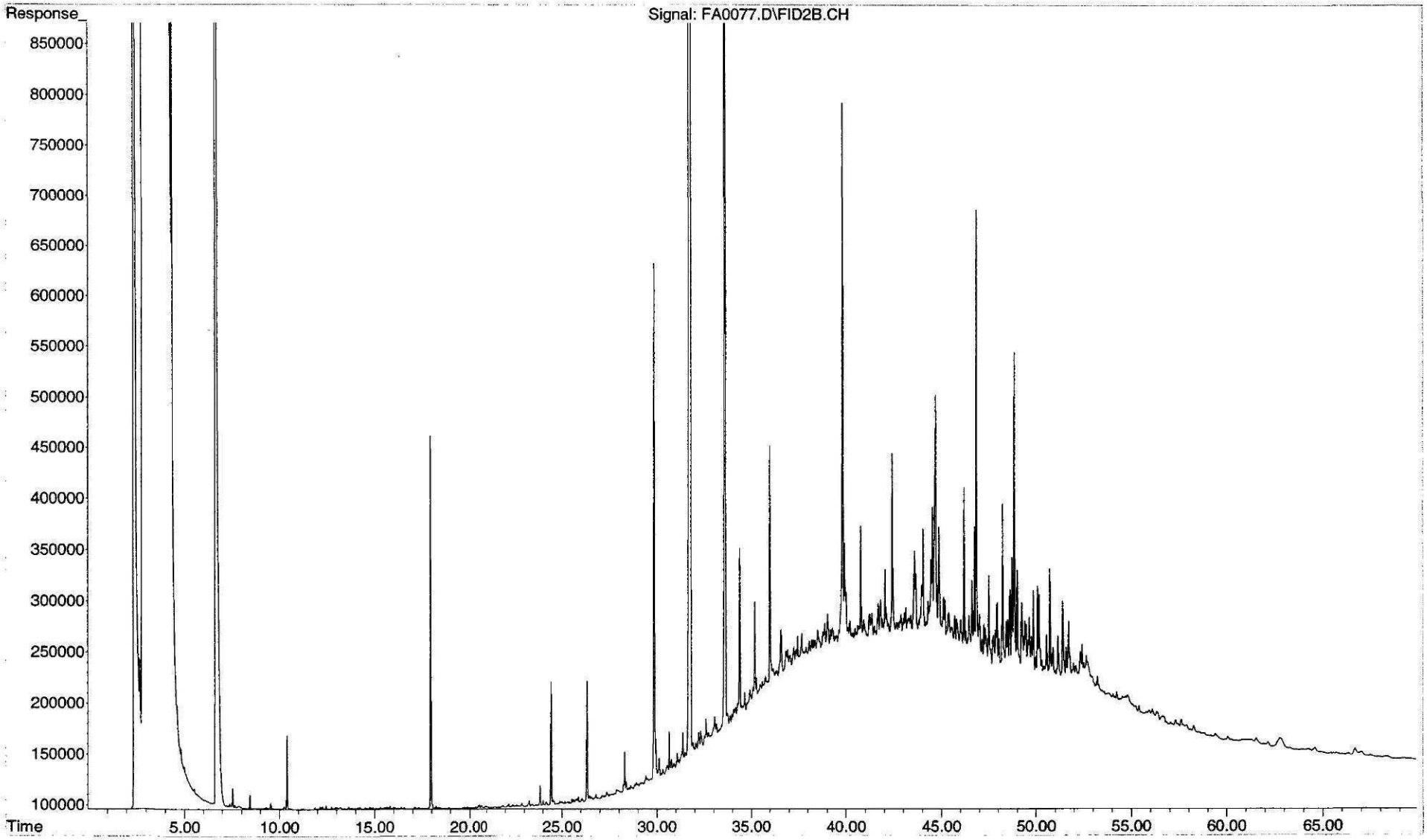
File : F:\A\DATA\SQFA003.SEC\FA0073.D
Operator : JAR
Acquired : 7-25-2003 08:05:33 PM using AcqMethod
Instrument : FID 1
Sample Name: T2364-D
Misc Info : LPX-SD-4207-0009-01
Vial Number: 20



File : F:\A\DATA\SQFA003.SEC\FA0075.D
Operator : JAR
Acquired : 7-25-2003 09:25:21 PM using AcqMethod
Instrument : FID 1
Sample Name: T2364DUP-D
Misc Info : LPX-SD-4207-0009-01
Vial Number: 21



File : F:\A\DATA\SQFA003.SEC\FA0077.D
Operator : JAR
Acquired : 25 Jul 2003 10:44 pm using AcqMethod
Instrument : FID 1
Sample Name: T2385-D
Misc Info : LPX-SD-4203-0012-01
Vial Number: 22



Attachment C

Quantitative PAH Results (GC/MS/SIM)

PAH QA/QC SUMMARY
QC Batch 03-0619

PROJECT: USACE NAE Delivery Order #01 Centredale, Task RI-8

PARAMETER: PAH

LABORATORY: Battelle, Duxbury, MA

MATRIX: Sediment

SAMPLE CUSTODY: Sediment samples were collected in the field from May 6-9, 2003. Samples arrived at Battelle Duxbury in one shipment and cooler temperatures ranged from 2.9 to 8.8 °C. Receipt cooler temperatures for the five sediment samples selected for analysis were:

T2360, T2361, and T2364 were received at 8.8 °C;
T2334 was received at 3.0 °C;
T2385 was received at 4.0 °C.

All samples were received in good condition.

QA/QC MEASUREMENT PERFORMANCE CRITERIA*:

	Reference Method	Blank	Surrogate Recovery	LCS/MS Recovery	SRM % Diff.	Duplicate Precision	Control Oil Precision
PAH	Battelle SOP 5-157	<ssRL[a]	40-125% Recovery	40-120% Recovery [b]	≤30% PD [c]	≤30% RPD [d]	< 25% PD [e]

[a] ssRL = sample-specific reporting limit; Associated sample concentrations should be >5× blank values.
[b] For 90% of analytes; Analyte concentration in MS must be >5× background to be used for data quality assessment
[c] For 90% of analytes; Analyte concentration in sample replicates must be >ssRL to be used for data quality assessment
[d] From certified values and the passing criteria from variances generated using the range of certified values; using surrogate corrected data; certified values in SRM must be >ssRL to be used for data quality assessment
[e] From the historical mean value measured for North Slope Crude oil sample.

* Please note that the petroleum hydrocarbon assessment of selected sediment cores collected in May 2003 is outside the scope of Centredale Quality Assurance Project Plan (QAPP), therefore no project specific QA/QC criteria available. The laboratory default QA/QC criteria are used in this task.

METHOD: Sediment samples were prepared and analyzed for TPH, alkanes, isoprenoids, PAHs and hopane following Battelle's Standard Operating Procedures (SOP). Briefly,

Sediment Sample Preparation – Sediment samples were extracted for TPH, alkanes, isoprenoids, PAHs and hopane following Battelle Duxbury SOP 5-307, *Soil/Sediment Extraction for Petroleum Contaminant Analysis Using the Accelerated Solvent Extractor*. Briefly, approximately 10 g of well-mixed, wet sediment material was weighed into an extraction vessel and spiked with the surrogate internal standard (SIS) compounds. Next, the sample was extracted with dichloromethane (DCM) using Dionex™ ASE 200 Accelerated Solvent Extractor (1500 psi, 100°C). The extract was dried over hydromatrix diatomaceous earth or sodium sulfate, concentrated to approximately 2 to 3 mL using Kuderna-Danish and nitrogen evaporation techniques. Sample extracts were treated with activated copper to remove elemental sulfur. The extract was then processed through an alumina cleanup column. Gravimetric analysis was performed for both pre-column and post-column extracts to estimate the dilution factor for the sample extracts. The extract was concentrated under nitrogen to approximately 1 mL, fortified with recovery internal standard (RIS) compounds that are used for quantification, and split for TPH/alkanes/isoprenoids and PAHs/hopane analyses by GC/FID and GC/MS, respectively.

METHOD (cont):

GC/MS Analysis – PAHs/hopane were analyzed by GC/MS (Hewlett Packard 6890) using a 60-m DB5 column and helium as the carrier gas. A minimum of a five-point calibration curve was used for PAH/hopane analysis, ranging from approximately 0.01 to 10.0 µg/mL. Concentrations of PAH/hopane were determined by the method of internal standards, using the RIS. All sediment results were reported in a microgram per kilogram dry-weight concentration basis (µg/kg).

HOLDING TIMES:

Samples were prepared for analysis in one analytical batch. Samples were extracted and analyzed within holding times. Sediment samples were held frozen and in the dark until extraction.

Batch	Extraction Date	Analysis Date
03-0619	07/16/2003	07/24–25/2003

DETECTION LIMITS:

PAH results are reported relative to sample-specific reporting limits (ssRL) for that compound, as follows:

- Non-detects are reported as "null" and U flagged.
- Compounds detected at a concentration below the ssRL are reported and J flagged.

Note that the ssRL is based on the low calibration standard and adjusted for sample specific processing factors and volumes.

BLANKS:

A laboratory procedural blank (PB) was prepared with the analytical batch. Blanks are analyzed to ensure that the sample extraction and analysis methods were free of contamination.

03-0619 – Naphthalene, C1-naphthalenes and C2-naphthalenes were detected in the procedural blank at values above the ssRL.

Corrective Action – Concentrations of Naphthalene, C1-naphthalenes and C2-naphthalenes in the associated study samples are well above five times blank values, suggesting that laboratory contamination had minimal impact on sample values.

LABORATORY CONTROL SAMPLE

One laboratory control sample (LCS) was prepared with the analytical batch. The LCS was fortified with representative PAH to monitor data quality in terms of accuracy.

03-0619 – No exceedances.

LCS recoveries ranged from:

	PAH
BC924LCS	52 – 111%

MATRIX SPIKES:

One matrix spike (MS) sample was prepared with the sediment batch to measure data quality in terms of accuracy and precision. The MS was fortified with PAH to monitor data quality in terms of accuracy.

03-0619 – 7 out of 23 PAHs were recovered outside the control limits (40-120%) in the MS. Of these, 4 met the contingency criteria.

Recoveries ranged from:

	PAH
T2360MS-D	38 – 137%

MATRIX SPIKE (CONT):

Corrective Action – Four PAH were recovered above the upper control limit (120%) in the MS, however concentrations of these PAHs in the MS were less than five times background values, indicating that the MS was not fortified with high enough levels of these PAHs to accurately recover the PAHs relative to the background concentrations. Recovery data for these PAHs have been flagged with the "n" qualifier on the final report tables.

Three other PAHs were also recovered outside the control limits (40-120%), including Decalin (38%), Perylene (131%), and Dibenz(a,h)anthracene (125%). Recovery data for these PAHs have been flagged with the "N" qualifier on the final report tables. QC results for Decalin, Perylene, and Dibenz(a,h)anthracene were acceptable for the LCS and SRM; no further corrective action taken.

SURROGATES:

Three PAH surrogate compounds were added to each sample prior to extraction, including Naphthalene-d8, Phenanthrene-d10, and Chrysene-d12. Recovery data were calculated to measure data quality in terms of accuracy (extraction efficiency).

03-0619 – No exceedances.

DUPLICATES:

A laboratory duplicate was prepared with the batch. The relative percent difference (RPDs) between laboratory duplicate analyses for PAHs and hopane were calculated to measure data quality in terms of precision.

03-0619 – All but one compound met the QC criteria.

RPDs ranged from 1.9 to 31.5%.

Corrective Action – C3-fluorenes was just slightly above the control limit in the duplicate (RPD = 31.5%). However, this single exceedance represented only 2% of the target PAH and the work plan allows for up to 10% of the PAH to exceed the control limits. No corrective action taken other than flagging the exceedance on the final report table.

CONTROL OIL:

A North Slope Crude oil was prepared with the batch. The percent difference (PD) between measured and historical values was calculated to measure data quality in terms of accuracy.

03-0619 – All but two compounds met the QC criteria.

PDs ranged from 0.74 to 30.1%.

Corrective Action – C2- and C3-chrysenes was just slightly above the control limit in the control oil sample (PD = 30.1 and 29%, respectively). The integration for these analytes was double checked to ensure the consistence and no error was noted. No corrective action taken other than flagging the exceedance on the final report table.

PAH QA/QC SUMMARY
QC Batch 03-0619

SRM: A standard reference material (SRM, NIST 1944) was prepared with the sediment analytical batch. The PD between detected concentrations and *certified values* was calculated to measure data quality in terms of accuracy. ***Note*** – if the detected value fell within the certified range, but the PD is > 30%, data will be qualified with "n". Also note that the SRM is certified for only 15 of the target compounds.

03-0619 – No exceedances.

PDs ranged from:

	PAH
BC925SRM	1.6 – 32.6%

Naphthalene was under-recovered in the SRM. Even so, this compound met the contingency criteria and is flagged with "n" qualifier accordingly.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	Procedural Blank	
Battelle Sample ID	BC923PB	
Matrix	Sediment	
Batch ID	03-0619	
Analytical Method	8270M	
Sequence	SQB998.S	
Data File	B8051.D	
Collection Date	NA	
Receipt Date	NA	
Extraction Date	07/16/03	
Analysis Date	07/24/03	
Sample Dry Weight (g)	4	
Percent Moisture	62.64	
Primary Dilution Factor	1.00	
Secondary Dilution Factor	NA	
PIV (µl)	1000	
Min Reporting Limit	2.53	
Concentration Units	µg/kg	
Decalin	U	
C1-Decalins	U	
C2-Decalins	U	
C3-Decalins	U	
C4-Decalins	U	
Benzo(b)thiophene	U	
C1-Benzo(b)thiophenes	U	
C2-Benzo(b)thiophenes	U	
C3-Benzo(b)thiophenes	U	
C4-Benzo(b)thiophenes	U	
Naphthalene	6.50	
C1-Naphthalenes	8.42	
C2-Naphthalenes	6.60	
C3-Naphthalenes	2.11	J
C4-Naphthalenes	U	
Biphenyl	0.82	J
Acenaphthylene	U	
Acenaphthene	U	
Dibenzofuran	0.23	J
Fluorene	U	
C1-Fluorenes	U	
C2-Fluorenes	U	
C3-Fluorenes	U	
Anthracene	U	
Phenanthrene	0.34	J
C1-Phenanthrenes/Anthracenes	U	
C2-Phenanthrenes/Anthracenes	U	
C3-Phenanthrenes/Anthracenes	U	
C4-Phenanthrenes/Anthracenes	U	
Dibenzothiophene	0.34	J
C1-Dibenzothiophenes	U	
C2-Dibenzothiophenes	U	
C3-Dibenzothiophenes	U	
C4-Dibenzothiophenes	U	
Fluoranthene	U	
Pyrene	U	
C1-Fluoranthenes/Pyrenes	U	
C2-Fluoranthenes/Pyrenes	U	
C3-Fluoranthenes/Pyrenes	U	
Benzo[a]anthracene	U	
Chrysene	U	
C1-Chrysenes	U	
C2-Chrysenes	U	
C3-Chrysenes	U	
C4-Chrysenes	U	
Benzo[b]fluoranthene	U	
Benzo[j/k]fluoranthene	U	
Benzo[e]pyrene	U	
Benzo[a]pyrene	U	
Perylene	U	
Indeno[1,2,3-c,d]pyrene	U	
Dibenz[a,h]anthracene	U	
Benzo[g,h,i]perylene	U	
Hopane	U	
Surrogate Recoveries (%)		
Naphthalene-d8	68	
Phenanthrene-d10	77	
Chrysene-d12	99	

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	Laboratory control Sample			
Battelle Sample ID		BC924LCS		
Matrix		Sediment		
Batch ID		*03-0619*		
Analytical Method		8270M		
Sequence		SQB998.S		
Data File		B8052.D		
Collection Date		NA		
Receipt Date		NA		
Extraction Date		07/16/03		
Analysis Date		07/24/03		
Sample Dry Weight (g)		NA		
Percent Moisture		NA		
Primary Dilution Factor		1.00		
Secondary Dilution Factor		NA		
PIV (µl)		1000		
Min Reporting Limit		NA		
Concentration Units	FZ46	ng	% Recovery	Q
Decalin	1076	562.73	52	
C1-Decalins		U		
C2-Decalins		U		
C3-Decalins		U		
C4-Decalins		U		
Benzo(b)thiophene	985	778.02	79	
C1-Benzo(b)thiophenes		U		
C2-Benzo(b)thiophenes		U		
C3-Benzo(b)thiophenes		U		
C4-Benzo(b)thiophenes		U		
Naphthalene	1002	779.41	78	
C1-Naphthalenes		U		
C2-Naphthalenes		U		
C3-Naphthalenes		U		
C4-Naphthalenes		U		
Biphenyl	1003	810.93	81	
Acenaphthylene	1002	742.50	74	
Acenaphthene	1001	773.60	77	
Dibenzofuran	1000	823.97	82	
Fluorene	1001	832.79	83	
C1-Fluorenes		U		
C2-Fluorenes		U		
C3-Fluorenes		U		
Anthracene	1002	877.03	88	
Phenanthrene	1001	842.49	84	
C1-Phenanthrenes/Anthracenes		U		
C2-Phenanthrenes/Anthracenes		U		
C3-Phenanthrenes/Anthracenes		U		
C4-Phenanthrenes/Anthracenes		U		
Dibenzothiophene	1004	774.12	77	
C1-Dibenzothiophenes		U		
C2-Dibenzothiophenes		U		
C3-Dibenzothiophenes		U		
C4-Dibenzothiophenes		U		
Fluoranthene	1001	912.61	91	
Pyrene	1001	933.20	93	
C1-Fluoranthenes/Pyrenes		U		
C2-Fluoranthenes/Pyrenes		U		
C3-Fluoranthenes/Pyrenes		U		
Benzo[a]anthracene	1001	1005.97	101	
Chrysene	1002	985.66	98	
C1-Chrysenes		U		
C2-Chrysenes		U		
C3-Chrysenes		U		
C4-Chrysenes		U		
Benzo[b]fluoranthene	*1002*	*1075.84*	*107*	
Benzo[j/k]fluoranthene	1002	1018.52	102	
Benzo[e]pyrene	998	1019.71	102	
Benzo[a]pyrene	1001	1094.49	109	
Perylene	1000	1065.92	107	
Indeno[1,2,3-c,d]pyrene	1002	1106.75	111	
Dibenz[a,h]anthracene	1001	1111.15	111	
Benzo[g,h,i]perylene	1002	1028.49	103	
Hopane		U		

Surrogate Recoveries (%)	
Naphthalene-d8	85
Phenanthrene-d10	89
Chrysene-d12	105

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID		CMS-SD-4223-0004-01		CMS-SD-4223-0004-01			
Battelle Sample ID		T2360-D		T2360MS-D			
Matrix		Sediment		Sediment			
Batch ID		03-0619		03-0619			
Analytical Method		8270M		8270M			
Sequence		SQB998.S		SQB998.S			
Data File		B8055.D		B8056.D			
Collection Date		05/08/03		05/08/03			
Receipt Date		05/12/03		05/12/03			
Extraction Date		07/16/03		07/16/03			
Analysis Date		07/24/03		07/25/03			
Sample Dry Weight (g)		3.7		1.88			
Percent Moisture		63.12		63.12			
Primary Dilution Factor		10.53		5.26			
Secondary Dilution Factor		NA		NA			
PIV (µl)		1000		1000			
Min Reporting Limit		28.73		28.27			
Concentration Units	FZ46	µg/kg		µg/kg		% Recovery	Q
Decalin	10764		U	2173.08		38	N
C1-Decalins			U		U		
C2-Decalins			U		U		
C3-Decalins			U		U		
C4-Decalins			U		U		
Benzo(b)thiophene	9848	5.30	J	3056.83		58	
C1-Benzo(b)thiophenes		10.78	J	113.00			
C2-Benzo(b)thiophenes		10.65	J	9.16	J		
C3-Benzo(b)thiophenes			U		U		
C4-Benzo(b)thiophenes			U		U		
Naphthalene	10015	102.67		3102.02		56	
C1-Naphthalenes		60.50		4037.14			
C2-Naphthalenes		78.64		2107.81			
C3-Naphthalenes		130.27		2058.23			
C4-Naphthalenes		115.24		329.11			
Biphenyl	10030	58.07		3865.96		71	
Acenaphthylene	10015	219.55		3953.88		70	
Acenaphthene	10010	72.57		3967.56		73	
Dibenzofuran	10000	70.60		4411.71		82	
Fluorene	10005	100.05		4645.98		85	
C1-Fluorenes		60.44		78.90			
C2-Fluorenes		101.76		124.03			
C3-Fluorenes		103.35		173.13			
Anthracene	10015	355.97		5383.21		94	
Phenanthrene	10010	1733.98		6627.93		92	
C1-Phenanthrenes/Anthracenes		793.60		4434.92			
C2-Phenanthrenes/Anthracenes		783.12		831.35			
C3-Phenanthrenes/Anthracenes		456.45		554.90			
C4-Phenanthrenes/Anthracenes		206.37		240.16			
Dibenzothiophene	10036	99.56		4552.30		83	
C1-Dibenzothiophenes		103.19		196.20			
C2-Dibenzothiophenes		187.59		234.19			
C3-Dibenzothiophenes		197.41		232.08			
C4-Dibenzothiophenes		134.07		186.69			
Fluoranthene	10010	4461.85		9679.91		98	
Pyrene	10010	3956.31		9452.67		103	
C1-Fluoranthenes/Pyrenes		1794.44		1898.08			
C2-Fluoranthenes/Pyrenes		1493.26		1614.62			
C3-Fluoranthenes/Pyrenes		763.84		906.59			
Benzo[a]anthracene	10005	2147.28		8470.52		119	
Chrysene	10015	3469.09		9428.01		112	
C1-Chrysenes		1341.51		1437.49			
C2-Chrysenes		736.11		839.50			
C3-Chrysenes		565.53		638.02			
C4-Chrysenes			U		U		
Benzo[b]fluoranthene	10020	3903.85		11207.24		137	n
Benzo[j/k]fluoranthene	10020	3836.05		10113.75		118	
Benzo[e]pyrene	9976	3311.77		10012.11		126	n
Benzo[a]pyrene	10005	3183.09		10266.59		133	n
Perylene	10002	742.82		7691.68		131	N
Indeno[1,2,3-c,d]pyrene	10015	3263.55		10349.14		133	n
Dibenz[a,h]anthracene	10010	653.86		7306.70		125	N
Benzo[g,h,i]perylene	10020	2807.22		9106.57		118	
Hopane		1163.40		1619.41			
Surrogate Recoveries (%)							
Naphthalene-d8		59		58			
Phenanthrene-d10		87		89			
Chrysene-d12		111		110			

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID		NIST 1944			
Battelle Sample ID		BC925SRM			
Matrix		Sediment			
Batch ID		03-0619			
Analytical Method		8270M			
Sequence		SQB998.S			
Data File		B8053.D			
Collection Date		NA			
Receipt Date		NA			
Extraction Date		07/16/03			
Analysis Date		07/24/03			
Sample Dry Weight (g)		1.08			
Percent Moisture		1.25			
Primary Dilution Factor		1.00			
Secondary Dilution Factor		NA			
PIV (µl)		1000			
Min Reporting Limit		9.35			
Concentration Units	NIST 1944	µg/kg	% Difference		Limit
Decalin		28.81			
C1-Decalins		53.23			
C2-Decalins		62.16			
C3-Decalins		105.52			
C4-Decalins		81.90			
Benzo(b)thiophene		47.80			
C1-Benzo(b)thiophenes		82.64			
C2-Benzo(b)thiophenes		78.64			
C3-Benzo(b)thiophenes		114.51			
C4-Benzo(b)thiophenes		157.81			
Naphthalene	1650	1112.63	32.6	n	48.8
C1-Naphthalenes		691.98			
C2-Naphthalenes		950.78			
C3-Naphthalenes		1345.83			
C4-Naphthalenes		1503.06			
Biphenyl		151.41			
Acenaphthylene		684.54			
Acenaphthene		255.10			
Dibenzofuran		311.54			
Fluorene		359.01			
C1-Fluorenes		571.56			
C2-Fluorenes		1163.86			
C3-Fluorenes		2554.61			
Anthracene	1770	1394.63	21.2		48.6
Phenanthrene	5270	4670.17	11.4		34.2
C1-Phenanthrenes/Anthracenes		5044.37			
C2-Phenanthrenes/Anthracenes		5812.93			
C3-Phenanthrenes/Anthracenes		4010.04			
C4-Phenanthrenes/Anthracenes		2016.18			
Dibenzothiophene		650.79			
C1-Dibenzothiophenes		1619.99			
C2-Dibenzothiophenes		2460.07			
C3-Dibenzothiophenes		2561.94			
C4-Dibenzothiophenes		1165.56			
Fluoranthene	8920	8505.70	4.6		33.6
Pyrene	9700	9392.97	3.2		34.3
C1-Fluoranthenes/Pyrenes		6926.76			
C2-Fluoranthenes/Pyrenes		5467.27			
C3-Fluoranthenes/Pyrenes		2935.51			
Benzo[a]anthracene	4720	4130.84	12.5		32.3
Chrysene	5900	5065.42	14.1		36.3
C1-Chrysenes		3924.52			
C2-Chrysenes		2223.27			
C3-Chrysenes		1256.58			
C4-Chrysenes		588.98			
Benzo[b]fluoranthene	3870	3770.95	2.6		40.9
Benzo[j/k]fluoranthene	4390	4243.70	3.3		44.6
Benzo[e]pyrene	3280	3358.35	2.4		33.4
Benzo[a]pyrene	4300	3911.21	9.0		33.0
Perylene	1170	1017.03	13.1		50.5
Indeno[1,2,3-c,d]pyrene	2780	2824.62	1.6		33.6
Dibenz[a,h]anthracene	759	732.10	3.5		40.8
Benzo[g,h,i]perylene	2840	2550.17	10.2		33.5
Hopane		2710.95			

Surrogate Recoveries (%)	
Naphthalene-d8	54
Phenanthrene-d10	87
Chrysene-d12	113

Chrysene value is a combination of Chrysene (certified 4860) and Triphenylene (certified 1040).
Dibenz(a,h)anthracene is a combination of Dibenz(a,h)anthracene (certified 420) and Dibenz(a,c)anthracene (certified 335)
NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID		North Slope Crude		
Battelle Sample ID		FZ37		
Matrix		Sediment		
Batch ID		03-0619		
Analytical Method		8270M		
Sequence		SQB998.S		
Data File		B8050.D		
Collection Date		NA		
Receipt Date		NA		
Extraction Date		NA		
Analysis Date		07/24/03		
Sample Dry Weight (g)		NA		
Percent Moisture		NA		
Primary Dilution Factor		1.00		
Secondary Dilution Factor		NA		
PIV (µl)		NA		
Min Reporting Limit		NA		
Concentration Units	Average NSC Values	µg/kg	% Difference	Q
Decalin		478.73		
C1-Decalins		777.68		
C2-Decalins		738.92		
C3-Decalins		577.41		
C4-Decalins		237.75		
Benzo(b)thiophene		4.64		
C1-Benzo(b)thiophenes		31.90		
C2-Benzo(b)thiophenes		51.87		
C3-Benzo(b)thiophenes		97.87		
C4-Benzo(b)thiophenes		102.19		
Naphthalene	706	620.10	12.2	
C1-Naphthalenes	1520	1251.13	17.7	
C2-Naphthalenes	1900	1541.84	18.8	
C3-Naphthalenes	1430	1076.26	24.7	
C4-Naphthalenes	800	629.98	21.2	
Biphenyl	211	190.76	9.59	
Acenaphthylene		7.94		
Acenaphthene		7.68		
Dibenzofuran		62.36		
Fluorene	81.2	79.77	1.76	
C1-Fluorenes	223	201.51	9.63	
C2-Fluorenes	342	291.67	14.7	
C3-Fluorenes	324	266.18	17.8	
Anthracene				
Phenanthrene	263	250.63	4.7	
C1-Phenanthrenes/Anthracenes	560	485.03	13.4	
C2-Phenanthrenes/Anthracenes	670	579.58	13.5	
C3-Phenanthrenes/Anthracenes	471	419.34	11	
C4-Phenanthrenes/Anthracenes	176	164.53	6.52	
Dibenzothiophene	215	196.39	8.66	
C1-Dibenzothiophenes	428	377.76	11.7	
C2-Dibenzothiophenes	585	482.96	17.4	
C3-Dibenzothiophenes	487	420.79	13.6	
C4-Dibenzothiophenes		232.73		
Fluoranthene		3.81		
Pyrene	17.6	14.30	18.8	
C1-Fluoranthenes/Pyrenes	77.4	72.62	6.18	
C2-Fluoranthenes/Pyrenes	131	130.03	0.74	
C3-Fluoranthenes/Pyrenes	140	158.81	13.4	
Benzo[a]anthracene		2.12		
Chrysene	49.4	52.56	6.4	
C1-Chrysenes	77.4	89.83	16.1	
C2-Chrysenes	91.8	119.46	30.1	N
C3-Chrysenes	82.2	106.02	29	N
C4-Chrysenes	45.8	54.70	19.4	
Benzo[b]fluoranthene	7.31	8.38	14.7	
Benzo[j/k]fluoranthene				
Benzo[e]pyrene	13	14.69	15.7	
Benzo[a]pyrene				
Perylene				
Indeno[1,2,3-c,d]pyrene				
Dibenz[a,h]anthracene		1.05		
Benzo[g,h,i]perylene	3.89	3.78	2.83	
Hopane		134.32		
EPA PAH		1052.12		
Total PAH		10669.11		
Surrogate Recoveries (%)				
Naphthalene-d8		96		
Phenanthrene-d10		104		
Chrysene-d12		124		

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.
EPA PAH - Sum of EPA 16 priority PAHs.
Total PAH - Sum of PAHs naphthalene through benzo([g,h,i]perylene.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	LPX-SD-4207-0009-01	LPX-SD-4207-0009-01		
Battelle Sample ID	*T2364-D*	*T2364DUP-D*		
Matrix	Sediment	Sediment		
Batch ID	03-0619	03-0619		
Analytical Method	8270M	8270M		
Sequence	SQB998.S	SQB998.S		
Data File	B8058.D	B8059.D		
Collection Date	05/07/03	05/07/03		
Receipt Date	05/12/03	05/12/03		
Extraction Date	07/16/03	07/16/03		
Analysis Date	07/25/03	07/25/03		
Sample Dry Weight (g)	3.83	3.72		
Percent Moisture	63.16	63.16		
Primary Dilution Factor	10.53	10.53		
Secondary Dilution Factor	NA	NA		
PtV (µl)	1000	1000		
Min Reporting Limit	27.76	28.58		
Concentration Units	µg/kg	µg/kg	RPD	Q
Decalin	U	U		
C1-Decalins	27.86	29.82	6.8	
C2-Decalins	U	U		
C3-Decalins	U	U		
C4-Decalins	U	U		
Benzo(b)thiophene	5.47 J	6.60 J	18.9	
C1-Benzo(b)thiophenes	11.94 J	12.20 J	2.1	
C2-Benzo(b)thiophenes	U	9.49 J		
C3-Benzo(b)thiophenes	U	U		
C4-Benzo(b)thiophenes	U	U		
Naphthalene	110.07	124.11	12.0	
C1-Naphthalenes	49.17	58.71	17.7	
C2-Naphthalenes	104.86	130.44	21.7	
C3-Naphthalenes	142.70	168.61	16.6	
C4-Naphthalenes	145.53	186.50	24.7	
Biphenyl	23.70 J	31.56	28.5	
Acenaphthylene	255.59	337.72	27.7	
Acenaphthene	198.41	221.65	11.1	
Dibenzofuran	168.04	200.80	17.7	
Fluorene	412.66	489.16	17.0	
C1-Fluorenes	147.42	185.02	22.6	
C2-Fluorenes	205.60	255.13	21.5	
C3-Fluorenes	243.73	334.84	31.5	N
Anthracene	850.46	1033.06	19.4	
Phenanthrene	5755.72	6966.83	19.0	
C1-Phenanthrenes/Anthracenes	1735.24	2143.65	21.0	
C2-Phenanthrenes/Anthracenes	1190.09	1473.27	21.3	
C3-Phenanthrenes/Anthracenes	753.01	937.90	21.9	
C4-Phenanthrenes/Anthracenes	428.27	549.08	24.7	
Dibenzothiophene	293.00	356.96	19.7	
C1-Dibenzothiophenes	192.10	241.38	22.7	
C2-Dibenzothiophenes	292.09	376.68	25.3	
C3-Dibenzothiophenes	375.45	498.59	28.2	
C4-Dibenzothiophenes	288.74	368.80	24.4	
Fluoranthene	13621.36	16483.62	19.0	
Pyrene	10926.49	13078.54	17.9	
C1-Fluoranthenes/Pyrenes	4772.53	5678.68	17.3	
C2-Fluoranthenes/Pyrenes	2780.37	3357.35	18.8	
C3-Fluoranthenes/Pyrenes	1283.03	1600.51	22.0	
Benzo[a]anthracene	5336.32	6081.65	13.0	
Chrysene	8344.93	9852.54	16.6	
C1-Chrysenes	2657.12	3044.45	13.6	
C2-Chrysenes	1219.27	1400.91	13.9	
C3-Chrysenes	1001.84	1021.32	1.9	
C4-Chrysenes	U	U		
Benzo[b]fluoranthene	8613.46	9979.91	14.7	
Benzo[j/k]fluoranthene	8166.46	9824.87	18.4	
Benzo[e]pyrene	6238.55	7377.18	16.7	
Benzo[a]pyrene	7675.79	8824.07	13.9	
Perylene	1785.27	2014.43	12.1	
Indeno[1,2,3-c,d]pyrene	6298.49	7467.80	17.0	
Dibenz[a,h]anthracene	1188.04	1420.08	17.8	
Benzo[g,h,i]perylene	5319.00	6335.20	17.4	
Hopane	1659.48	2187.68	27.4	
EPA PAH	83073.24	98520.81		
Total PAH	111589.98	132513.38		
Surrogate Recoveries (%)				
Naphthalene-d8	*59*	*60*		
Phenanthrene-d10	88	89		
Chrysene-d12	115	114		

NA - Not applicable
J - Result < Sample RL.
U - Not Detected.
D - Values reported using secondary dilution factor.
N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.
EPA PAH - Sum of EPA 16 priority PAHs.
Total PAH - Sum of PAHs naphthalene through benzo([g,h,i]perylene.

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Project Name Centredale Delivery Order 01, Task RI-8
Project Number G487002-RI8A

Client Sample ID	LPX-SD-4205-0015-01	CMS-SD-4223-0004-01	LPX-SD-4208-0011-01	LPX-SD-4207-0009-01	LPX-SD-4203-0012-01
Battelle Sample ID	T2334-D	T2360-D	T2361-D	T2364-D	T2385-D
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment
Batch ID	03-0619	03-0619	03-0619	03-0619	03-0619
Analytical Method	8270M	8270M	8270M	8270M	8270M
Sequence	SQB998.S	SQB998.S	SQB998.S	SQB998.S	SQB998.S
Data File	B8054.D	B8055.D	B8057.D	B8058.D	B8060.D
Collection Date	05/08/03	05/08/03	05/07/03	05/07/03	05/08/03
Receipt Date	05/12/03	05/12/03	05/12/03	05/12/03	05/12/03
Extraction Date	07/16/03	07/16/03	07/16/03	07/16/03	07/16/03
Analysis Date	07/24/03	07/24/03	07/25/03	07/25/03	07/25/03
Sample Dry Weight (g)	3.66	3.70	4.48	3.83	3.25
Percent Moisture	63.52	63.12	55.21	63.16	68.20
Primary Dilution Factor	10.53	10.53	7.02	10.53	5.85
Secondary Dilution Factor	NA	NA	NA	NA	NA
PIV (µl)	1000	1000	1000	1000	1000
Min Reporting Limit	29.05	28.73	15.82	27.76	18.17
Concentration Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Decalin	U	U	U	U	U
C1-Decalins	U	U	U	27.86	18.35
C2-Decalins	U	U	U	U	U
C3-Decalins	U	U	U	U	U
C4-Decalins	U	U	U	U	U
Benzo(b)thiophene	8.70 J	5.30 J	7.02 J	5.47 J	6.86 J
C1-Benzo(b)thiophenes	16.53 J	10.78 J	9.07 J	11.94 J	11.31 J
C2-Benzo(b)thiophenes	U	10.65 J	8.02 J	U	U
C3-Benzo(b)thiophenes	U	U	9.87 J	U	U
C4-Benzo(b)thiophenes	U	U	U	U	U
Naphthalene	158.58	102.67	88.02	110.07	97.96
C1-Naphthalenes	58.00	60.50	44.93	49.17	54.65
C2-Naphthalenes	148.46	78.64	80.13	104.86	100.66
C3-Naphthalenes	175.61	130.27	99.85	142.70	125.97
C4-Naphthalenes	178.20	115.24	92.26	145.53	126.85
Biphenyl	63.83	56.07	34.78	23.70 J	40.69
Acenaphthylene	360.86	219.55	197.02	255.59	264.51
Acenaphthene	144.57	72.57	101.53	198.41	63.79
Dibenzofuran	148.69	70.60	82.36	168.04	83.13
Fluorene	288.32	100.05	149.03	412.66	113.09
C1-Fluorenes	146.75	60.44	85.50	147.42	101.13
C2-Fluorenes	231.20	101.76	119.92	205.60	153.18
C3-Fluorenes	270.91	103.35	145.15	243.73	203.39
Anthracene	744.13	355.97	435.19	850.46	382.67
Phenanthrene	3668.69	1733.98	1798.72	5755.72	1047.57
C1-Phenanthrenes/Anthracenes	1544.98	793.60	836.24	1735.24	758.34
C2-Phenanthrenes/Anthracenes	1278.87	783.12	689.40	1190.09	769.04
C3-Phenanthrenes/Anthracenes	910.71	456.45	460.84	753.01	587.52
C4-Phenanthrenes/Anthracenes	519.36	206.37	255.93	428.27	395.84
Dibenzothiophene	210.93	99.56	126.42	293.00	107.46
C1-Dibenzothiophenes	196.88	103.19	107.61	192.10	133.11
C2-Dibenzothiophenes	290.04	187.59	153.16	292.09	181.25
C3-Dibenzothiophenes	420.85	197.41	195.47	375.45	246.63
C4-Dibenzothiophenes	341.34	134.07	163.49	288.74	252.51
Fluoranthene	9283.64	4461.85	5126.60	13621.36	3020.62
Pyrene	8111.57	3956.31	4492.83	10926.49	2973.30
C1-Fluoranthenes/Pyrenes	4103.91	1794.44	2223.07	4772.53	1893.74
C2-Fluoranthenes/Pyrenes	2766.48	1493.26	1516.95	2780.37	1365.42
C3-Fluoranthenes/Pyrenes	1496.03	763.84	761.10	1283.03	919.61
Benzo[a]anthracene	4248.32	2147.28	2377.65	5336.32	1571.32
Chrysene	6568.82	3469.09	3457.03	8344.93	2397.21
C1-Chrysenes	2820.05	1341.51	1538.60	2657.12	1398.53
C2-Chrysenes	1333.42	736.11	743.10	1219.27	863.06
C3-Chrysenes	973.54	565.53	547.21	1001.84	609.86
C4-Chrysenes	U	U	U	U	U
Benzo[b]fluoranthene	6976.50	3903.85	3870.65	8613.46	2626.74
Benzo[j/k]fluoranthene	7062.81	3836.05	3731.58	8166.48	2578.98
Benzo[e]pyrene	5661.66	3311.77	3061.81	6238.55	2294.32
Benzo[a]pyrene	6265.00	3183.09	3473.13	7675.79	2421.86
Perylene	1569.86	742.82	908.52	1785.27	1215.09
Indeno[1,2,3-c,d]pyrene	5522.14	3263.55	3054.63	6298.49	2133.82
Dibenz[a,h]anthracene	1153.22	653.86	605.37	1188.04	454.59
Benzo[g,h,i]perylene	4810.82	2807.22	2642.55	5319.00	1957.04
Hopane	2517.48	1163.40	1221.68	1659.48	1934.83
EPA PAH	65367.60	34266.94	35601.51	83073.24	24105.07
Total PAH	93227.94	48756.47	50675.30	111589.98	39066.05
Surrogate Recoveries (%)					
Naphthalene-d8	57	59	58	59	54
Phenanthrene-d10	90	87	89	88	83
Chrysene-d12	115	111	115	115	111

NA - Not applicable
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U - Not Detected.
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N - Outside of DQO.
n - Outside of DQO, but meets contingency criteria.
ME - Significant matrix interference - Estimated value.
EPA PAH - Sum of EPA 16 priority PAHs.
Total PAH - Sum of PAHs naphthalene through benzo([g,h,i]perylene.

Attachment D

Detailed PAH Histograms (GC/MS/SIM)

Attachment E

Triterpane Fingerprints (GC/MS/SIM)

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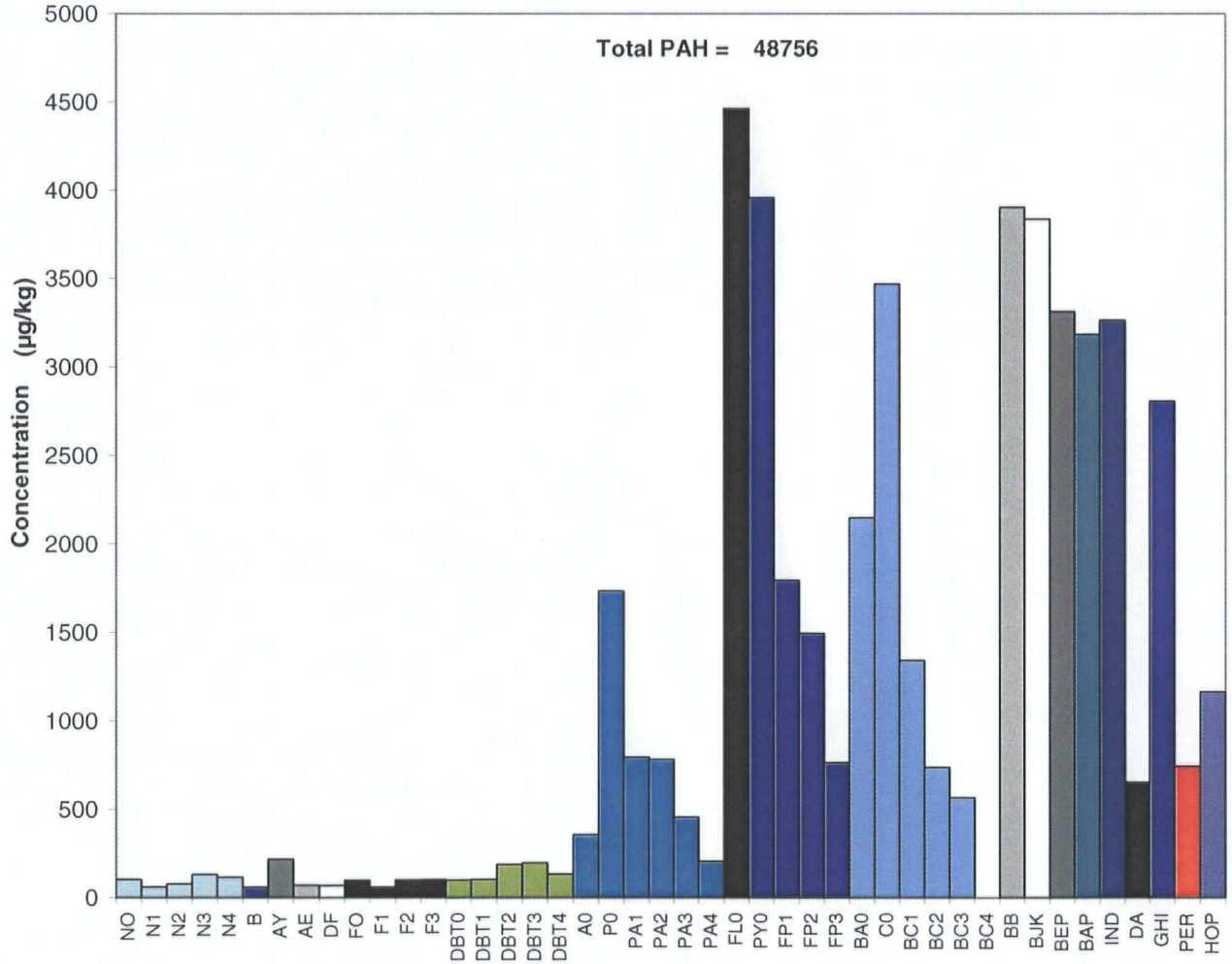
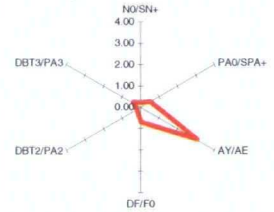
Alkylated PAH Overview

Sample ID:

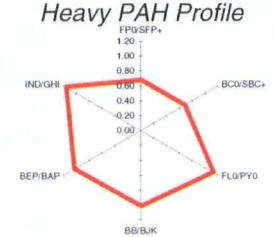
CMS-4223



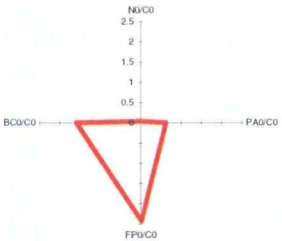
Light PAH Profile



Heavy PAH Profile



Weathering Profile



CMS-4223

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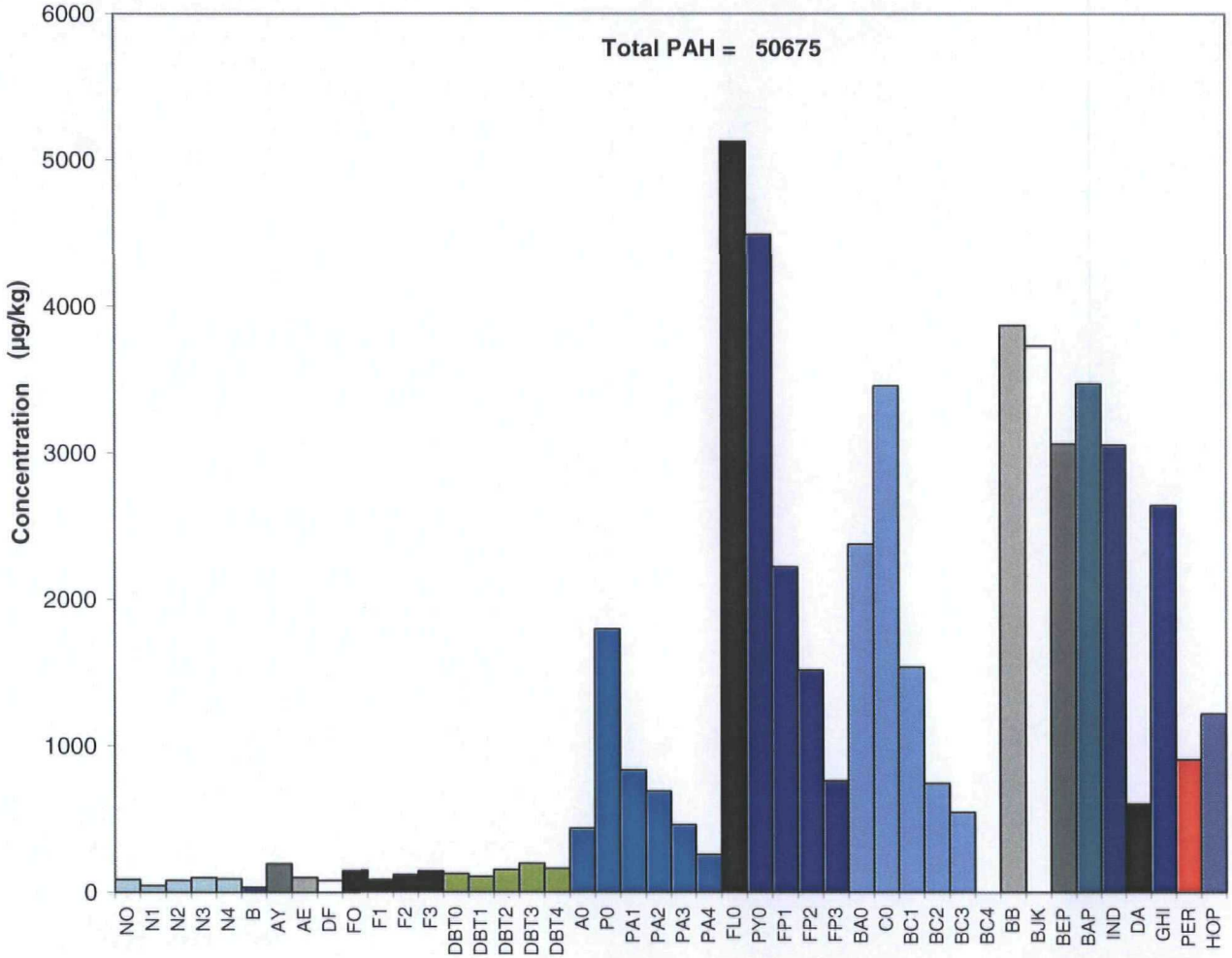
Alkylated PAH Overview

Sample ID:

LPX-4208



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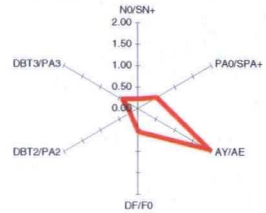

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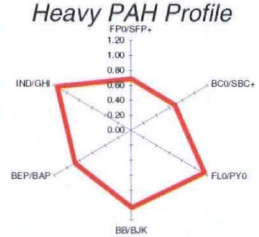

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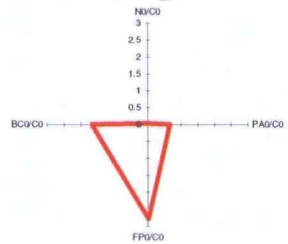

LPX-4208

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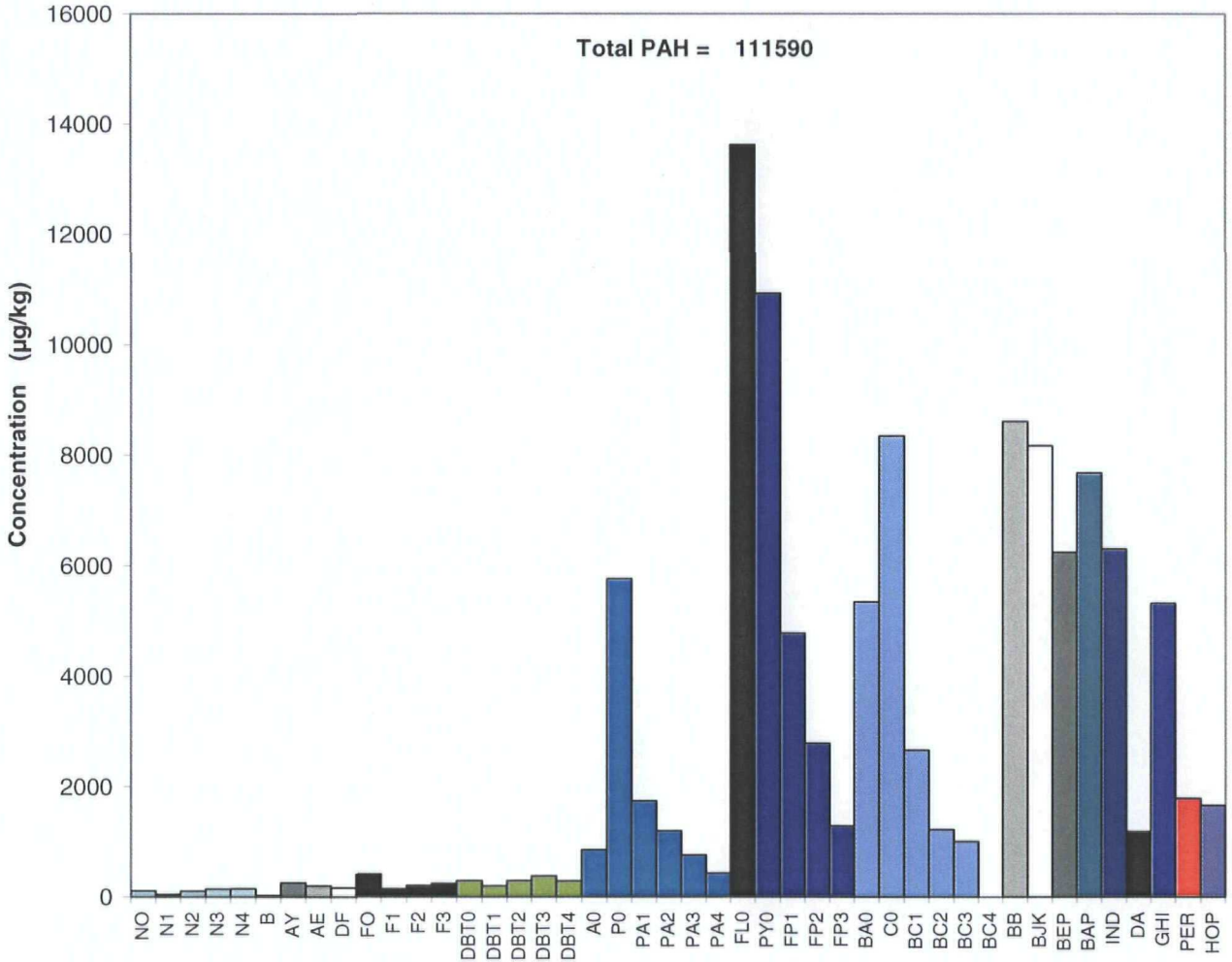
Alkylated PAH Overview

Sample ID:

LPX-4207



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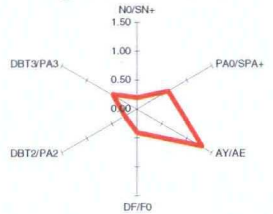

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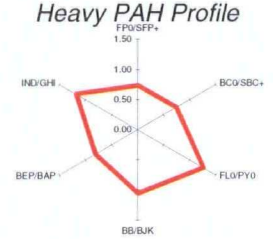
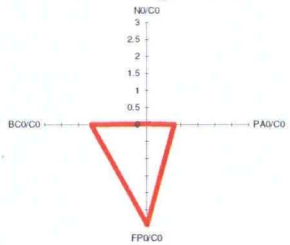


Weathering Profile



LPX-4207

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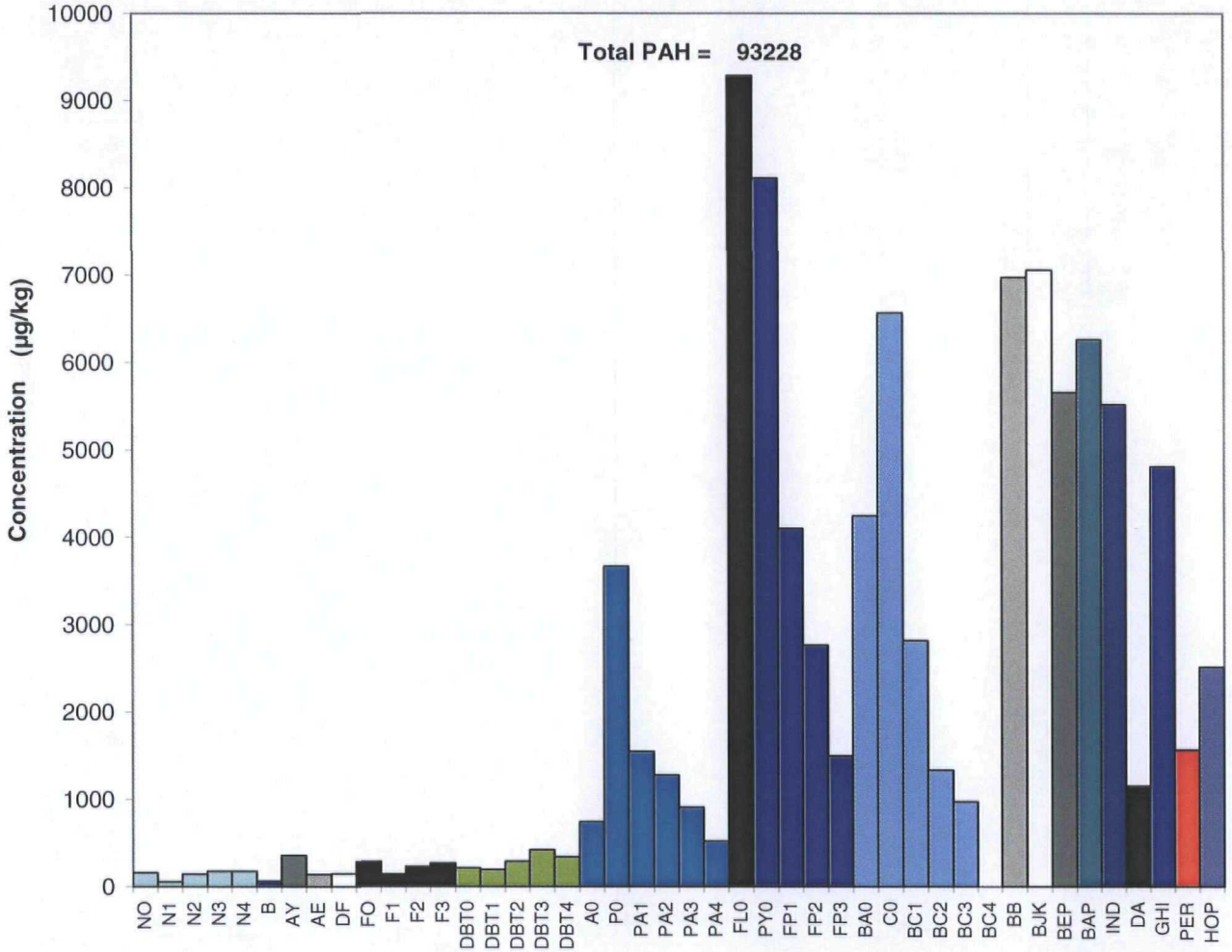
Alkylated PAH Overview

Sample ID:

LPX-4205



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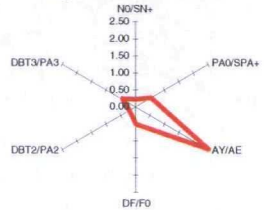

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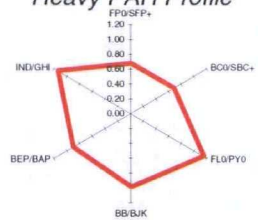
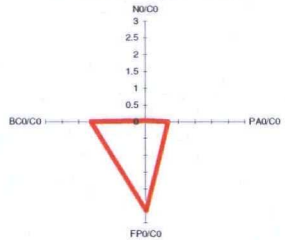


Weathering Profile



LPX-4205

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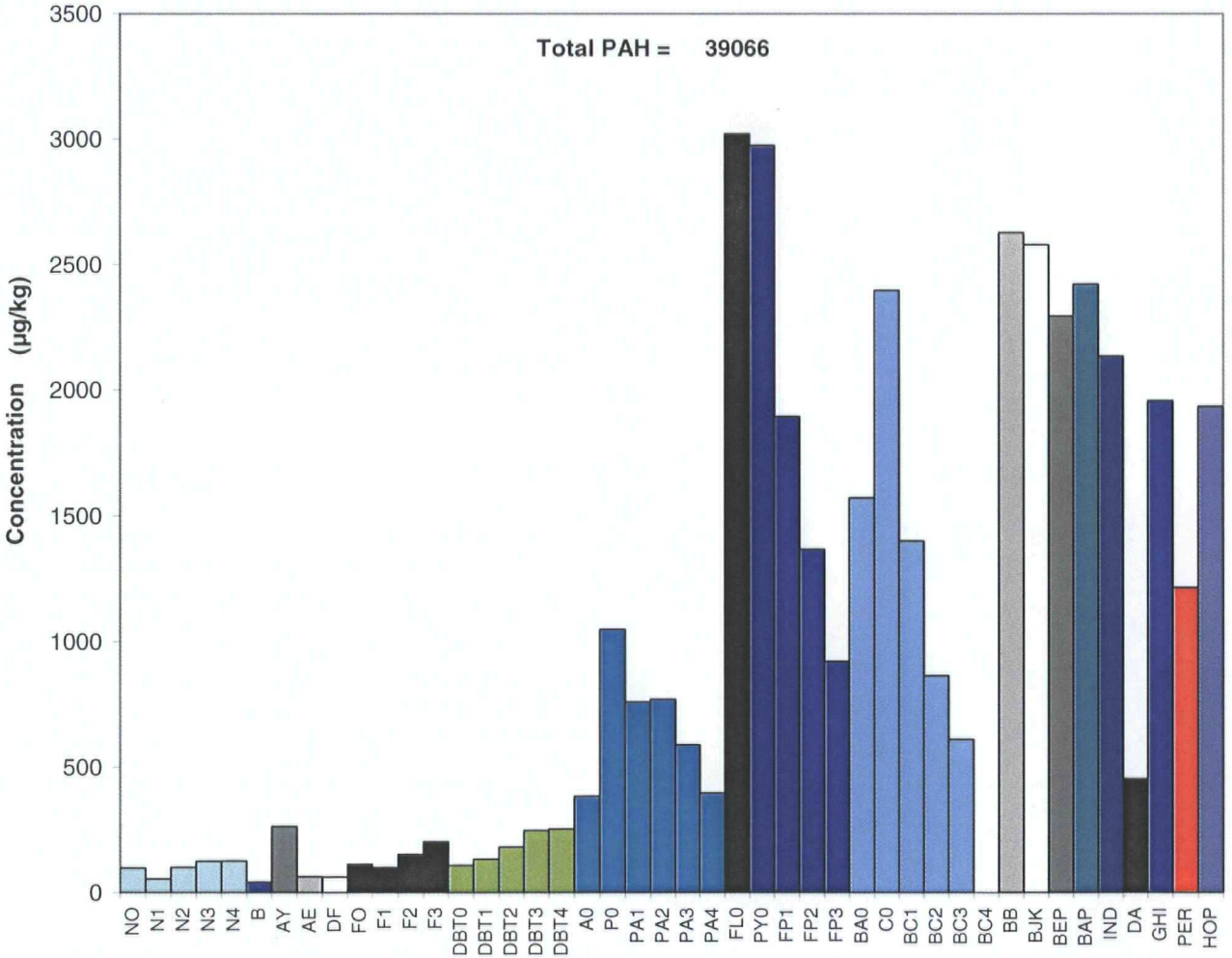
Alkylated PAH Overview

Sample ID:

LPX-4203



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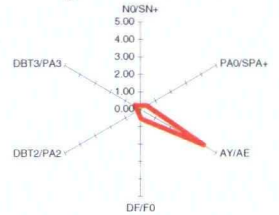

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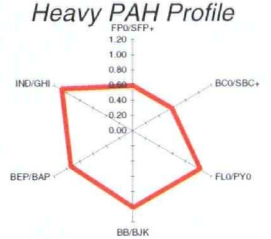
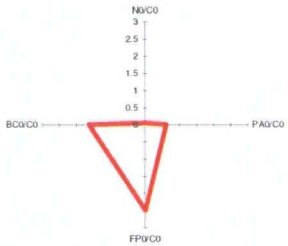


Weathering Profile



LPX-4203

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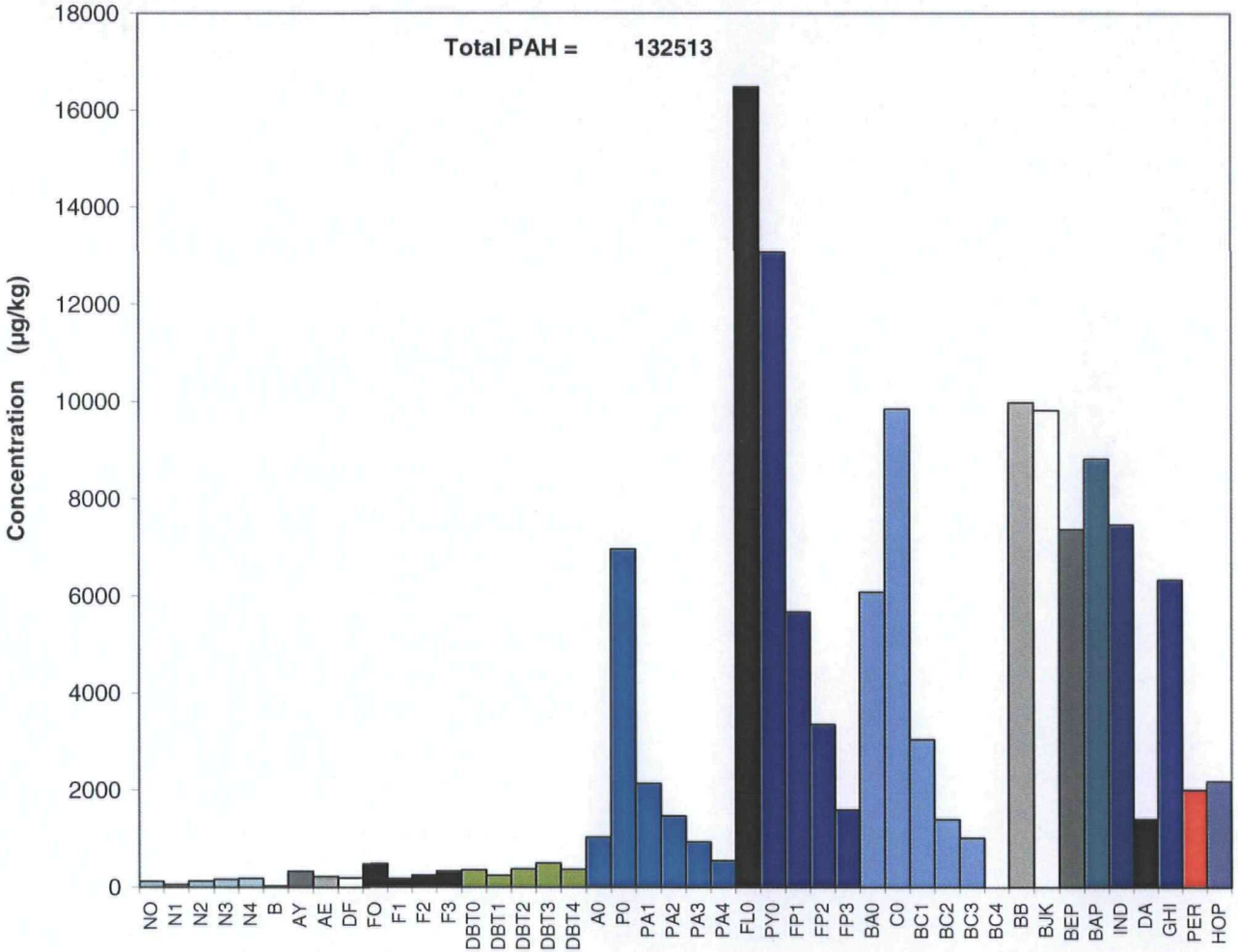
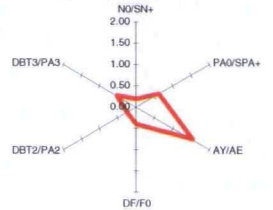
Alkylated PAH Overview

Sample ID:

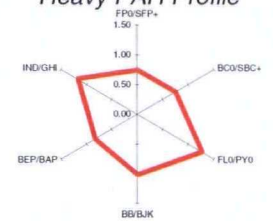
LPX-4207DUP



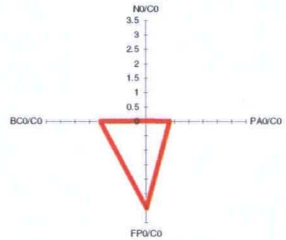
Light PAH Profile



Heavy PAH Profile



Weathering Profile



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LPX-4207DUP

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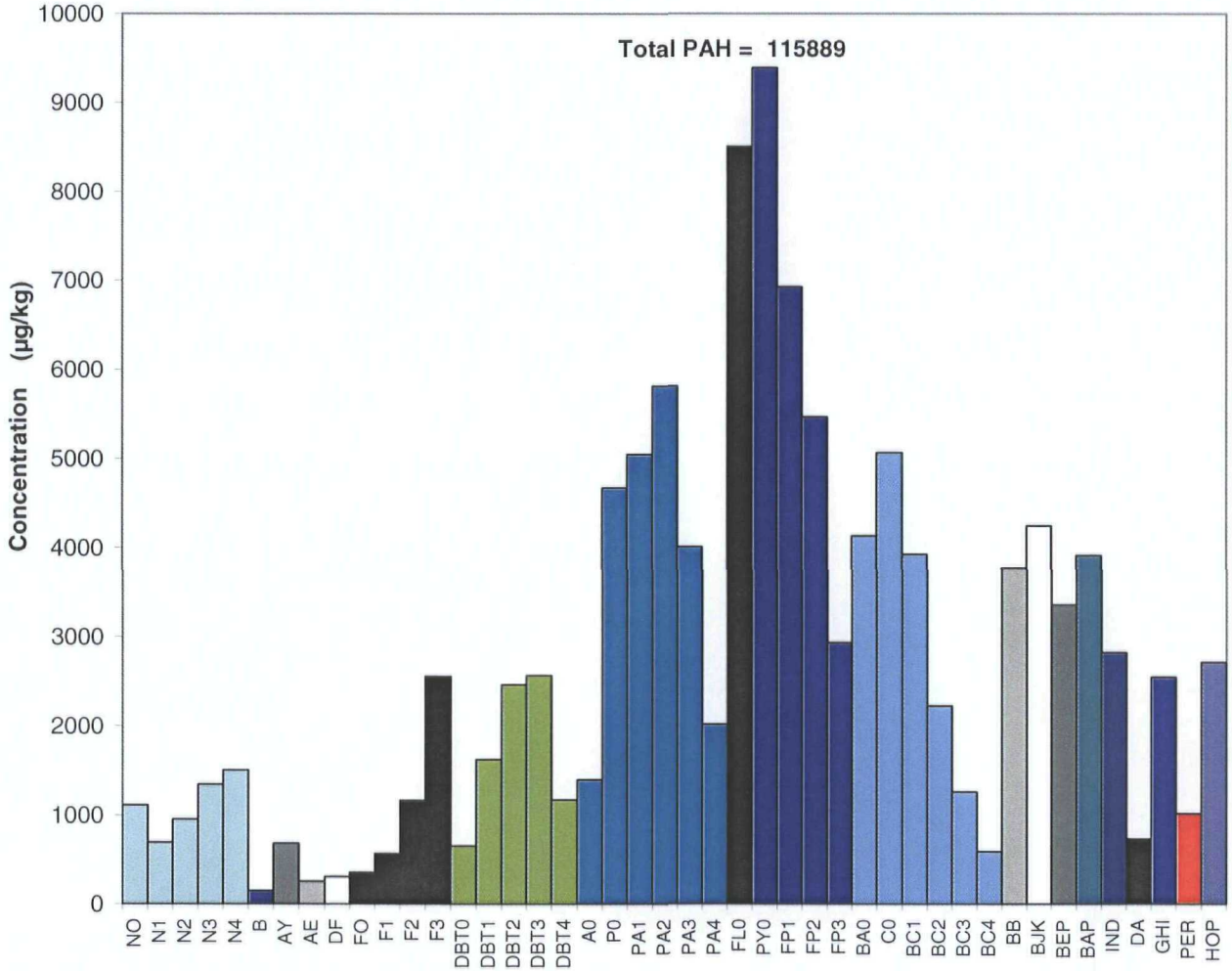
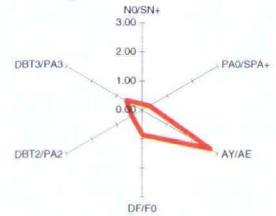
Alkylated PAH Overview

Sample ID:

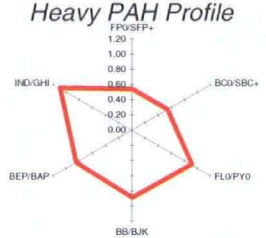
BC925SRM



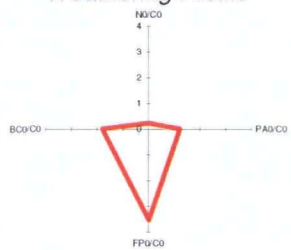
Light PAH Profile



Heavy PAH Profile

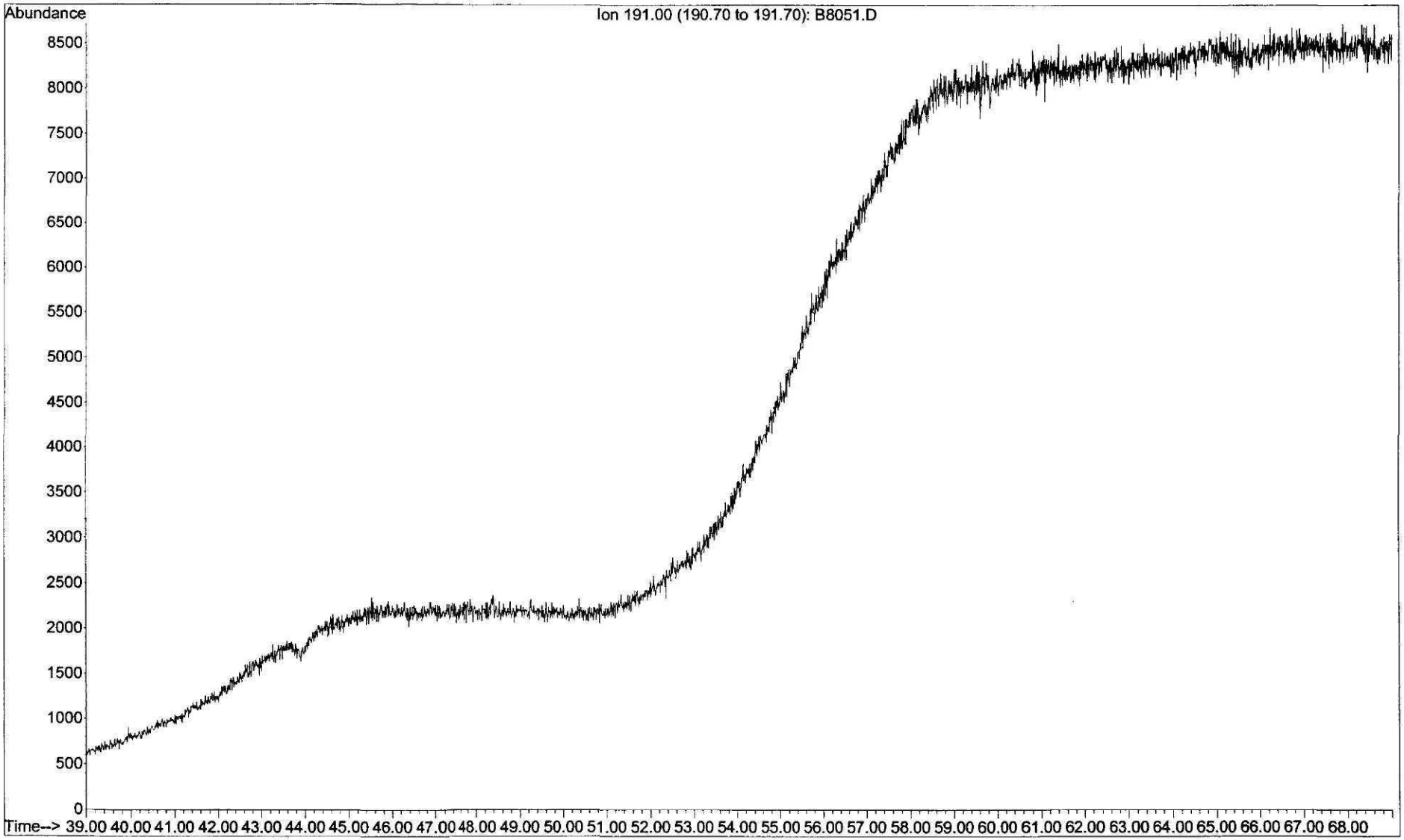


Weathering Profile

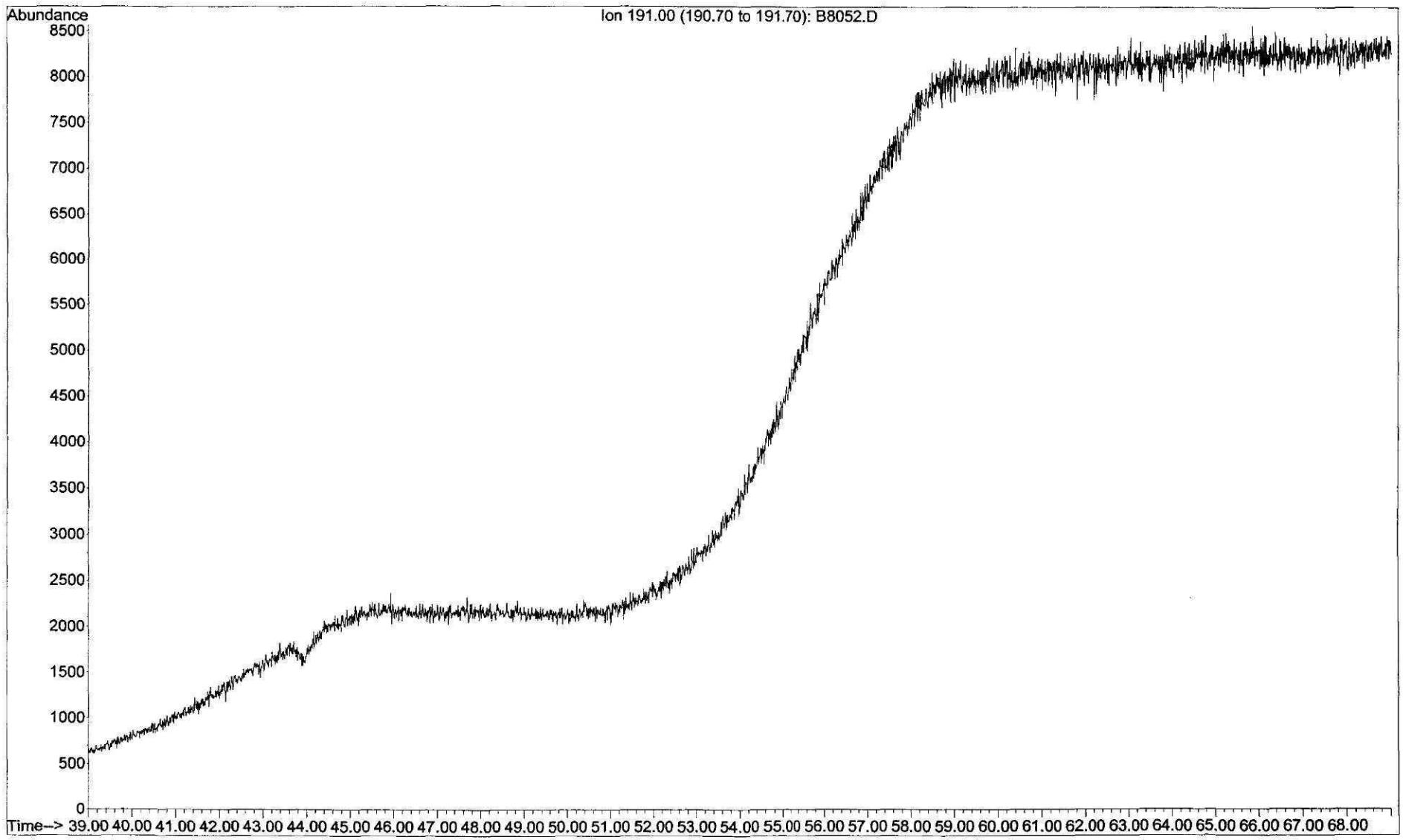


BC925SRM

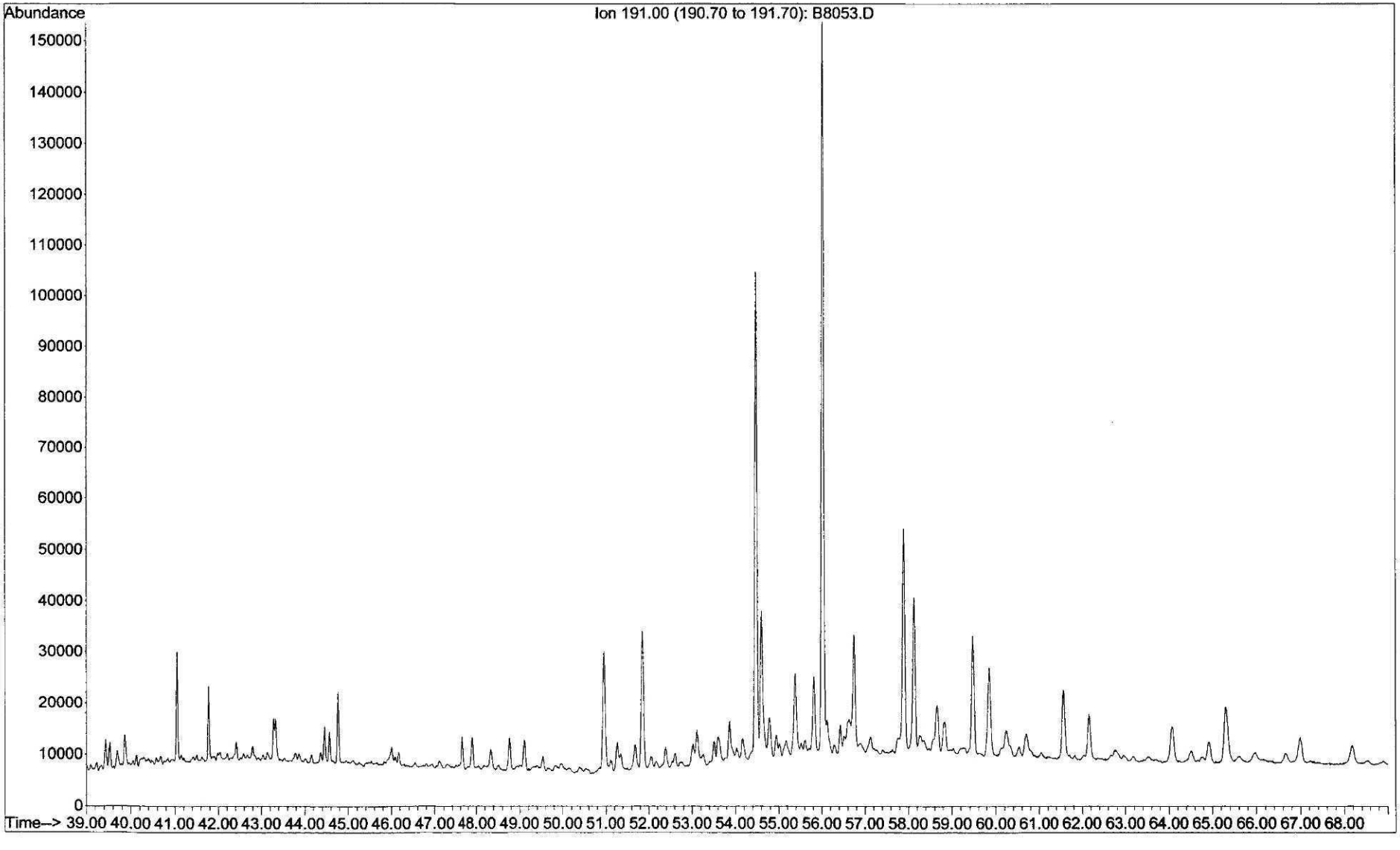
File : I:\B\DATA\SQB998\B8051.D
Operator : JAR
Acquired : 24 Jul 2003 5:00 pm using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: BC923PB
Misc Info : Procedural Blank
Vial Number: 11



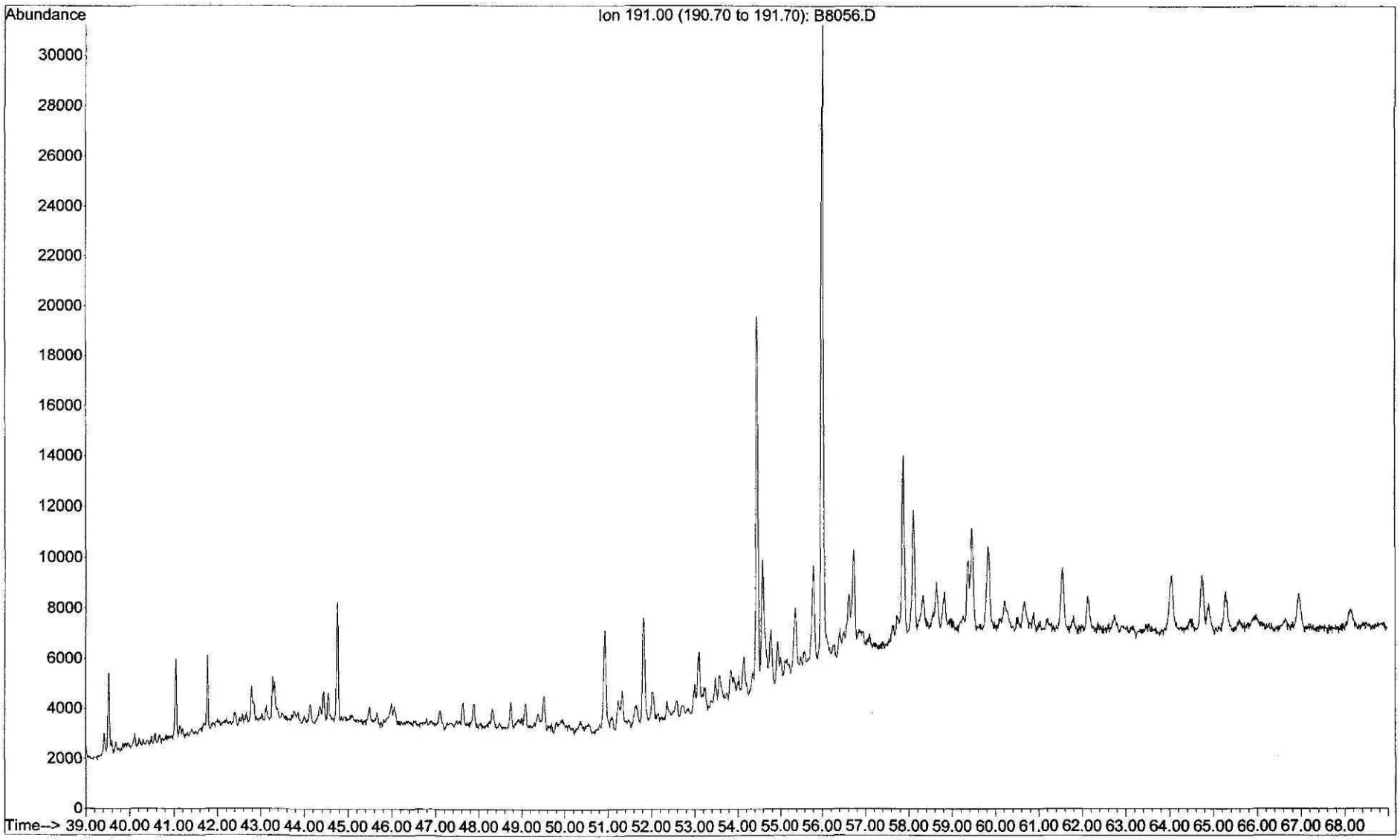
File : I:\B\DATA\SQB998\B8052.D
Operator : JAR
Acquired : 24 Jul 2003 6:25 pm using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: BC924LCS
Misc Info : Laboratory control Sample
Vial Number: 12



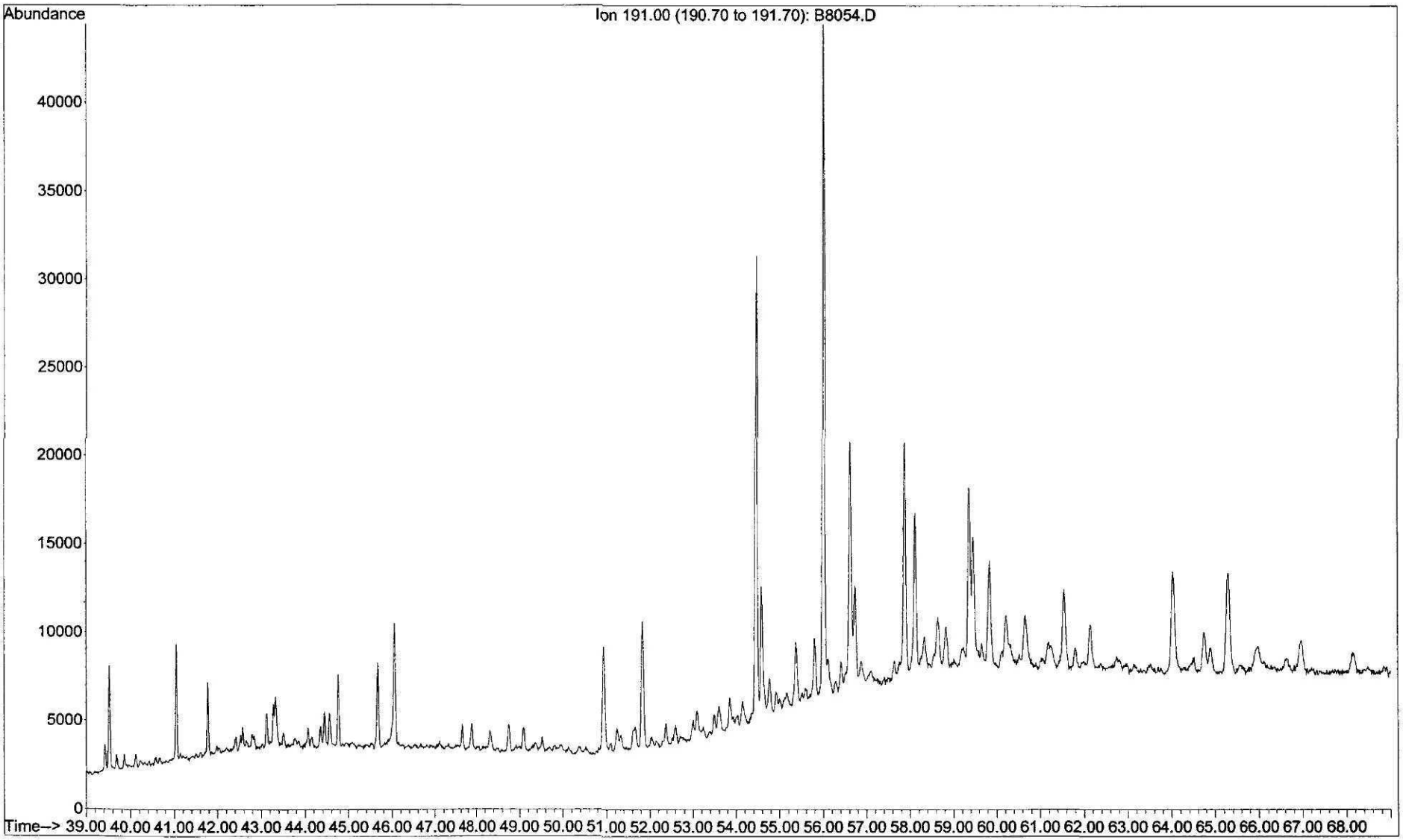
File : I:\B\DATA\SQB998\B8053.D
Operator : JAR
Acquired : 24 Jul 2003 7:50 pm using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: BC925SRM
Misc Info : NIST 1944
Vial Number: 13



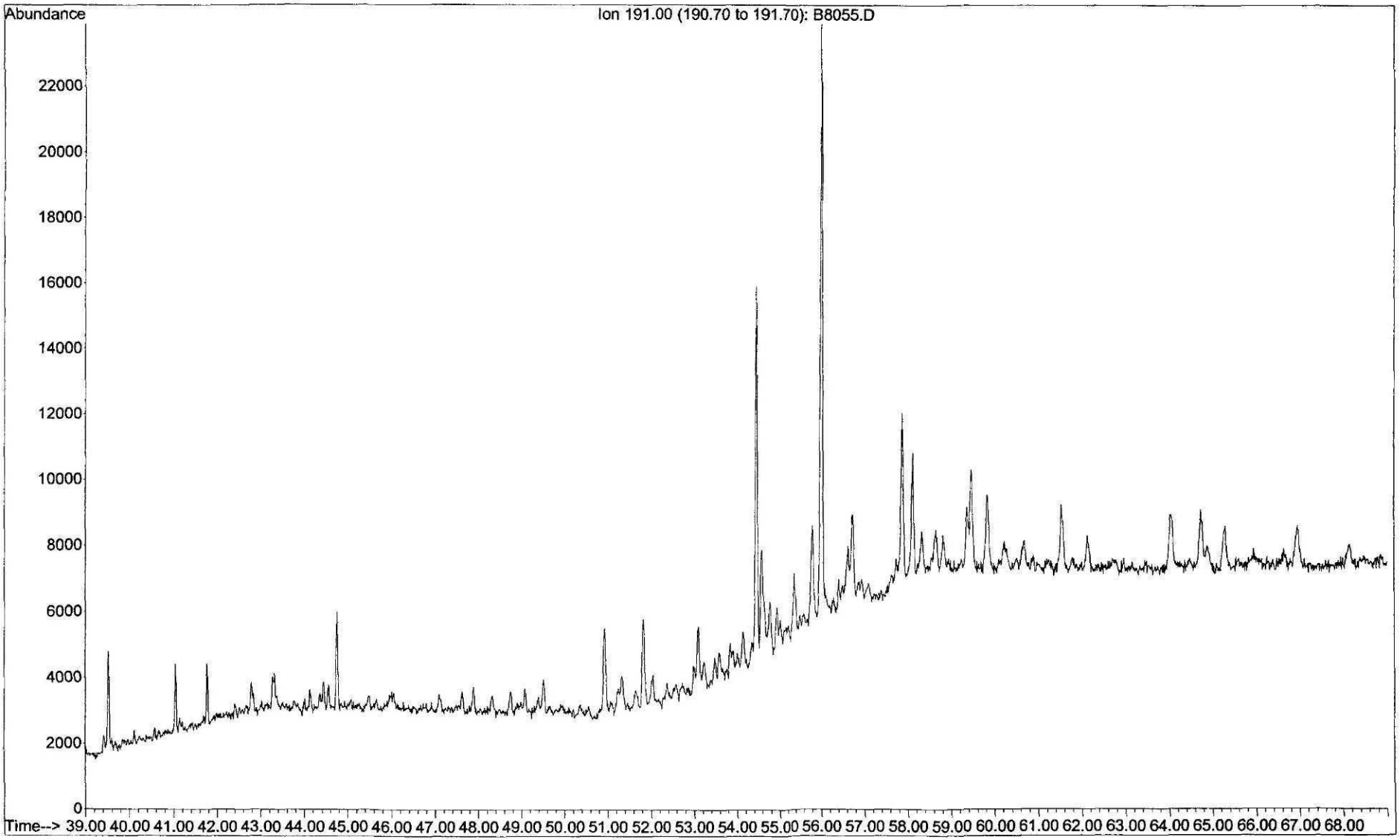
File : I:\B\DATA\SQB998\B8056.D
Operator : JAR
Acquired : 25 Jul 2003 12:04 am using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2360MS-D
Misc Info : CMS-SD-4223-0004-01
Vial Number: 16



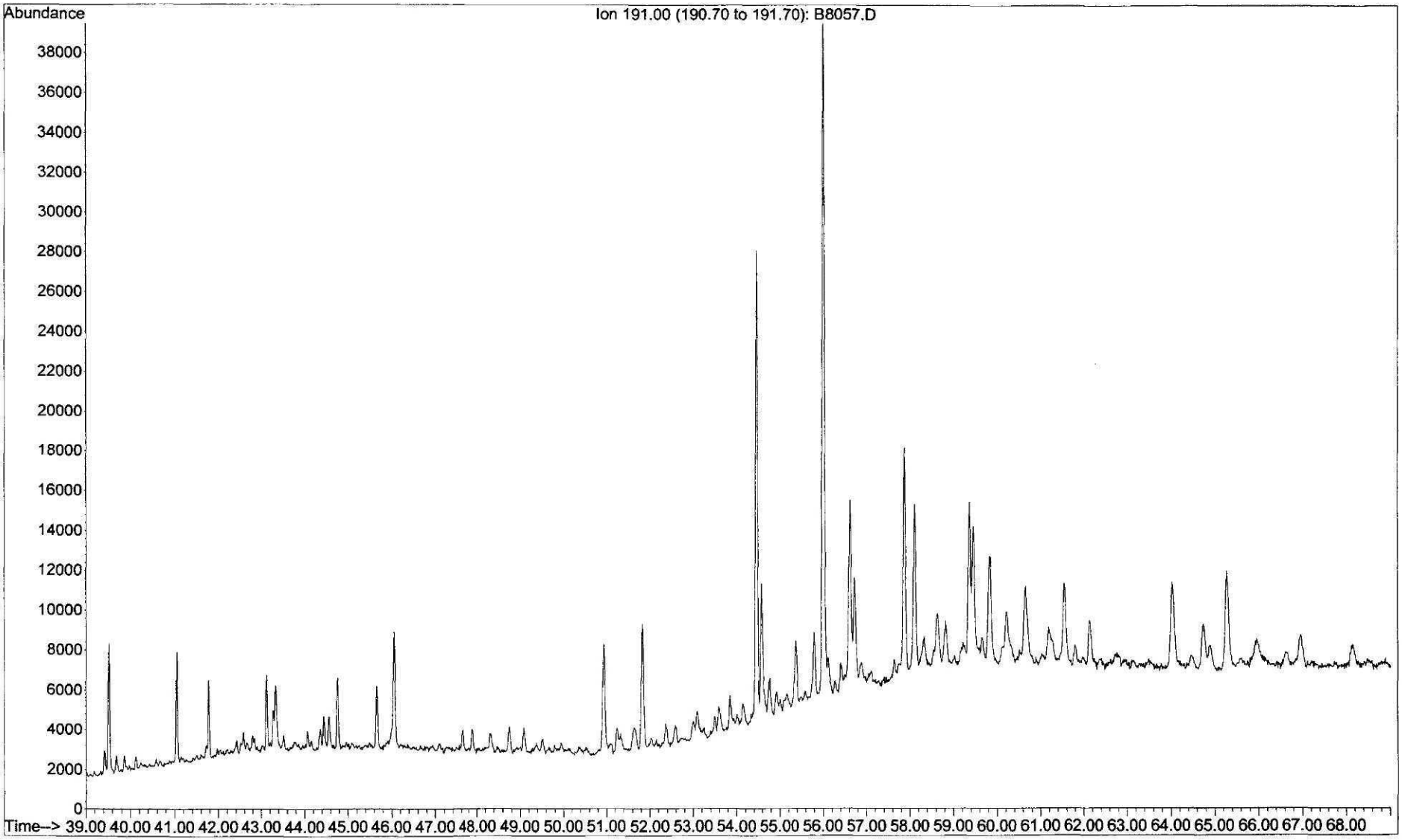
File : I:\B\DATA\SQB998\B8054.D
Operator : JAR
Acquired : 24 Jul 2003 9:14 pm using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2334-D
Misc Info : LPX-SD-4205-0015-01
Vial Number: 14



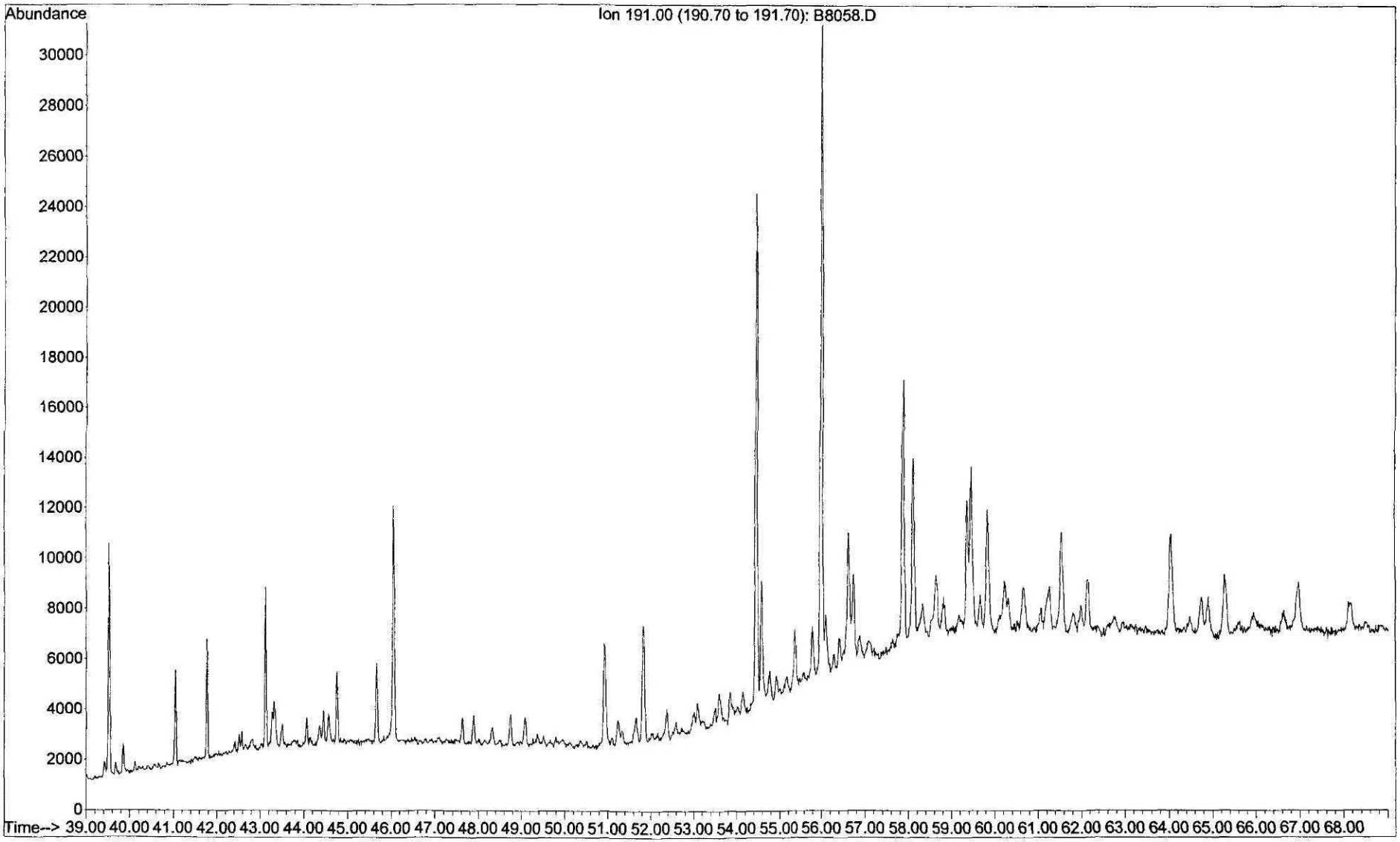
File : I:\B\DATA\SQB998\B8055.D
Operator : JAR
Acquired : 24 Jul 2003 10:40 pm using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2360-D
Misc Info : CMS-SD-4223-0004-01
Vial Number: 15



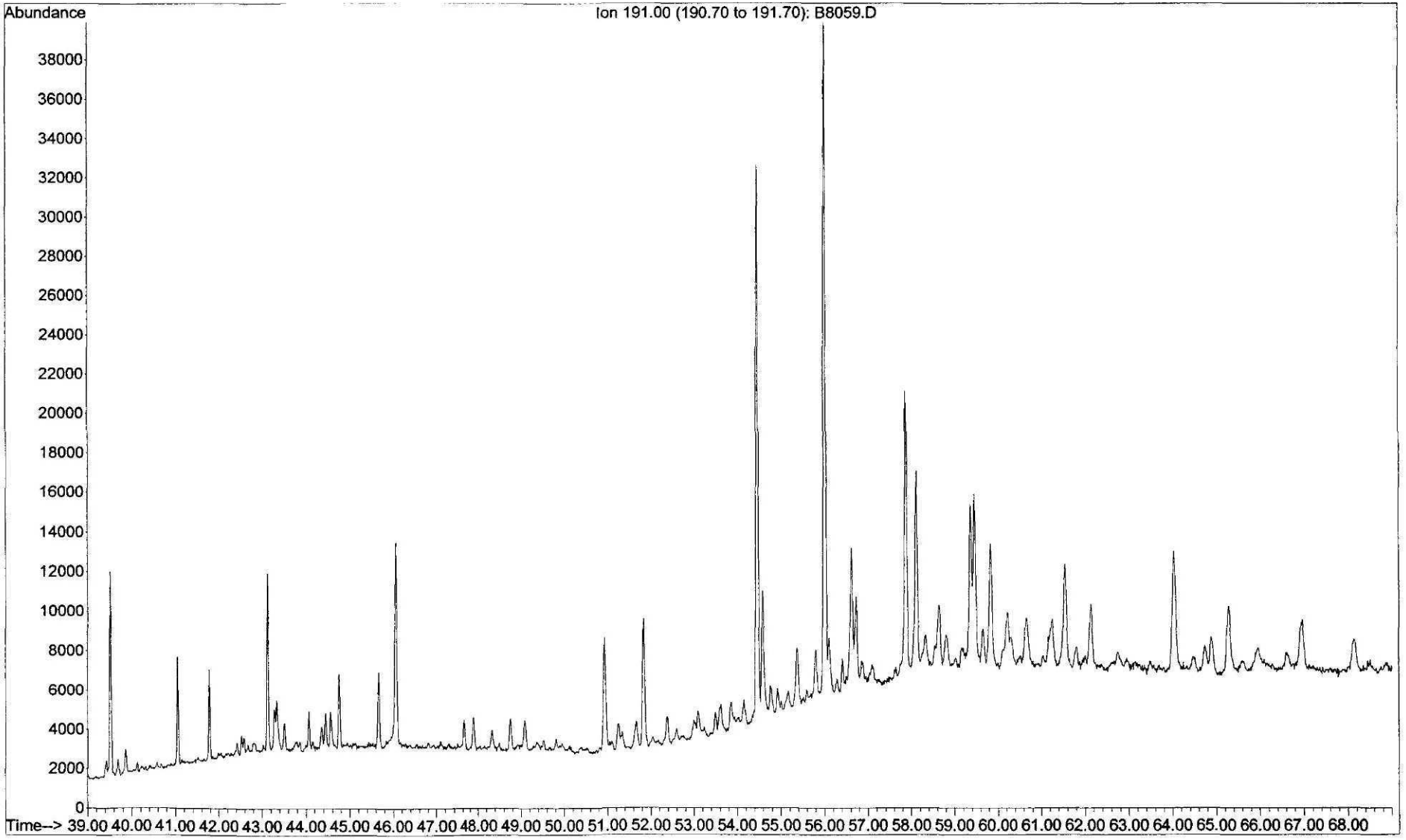
File : I:\B\DATA\SQB998\B8057.D
Operator : JAR
Acquired : 25 Jul 2003 1:28 am using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2361-D
Misc Info : LPX-SD-4208-0011-01
Vial Number: 17



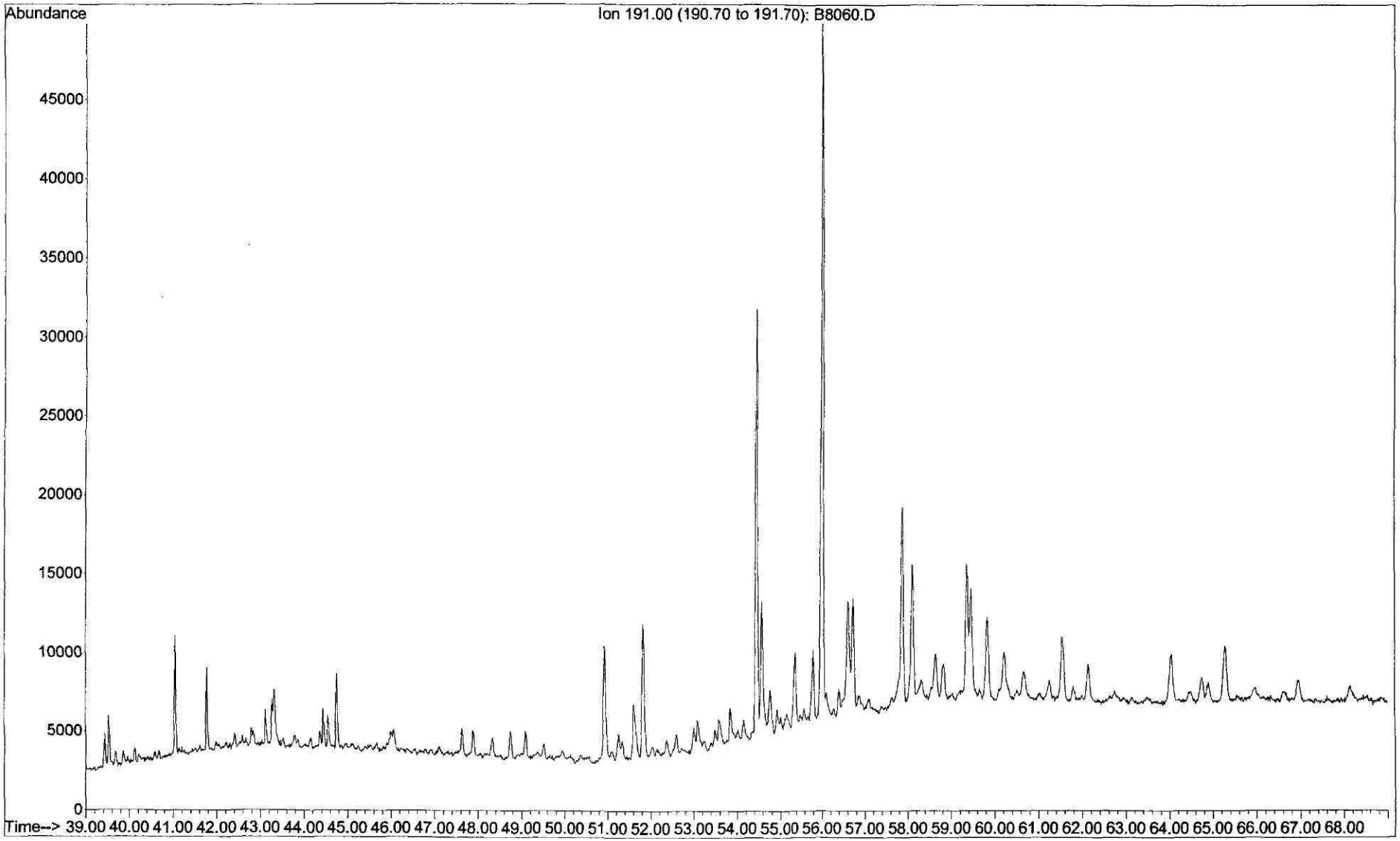
File : I:\B\DATA\SQB998\B8058.D
Operator : JAR
Acquired : 25 Jul 2003 2:53 am using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2364-D
Misc Info : LPX-SD-4207-0009-01
Vial Number: 18



File : I:\B\DATA\SQB998\B8059.D
Operator : JAR
Acquired : 25 Jul 2003 4:17 am using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2364DUP-D
Misc Info : LPX-SD-4207-0009-01
Vial Number: 19



File : I:\B\DATA\SQB998\B8060.D
Operator : JAR
Acquired : 25 Jul 2003 5:42 am using AcqMethod CENTRE
Instrument : GCMS2
Sample Name: T2385-D
Misc Info : LPX-SD-4203-0012-01
Vial Number: 20



Attachment F

Total Organic Carbon

(from Centredale Task RI-8 Sediment Investigation; pre-third party validated)

Project Name: Centredale Delivery Order 01, Task RI-8

CLIENT SAMPLE ID	PARAMETER	LAB RESULT	UNITS
CMS-SD-4223-0004-01	Total Organic Carbon	15.00	PCT
LPX-SD-4203-0012-01	Total Organic Carbon	9.17	PCT
LPX-SD-4205-0015-01	Total Organic Carbon	12.17	PCT
LPX-SD-4207-0009-01	Total Organic Carbon	8.96	PCT
LPX-SD-4208-0011-01	Total Organic Carbon	7.89	PCT