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CHEMISTRY AND CHEMICAL ENGINEERING DIVISION
DEPARTMENT OF ANALYTICAL AND ENVIRONMENTAL CHEMISTRY

March 19, 2015

CH2M Hill Plateau Remediation Co.
2420 Stevens Drive
Richland, Washington 99352

Attn: Scot Fitzgerald

Subject:	Contract No:	55865
	SDG Number:	566821
	SwRI Project Number:	20933.01.006
	SwRI Task Order Number:	141222-2
	SwRI Sample Receipt Number:	54424
	Samples Received:	12/20/2014
	Item(s):	TOC Characterization

Dear Mr. Fitzgerald:

Please find the enclosed results for the one (01) overall sample received on the above referenced date. Should you have any questions, please do not hesitate to contact me at (210) 522-3242, Radonna.spies@swri.org.

Sincerely,

Radonna Spies
Group Leader

APPROVED:

Michael J. Dammann
Director

RS: dr
Encl

Characterization of Total Organic Carbon in Groundwater from Well 299-E27-10

Analytical Report

Southwest Research Institute
Project 20933.01.006
Task Order #141222-2
SRR #54424

Prepared by

Radonna Spies
Group Leader
Analytical and Environmental Chemistry Department
Chemistry and Chemical Engineering Division

Prepared for

CH2M Hill Plateau Remediation Company (CHPRC)
RFP 273912

INTRODUCTION

Eight containers of one water sample was were received at SwRI on 12/20/2014. The chain of custody (COC) indicated the collection end date (CED) as 12/19/14. COC copy is located in Appendix A. The sample was logged into the SwRI laboratory information system (LIMS) under SSR #54424 and assigned to Task Order #141222-2. The sample was received under CHPRC RFP 273912 Characterization of Total Organic Carbon in Groundwater from Well 299-E27-10.

Table 1. CPP-749 TO# 141124-8 Corrosion Coupon Login Information

SwRI Sample ID	Customer ID	CED
566821	CB303K8	12/19/14

EXPERIMENTAL AND RESULTS

TOC

Initially, duplicate aliquots of the sample were analyzed for total organic carbon to confirm it the sample contained TOC results comparable to historical data. A second set of aliquots of the sample were filtered using an Advantec Grade GC50 glass fiber filter; the GC50 is a binderless, fine-porosity (<0.45 micron particle retention) filter. Filtration was used to determine whether the organic carbon is dissolved, a solid particulate, or a mixture of both. The TOC determination was conducted following EPA SW846 Method 9060 using a Tekmar-Dohrmann Phoenix 8000 Analyzer. The Phoenix 8000 automatically removes inorganic carbon prior to the TOC determination. In the first chamber of the instrument the sample is acidified with phosphoric acid and sparged to remove the inorganic carbon. The acidified and sparged sample is then pumped into the UV reactor where the TOC is oxidized with persulfate. The CO_2 produced is measured using a non-dispersive infrared detector (NDIR). A third set of aliquot of sample was pre-acidified and sparged with nitrogen prior to the Phoenix TOC analysis to ensure the inorganic carbon was being fully eliminated during the analysis.

Each TOC result is the average of replicate injections. Samples were analyzed in duplicate and a matrix spike performed. A procedure blank was taken through each sample preparation to document possible contamination. The Sample Analysis Data Sheets are located in Appendix B. Table 2 summarizes the sample and duplicate analysis results for each process, along with the average for comparison. The results indicate the organic carbon is dissolved and non-purgable (NPOC).

Table 2 TOC Results for Unfiltered, Filtered and Pre-Acidified and Sparged Samples

	TOC Concentration, mg/L		
Sample	Unfiltered Result	Filtered Result	Unfiltered Pre Acidified and Sparged Result
B303K8	0.592	0.586	0.580
B303K8 Dup	0.584	0.588	0.573
Average	0.588	0.587	0.577

The TOC results in Table 2 comparable to the historic TOC values provided to SwRI by CHPRC; therefore, SwRI proceeded with the characterization of the TOC. Two 400ml aliquots of sample and one 400 mL aliquot of deionized water (procedure blank) were concentrated to a final volume of 20 mL using a Labconco Rapidvap N2 Evaporation System. The RapidVap use nitrogen blow down, vortex motion and heat to speed evaporation. The stream of nitrogen is directed downward onto the surface of the sample and reduces the partial pressure over the liquid to speed evaporation. The system is enclosed to reduce the possibility of contamination from the environment. Large amounts of solid were present in the concentrated sample due to dissolved salts precipitating out. The sample was filtered to remove the solids before continuing with subsequent total organic carbon analyses. The concentrates were analyzed for total organic carbon to confirm that organic carbon was not lost during the evaporation process. Table 3 contains the organic carbon results in found in the concentrates. The results were also corrected for the concentration factor (x20) to compare to the initial organic results found in Table 2. The procedure blank was less than the reporting limit, and Sample Analysis Data Sheets are also located in Appendix B. The results agreed well with the initial TOC results; therefore, the concentrate samples were submitted for Mass Spectrometry analysis.

Table 3. TOC Results for Concentrated sample with Comparison to Initial Results

	TOC Concentration, mg/L		
Sample	Concentrated Result	Result Corrected for the (x20) Concentration Factor	% RPD (compared to filtered avg result)
B303K8	11.9	0.589	0.260 %
B303K8 Dup	13.6	0.680	14.7 %

MASS SPECTROMETRY

Gas chromatography–mass spectrometry (GC-MS)

GC-MS analysis was conducted using an Agilent 6890 GC interfaced to a 5973 quadrupole mass spectrometer. The GC column was a DB-5MS (30 m x 0.25 mm x 0.25 um) analytical column. The injector temp was 250 °C in pulsed splitless injection mode. The oven program temperature was 60 °C: 1 min: 10 °C/min: 300 °C: 10 min, and the quadrupole MS detector scan was 30 amu – 625 amu.

The concentrated samples were extracted with dichloromethane (DCM); 1 mL of sample + 1 mL of DCM were vortexed for 1 minute, centrifuged at 6000 RPM for 5 min and the DCM fraction analyzed by GC-MS after addition of sodium sulfate. There were no peaks observed in the sample or blanks. The chromatograms are presented in Figures 1-3 in Appendix C. A direct injection of the aqueous samples (0.5 uL) was also performed. Again, no peaks other than column bleed, were observed. The chromatograms are presented in Figures 4-6 of Appendix C.

Liquid Chromatography-Mass Spectrometry (LC-MS)

Direct infusion mass spectrometry acquisition was performed first without any chromatographic separation. In direct infusion, the sample is injected directly into the mass spectrometer. Due to the concentrated dissolved salt content of the water samples, the results obtained from the direct infusion experiment was difficult to interpret; therefore, an ultra high pressure liquid chromatography (UHPLC) column was added for the following experiments to provide chromatographic separation of the different species in the samples.

LC-MS analysis was conducted using Agilent 1290 UHPLC binary pump system with Agilent 6460 triple quadrupole mass spectrometer. The analytical column used was a Restek Pinnacle DB Aqueous C18 column (2.1 x 100 mm; 1.9 µm particle size). The temperature of the column was maintained at 55 ^{o}C. Mobile phases consisted of (A) water with 10 mM ammonium formate with 0.1% formic acid and (B) acetonitrile:methanol (8:2) with 0.1% formic acid. Gradient conditions were as follows:

Time (min)	% A	% B	Flowrate (mL/min)
0.0	94.0	6.0	0.30
10.0	0.0	100.0	0.35
14.0	0.0	100.0	0.50
15.0	94.0	6.0	0.30

The Agilent 6460 triple quadrupole mass spectrometer was fitted with the Agilent Jet Stream interface. The eluant existing the UHPLC was vaporized using heated nitrogen gas to form an aerosol. A high voltage (2-4 kV in positive or negative polarity) was then applied to the aerosol to produce charged ions prior to entering the mass spectrometer. This ionization process is referred to as electrospray ionization (ESI). In positive polarity (ESI+), molecular ion adducts such as $[M+H]^+$, $[M+Na]^+$ or $[M+NH_4]^+$ are formed. The first LC/MS experiment was conducted in positive polarity and the mass spectrometer detector was set to scan from 100-1500 amu. Ion 262 was detected in the concentrated samples of B303K8 and B303K8 duplicate. This ion was not detected in the procedure blank or the deionized water blank. The molecular weight of this compound was most likely 261 since m/z 262 was probably the $(M+H)^+$. With the odd number molecular weight, the compound presumably contained odd number of nitrogen in its structure. (See Figure 1)

A product ion scan experiment was performed to generate the product ions of m/z 262. The first mass analyzer was used to select m/z 262 as the precursor ion. The precursor ion was passed into the collision cell and an inert gas (nitrogen) was used to induce fragmentation. The second mass analyzer acquired the mass spectra of the ions exiting the collision cell. Two different conditions were performed to induce fragmentation. In the first experiment, the collision induced dissociation (CID) was set at 15. In the second experiment, the CID was increased to 25 to induce more fragmentation. The major product ions formed included 69, 86, 149, 174, 202 and 217. These major fragment ions were also positively charged. For example, product ion 217 represented $(M+H-45)^+$.(See Figure 2)

In addition to positive polarity experiments, ionization in negative polarity full scan mode was conducted. Chromatographic conditions were identical to the positive polarity full scan mode described in paragraph 2. The scan range in negative polarity was also from 100-1500 amu. A broad chromatographic peak was observed in both the sample and the sample duplicate concentrate from about 2-4 minutes. Based on the mass spectra results, dissolved organic matter such as fulvic acids and/or humic acids were most likely present in the samples (see Figure 3). The broad chromatographic peak was only observed in negative polarity mode suggesting that the compounds contained carboxylic acids functional groups. In addition, the complexity of the mass spectra is similar to the spectra reported by Posiva in Finland. (http://www.posiva.fi/files/352/WR2007-23web.pdf)

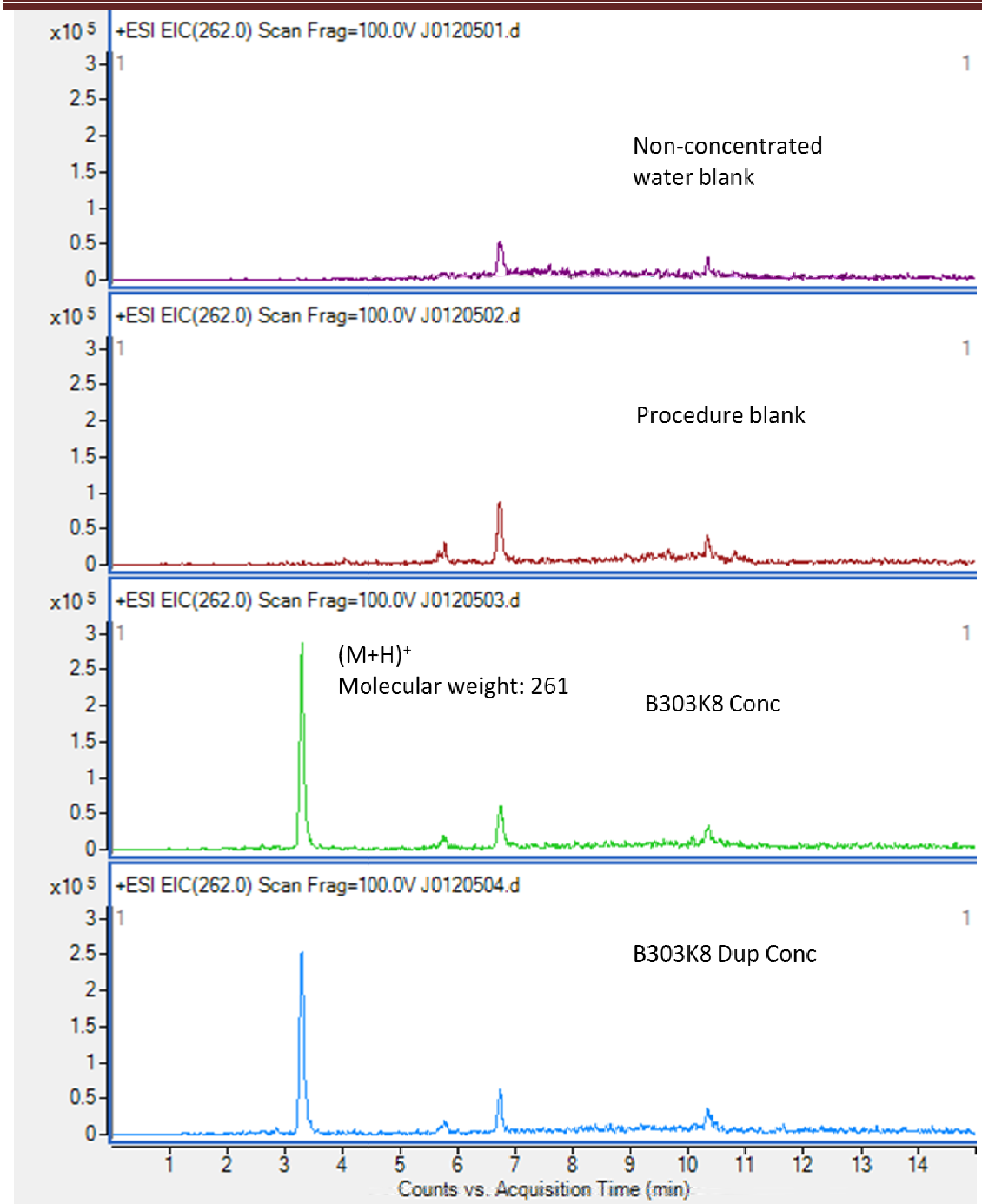


Figure 1: Extracted ion chromatogram (EIC) of m/z 262 in water blank, procedure blank, B303K8 concentrate and B303K8 duplicate concentrate

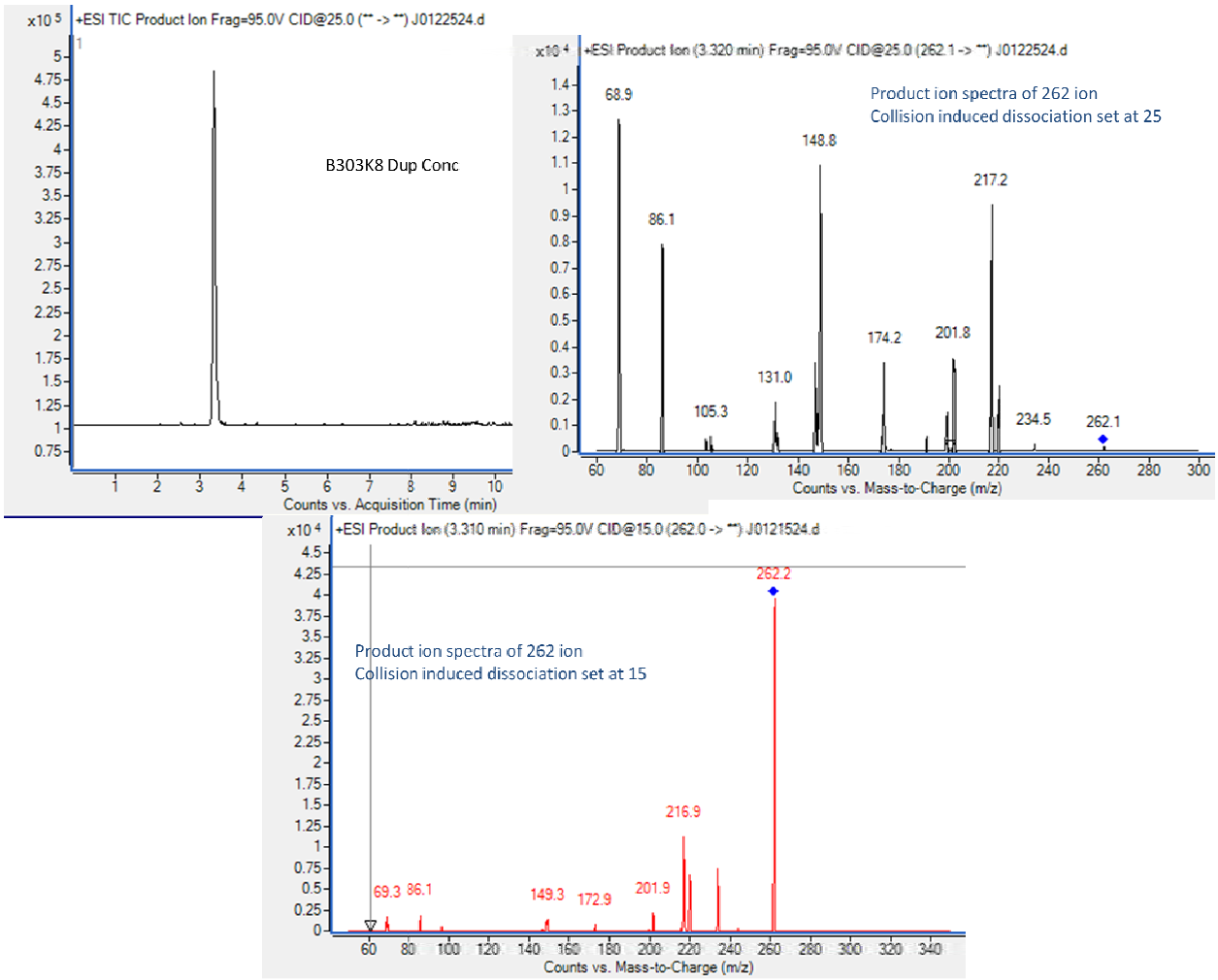


Figure 2: Product ion scan spectra of m/z 262 precursor ion. The collision induced dissociation was set at 25 on the top spectra which showed more fragmentation than the one in red which was set at 15.

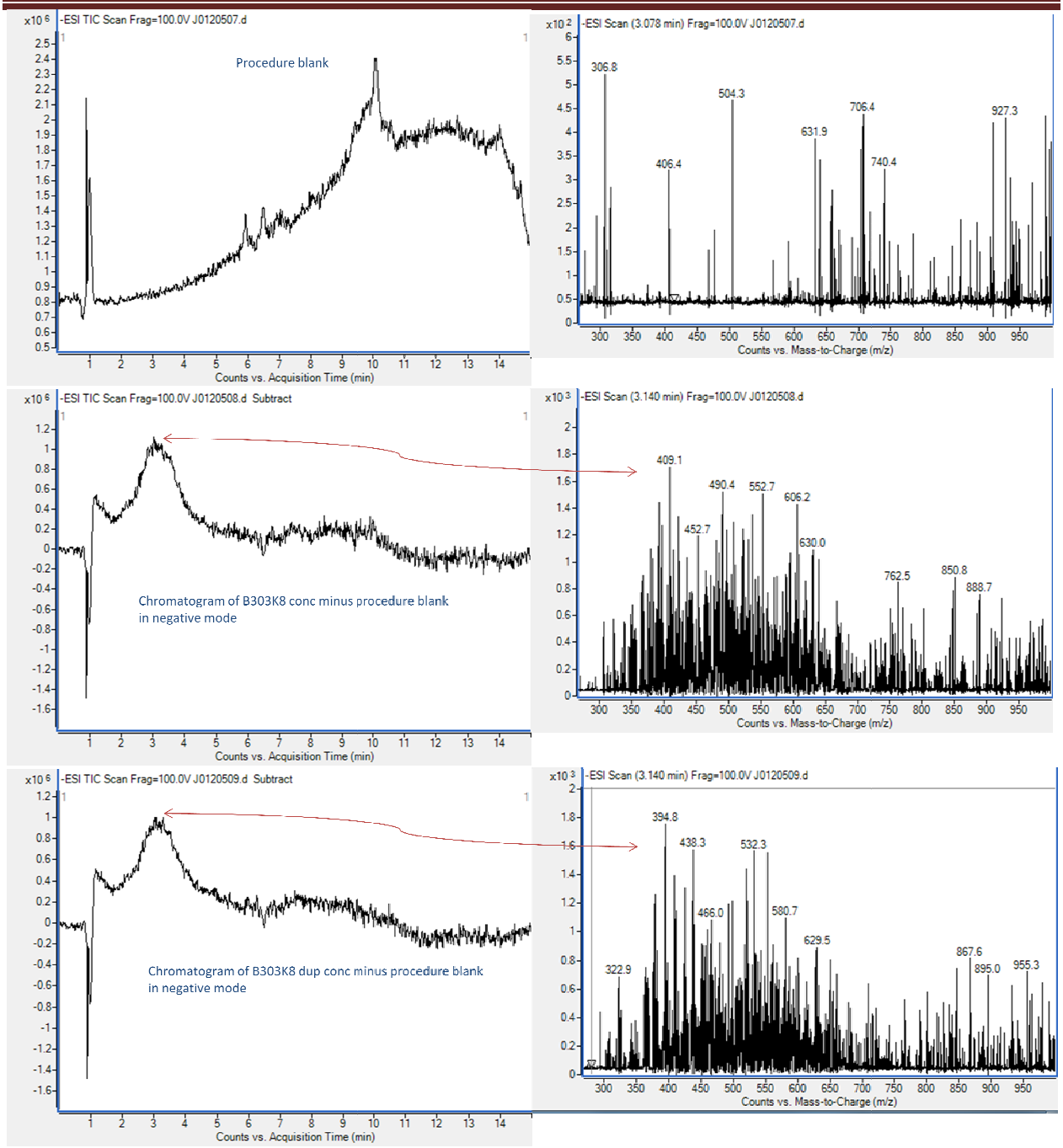


Figure 3 (left): Total ion chromatograms (TIC) of the procedure blank, B303K8 concentrate and B303K8 duplicate concentrate in negative electrospray ionization mode.

Figure 3 (right): Negative mode electrospray mass spectra of the broad peak centered around 3.14 minutes. The mass spectra were indicative of fulvic and/or humic acids.

CONCLUSION

Based on the analysis, the TOC exists as dissolved non-purgable (non-volatile) organic carbon (NPOC). It appears that fulvic acids and/or humic acids are likely present in the sample based on the LC-MS analysis. The broad chromatographic peak was only observed in negative polarity mode suggesting that the compounds contained carboxylic acids functional groups. In addition, the complexity of the mass spectra is similar to the spectra reported by Posiva in Finland. Additionally, the LC-MS detected a compound with possible m/z 261. With the odd number molecular weight, the compound presumably contains an odd number of nitrogen in its structure. Unfortunately, there are no spectral libraries for LC/MS identification, and existing GC-MS libraries are not applicable to LC-MS analysis. An attempt to gain some insight on the compound was made by evaluating some of the mass losses. For example, the first mass loss of 45 (262-217) could be attributed to C_2H_5O, CHO_2, CH_3NO, CH_5N_2 or C_2H_7N. The mass loss of 28 (202-174) could attributed to CO, C_2H_4 or CH_2N. Another mass loss of 17 (86-69) could be attributed to OH or NH_3. Therefore, nothing definitive could be concluded.

Further analysis would be required to identify and quantitate the suspected nitrogen containing compound and confirm the presence of fulvic acids and/or humic acids. For the nitrogen containing compound, SwRI recommends performing additional LC/MS experiment but using quadrupole-time of flight (q-TOF) mass spectrometer to determine the exact mass and molecular formula of the suspected compound. Once the molecular formula is determined, the fragments from the product ion scan would be useful in determining the identity of the compound. Also any history regarding the ground water site may be useful in determining the identity of the compound.

As for presence of fulvic acids and/or humic acids, SwRI recommends getting reference materials from the International Humic Substance Society in Minnesota (https://ihss.humicsubstances.org/orders.html) to compare against the spectra of the ground water sample. If additional water sample (1-5 L) can be obtained, the water sample can be passed through resins such as XAD-8 to concentrate the NPOC. Further analysis such as HPLC with UV and fluorescence detectors and/or LC/MS analysis using a size exclusion chromatography column will confirm the presence of fulvic acids and/or humic acids.

SOUTHWEST RESEARCH INSTITUTE
CLIENT: CH2M Hill Plateau Remediation
SwRI PROJECT#: 20933.01.006
SwRI TASK ORDER: 141222-2
SwRI SRR: 54424
SDG: 566821
VTSR: 12.20.2014

Appendix A
Chain of Custody (COC)

81105

010002

March 19, 2015

CH2MHill Plateau Remediation Company	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST			F15-010-001	PAGE 1 OF 1
COLLECTOR S.W. King/CHPRC	COMPANY CONTACT FITZGERALD, SL	TELEPHONE NO. 373-7495	PROJECT COORDINATOR FITZGERALD, SL	PRICE CODE 70	DATA TURNAROUND
SAMPLING LOCATION 299-E27-10	PROJECT DESIGNATION Characterization of Total Organic Carbon at well 299-E27-10		SAF NO. F15-010	AIR QUALITY ☐	60 Days / 60 Days
ICE CHEST NO. GWS-154	FIELD LOGBOOK NO. HNF-N-506-71 /32	ACTUAL SAMPLE DEPTH 69.625 Depth to water	COA 302898	METHOD OF SHIPMENT Commercial Carrier	ORIGINAL
SHIPPED TO Southwest Research Institute	OFFSITE PROPERTY NO. 5294		BILL OF LADING/AIR BILL NO. 7723 2236 0428		

MATRIX*	POSSIBLE SAMPLE HAZARDS/ REMARKS	PRESERVATION	Cool<6C
A=Air DL=Drum Liquids DS=Drum Solids L=Liquid O=Oil S=Soil SE=Sediment T=Tissue V=Vegetation W=Water WI=Wipe X=Other		HOLDING TIME	6 Months
		TYPE OF CONTAINER	aG
		NO. OF CONTAINER(S)	8
		VOLUME	1L
	SPECIAL HANDLING AND/OR STORAGE	SAMPLE ANALYSIS	Generic Testing;

Client: CH2M Hill Plateau Remediation Company SwRI SRR #54424
SwRI Project # 20859.01.00X Case: 299-E27-10
VTSR: 12/20/14 1305 Sample(s) Received: Intact
Battery Check: Y Background Check: <100 cpm (Lab 103)
Cooler/Container Wipe: <100 cpm Temp.: 1.2 °C (wet ice) / SN # 021056
Total cpm-mR/h (samples): <100 cpm; <0.5 mR/hr Wipe Frisk Description: Cooler(s) - 1
(see Radioactive Material Receiving Form for more information)

SAMPLE NO.	MATRIX*	SAMPLE DATE	SAMPLE TIME	
B303K8	WATER	DEC 19 2014	0825	✓

CHAIN OF POSSESSION		SIGN/ PRINT NAMES	
RELINQUISHED BY/REMOVED FROM S.W. King/CHPRC	DATE/TIME DEC 19 2014 0920	RECEIVED BY/STORED IN F.M. Hall/CHPRC	DATE/TIME DEC 19 2014 0920
RELINQUISHED BY/REMOVED FROM F.M. Hall/CHPRC	DATE/TIME DEC 19 2014 1400	RECEIVED BY/STORED IN FEDEX	DATE/TIME
RELINQUISHED BY/REMOVED FROM Fed Ex	DATE/TIME 12/20/14 1305	RECEIVED BY/STORED IN Steven Douglas	DATE/TIME 12/20/14 1305
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME
RELINQUISHED BY/REMOVED FROM	DATE/TIME	RECEIVED BY/STORED IN	DATE/TIME

SPECIAL INSTRUCTIONS

** Laboratory will perform all analyses outlined in SOW from the 8 generic testing bottles.

** Laboratory will provide copies of Chain of Custody, shipping documents, and laboratory receipt documents to ^CPP Sample Management (CPP_Sample_Management@rl.gov). When complete the final report will also be sent to ^CPP Sample Management.

LABORATORY SECTION	RECEIVED BY	TITLE	DATE/TIME
FINAL SAMPLE DISPOSITION	DISPOSAL METHOD	DISPOSED BY	DATE/TIME

PRINTED ON 12/8/2014

A-6003-618 (REV 2)

Appendix B

Total Organic Carbon (TOC)

Raw Data

010004

March 19, 2015

Southwest Research Institute

Total Organic Carbon - (TOC)

Controlled Electronic Benchsheet

Client: CH2M Hill Plateau Remediation Company
Project #: 20933.01.006
TO#: 141222-2
Method: 9060M

✓ M. Gabaldon 1/8/15

Date: 01/08/15
Analyst: James Moken JM
RL = 0.2 mg/l
Sig Figs: 3

Calibration Source: 68-03-WCS9 — Conc: 1000 mg/L
ICV/CCV Source: Inorg #46390 — TV = 43.6 mg/L
MS Source: 68-03-WCS9 — Conc: 1000 mg/L

NOTES: EPP: 5000-R, 1000-2, 200-K AS - Acidified and sparged. F - Filtered
566812S (all) - (1000*0.150)/30 = 5 mg/L TOC

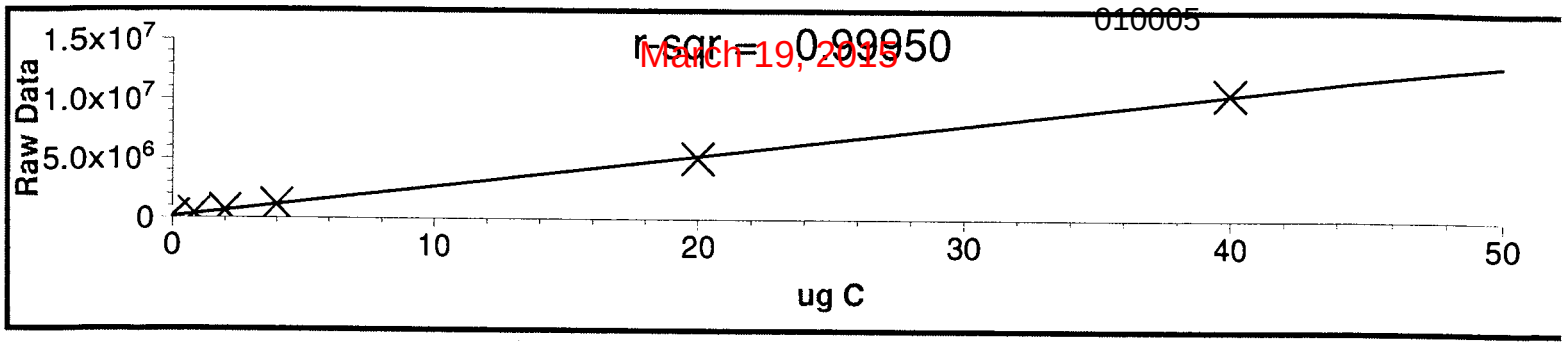
Seq #	Sample ID	Dilution Factor	Instument Reading, mg/L	TOC Conc.	Units	RL	%Rec	%RPD	Avg	Uncert
1	ICV DF10	10	4.1562	41.6	mg/L	2.00	95.4% R, TV =43.6 mg/L			2.69
2	ICB	1	0.0610	<0.20	mg/L	0.200				0.100
3	566821-1	1	0.5962	0.596	mg/L	0.200				
4	566821-2	1	0.5886	0.589	mg/L	0.200		1.28%	0.592	0.106
5	566821D-1	1	0.5778	0.578	mg/L	0.200				
6	566821D-2	1	0.5896	0.590	mg/L	0.200		2.02%	0.584	0.106
7	566821S-1	1	5.3578	5.36	mg/L	0.200				
8	566821S-2	1	5.3842	5.38	mg/L	0.200	95.6%	0.372%	5.37	0.337
9	Filter Blank-1	1	0.0759	<0.20	mg/L	0.200				
10	Filter Blank-2	1	0.0327	<0.20	mg/L	0.200		0.00%	<0.20* ~~0.00~~	0.100
11	566821F-1	1	0.5750	0.575	mg/L	0.200				
12	566821F-2	1	0.5979	0.598	mg/L	0.200		3.90%	0.586	0.106
13	566821FD-1	1	0.5781	0.578	mg/L	0.200				
14	566821FD-2	1	0.5983	0.598	mg/L	0.200		3.43%	0.588	0.106
15	566821FS-1	1	5.3455	5.35	mg/L	0.200				
16	566821FS-2	1	5.3817	5.38	mg/L	0.200	95.6%	0.559%	5.37*	0.337
17	AS Blank-1	1	0.1308	<0.20	mg/L	0.200				
18	AS Blank-2	1	0.0912	<0.20	mg/L	0.200		0.00%	<0.20* ~~0.00~~	0.100
19	AS 566821-1	1	0.5816	0.582	mg/L	0.200				
20	AS 566821-2	1	0.5779	0.578	mg/L	0.200		0.638%	0.580	0.106
21	AS 566821-1D	1	0.5698	0.570	mg/L	0.200				
22	AS 566821-2D	1	0.5765	0.577	mg/L	0.200		1.17%	0.573	0.106
23	CCV DF10	10	4.1982	42.0	mg/L	2.00	96.3% R, TV =43.6 mg/L			2.71
24	CCB	1	0.0733	<0.20	mg/L	0.200				0.100
25	AS 566821S-1	1	5.3052	5.31	mg/L	0.200				
26	AS 566821S-2	1	5.4209	5.42	mg/L	0.200	95.7%	2.05%	5.37	0.337
27	CCV2 DF10	10	4.2196	42.2	mg/L	2.00	96.8% R, TV =43.6 mg/L			2.72
28	CCB2	1	0.0805	<0.20	mg/L	0.200				0.100

Sample Calc: ICV

4.1562 x 10 = 41.6 mg/L

* cl 1/21/15 gcm

Conc. mg/L = Instrument Reading, mg/L x Dilution Factor


010005
r-sqr = 0.99950
March 19, 2015
Raw Data
1.5x10^7
1.0x10^7
5.0x10^6
0
0
10
20
30
40
50
ug C

Calibration Report

March 19, 2015

Cal. Curve ID: 150108OC
Created: 01/08/2015 11:15
Calibration Factor (m): 2.594e+05
Y Intercept (b): 98818
r-squared: 0.99950

Standard ID	Y Raw Data	X Expected ug C	Measured ug C	Message	Date & Time
S0	151567	0.000	0.203		01/08/2015 10:33
S0.2	357540	0.800	0.998		01/08/2015 10:40
S0.5	628723	2.000	2.043		01/08/2015 10:46
S1	1105001	4.000	3.879		01/08/2015 10:53
S5	5115410	20.000	19.342		01/08/2015 11:00
S10	10560490	40.000	40.335		01/08/2015 11:08

Multiple Analysis Report

March 19, 2015

Sample ID	Result	Std. Dev.	RSD	Mode
BLK	0.1406	0.0116	8.25	TOC
S0	151567			TOC
S0.2	357540			TOC
S0.5	628723			TOC
S1	1105001			TOC
S5	5115409			TOC
S10	10560490			TOC
BLANK	0.1361	0.1385	101.82	TOC
ICV DF10	4.1562			TOC
ICB	0.0610			TOC
566821	0.5924	0.0054	0.91	TOC
566821D	0.5837	0.0083	1.43	TOC
566821S	5.3710	0.0187	0.35	TOC
Filter blank	0.0543	0.0305	56.26	TOC
566821F	0.5864	0.0162	2.76	TOC
566821FD	0.5882	0.0143	2.43	TOC
566821FS	5.3636	0.0256	0.48	TOC
AS Blank	0.1110	0.0280	25.23	TOC
AS 566821	0.5798	0.0026	0.45	TOC
AS 566821D	0.5732	0.0047	0.83	TOC
CCV df10	4.1982			TOC
CCB	0.0733			TOC
AS 566821S	5.3630	0.0818	1.53	TOC
CCV2 df10	4.2196			TOC
CCB2	0.0805			TOC

Detailed Analysis Report

March 19, 2015

Sample ID: BLK
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 10:27
Sample Type: Sample

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.1488	0.5952	142844	12.220	13.219	59
2	0.1324	0.5296	127113	12.237	13.231	58

Mean: 0.1406 Std Dev: 0.0116 RSD: 8.25

Sample ID: S0
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 10:33
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			151567	12.241	13.233	59

Sample ID: S0.2
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 10:40
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			357540	12.218	13.212	67

Sample ID: S0.5
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 10:46
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			628723	12.267	13.261	72

Sample ID: S1
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 10:53
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			1105001	12.162	13.162	79

Sample ID: S5
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 11:00
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning	Ending	Integration

1	5115409	Baseline 12.188	Baseline 13.187	Time 109

Sample ID: S10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 15010800
Operator ID: USER1

Mode: TOC
Filename: 01081015
Timestamp: 01/08/2015 11:08
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			10560490	12.375	13.375	127

Sample ID: BLANK
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 15010800
Operator ID: USER1

Mode: TOC
Filename: 01081136
Timestamp: 01/08/2015 11:48
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.2340	0.9359	341559	12.348	13.343	68
2	0.0381	0.1525	138370	12.341	13.334	60

Mean: 0.1361 Std Dev: 0.1385 RSD: 101.82

Sample ID: ICV DF10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 15010800
Operator ID: USER1

Mode: TOC
Filename: 01081136
Timestamp: 01/08/2015 11:55
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	4.1562	16.6246	4410716	12.316	13.313	110

Sample ID: ICB
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 15010800
Operator ID: USER1

Mode: TOC
Filename: 01081136
Timestamp: 01/08/2015 12:01
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.0610	0.2440	162116	12.497	13.496	58

Sample ID: 566821
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 15010800
Operator ID: USER1

Mode: TOC
Filename: 01081202
Timestamp: 01/08/2015 12:15
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5962	2.3846	717318	12.311	13.307	93
2	0.5886	2.3543	709459	12.414	13.407	91

Mean: 0.5924 Std Dev: 0.0054 RSD: 0.91

Sample ID: 566821D

Mode: TOC

Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1
Filename: 01081202
Timestamp: 01/08/2015 12:28
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5778	2.3114	698319	12.355	13.355	91
2	0.5896	2.3585	710547	12.295	13.288	92

Mean: 0.5837 Std Dev: 0.0083 RSD: 1.43

Sample ID: 566821S
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1
Mode: TOC
Filename: 01081202
Timestamp: 01/08/2015 12:43
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	5.3578	21.4311	5657369	12.263	13.262	119
2	5.3842	21.5366	5684740	12.427	13.424	117

Mean: 5.3710 Std Dev: 0.0187 RSD: 0.35

Sample ID: Filter blank
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1
Mode: TOC
Filename: 01081243
Timestamp: 01/08/2015 12:55
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.0759	0.3036	177574	12.456	13.456	58
2	0.0327	0.1310	132795	12.431	13.425	57

Mean: 0.0543 Std Dev: 0.0305 RSD: 56.26

Sample ID: 566821F
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1
Mode: TOC
Filename: 01081243
Timestamp: 01/08/2015 13:08
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5750	2.3001	695398	12.517	13.511	89
2	0.5979	2.3915	719090	12.518	13.510	90

Mean: 0.5864 Std Dev: 0.0162 RSD: 2.76

Sample ID: 566821FD
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1
Mode: TOC
Filename: 01081243
Timestamp: 01/08/2015 13:22
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5781	2.3124	698590	12.566	13.559	89
2	0.5983	2.3932	719551	12.531	13.523	90

Mean: 0.5882 Std Dev: 0.0143 RSD: 2.43

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Sample ID: 566821FS
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081243
Timestamp: 01/08/2015 13:36
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	5.3455	21.3819	5644618	12.512	13.510	121
2	5.3817	21.5269	5682213	12.543	13.540	116

Mean: 5.3636 Std Dev: 0.0256 RSD: 0.48

Sample ID: AS Blank
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081243
Timestamp: 01/08/2015 13:48
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.1308	0.5232	234525	12.659	13.655	61
2	0.0912	0.3649	193449	12.532	13.525	61

Mean: 0.1110 Std Dev: 0.0280 RSD: 25.23

Sample ID: AS 566821
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081349
Timestamp: 01/08/2015 14:02
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5816	2.3264	702213	12.493	13.492	95
2	0.5779	2.3116	698378	12.502	13.495	95

Mean: 0.5798 Std Dev: 0.0026 RSD: 0.45

Sample ID: AS 566821D
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081349
Timestamp: 01/08/2015 14:16
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5698	2.2793	690007	12.504	13.497	94
2	0.5765	2.3062	696962	12.434	13.426	95

Mean: 0.5732 Std Dev: 0.0047 RSD: 0.83

Sample ID: CCV df10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150108OC
Operator ID: USER1

Mode: TOC
Filename: 01081417
Timestamp: 01/08/2015 14:24
Sample Type: Cal. Verification

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Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	4.1982	16.7927	4454317	12.372	13.369	115

Sample ID: CCB
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1

Mode: TOC
Filename: 01081417
Timestamp: 01/08/2015 14:30
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.0733	0.2933	174883	12.427	13.418	58

Sample ID: AS 566821S
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1

Mode: TOC
Filename: 01081431
Timestamp: 01/08/2015 14:45
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	5.3052	21.2210	5602863	12.513	13.510	119
2	5.4209	21.6836	5722852	12.445	13.442	117

Mean: 5.3630 Std Dev: 0.0818 RSD: 1.53

Sample ID: CCV2 df10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1

Mode: TOC
Filename: 01081431
Timestamp: 01/08/2015 14:52
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	4.2196	16.8785	4476576	12.535	13.533	112

Sample ID: CCB2
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 1501080C
Operator ID: USER1

Mode: TOC
Filename: 01081431
Timestamp: 01/08/2015 14:58
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.0805	0.3218	182283	12.496	13.491	58

010013

March 19, 2015

Southwest Research Institute

Total Organic Carbon - (TOC)

Controlled Electronic Benchsheet

Client: CH2M Hill Plateau Remediation Company
Project #: 20933.01.006
TO#: 141222-2
Method: 9060M

Date: 01/19/15
Analyst: James Moken
RL = 0.2 mg/l
Sig Figs: 3

Calibration Source: 68-03-WCS9 Conc: 1000 mg/L
ICV/CCV Source: Inorg #46391 TV = 82.0 mg/L
MS Source: 68-03-WCS9 Conc: 1000 mg/L

NOTES: EPP: 5000-R, 1000-2, 200-K C - Concentrated sample

Seq #	Sample ID	Dilution Factor	Instument Reading, mg/L	TOC Conc.	Units	RL	%Rec	%RPD	Avg	Uncert
1	ICV DF10	10	8.1575	81.6	mg/L	2.00	99.5% R, TV =82.0 mg/L			5.00
2	ICB	1	0.1070	<0.20	mg/L	0.200				0.100
3	566821-1	1	0.5246	0.525	mg/L	0.200				
4	566821-2	1	0.5245	0.525	mg/L	0.200		0.0191%	0.525	0.105
5	PBC-1	20	0.0974	<4.00	mg/L	4.00				
6	PBC-2	20	0.1046	<4.00	mg/L	4.00		0.00%	<4.00	2.00
7	566821C-1	20	0.5974	11.9	mg/L	4.00				
8	566821C-2	20	0.5962	11.9	mg/L	4.00		0.00%	11.9	2.12
9	566821CD-1	20	0.6815	13.6	mg/L	4.00				
10	566821CD-2	20	0.6820	13.6	mg/L	4.00		0.00%	13.6	2.16
11	CCV DF10	10	8.0882	80.9	mg/L	2.00	98.7% R, TV =82.0 mg/L			4.96
12	CCB	1	0.0870	<0.20	mg/L	0.200				0.100

Sample ID	Sample TOC value (mg/L)	TOC concentrated (mg/L)	Total Volume Concentrated (mL)	Final Volume (mL)	TOC recalculated (mg/L)	RPD
566821	0.592	11.9	404	20	0.589	0.589%
566821D	0.584	13.6	400	20	0.680	15.2%
RPD	1.36%	13.3%			14.4%	

Sample calculation; 568821 C-1

$0.5974 \times 20 = \boxed{11.9 \text{ mg/L}}$

TOC Recalculated

$11.9 \times \frac{20}{404} = \boxed{0.589 \text{ mg/L}}$

Conc. mg/L = Instrument Reading, mg/L x Dilution Factor

March 19, 2015

176 TITLE TAP 01-0406-159 TO# 141222-2

SWRI

PROJECT NO. 20432.01.006

BOOK NO. 1/1-0406-044

2 WO 1/21/15 gau

Work continued from Page

176-01. 100ppm TOC std

2mL of 1000ppm TOC std (# 68-03-WCS9) to F.V. 20mL with DI H_2O

TOC std	TOC conc	amount of 100ppm added	F.V.
S0	0mg/L	0mL	20mL
S0.2	0.02mg/L	0.04mL	20mL
S0.5	0.05mg/L	0.1mL	20mL
S1.0	TESAM 1/19/15 ~~0~~ 1.0mg/L	0.2mL	20mL
S5.0	5.0mg/L	1.0mL	20mL
S10.0	10.0mg/L	2.0mL	20mL

NDIR: 12.2

TOC Reagent: 111-01-WCS10
Acid Reagent: 111-02-WCS10

Epp: 5000-R, 1000-2, 200-K

176-02 ICV/CCV TV=82mg/L DF 200

0.1mL ERA std (#46391) to F.V. 20mL with DI H_2O

	Initial volume	F.V.
PB	400mL	20mL
566821	40~~0~~4.4 mL TESAM 1/19/15	20mL
566821D	400mL	20mL

SAM 1/19/15

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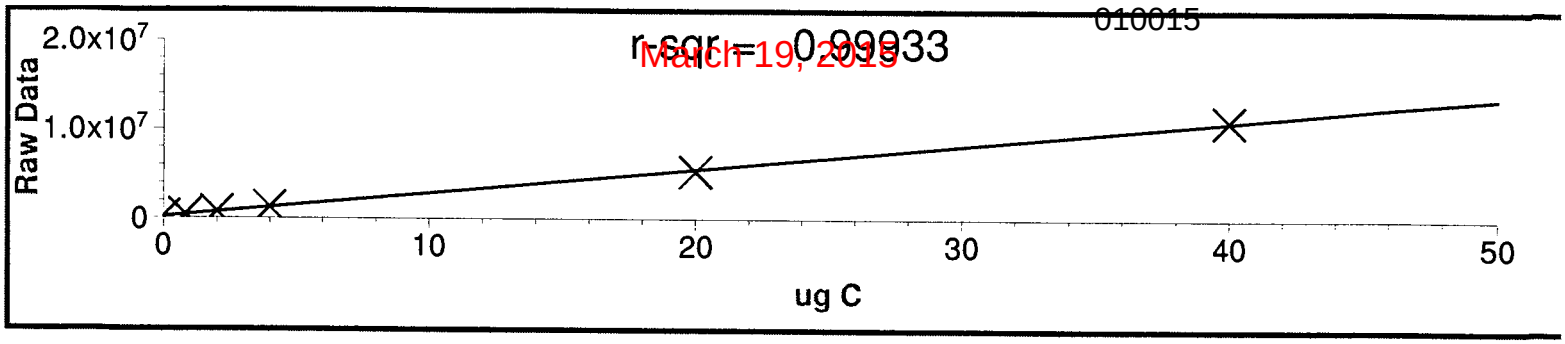
Work continued to Page

SIGNATURE [signature] DATE 1/19/15

DISCLOSED TO AND UNDERSTOOD BY [signature] DATE WITNESS DATE 1/21/15



March 19, 2015

Calibration Report

March 19, 2015

Cal. Curve ID: 150119oc
Created: 01/19/2015 12:07
Calibration Factor (m): 2.691e+05
Y Intercept (b): 164795
r-squared: 0.99933

Standard ID	Y Raw Data	X Expected ug C	Measured ug C	Message	Date & Time
S0	233044	0.000	0.254		01/19/2015 11:28
S0.2	417684	0.800	0.940		01/19/2015 11:34
S0.5	717077	2.000	2.053		01/19/2015 11:41
S1	1226589	4.000	3.946		01/19/2015 11:48
S5	5335036	20.000	19.216		01/19/2015 11:55
S10	11032957	40.000	40.392		01/19/2015 12:03

Multiple Analysis Report

March 19, 2015

Sample ID	Result	Std. Dev.	RSD	Mode
BLK	0.1991			TOC
S0	233044			TOC
S0.2	417683			TOC
S0.5	717077			TOC
S1	1226589			TOC
S5	5335037			TOC
S10	11032957			TOC
b	0.1251			TOC
ICV DF10	8.1575			TOC
ICB	0.1070			TOC
566821	0.5246	0.0001	0.01	TOC
PBC DF20	0.1010	0.0051	5.04	TOC
566821C DF20	0.5968	0.0008	0.14	TOC
566821CD DF20	0.6817	0.0004	0.05	TOC
CCV DF20	8.0882			TOC
CCB	0.0870			TOC

Detailed Analysis Report

March 19, 2015

Sample ID: BLK
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:22
Sample Type: Sample

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.1991	0.7963	191108	12.252	13.249	62

Sample ID: S0
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:28
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			233044	12.275	13.266	63

Sample ID: S0.2
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:34
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			417683	12.331	13.321	68

Sample ID: S0.5
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:41
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			717077	12.202	13.197	74

Sample ID: S1
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:48
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			1226589	12.263	13.261	79

Sample ID: S5
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 11:55
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			5335037	12.209	13.207	107

March 19, 2015

Sample ID: S10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191116
Timestamp: 01/19/2015 12:03
Sample Type: TOC Standard

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1			11032957	12.254	13.253	141

Sample ID: b
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 12:15
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.1251	0.5005	299476	12.244	13.236	64

Sample ID: ICV DF10
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 12:23
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	8.1575	32.6302	8944469	12.160	13.159	152

Sample ID: ICB
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 12:29
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.1070	0.4281	279973	12.340	13.336	63

Sample ID: 566821
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 12:43
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5246	2.0984	729410	12.210	13.203	94
2	0.5245	2.0980	729291	12.184	13.181	94

Mean: 0.5246 Std Dev: 0.0001 RSD: 0.01

Sample ID: PBC DF20
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 12:55
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time

1	0.0974	0.3898	269674	12.201	13.205	64
2	0.1046	0.4186	277414	12.118	13.109	65

Mean: 0.1010 Std Dev: 0.0051 RSD: 5.04

Sample ID: 566821C DF20
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 13:08
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.5974	2.3897	807784	12.095	13.092	92
2	0.5962	2.3850	806509	12.158	13.157	92

Mean: 0.5968 Std Dev: 0.0008 RSD: 0.14

Sample ID: 566821CD DF20
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191209
Timestamp: 01/19/2015 13:22
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.6815	2.7261	898290	12.130	13.124	92
2	0.6820	2.7279	898780	12.150	13.145	91

Mean: 0.6817 Std Dev: 0.0004 RSD: 0.05

NO 1/21/15 gcu

Sample ID: CCV DF20
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191337
Timestamp: 01/19/2015 13:45
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	8.0882	32.3527	8869814	12.151	13.151	158

Sample ID: CCB
Method: TOC Range 0.1 - 20 ppm C
Cal. Curve: 150119oc
Operator ID: USER1

Mode: TOC
Filename: 01191337
Timestamp: 01/19/2015 13:51
Sample Type: Cal. Verification

Rep #	ppm C	ug C	Raw Data	Beginning Baseline	Ending Baseline	Integration Time
1	0.0870	0.3479	258415	12.432	13.431	60

Appendix C

GC-MS Chromatograms

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120501.D
Operator    : MZ
Acquired    : 20 Jan 2015  12:20 pm using AcqMethod CH2M_FS.M
Instrument :   Yoda
Sample Name: DCM LOT DJ206
Misc Info   : 20933.01.006
Vial Number: 2
```

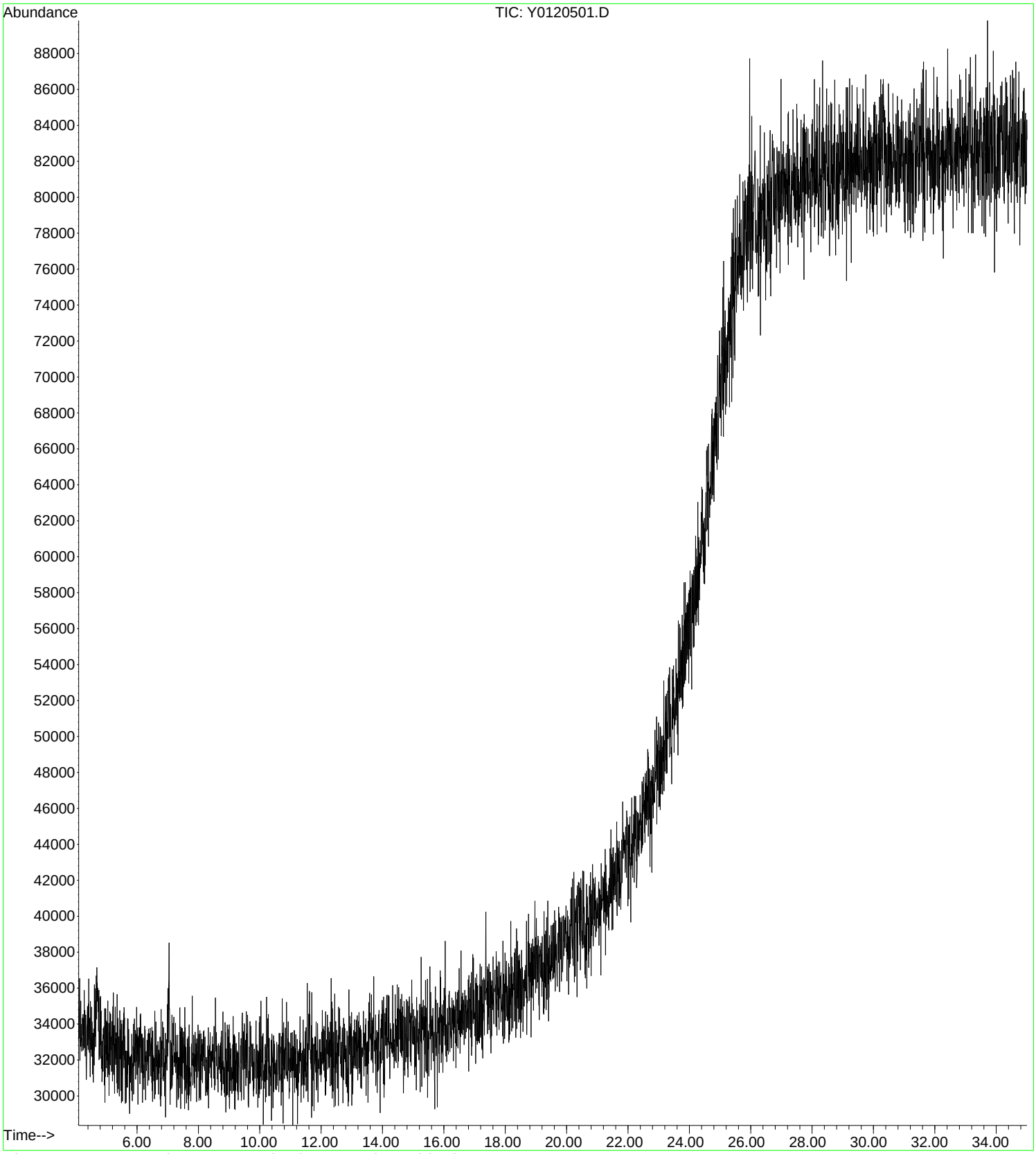


Figure 1. GC-MS Chromatograph of DCM solvent blank

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120503.D
Operator    : MZ
Acquired    : 20 Jan 2015   1:41 pm using AcqMethod CH2M_FS.M
Instrument :   Yoda
Sample Name: B303K8; 566821 (DCM extract)
Misc Info   : 20933.01.006
Vial Number: 4
```

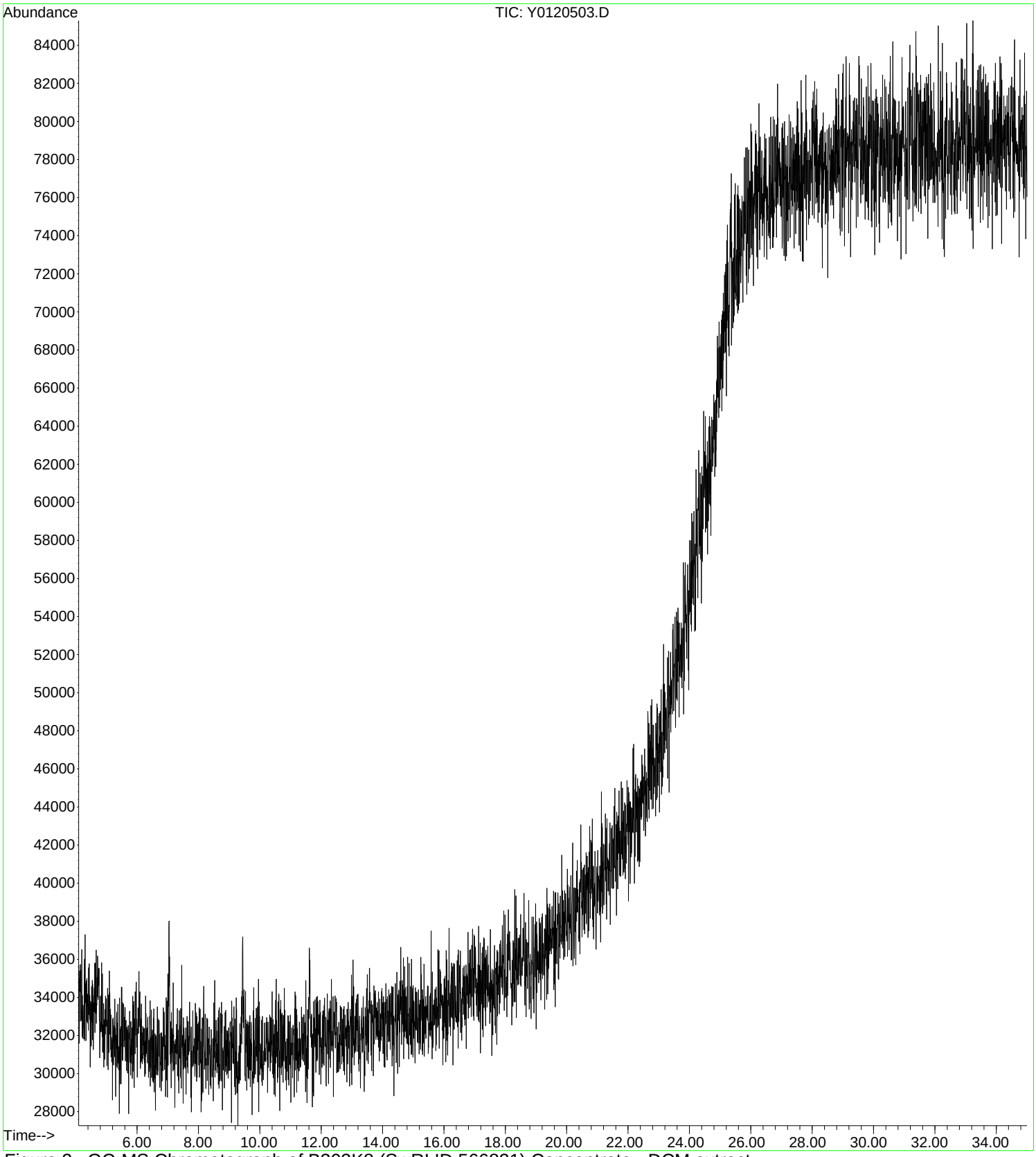


Figure 2. GC-MS Chromatograph of B303K8 (SwRI ID 566821) Concentrate - DCM extract

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120504.D
Operator    : MZ
Acquired    : 20 Jan 2015   2:22 pm using AcqMethod CH2M_FS.M
Instrument :   Yoda
Sample Name: B303K8; DUP; 566821 (DCM extract)
Misc Info   : 20933.01.006
Vial Number: 5
```

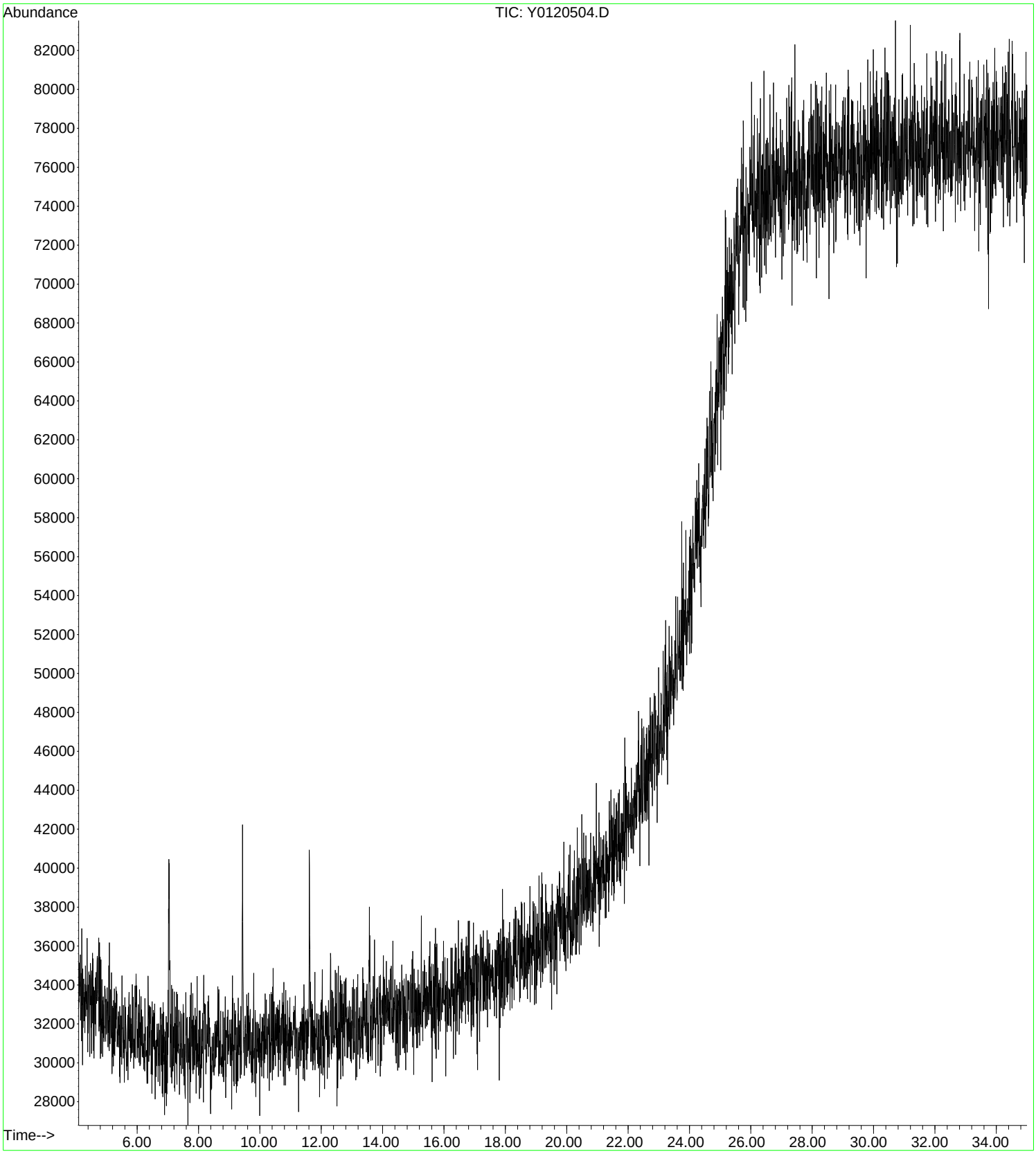


Figure 3. GC-MS Chromatograph of B303K8 Duplicate (SwRI ID 566821) Concentrate - DCM extract

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120506.D
Operator    : MZ
Acquired    : 20 Jan 2015   4:04 pm using AcqMethod CH2M_DI.M
Instrument :   Yoda
Sample Name: PB(BLANK); 567525
Misc Info   : 20933.01.006
Vial Number: 1
```

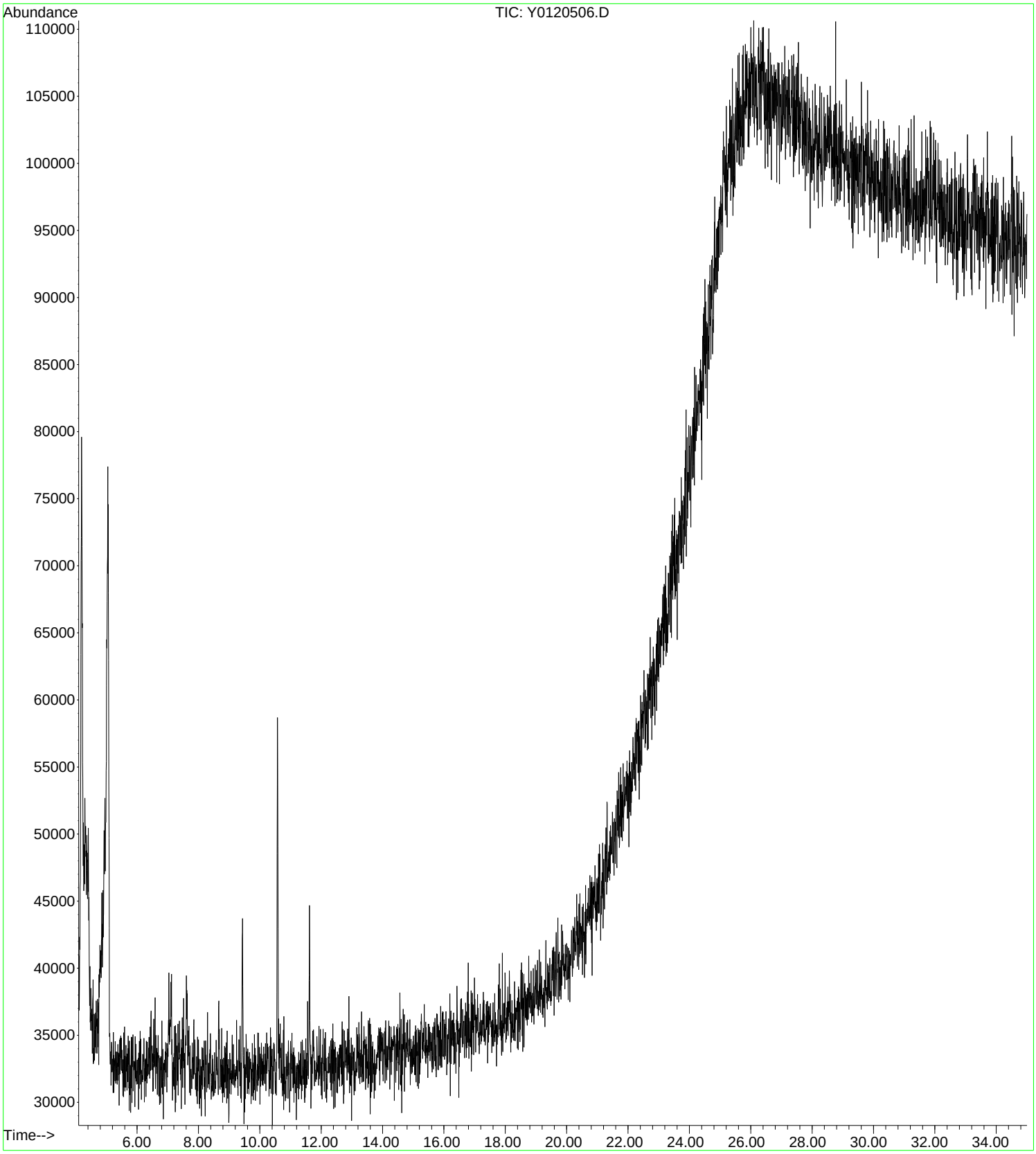


Figure 4. GC-MS Chromatograph of Procedure Blank (PB)

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120507.D
Operator    : MZ
Acquired    : 20 Jan 2015   4:45 pm using AcqMethod CH2M_DI.M
Instrument :   Yoda
Sample Name: B303K8; 566821
Misc Info   : 20933.01.006
Vial Number: 2
```

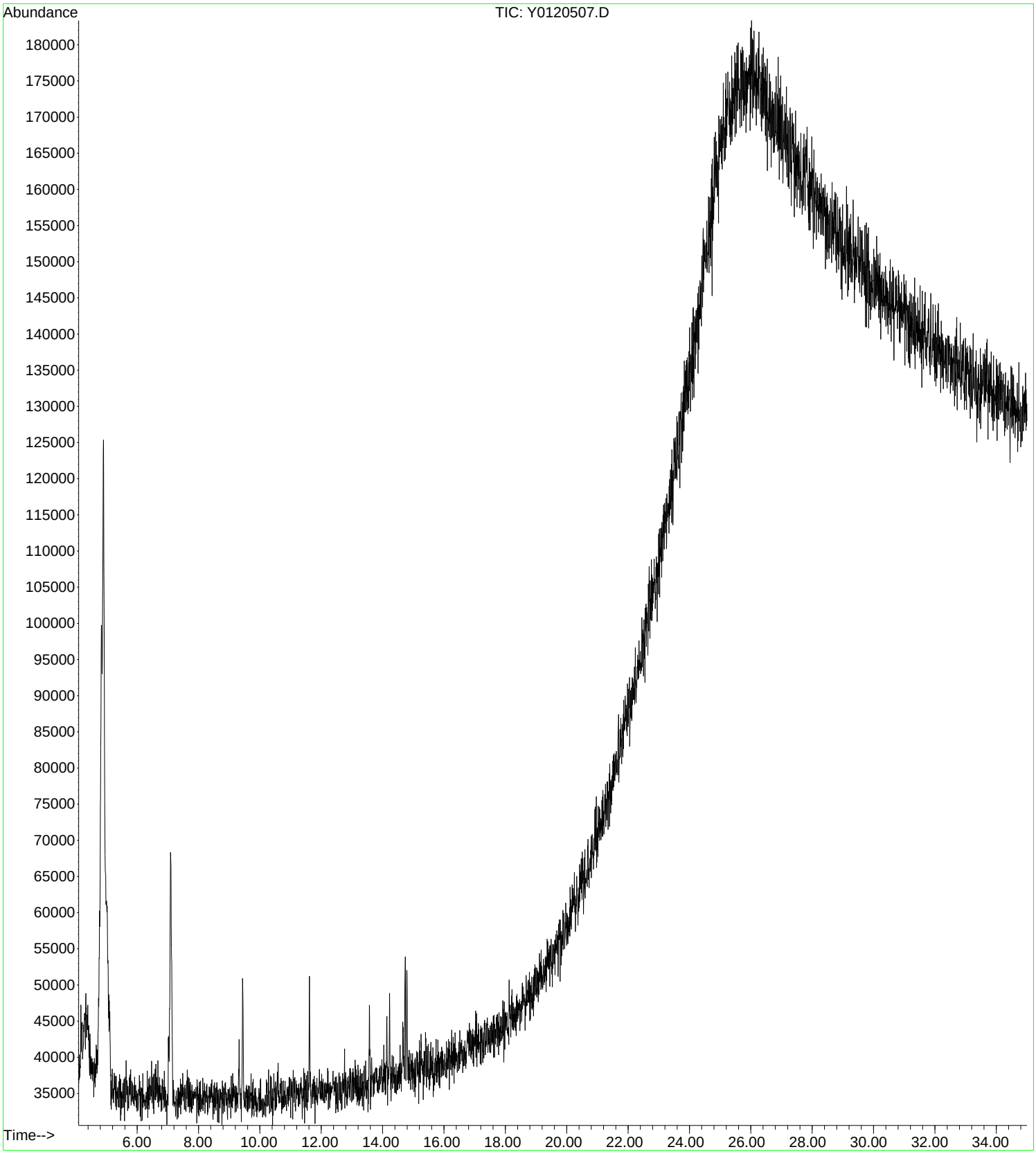


Figure 5. GC-MS Chromatogrph of B303K8 (SwRI ID 566821) Concentrate - Direct Inject

March 19, 2015

```
File        :C:\MSDCHEM\1\DATA\2015\Y012015\Y0120507.D
Operator    : MZ
Acquired    : 20 Jan 2015   4:45 pm using AcqMethod CH2M_DI.M
Instrument :   Yoda
Sample Name: B303K8; 566821
Misc Info   : 20933.01.006
Vial Number: 2
```

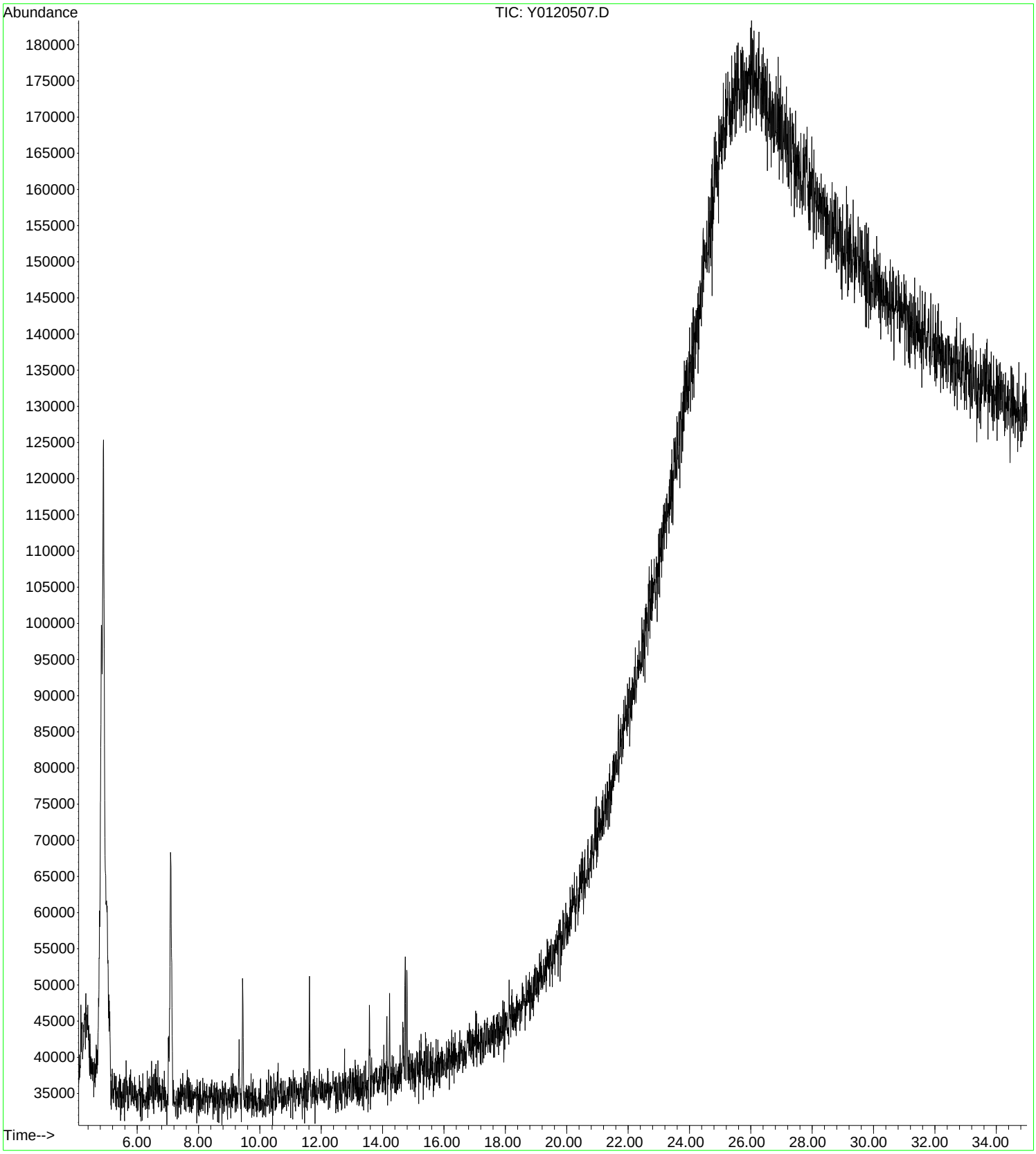


Figure 6. GC-MS Chromatograph of B303K8 (SwRI ID 566821) Concentrate - Direct Inject

SOUTHWEST RESEARCH INSTITUTE
CLIENT: CH2M Hill Plateau Remediation
SwRI PROJECT#: 20933.01.006
SwRI TASK ORDER: 141222-2
SwRI SRR: 54424
SDG: 566821
VTSR: 12.20.2014

Sample Receipt Paperwork

March 19, 2015

Sample Receipt

Southwest Research Institute

Sample Receipt Number: 54424
Revision: 1

This Receipt was Revised 01/08/2015

VTSR: 12/20/14

Time: 13:05:00

Project: **20933.01.006**
Case #: **299-E27-10**
Client: **CH2M Hill Plateau Remediation Company**

Manager: SPIES, RADONNA
Logged in by: SDOUGLAS
Creation Date: 12/22/14

54424 CH2M Hill Plateau Remediatio

Notes

Samples were received intact. (wet ice)

Fed Ex Tracking #:
772322360428 - 1.2 °C

Parameters: Analysis/located on Task Order.

See chain-of-custody as part of the SRR system for more information.

Phases:
001 - admin
006 - wetchem

Rev. 1
Changed project number.

Backaround CPM: <100 cpm
Container Wipe CPM: <100 cpm
Total CPM: <100

System ID	Customer ID	CED	Matrix	Containers	Special Reqs.
566821	B303K8	12/19/14	Water	8	

Containers: 8 **Samples: 1**

These documents are associated with this receipt: 170389[COC for SRR 54424], 170390[SRR Paperwork for SRR 54424], 171063[]

Thermometer: 021056
Temperature: 1.2

March 19, 2015

Southwest Research Institute

Laboratory Task Order

TO #: 141222-2 Revision: 2

Project(s): 20933.01.006
Manager(s): SPIES, RADONNA
To Client: 02/16/15

SDG: 566821

SRR #'s: 54424
Client(s): CH2M Hill Plateau Remediation Company

Instructions

RFP 273912
TITLE: Characterization of Total Organic Carbon in Groundwater from Well 299-E27-10

4. TOC Measurement - The Contractor will analyze each of the filtered and non-filtered samples in Step 3 using method 9060 or the equivalent. This analysis will confirm that the Contractor is able to get the same result as historical data, and will indicate whether the organic matter is dissolved or particulate in nature or a mixture of both.

12. Mass Spectrometry Analysis - The concentrate will be analyzed by three different methods. The first method will utilize direct injection GC-MS to identify peaks that could represent the concentrated organic matter.
Using the second method, the concentrated organic matter sample will undergo analysis by LC-MS/MS. Third, the concentrated organic sample will be analyzed via direct infusion into the mass spectrometer portion of an electro-spray mass spectrometer.

Documents Related to this task order: 170389[COC for SRR 54424], 170390[SRR Paperwork for SRR 54424], 171063[]

Deliverables --> Hard Copy: -YES- EDD: no PDF: no

Test: flowinj msms
Section: TDG
Holding: 14 days from VTSR
direct flow injection onto MS/MS ESI
Cnt: 1

System ID	Type	Cont	Matrix	Customer ID	VTSR	Method Date
566821		1	Water	B303K8	20 Dec 14	03 Jan 15

Test: GC/MS TIC
Section: BNA
Holding: 28 days from VTSR
Analysis by GC/MS for TIC Screen
Cnt: 1

System ID	Type	Cont	Matrix	Customer ID	VTSR	Method Date
566821		1	Water	B303K8	20 Dec 14	17 Jan 15

Test: LCMSMS
Section: TDG
Holding: 14 days from VTSR
LC-MS/MS analysis
Cnt: 1

System ID	Type	Cont	Matrix	Customer ID	VTSR	Method Date
566821		1	Water	B303K8	20 Dec 14	03 Jan 15

Test: TOC_9060M
Section: WETCHEM
Holding: 28 days from CED
TOC by 9060 (modified)
Cnt: 1

System ID	Type	Cont	Matrix	Customer ID	CED	Method Date
566821		1	Water	B303K8	19 Dec 14	16 Jan 15

March 19, 2015

SAMPLE LOG-IN SHEET

Lab Name: Southwest Research Institute	Page 1 of 1
Received By (Print Name): STEVEN DOUGLAS	Log-in Date: 12/22/2014
Received By (Signature):	
Case Number: 299-E27-10	Sample Delivery Group No.: N/A
SAS Number: N/A	
Remarks: 20859.01.00X	

1.	Custody Seal(s)	Present/Absent* Intact/Broken
2.	Custody Seal Nos.	N/A
3.	Chain-of Custody Records	Present/Absent*
4.	Traffic Reports or Packing Lists	Present/Absent*
5.	Airbill	Airbill/Sticker Present/Absent*
6.	Airbill No.	772322360428
7.	Sample Tags	Present/Absent*
	Sample Tag Numbers	Listed/Not listed on Chain of Custody
8.	Sample Condition	Intact/Broken*/Leaking
9.	Cooler Temperature	1.2C
10.	Does Information on custody records, traffic reports, and sample tags agree?	Yes/No*
11.	Date Received at Lab	12/20/2014
12.	Time Received	13:05:00

EPA Sample #	Corresponding Sample Tag #	Corresponding Assigned Lab #	Remarks: Condition of Sample Shipment, etc
B303K8	N/A	566821	Intact

Sample Transfer	
Fraction: INORG	Fraction
Area #: R.13	Area #
By: STEVEN	By
On: 12/20/2014 DOUGLAS	On

* Contact SMO and attach record of resolution

Reviewed By:	Logbook No.: Sample Receipt (54424)
Date: 12.22.14	Logbook Page No.: ~~8944~~ 8946 SEC 1 of 1

FORM DC-1

OLMO4.2

March 19, 2015

Southwest Research Institute

Traffic Report

Sample Custodian Signature: _____

1. Custody Seal	Present
2. Chain of Custody	Present
3. Sample Tags	Not Present
Sample Tag Numbers	Not on COC
4. SMO Forms	Present

Client: CH2M Hill Plateau Remediation Company

Project: 20859.01.00X

Case: 299-E27-10 / SDG: _____

Sample Receipt: 54424

Airbill: 772322360428

Custody Seal #(s): N/A

Date Received	Time Received	COC Record	SMO Sample #	Corresponding		Traffic Rpt, Tags, COC Agree	Sample Condition
				Sample Tag #	SwRI #		
12/20/14	13:05:00	F15-010-001	B303K8	N/A	566821	YES	Intact