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LABORATORY REPORT

PREPARED FOR:

Tim Sperry
Smog Armor
659 NW 38 Cir
Boca Raton, FL 33431

Report Date: October 21, 2019
Date Submitted: September 9, 2019
Project Number: ITL#119592-B
Purchase Order: Credit Card

SAMPLE CHARACTERIZATION:

Identification	Additional Info.
A	NA

PROJECT DETAILS:

History & Objective:
The product has a zero-VOC (volatile organic compound) coating that contains an active mineral that adsorbs airborne VOC (when the coating is dried). The objective of the project was to test the efficiency of the dried coating and its ability to adsorb VOCs in a closed system (quantify based on percentages of VOCs adsorbed). This was performed by calculating the reduction in the amount of formaldehyde (CAS 50-00-0, b.p. 96ºC, density 1.070 g/mL), ethanol (EtOH, CAS 64-17-5, b.p. 78 ºC, density 0.790 g/mL), acetone (CAS 67-64-1, b.p. 56 ºC, density 0.790 g/mL), carbon disulfide (CS_2, CAS 75-15-0, b.p. 46 ºC, density 1.266 g/mL) and benzene (CAS 71-43-2, b.p. 80 ºC, density 0.874 g/mL) but to also identify any other VOCs.
Technique(s):
Static Headspace (SHS) – Gas Chromatography/Mass Spectroscopy (GC/MS)

ACCEPTANCE CRITERIA:

NONE Specified		
Technique	Findings of Results (RESULTS section)	Pass/Fail
SHS-GC/MS	Tables 1 & 3 (attached)	NA

TEST PROCEDURES:

Sample Type	Other	Tested "as-received"
		✓
Specification:	NA	
Date of Outgas, Analysis:	10/18/19	
Method Name:	Formhs1.M	
Outgas Temp & Time:	40ºC – 1 Hour	
Sample Type/Description:	Solid (dried paint)	
Surface Area:	NA	
Details & Notation:	NA grams. The sample was submitted to ITL as dried paint in a sealed, 20-mL headspace vial. The cap was removed from the vial, the sample spiked with 2 µL of a "mixture" of the compounds of interest.	

The sample vial was placed onto an *Agilent Technologies 7697A Headspace Sampler* to outgas where the gasses within the headspace vial were analyzed using a *Hewlett Packard 6890 Gas Chromatograph/5973 Mass Selective Detector.*

A blank was analyzed prior to sample to ensure that the system did not contain any compounds of interest, which it did not. An external standard (2 µL) containing a "mixture" of the (5) compounds of interest was analyzed in duplicate following the sample analysis. The "mixture" was prepared with 100 µL formaldehyde, 30 µL of benzene and CS_2, and 5 µL of EtOH and acetone. The average response from the external standard injections was used to quantify the amount of formaldehyde, EtOH, acetone, CS_2 and benzene detected in the sample as well as to calculate the reduction of each compound.

RESULTS:

Table 1: Summary of SHS- GC/MS Results

	Formaldehyde[1] (% Reduction)	EtOH[2] (% Reduction)	Acetone[3] (% Reduction)	CS_2[4] (% Reduction)	Benzene[5*] (% Reduction)
I	95.046	73.661	42.562	30.833	37.899

Notes:

- The total reduction for the compounds assumes that effects from any other VOCs in this sample matrix aren't inhibiting the amount detectable based on the interactions with other VOCs. It also assumes that the sample is free from any of the compounds of interest.
- * Even though the compound was detected in the sample as a co-eluting mixture, the response for the mixture was included in this category.
- [1] Quantified based on the response of formaldehyde in the standard (mixture).
- [2] Quantified based on the response of EtOH in the standard (mixture).
- [3] Quantified based on the response of acetone in the standard (mixture).
- [4] Quantified based on the response of carbon disulfide in the standard (mixture).
- [5] Quantified based on the response of benzene in the standard (mixture).

The complete results are listed in Table 3 included with this report. The compounds identified in the sample were quantified based on the average response of the two external standard injections performed following the sample analysis.

The analysis of the external standard showed that the retention time for formaldehyde was 2.11 minutes, 10.48 minutes for EtOH, 10.85 minutes for acetone, 11.46 minutes for CS_2 and 13.24 minutes for benzene. The resulting mass spectrum for any compounds eluting at these retention time (2.11, 10.48, 10.85, 11.46 and 13.24 minutes) was compared to a reference mass spectrum to confirm or refute its presence.

The total reduction reported was calculated using the following equation:

$$\text{Total \% Reduction: } 100 - ((\text{Analyte}^{\text{Sample}} / \text{Analyte}^{\text{Added}}) * 100)$$

$\text{Analyte}^{\text{Sample}}$ = Amount of analyte detected in sample (µg).
$\text{Analyte}^{\text{Added}}$ = Amount of analyte added to sample prior to testing (concentration in standard "mixture").

The compounds seen in the blank are listed above the results. Those compounds that were seen in the blank are shown in **bold** in the sample table. Those compounds which had a response less than or equal to what was seen in the blank were denoted with an asterisk (*) and were NOT included in the totals.

The relative percent of each compound is listed along with the retention time, response, and match quality. The relative percent is computed by dividing the individual compound response by the total outgassing response for the sample and the resultant multiplied by one hundred (100).

DISCUSSION:
A match quality was assigned to each compound identified in Table 3. The match quality indicates how well the unknown spectra match that of a reference library. Values in the 90's indicate a very reliable match, 80's and 70's can be considered a fair match while anything below that should be used more as a guide as to what type of compound the unknown is.

Upon further investigation of the mass spectra at each retention time it was noticed that some retention times appeared to contain two co-eluting compounds. Co-eluting compounds were *italicized* as mixtures in the sample table and if they contained a compound of interest the response for the mixture was included in totals for that category. The sample contained a "hump" eluting from 17.6 to 18.7 minutes in the chromatogram. It was determined that the hump contained a mixture of compounds.

The search of the mass spectrum of some of the retention times resulted in no good matches. These compounds were identified as <unknown> in the table.

Figures 1 through 3 included with the report shows the various chromatograms for the project. Table 2 below summarizes how the Figures were labeled.

Table 2: Explanation for Sample Chromatograms contained in Figures 1 through 3

Figure	Sample Chromatogram(s)
1	A (as it was integrated)
2	A (expanded view)
3	A compared to formaldehyde standard (expanded view)

SAMPLE DISPOSITION AND DATA STORAGE:
The samples from this project will be stored for at least 3 months from the date of this report. Samples may then be discarded unless instructions for return or other disposition are received. All data will be kept on file for 3 years. Additional report copies can be obtained upon request.

Submitted by:

Mathew Adams
Analytical Chemist

Reviewed by:

Gary A. Smith
Owner and President

REVISION RECORD:

Rev	Description	Date	Author	Approved
0	Released	10/21/19	MPA	GAS

Table 3
Summary of Results from Static Headspace - GC/MS Analysis

SAMPLE NAME: **Blank (Prior to Sample Analysis)**
Date Tested: 10/18/19
Outgassing Paramters: 1 hr @ 40C

One Pt. Standar Raw Area: 1258.8 ug Formaldehyde
36131338 (average of two)

RETENTION TIME	RAW AREA	***IDENTIFICATION***	MATCH QUALITY	RELATIVE PERCENT	**Amount (ug)**
1.21	*175549442*	*Air Mixture*		*100.000*	*6116.066*
Total	**175549442**				
		Organics Total			**6116.066**

SAMPLE NAME: **External Standard (mixture) #1 (after sample analysis)**
Date Tested: 10/18/19
Outgassing Paramters: 1 hr @ 40C

RETENTION TIME	RAW AREA	***IDENTIFICATION***	MATCH QUALITY	RELATIVE PERCENT	**Amount (ug)**
1.21	*168177868*	*Mixture of air, carbon dioxide and others*		*24.83*	*5859.243*
2.67	36445442	Formaldehyde	90	5.38	1269.743
8.93	26972200	Methanol	90	3.98	939.700
10.48	19568225	Ethanol	90	2.89	681.748
10.85	21304280	Acetone	90	3.15	742.232
11.51	179574327	Carbon disulfide	90	26.52	6256.291
11.56	10063420	Dimethoxymethane	90	1.49	350.535
12.74	9681571	unknown		1.43	337.302
13.16	372555	unknown		0.06	12.980
13.45	176412330	Benzene	90	26.05	6146.128
13.60	686118	unknown		0.10	23.904
13.74	169393	unknown		0.03	5.902
13.90	11311718	unknown		1.67	394.095
13.96	130501	unknown		0.02	4.547
14.08	620398	unknown		0.09	21.614
14.17	3037541	unknown		0.45	105.827
14.61	596500	unknown		0.09	20.782
15.11	7331052	unknown		1.08	255.411
15.25	402660	unknown		0.06	14.028
15.28	292421	unknown		0.04	10.188
16.12	3584077	unknown		0.53	124.868
17.00	498585	unknown		0.07	17.370
Total	**677231182**				
		Organics Total			**23594.438**

SAMPLE NAME: **External Standard (mixture) #2 (after sample analysis)**
Date Tested: 10/18/19
Outgassing Paramters: 1 hr @ 40C

RETENTION TIME	RAW AREA	***IDENTIFICATION***	MATCH QUALITY	RELATIVE PERCENT	**Amount (ug)**
1.21	*168005552*	*Mixture of air, carbon dioxide and others*		*35.42*	*5853.240*
2.67	35817234	Formaldehyde	90	7.55	1247.857
8.93	28460649	Methanol	90	6.00	991.557
10.48	19394894	Ethanol	90	4.09	675.710
10.85	17418275	Acetone	90	3.67	606.845
11.51	80886442	Carbon disulfide	90	17.05	2818.048
11.56	5539601	Dimethoxymethane	90	1.17	192.997
12.74	7523731	unknown		1.59	262.123
13.16	310553	unknown		0.07	10.820
13.45	93501786	Benzene	90	19.71	3257.561
13.49	*683457*	*Mixture of benzene and others*		*0.14*	*23.811*
13.60	541599	unknown		0.11	18.869
13.74	157827	unknown		0.03	5.499
13.90	7191166	unknown		1.52	250.537
14.08	484284	unknown		0.10	16.872
14.17	2226837	unknown		0.47	77.582
14.61	324349	unknown		0.07	11.300
15.11	3976429	unknown		0.84	138.537
15.25	234930	unknown		0.05	8.185
15.28	114813	unknown		0.02	4.000
16.12	1486182	unknown		0.31	51.778
17.00	100161	unknown		0.02	3.490
Total	**474380751**				
		Organics Total			**16527.218**

Table 3
Summary of Results from Static Headspace - GC/MS Analysis

SAMPLE NAME: I
Sample Wt: NA grams
Surface Area: NA
Sample Type: Solid (dried paint)
Parts Tested: NA
Date Tested: 10/18/19
Outgassing Paramters: 1 hr @ 400C
Method Name: Formhs1.M

One Pt. Standard 1258.8 ug Formaldehyde
Raw Area: 36131338 (Ave. of 2 standards)

One Pt. Standard 46.5 ug Ethanol (EtOH)
Raw Area: 19481560 (Ave. of 2 standards)

One Pt. Standard 46.5 ug Acetone
Raw Area: 19361278 (Ave. of 2 standards)

One Pt. Standard 446.8 ug CS_2
Raw Area: 130230385 (Ave. of 2 standards)

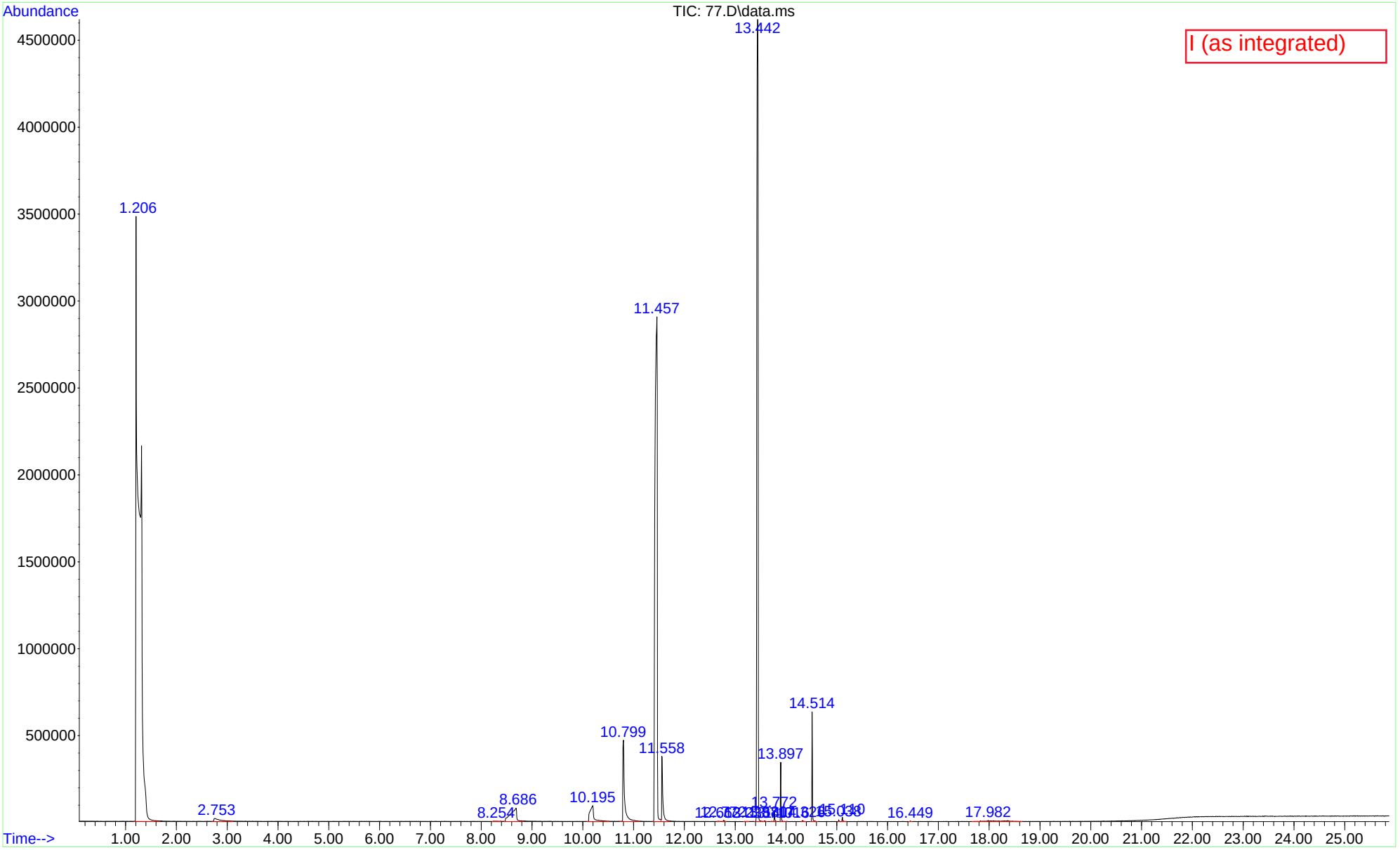
One Pt. Standard 308.5 ug Benzene
Raw Area: 134957058 (Ave. of 2 standards)

RETENTION TIME	RAW AREA	***IDENTIFICATION***	MATCH QUALITY	CLASSIFICATION	RELATIVE PERCENT	*Formaldehyde Calc* Amount (µg)	*Foramaldehyde Calc* Amount (µg/gram)	*EtOH Calc* Amount (µg)	*EtOH Calc* Amount (µg/gram)	*Acetone Calc* Amount (µg)	*Acetone Calc* Amount (µg/gram)	*CS, Calc* Amount (µg)	*CS, Calc* Amount (µg/gram)	*Benzene Calc* Amount (µg)	*Benzene Calc* Amount (µg/gram)
1.21	***165560487***	***Mixture of air, carbon dioxide and others (*)***			***43.56***	***5768.055***		***395.172***		***397.627***		***568.012***		***378.457***	
2.75	1790110	Formaldehyde	90	Formaldehyde	0.47	62.367		4.273		4.299		6.142		4.092	
8.25	213377	Acetaldehyde	70		0.06	7.434		0.509		0.512		0.732		0.488	
8.69	6536801	Methanol	90		1.72	227.739		15.603		15.699		22.427		14.943	
10.20	5131344	Ethanol	90	Ethanol	1.35	178.774		12.248		12.324		17.605		11.730	
10.80	11120675	Acetone	90	Acetone	2.93	387.439		26.544		26.709		38.153		25.421	
11.46	90024796	Carbon disulfide	90	Carbon disulfide	23.69	3136.424		214.878		216.213		308.861		205.789	
11.56	5969317	Dimethoxymethane	90		1.57	207.968		14.248		14.337		20.480		13.645	
12.66	67405	unknown			0.02	2.348		0.161		0.162		0.231		0.154	
12.77	152689	Butanal	80		0.04	5.320		0.364		0.367		0.524		0.349	
13.24	72181	unknown			0.02	2.515		0.172		0.173		0.248		0.165	
13.44	83710269	Benzene	90	Benzene	22.03	2916.429		199.806		201.047		287.197		191.354	
13.58	*99550*	*Mixture of butanol and benzene*		*Benzene*	*0.03*	*3.468*		*0.238*		*0.239*		*0.342*		0.228	
13.72	*25994*	*unknown*			*0.01*	*0.906*		*0.062*		*0.062*		*0.089*		0.059	
13.77	531699	Pentanal	90		0.14	18.524		1.269		1.277		1.824		1.215	
13.90	2539271	unknown			0.67	88.467		6.061		6.099		8.712		5.805	
14.02	25015	unknown			0.01	0.872		0.060		0.060		0.086		0.057	
14.33	128331	Pentanol	50		0.03	4.471		0.306		0.308		0.440		0.293	
14.51	4442991	Hexanal	90		1.17	154.792		10.605		10.671		15.243		10.156	
15.04	77618	Butyl ether	90		0.02	2.704		0.185		0.186		0.266		0.177	
15.11	261366	unknown			0.07	9.106		0.624		0.628		0.897		0.597	
16.45	47290	Decamethylcyclopentasiloxane	90		0.01	1.648		0.113		0.114		0.162		0.108	
17.98	*1518013*	*Nonyl phenol, hydrocarbon and others mixture*			*0.40*	*52.887*		*3.623*		*3.646*		*5.208*		3.470	
	Total 380046589														
				Top 30 peaks % of Total:	NA										
				Integration Threshold of lowest concentrated peak (ug-Formaldehyde):	0.872										
	NA	INTEGRATION OF ENTIRE BASELINE				NA		NA		NA		NA		NA	
		Total Organics (Top 30)				**7472.602**		**511.951**		**515.131**		**735.868**		**490.296**	
				Expected RT											
		Formaldehdye		2.67		**62.367**		**4.273**		**4.299**		**6.142**		**4.092**	
		Ethanol		10.48		**178.774**		**12.248**		**12.324**		**17.605**		**11.730**	
		Acetone		10.85		**387.439**		**26.544**		**26.709**		**38.153**		**25.421**	
		Carbon Disulfide (CS_2)		11.51		**3136.424**		**214.878**		**216.213**		**308.861**		**205.789**	
		Benzene		13.45		**2919.897**		**200.043**		**201.286**		**287.538**		**191.582**	
		Others (Top 30)													
		Others (Total Integration)													
		Formaldehyde Reduction (%)				**95.046**									
		Ethanol Reduction (%)				**73.661**									
		Acetone Reduction (%)				**42.562**									
		CS_2 Reduction (%)				**30.873**									
		Benzene Reduction (%)				**37.899**									

Compounds in Italics appear to be co-eluting
Compounds in bold were seen in standards and/or blank
(*) Compounds seen at levels less than or equal to standards and/or blank, NOT included in Totals
Residual compounds from a previous analysis, NOT included in Totals
<WS> Compound seen at comparable level of weekly standard, NOT included in Totals

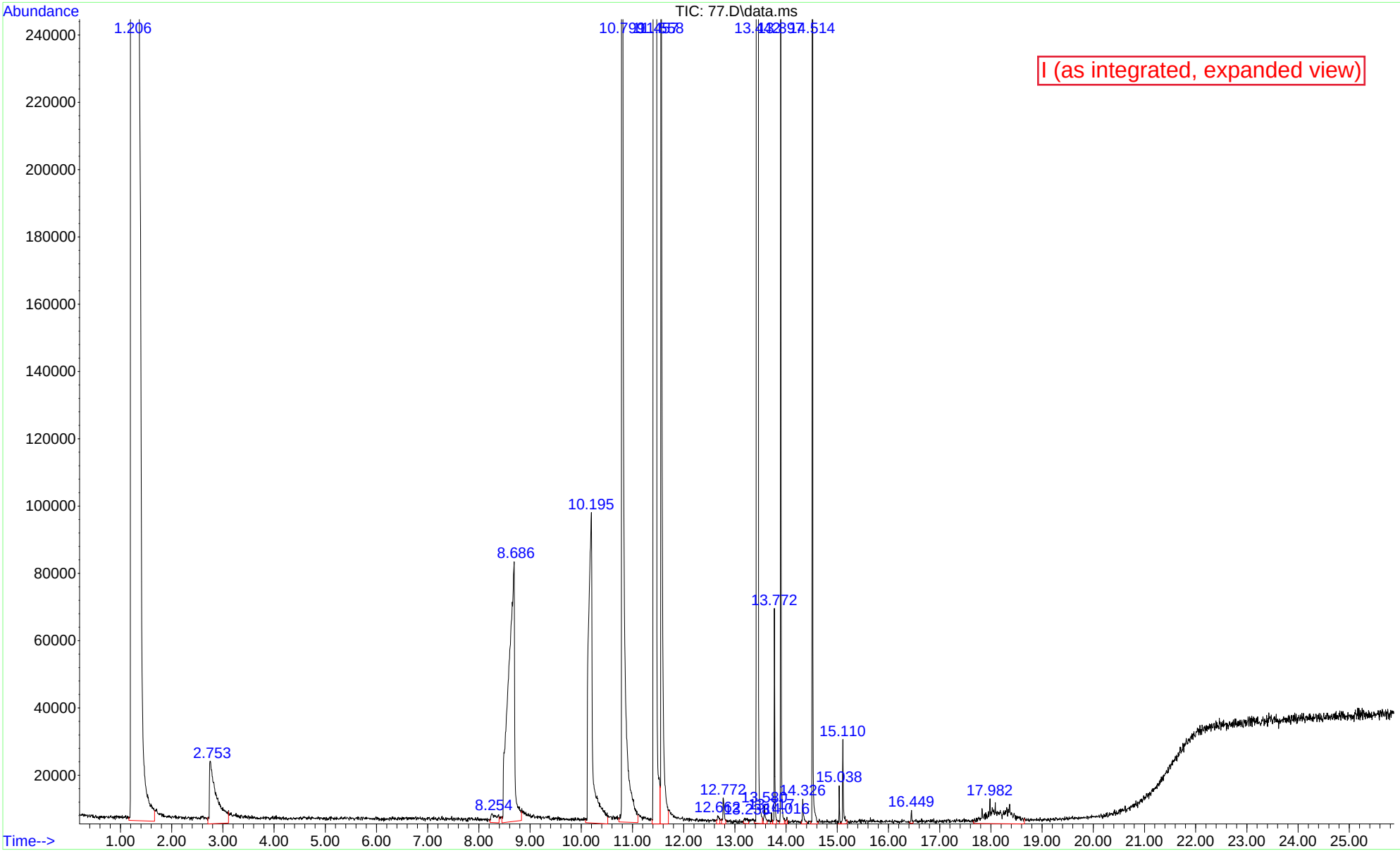
Figure 1

```
File       :S:\ADAMS\GC2\11SEP19H\77.D
Operator   :
Acquired   : 18 Oct 2019  10:38     using AcqMethod FORMHS1.M
Instrument :   Instrument #2
Sample Name: I + Spike
Misc Info  :
Vial Number: 7
```



```
File       :S:\ADAMS\GC2\11SEP19H\77.D
Operator   :
Acquired   : 18 Oct 2019  10:38     using AcqMethod FORMHS1.M
Instrument :   Instrument #2
Sample Name: I + Spike
Misc Info  :
Vial Number: 7
```

Figure 2



```
File       :S:\ADAMS\GC2\11SEP19H\77.D
Operator   :
Acquired   : 18 Oct 19  10:38 am using AcqMethod FORMHS1.M
Instrument :   Instrument #2
Sample Name: I + Spike
Misc Info  :
Vial Number: 7
```

Figure 3