Final Report

Comparison of Exhaust Emissions Between E10 CaRFG and Splash Blended E15

Prepared for:

California Air Resources Board (CARB), Growth Energy Inc./Renewable Fuels Association (RFA), and USCAR

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Executive Summary

For this program, two fuels, namely an E10 and E15, were tested on twenty 2016 and newer modern gasoline fueled vehicles over triplicate Federal Test Procedure (FTP) cycles. The E10 fuel was a California Reformulated Gasoline. The summer-grade E10 fuel was sourced from four (4) different refineries that were selected by CARB. The E10 fuels were blended together in four equal parts to create the final E10 fuel. The E15 fuel was created by splash blending denatured ASTM D4806 fuel grade ethanol with the final E10 fuel. Testing was performed on twenty light-duty gasoline vehicles that included a mixture of technologies, such as gasoline direct injection (GDI), port fuel injection (PFI) as well as PFI+GDI fuel systems that are representative of the current California gasoline fleet. One hybrid electric vehicle (HEV) equipped with a PFI engine was also used. The vehicle test matrix had provisions for five vehicles on each emissions standards category (i.e., SULEV30, ULEV50, ULEV70, and ULEV125).

Emissions measurements were conducted in CE-CERT's new state-of-the-art Light-Duty Laboratory (LDL) according to the U.S. EPA protocols for light-duty emission testing as given in the CFR, Title 40, Part 1065/1066. Measurements included regulated emissions of NOx, CO, THC, NMHC, CO_2, CH_4, and PM mass. Gravimetric PM mass samples were collected for each of the three individual phases of the FTP (i.e., cold-start, hot-running, and hot-start) and weighted PM mass over FTP cycle was calculated based on PM mass data from each phase of the FTP. Real-time soot mass or black carbon emissions were measured using an AVL Micro-Soot Sensor (MSS). Solid particle number emissions were measured according to the European Particle Measurement Programme (PMP) from the CVS tunnel using a AVL Particle Counter (APC plus) with a cut-off particle diameter of 23 nm. Carbonyl compounds (aldehydes and ketones) were sampled on 2,4-dinitrophenylhydrazine (DNPH) coated silica cartridges from the main CVS tunnel using a mass flow controller to regulate the flow to 1 L/min through the cartridge. Hydrocarbon species and ethanol were collected using a 6 L specially prepared SUMMA passivated canister, which was connected to the CVS system. Analysis of the hydrocarbon species was conducted using a Gas Chromatography/Mass Spectrometry/Flame Ionization Detector (GC/MS/FID) analytical system according to the EPA TO-12/PAMS and EPA TO-15A methods. Nitrous oxide (N_2O) and ammonia (NH_3) emissions were measured at the tailpipe using a Horiba FTX-ONE-CS Fourier Transform Infrared (FTIR) system.

Statistical analyses for each pollutant were run using the Mixed procedure in PC/SAS from SAS Institute, Inc. Mixed models are a type of model that include both fixed and random factors. The fuel type was treated as a fixed factor in the model, while vehicles were treated as a random factor. The pollutants of phase 1, phase 2, phase 3, and weighted THC, phase 1, phase 2, and phase 3 NMHC, phase 2 CO, phase 2, phase 3, and weighted NOx, phase 2 and phase 3 PM mass, weighted fuel economy, weighted solid particle number, 1,3-butadiene, benzene, toluene, ethanol, formaldehyde, and acetaldehyde were all analyzed on the original scale. All the other emissions (weighted NMHC, phase 1, phase 3, and weighted CO, phase 1 NOx, phase 1 and weighted PM mass, *m/p*-xylenes, *o*-xylene, and ethylbenzene) were analyzed on the original natural log scale. For some variables that include zeros or negative values, a constant was added to the original value before taking the logarithm.

The results for the regulated emissions, fuel economy, particulates, and toxics are summarized in Table ES-1 and Table ES-2. Table ES-1 shows the statistical comparison between E10 and E15 for all vehicles by FTP phase or bag, whereas Table ES-2 shows the statistical comparisons for the weighted emissions. For the statistical analyses, results are statistically significant for $p \leq 0.05$ or marginally statistically significant for $0.05 < p \leq 0.1$. The fleet of twenty vehicles showed statistically significant effects for some pollutants, but not for others. NOx emissions, a target pollutant of concern for this program, did not show any statistically significant difference between the fuels for the FTP and nor for each individual FTP phase.

Cold-start and weighted THC emissions showed statistically significant reductions of 6% and 5%, respectively, for E15 compared to E10. For the cold-start NMHC emissions, E15 showed a 7% statistically significant reduction compared to E10, while for the hot-start NMHC emissions, E15 showed a 15% marginally statistically significant reduction compared to E10. The weighted NMHC emissions showed a marginally statistically significant reduction of 9% for E15 compared E10.

Cold-start and hot-start CO emissions showed statistically significant reductions of 12% and 27%, respectively, for E15 compared to E10. The weighted CO emissions showed a statistically significant reduction of 17% for E15 compared to E10 across the fleet of 20 vehicles.

Hot-start CO_2 emissions showed a marginally statistically significant reduction of 0.3 % for E15 compared to E10. Carbon-balance weighted fuel economy showed a statistically significant reduction of 1% for E15 compared to E10 across the fleet of 20 vehicles.

The PM mass showed strong, statistically significant fuel trends over the entire FTP cycle and each individual phase. For the cold-start and hot-running phases, PM mass emissions showed statistically significant reductions of 16% and 54%, respectively, for E15 compared to E10. Hot-start PM mass emissions were 43% lower for E15 compared to E10, at a marginally statistically significant level. The weighted PM mass emissions showed a statistically significant reduction of 18% for E15 compared to E10 across the fleet of 20 vehicles.

Only the weighted solid particle number (SPN) emissions were included in the statistical analyses. Results showed that E15 was 12% lower than E10, at a statistically significant level.

For the BTEX and 1,3-butadiene emissions, only ethylbenzene, m/p-xylenes and o-xylene emissions showed statistically significant results between the fuels. For cumulative ethylbenzene emissions, E15 showed a statistically significant reduction of 11% compared to E10. For cumulative m/p-xylenes and o-xylene emissions, E15 showed marginally statistically significant reductions of 10% and 9%, respectively, compared to E10. The cumulative ethanol emissions showed a strong, statistically significant increase of 77% for E15 compared to E10. The cumulative acetaldehyde emissions also showed a strong, statistically significant increase of 31% for E15 compared to E10 across the fleet of 20 vehicles.

Calculated NMOG and ozone forming potential (OFP) emissions data were not included in the comprehensive statistical analysis, but were examined for fuel effects using a two-sample equal variance t-test. Both NMOG emissions and OFP showed statistically significant fuel effects for

some vehicles, but not for others. Overall, NMOG emissions trended lower for E15 compared to E10. Similar to NMOG, OFP showed a decreasing trend for E15 compared to E10, indicating that the introduction of E15 in the California gasoline market will likely not contribute to increases in ozone formation.

Table ES-1 Summary of Statistical Comparisons for E10 and E15 by Bag

	Bag 1 (Cold-start)		Bag 2 (Hot-running)		Bag 3 (Hot-start)	
NO_x g/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	0.0230	0.0215	0.00271	0.00258	0.00411	0.00349
	Statistical Analysis					
	E15 7% lower than E10 Not Significant (p=0.315)		E15 5% lower than E10 Not Significant (p=0.603)		E15 15% lower than E10 Not Significant (p=0.462)	
THC g/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	0.0621	0.0583	0.00178	0.00157	0.00646	0.00644
	Statistical Analysis					
	E15 6% lower than E10 Statistically Significant (p=0.0315)		E15 12% lower than E10 Not Significant (p=0.136)		E15 0.3% lower than E10 Not Significant (p=0.954)	
NMHC g/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	0.0488	0.0456	0.000330	0.000280	0.00175	0.00148
	Statistical Analysis					
	E15 7% lower than E10 Statistically Significant (p=0.0340)		E15 15% lower than E10 Not Significant (p=0.567)		E15 15% lower than E10 Marginally Statistically Significant (p=0.0694)	
CO g/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	1.08	0.954	0.00600	0.00576	0.292	0.214
	Statistical Analysis					
	E15 12% lower than E10 Statistically Significant (p=0.0113)		E15 4% lower than E10 Not Significant (p=0.893)		**E15 27% lower than E10 Statistically Significant (p=0.00450)**	
CO_2 g/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	363	361	352	355	311	310
	Statistical Analysis					
	E15 1% lower than E10 Not Significant (p=0.336)		E15 1% higher than E10 Not Significant (p=0.202)		E15 0.3% lower than E10 Marginally Statistically Significant (p=0.0746)	
PM Mass mg/mi	**Least Square Means**					
	E10	E15	E10	E15	E10	E15
	3.34	2.79	0.0293	0.0134	0.0727	0.0417

	Statistical Analysis		
	E15 16% lower than E10 Statistically Significant (p=0.0194)	**E15 54% lower than E10 Statistically Significant (p=0.0221)**	E15 43% lower than E10 Marginally Statistically Significant (p=0.0794)

Table ES-2 Summary of Statistical Comparisons for E10 and E15 for the Weighted and Cumulative Emissions

	Weighted	
NO_x g/mi	**Least Square Means**	
	E10	E15
	0.00737	0.00713
	Statistical Analysis	
	E15 3% lower than E10 Not Significant (p=0.500)	
THC g/mi	**Least Square Means**	
	E10	E15
	0.0161	0.0153
	Statistical Analysis	
	E15 5% lower than E10 Statistically Significant (p=0.0216)	
NMHC g/mi	**Least Square Means**	
	E10	E15
	0.0127	0.0116
	Statistical Analysis	
	E15 9% lower than E10 Marginally Statistically Significant (p=0.0875)	
CO g/mi	**Least Square Means**	
	E10	E15
	0.333	0.277
	Statistical Analysis	
	E15 17% lower than E10 Statistically Significant (p=0.0196)	
CO_2 g/mi	**Least Square Means**	
	E10	E15
	343	344
	Statistical Analysis	
	E15 0.3% higher than E10 Not Significant (p=0.779)	
Fuel Economy mpg	**Least Square Means**	
	E10	E15
	26.7	26.4

	Statistical Analysis	
	E15 1% lower than E10 Statistically Significant (p=0.00920)	
PM Mass mg/mi	**Least Square Means**	
	E10	E15
	0.858	0.700
	Statistical Analysis	
	E15 18% lower than E10 Statistically Significant (p=0.0275)	
SPN #/mile	**Least Square Means**	
	E10	E15
	9.58E+11	8.39E+11
	Statistical Analysis	
	E15 12% lower than E10 Statistically Significant (p=0.00690)	
1,3-Butadiene mg/mi	**Least Square Means**	
	E10	E15
	0.0251	0.0252
	Statistical Analysis	
	E15 0.4% higher than E10 Not Significant (p=0.919)	
Benzene mg/mi	**Least Square Means**	
	E10	E15
	0.871	0.874
	Statistical Analysis	
	E15 0.3% higher than E10 Not Significant (p=0.966)	
Toluene mg/mi	**Least Square Means**	
	E10	E15
	0.894	0.982
	Statistical Analysis	
	E15 10% higher than E10 Not Significant (p=0.551)	
Ethylbenzene mg/mi	**Least Square Means**	
	E10	E15
	0.231	0.205
	Statistical Analysis	
	E15 11% lower than E10 Statistically Significant (p=0.0498)	
m/p-xylenes mg/mi	**Least Square Means**	
	E10	E15
	0.739	0.666
	Statistical Analysis	
	E15 10% lower than E10 Marginally Statistically Significant (p=0.0649)	
o-xylene	**Least Square Means**	

mg/mi	E10	E15
	0.254	0.231
	Statistical Analysis	
	<u>E15 9% lower than E10 Marginally Statistically Significant (p=0.0504)</u>	
Ethanol	**Least Square Means**	
mg/mi	E10	E15
	0.468	0.828
	Statistical Analysis	
	E15 77% higher than E10 Statistically Significant (p=0.00870)	
Formaldehyde	**Least Square Means**	
mg/mi	E10	E15
	0.209	0.226
	Statistical Analysis	
	E15 8% higher than E10 Not Significant (p=0.439)	
Acetaldehyde	**Least Square Means**	
mg/mi	E10	E15
	0.284	0.373
	Statistical Analysis	
	E15 31% higher than E10 Statistically Significant (p<0.0001)	

***** Bold values are statistically significant $p \leq 0.05$; Underlined values are marginally statistically significant $0.05 < p \leq 0.10$

1 Introduction

The primary objective of this program is to better understand the impact of increasing ethanol blending on gaseous and particulate emissions from current gasoline direct injection (GDI) and port fuel injection (PFI) light-duty vehicles in California. For this project, two fuels, namely an E10 and E15, were tested on twenty 2016 and newer modern gasoline fueled vehicles over triplicate FTP cycles. Measurements included regulated emissions, fuel economy, PM mass, particle number, black carbon, and emissions of benzene, toluene, ethylbenzene, xylene isomers, 1,3-butadiene, ethanol, and carbonyl compounds.

2 Experimental Procedures

2.1 Test Fuels

Two fuels were used in this program, namely an E10 and an E15 fuel. The E10 fuel was a California Reformulated Gasoline. The summer-grade E10 fuel was sourced from four (4) different refineries that were selected by CARB. Three refineries were in the South Coast Air Basin (SCAB) and one refinery was in the Northern California (Bay Area). The SCAB refineries included PBF Energy (Los Angeles), Phillips 66 (Los Angeles), and Marathon (Wilmington). The Bay Area refinery was Chevron (Richmond). The E10 fuels from all four refineries were collected by C3 Fuels, LLC, a local fuels supplier located in SCAB specializing in supplying certification fuels, commercial fuels, and primary reference fuels. E10 fuel samples from each refinery were collected by C3 Fuels and provided to CE-CERT for storage. The E10 samples from each refinery have been stored in refrigerated conditions, if additional fuel properties analyses are requested by the sponsors.

The E10 fuels were blended together in four equal parts by C3 Fuels to create the final E10 fuel. The E15 fuel was created by splash blending denatured ASTM D4806 fuel grade ethanol with the final E10 fuel. Blending took place at C3 Fuels facility in Compton, CA. Denatured ethanol (E98) meeting ASTM D4806 Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel was supplied in-kind by Aemetis Inc. (ethanol facility Keyes, CA). A sample of the denatured ethanol was collected by UCR staff and analyzed for fuel properties at Southwest Research Institute (SwRI) in San Antonio, TX.

Three samples from three separate drums of E10 fuel and three samples from three separate drums of E15 fuel were collected by UCR staff and shipped to SwRI for fuel property analysis and detailed hydrocarbon analysis (DHA). All samples were tested for fuel properties according to the ASTM D4814-21c Standard Specification for Automotive Spark-Ignition Engine Fuel. Table 2-1 lists the fuel properties and test methods for each of the three E10 and E15 fuel samples analyzed at SwRI. Table 2-2 lists the average fuel properties for E10 and E15 fuels. Table 2-3 shows the properties and test methods for the denatured ethanol sample analyzed at SwRI.

Table 2-1 Main Physicochemical Properties of the Test Fuels for Each Drum

Property	Test Method	Unit	E10 Drum#2	E10 Drum#3	E10 Drum#4	E15 Drum#1	E15 Drum#2	E15 Drum#3
RVP (EPA Equation)	D5191	psi	7.43	7.44	7.41	7.33	7.35	7.36
DVPE (ASTM Equation)		psi	7.31	7.32	7.28	7.20	7.22	7.23
CARVP (California Equation)		psi	7.20	7.21	7.17	7.09	7.11	7.12
Research Octane Number	D2699Mdp	ON	91.10	91.20	91.10	94.10	93.40	93.40
Motor Octane Number	D2700Mdp	ON	83.60	83.50	83.50	85.10	85.10	85.00
API Gravity	D4052		59.15	59.15	59.15	58.48	58.48	58.48
Specific Gravity			0.74	0.74	0.74	0.74	0.74	0.74
Density at 15C		g/ml	0.74	0.74	0.74	0.74	0.74	0.74
Heat of Combustion, Gross	D4809	BTU/lb.	19255.00	19264.00	19274.00	18883.00	18862.00	18887.00
		MJ/kg	44.79	44.81	44.83	43.92	43.87	43.93
		cal/g	10697.20	10702.50	10707.80	10490.60	10478.90	10492.80
Heat of Combustion, Net		BTU/lb.	17970.00	17980.00	17996.00	17609.00	17592.00	17615.00
		MJ/kg	41.80	41.82	41.86	40.96	40.92	40.97
		cal/g	9983.60	9989.20	9998.10	9782.80	9773.30	9786.10
Methanol	D4815	Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethanol		Vol%	9.61	9.70	9.68	14.54	14.59	14.21
Isopropanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
tert-Butanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
n-Propanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methyl tert-butyl ether		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
sec-Butanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Diisopropylether		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Isobutanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethyl tert-butyl ether		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
tert-Pentanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
n-Butanol		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
tert-amyl methyl ether		Vol%	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Oxygen		wt.%	3.57	3.60	3.59	5.38	5.40	5.26
Carbon	D5291 CH	wt.%	82.80	82.76	82.85	81.08	80.71	80.93
Hydrogen		wt.%	14.08	14.08	14.00	13.96	13.92	13.94
Sulfur	D5453	ppm	6.23	5.79	6.74	4.47	4.62	4.33
Benzene	D5580	Vol%	0.59	0.60	0.60	0.56	0.56	0.56
Toluene		Vol%	4.03	4.04	4.04	3.81	3.81	3.81
Ethylbenzene		Vol%	0.94	0.94	0.94	0.89	0.89	0.89
p,m-Xylene		Vol%	3.85	3.85	3.85	3.65	3.65	3.64

o-Xylene		Vol%	1.36	1.36	1.37	1.29	1.29	1.29
C9 plus Aromatics		Vol%	8.73	8.74	8.74	8.27	8.27	8.25
Total Aromatics		Vol%	19.52	19.53	19.53	18.47	18.47	18.45
Olefin	D6550	Mass %	5.00	5.00	5.10	4.60	4.70	4.60
Distillation	D86							
IBP		degF	100.80	101.90	102.20	101.90	102.90	102.00
5%		degF	129.20	130.00	129.40	130.70	128.50	128.70
10%		degF	134.80	135.80	135.40	136.80	135.80	135.40
15%		degF	138.60	139.30	139.30	140.70	139.80	139.40
20%		degF	142.30	143.10	142.70	144.30	143.40	143.10
30%		degF	148.80	149.70	149.10	150.80	150.50	149.80
40%		degF	156.40	157.70	157.70	156.40	156.30	155.50
50%		degF	204.10	205.30	204.10	162.00	161.80	159.60
60%		degF	227.50	228.50	228.20	219.40	219.10	218.40
70%		degF	248.10	249.40	248.60	244.70	244.80	242.50
80%		degF	274.80	275.70	275.10	272.60	271.50	269.80
90%		degF	313.70	314.20	313.00	310.50	310.90	310.10
95%		degF	341.80	342.60	341.80	340.60	339.30	338.80
Final Boiling Point		degF	392.60	397.00	392.60	394.80	394.20	392.80
Recovered		mL	99.00	99.20	99.00	98.80	97.90	98.50
Residue		mL	0.70	0.70	0.70	0.70	0.70	0.70
Loss		mL	0.30	0.10	0.30	0.50	1.40	0.80
Particulate matter Index			1.15	1.16	1.16	1.07	1.11	1.10

Table 2-2 Average Physicochemical Properties of the E10 and E15 Test Fuels

Property	Test Method	Unit	E10-avg	E15-avg	CaRFG3 (Flat limits)
RVP (EPA Equation)	D5191	psi	7.43	7.35	7.00
DVPE (ASTM Equation)		psi	7.30	7.22	
CARVP (California Equation)		psi	7.19	7.11	
Research Octane Number	D2699Mdp	ON	91.13	93.63	
Motor Octane Number	D2700Mdp	ON	83.53	85.07	
API Gravity	D4052		59.15	58.48	
Specific Gravity			0.74	0.74	
Density at 15C		g/ml	0.74	0.74	
Heat of Combustion, Gross	D4809	BTU/lb.	19264.33	18877.33	
		MJ/kg	44.81	43.91	
		cal/g	10702.50	10487.43	
Heat of Combustion, Net		BTU/lb.	17982.00	17605.33	
		MJ/kg	41.83	40.95	
		cal/g	9990.30	9780.73	
Methanol	D4815	Vol%	<0.2	<0.2	
Ethanol		Vol%	9.66	14.45	
Isopropanol		Vol%	<0.2	<0.2	
tert-Butanol		Vol%	<0.2	<0.2	
n-Propanol		Vol%	<0.2	<0.2	
Methyl tert-butyl ether		Vol%	<0.2	<0.2	0.05
sec-Butanol		Vol%	<0.2	<0.2	
Diisopropylether		Vol%	<0.2	<0.2	
Isobutanol		Vol%	<0.2	<0.2	
Ethyl tert-butyl ether		Vol%	<0.2	<0.2	
tert-Pentanol		Vol%	<0.2	<0.2	
n-Butanol		Vol%	<0.2	<0.2	
tert-amyl methyl ether		Vol%	<0.2	<0.2	
Total Oxygen		wt.%	3.59	5.35	1.80 – 2.20
Carbon	D5291 CH	wt.%	82.80	80.91	
Hydrogen		wt.%	14.05	13.94	
Sulfur	D5453	ppm	6.25	4.47	20.00 (ppm by weight)
Benzene	D5580	Vol%	0.60	0.56	0.80
Toluene		Vol%	4.04	3.81	
Ethylbenzene		Vol%	0.94	0.89	
p,m-Xylene		Vol%	3.85	3.65	
o-Xylene		Vol%	1.36	1.29	
C9 plus Aromatics		Vol%	8.74	8.26	
Total Aromatics		Vol%	19.53	18.46	25.00

Olefin	D6550	Mass %	5.03	4.63	6.00 (Vol%)
DHA	D6730		File attached	File attached	
Distillation	D86				
IBP		degF	101.63	102.27	
5%		degF	129.53	129.30	
10%		degF	135.33	136.00	
15%		degF	139.07	139.97	
20%		degF	142.70	143.60	
30%		degF	149.20	150.37	
40%		degF	157.27	156.07	
50%		degF	204.50	161.13	213.00
60%		degF	228.07	218.97	
70%		degF	248.70	244.00	
80%		degF	275.20	271.30	
90%		degF	313.63	310.50	305.00
95%		degF	342.07	339.57	
Final Boiling Point		degF	394.07	393.93	
Recovered		mL	99.07	98.40	
Residue		mL	0.70	0.70	
Loss		mL	0.23	0.90	
Particulate Matter Index			1.15	1.10	

Table 2-3 Denatured Ethanol Properties

Property	Test method	Unit	Denatured Ethanol	Denatured ethanol (ASTM D 4806-99)
Acidity	D1613	mgKOH/g	0.04	
Acidity as Acetic Acid	D1613	wt.%	0.00	0.007
Copper	D1688 M	mg/L	<0.05	0.10 (mg/kg)
Unwashed Gum	D381	mg/100 mL	0.50	
Washed Gum	D381	mg/100 mL	<0.5	5.00
Clear and Bright	D4176		Pass	
Particulate	D4176		Pass	
Free Water	D4176		Pass	
Haze Rating	D4176		1.00	
Temperature of Sample	D4176	°C	6.00	
Sulfur	D5453	ppm	0.75	
Ethanol	D5501	Vol%	97.49	92.10
Methanol	D5501	Vol%	0.02	0.50
pHe	D6423		8.55	6.50 – 9.00
Total Chloride	D7319	ppm	<0.5	40.00 (Mass ppm, inorganic)
Total Sulfate	D7319	ppm	<0.5	
Potential Sulfate	D7319	ppm	<1.0	
Olefin Content	D7347	mass%	<0.1	
Benzene	D7576	Vol%	0.01	
Toluene	D7576	Vol%	<0.01	
Ethylbenzene	D7576	Vol%	<0.01	
p,m-Xylene	D7576	Vol%	<0.01	
o-Xylene	D7576	Vol%	<0.01	
C9 plus Aromatics	D7576	Vol%	<0.01	
Total Aromatics	D7576	Vol%	<0.29	
Water	E1064	wt.%	0.69	1.00 (Vol%)

2.2 Test Vehicles

Twenty light-duty vehicles were acquired for testing. The original vehicle list was selected by CARB in order to provide a wide range of makes, models, technology standards, and size. Some of the vehicles in the original list were difficult to acquire, so it was necessary for these vehicles to be replaced with vehicles of the same emissions technology standards, as well as match injection type, size, and model year to the extent possible. All changes have been reviewed by the program sponsors and finally, approved by CARB. A list of the vehicles that were used for this testing is provided in Table 2-4. The test matrix included 11 vehicles with gasoline direct injection (GDI), six (6) vehicles with port fuel injection (PFI) as well as two (2) PFI+GDI fuel systems that are representative of the current California gasoline fleet. One hybrid electric vehicle (HEV) equipped with a PFI engine was also used. All vehicles were equipped with three-way catalysts (TWCs).

For this program, each category (i.e., SULEV30, ULEV50, ULEV70, and ULEV125) included five (5) vehicles.

The test matrix included a mix of different manufacturers and passenger cars. The test matrix included 9 vehicles from domestic manufacturers (GM, Ford, and FCA) and 11 vehicles from foreign manufacturers (Kia, Honda, Nissan, Toyota, Mazda and Hyundai). The vehicles also represented a range of different engine displacements.

The vehicles were certified to meet the Federal Tier 3 exhaust emission standards or the California LEV-III, SULEV exhaust emissions standards.

The primary source for vehicles was rental fleets. Vehicles were also sourced from private dealerships operated in the greater Riverside area, from UCR's fleet services, and from private sources through long-term loan agreements. Vehicle odometers at the onset of testing ranged from 4,073 miles (Chevrolet Spark) to 74,339 miles (Mazda 3). All vehicles acquired for testing were inspected to ensure that they were in sound mechanical and operational condition using a standard checklist provided in Appendix A.

All vehicles were tested in their original configuration, with no lubricant oil changes prior to the emissions testing.

Table 2-4 Test Vehicle Specifications

	PFI#1	GDI#1	PFI#2	PFI#3	PFI+GDI#1	GDI#2	GDI#3	GDI#4	GDI#5	PFI#4	GDI#6	PFI#5	GDI#7	PFI_Hybrid#1	GDI#8	GDI#9	GDI#10	PFI+GDI#2	PFI#6	GDI#11
Year	2019	2018	2020	2016	2019	2018	2016	2020	2019	2021	2020	2020	2020	2020	2020	2020	2021	2017	2021	2018
Make	Dodge	Honda	Jeep	Nissan	Toyota	Honda	Mazda	Ford	Chevrolet	Chevrolet	KIA	Jeep	Nissan	Toyota	GMC	Buick	Chevrolet	Ford	Hyundai	Chevrolet
Model	Ram1500	Fit	Compass	Rogue	Rav4	Civic	Mazda3	Fusion	Impala	Spark	Optima	Cherokee	Armada	Prius	Acadia	Enclave	Colorado	F-150	Accent	Suburban
vehicle class (EPA)	LDT	LDV	LDT	LDT1	LDT1	LDV	LDV	LDV	LDV	LDV	LDV	LDT	LDT4	LDV	LDT	LDT	LDT	LDT	LDV	LDT
Miles at start (mi)	32234	35547	29174	63491	37329	35776	74339	33029	25728	4073	29377	23272	32731	10015	34942	32621	17603	7352	12226	34477
Engine size (L)	5.7	1.5	2.4	2.5	2.5	1.5	2.5	2	3.6	1.4	2.4	3.6	5.6	1.8	3.6	3.6	3.6	3.5	1.6	5.3
Fuel injection type	PFI	GDI	PFI	PFI	GDI+PFI	GDI	GDI	GDI	GDI	PFI	GDI	PFI	GDI	PFI	GDI	GDI	GDI	GDI+PFI	PFI	GDI
AIR system	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Turbo-charged	Naturally aspirated	Turbo-charged	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Naturally aspirated	Turbo-charged	Naturally aspirated	Naturally aspirated
Number of cylinders	8	4	4	4	4	4	4	4	6	4	4	6	8	4	6	6	6	6	4	8
Engine compression ratio	10.5-1	11.5:1	10:1	10:1	13:1	10.3:1	13:1	9.3:1	11.5:1	10.6:1	11.3:1	10.2:1	11.2:1	13:1	11.5:1	11.5:1	11.5:1	10.5:1	11.2:1	11:1
Emission standard	USEPA: T3 B70 CA: ULEV70	USEPA: T3B30 CA: SULEV30 PC	USEPA: T3 B50 CA: ULEV50	USEPA: For sale only in states with California emission standards CA: LEV3-ULEV70	USEPA: T3B50 CA: ULEV50	USEPA: IT3B125 CA: ULEV125 PC	USEPA: N/A CA: SULEV30 /PZEV	USEPA: T3B70 CA: ULEV70 PC	USEPA: TIER3 CA: PC/SULEV30	USEPA: TIER3 CA: PC/ULEV70	USEPA: T3B70 CA: ULEV70 PC	USEPA: T3 B30 CA: SULEV30	USEPA: T3 B125 CA: LEV3-ULEV125	USEPA: T3 B30 CA: SULEV30 PC	USEPA: TIER3 CA: ULEV50	USEPA: TIER3 CA: ULEV50	USEPA: TIER3 CA: ULEV50	USEPA: T2B5 CA: ULEV125	USEPA: T3B125 CA: ULEV125 PC	USEPA: TIER3 CA: ULEV125
Aftertreatment systems	HO2S TWC	WU-TWC TWC WR-HO2S EGR	HO2S TWC WR-HO2S	TWC(2) HO2S WR-HO2S	EGR EGRC WR-HO2S(2) TWC(2)	TWC WR-HO2S HO2S TC CAC	TWC WU-TWC HO2S WR-HO2S	TWC HO2S WR-HO2S CAC TC	HO2S TWC	HO2S TWC	WR-HO2S HO2S WU-TWC TWC	EGR EGRC HO2S TWC	2TWC(2) 2HO2S 2WR-HO2S	EGR EGRC WR-HO2S TWC(2) HO2S	HO2S TWC	HO2S TWC	HO2S TWC	TWC WR-HO2S HO2S TC CAC	WR-HO2S HO2S WU-TWC TWC EGR EGRC	HO2S TWC

2.3 Test Sequence, Randomization, and Fuel Conditioning

Each vehicle/fuel combination was tested three times using the Federal Test Procedure (FTP) emissions test cycle, which is used for emission certification and fuel economy testing of light-duty vehicles in the U.S. The entire FTP consists of three segments, including a cold-start transient phase (0-505 s), a stabilized or hot-running phase (506-1372 s), a hot-soak phase with the engine off (9-10 min), and a hot-start transient phase (0-505 s). The FTP has a duration of 1877 s, total distance of 11.04 miles, an average speed of 21.2 mph, and a maximum speed of 56.7 mph. The FTP test cycle is shown in Figure 2-1.

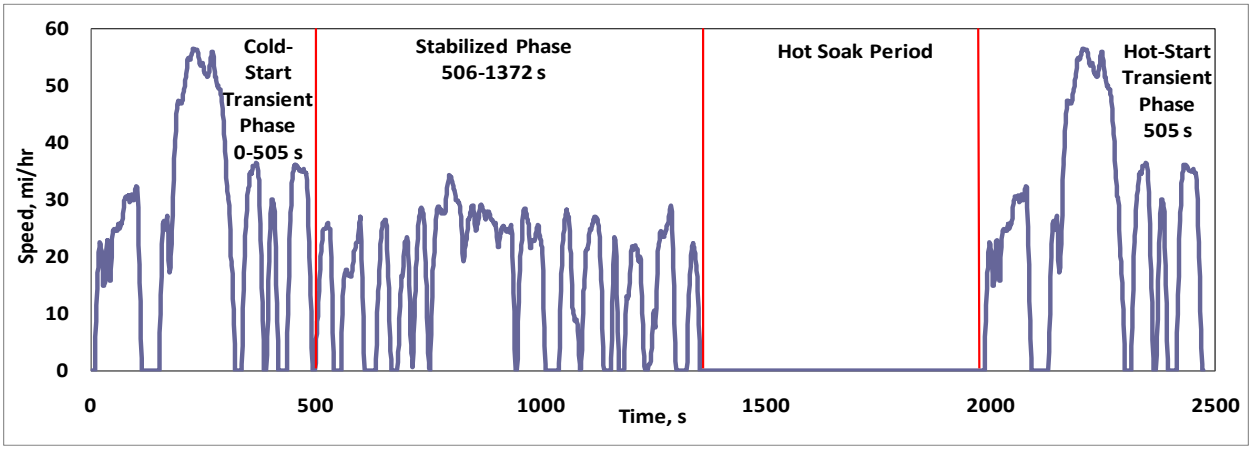

Figure 2-1. FTP Cycle

The fuel testing sequence for each vehicle is provided in Table 2-5. The testing order of the fuels for each vehicle was randomized, subject to logistical considerations.

Table 2-5 Test Matrix Randomization Sequence

Vehicle	Notation	Test Sequence	
Dodge Ram1500	PFI#1	E10	E15
Honda Fit	GDI#1	E10	E15
Jeep Compass	PFI#2	E10	E15
Nissan Rogue	PFI#3	E15	E10
Toyota Rav4	PFI+GDI#1	E10	E15
Honda Civic	GDI#2	E15	E10
Mazda3	GDI#3	E15	E10
Ford Fusion	GDI#4	E15	E10
Chevrolet Impala	GDI#5	E10	E15
Chevrolet Spark	PFI#4	E10	E15
KIA Optima	GDI#6	E10	E15
Jeep Cherokee	PFI#5	E10	E15
Nissan Armada	GDI#7	E15	E10
Toyota Prius	PFI_Hybrid#1	E10	E15
GMC Acadia	GDI#8	E15	E10
Buick Enclave	GDI#9	E10	E15
Chevrolet Colorado	GDI#10	E10	E15
Ford F-150	PFI+GDI#2	E10	E15
Hyundai Accent	PFI#6	E15	E10
Chevrolet Suburban	GDI#11	E15	E10

Before each test on a specific vehicle/fuel combination, the vehicle was preconditioned with a procedure that included a fuel drain and flush, and fill (40%), followed by a highway fuel economy test (HWFET) cycle #1, one additional drain and flush, and fill (40%), followed by a HWFET cycle #2 and two back-to-back LA4 cycles on the dynamometer. More details on the preconditioning procedure are outlined below:

A. Upon receiving the vehicle, CE-CERT's technical staff checked-in and inspected the vehicle, and prepared the vehicle for testing. Vehicle inspection checklist is provided in Appendix A.

B. The existing fuel in the tank was drained from the vehicle and the tank was flushed with the first test fuel. The tank was filled 40% full of the test fuel in CE-CERT's outdoor prep area.

C. Vehicle preconditioning was them performed as specified below using 2 HWFET (highway fuel economy test cycles), two back-to-back LA4 cycles, and two additional drain and 40% fills, as shown in Figure 2-2 and described in greater detail below. During the prep procedure, side fan cooling was applied to the fuel tank. Following the prep cycle, the vehicle was idled for two minutes, then shut down in preparation for the soak. After the 12 to 24 hours soak the first FTP test cycle was performed.

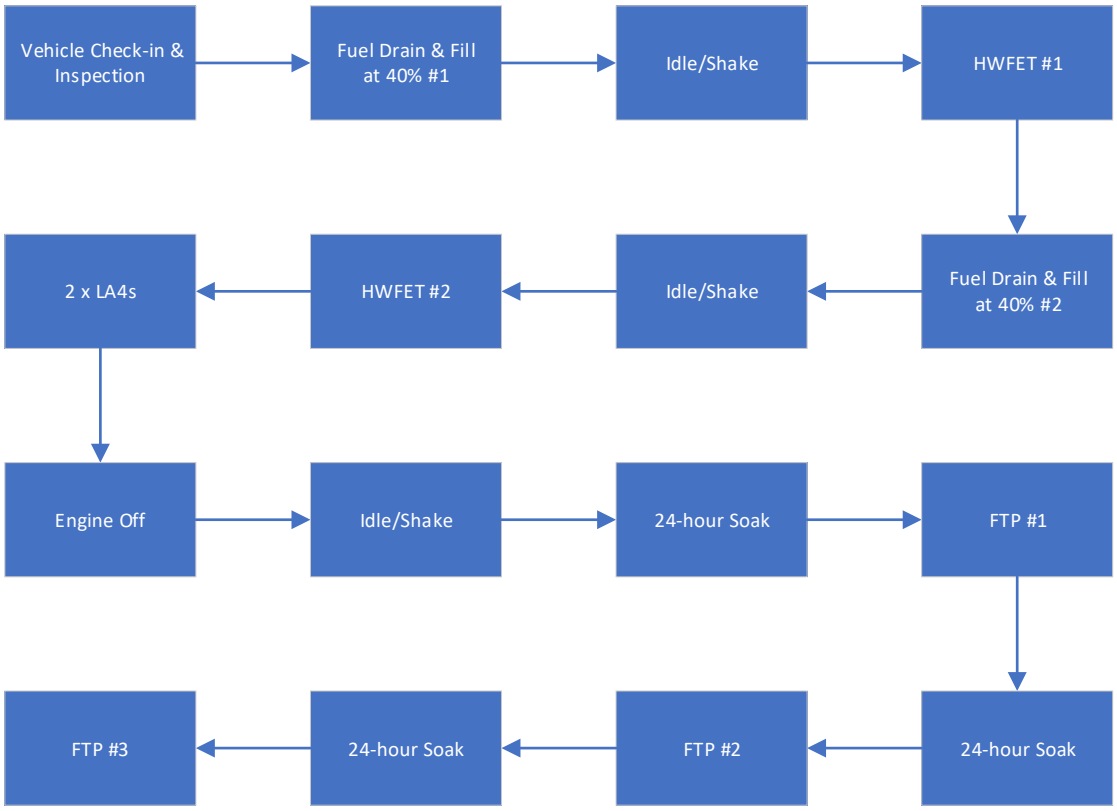

Figure 2-2. Prep and test procedure

Fuel Change, Conditioning, and Test Procedure

1. Drain vehicle fuel completely by disconnecting the fuel fill hose at the tank and then inserting a small plastic tube to pump out the residual fuel. Reattach the fuel fill hose.
2. Turn vehicle ignition to RUN position for 30 seconds to allow controls to allow fuel level reading to stabilize. Confirm the return of fuel gauge reading to zero.
3. Drain fuel, flush tank and refill to 40% with test fuel. Start vehicle and idle for 10 minutes to purge fuel lines.
4. Move vehicle in the test lab without starting the engine. Start vehicle and perform a HWFET #1 cycle.
5. Drain fuel again, flush tank and refill to 40% with test fuel. Shake and then allow the vehicle to idle for two minutes.
6. Move vehicle in the test lab without starting the engine. Start vehicle and perform a HWFET #2 cycle.
7. Perform the preconditioning for two back-to-back LA4 cycles. During the prep cycle, apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Following the prep cycle, allow the vehicle to idle for two minutes, then shut down the engine in preparation for the soak.
8. Move vehicle to soak area without starting the engine.
9. Park vehicle in soak area at proper temperature (75°F) for at least 8 hours and no more than 24 hours.
10. Move vehicle to test area without starting engine.
11. Perform #1 FTP cycle emissions test.
12. Move vehicle to soak area without starting the engine.

13. Park vehicle in soak area of proper temperature for 12-36 hours.
14. Move vehicle to test area without starting the engine.
15. Perform #2 FTP emissions test.
16. Move vehicle to test area without starting the engine.
17. Park vehicle in soak area of proper temperature for 12-36 hours.
18. Move vehicle to test area without starting the engine.
19. Perform #3 FTP emissions test.

D. While performing the FTP test cycle all tailpipe gaseous emissions were measured along with instantaneous and gravimetric PM emissions. Fuel economy and GHG emissions (carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4)) were also measured. For particulate emissions, characterization included solid particle number (>23 nm in diameter), gravimetric PM mass for each individual phase of the FTP cycle, and real-time soot mass emissions.
E. Additional emission measurements included carbonyl compounds, benzene, toluene, ethylbenzene, m/p/o-xylenes, and 1,3-butadiene.
F. The test matrix was designed to provide for randomization of the test fuels over the test fleet.

2.4 Emissions Testing

Vehicle emissions measurements were conducted in CE-CERT's new state-of-the-art Light-Duty Laboratory (LDL). The centerpiece of this laboratory is an AVL CVS i60 generation AMA SL (Slim Line) system using AVL's iGEM test cell automation software and an AVL dilution tunnel. The AVL CVS SL system was used to obtain standard bag measurements for THC, CO, NOx, non-methane hydrocarbons (NMHC), CH_4, and CO_2. The AVL CVS AMA SL system includes a flame ionization detection (FID) for THC and NMHC emissions, a methane cutter (Cutter FID SL) for CH_4 emissions, a chemiluminescence analyzer for NOx emissions, and a non-dispersive infrared (NDIR) analyzer for CO and CO_2 emissions. All gaseous emissions were determined according to the U.S. EPA protocols for light-duty emission testing as given in the CFR, Title 40, Part 1065/1066. The LDL is equipped with a 48-inch Burke E. Porter single-roll electric chassis dynamometer, capable of testing vehicles weighing up to 12,000 lbs.

Background concentrations were collected and analyzed during each FTP test through the AVL AMA system. The AMA system can automatically correct background concentrations for each test, following CFR, Title 40, Part 1066.610 protocols. All gaseous regulated emissions are reported background corrected. The background correction calculation is shown below:

$$Emissions_{background\ corrected} = Emissions_{dexh} - Emissions_{bkgnd} \cdot (1 - \left(\frac{1}{DF}\right))$$

Where,
$Emissions_{dexh}$ = Measured emission concentration in dilute exhaust
$Emissions_{bkgnd}$ = Measured emission concentration in dilution air
DF = Dilution factor

Fuel economy was determined using the carbon mass balance method, as discussed later in the report.

Nitrous oxide (N_2O) and ammonia (NH_3) emissions were measured at the tailpipe using a Horiba FTX-ONE-CS Fourier Transform Infrared (FTIR) system with a rate of one scan per 0.2 seconds, a cell volume of approximately 65 milliliters, and a pathlength of 2.4 meters. The FTIR has high sensitivity, permitting the detection of changes in gas concentration at the ppb (parts per billion) volume concentration level. The FTIR sampled from the raw exhaust (before the CVS tunnel).

A schematic of the experimental setup is shown in Figure 2-3.

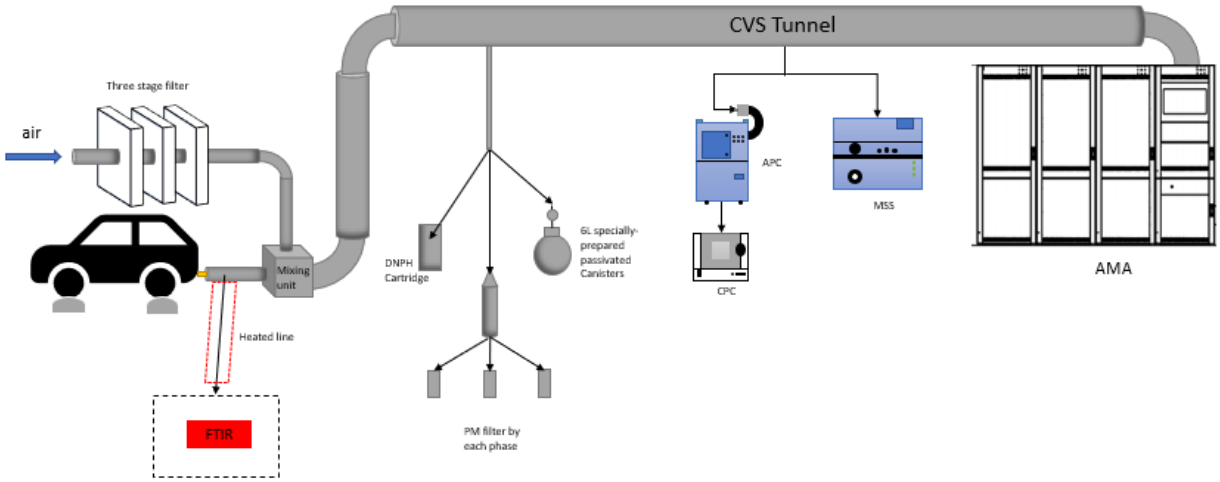

Figure 2-3. Schematic of Experimental Setup

Gravimetric PM mass samples were collected for each of the three individual phases of the FTP (i.e., cold-start, hot-running, and hot-start) and weighted PM mass over FTP cycle was calculated based on PM mass data from each phase of the FTP. Samples were flow weighted based on CE-CERT's new PM sampling system that was built following the procedures in CFR, Title 40, Part 1066 and associated references in CFR, Title 40, Part 1065. PM samples were collected on 47 mm diameter 2 µm pore Teflon filters (Whatman brand) with flow-weighting MFCs and weighed with a 1065-compliant ultra-precision microbalance in a temperature and humidity controlled clean chamber. Buoyancy corrections for barometric pressure differences were also made for the PM filter weights as per CFR, Title 40, Part 1065.

PM mass emissions were reported after background corrections. For this program, a total of six (6) blank filters were collected throughout the entire test campaign. The tunnel blank tests were performed just like regular FTP tests, except the exhaust sample line was collecting background air. Three filters were used to sample each phase of the FTP during the six tunnel blank tests. Tunnel blank tests were performed after emissions testing was completed in three vehicles. PM mass background correction was calculated based on CFR, Title 40, Part 1066.610:

$$PM_{background\ corrected} = PM_{dexh} - PM_{bkgnd} \cdot \left(1 - \left(\frac{1}{DF}\right)\right)$$

Where,
PM_{dexh} = Measured PM mass in dilute exhaust
PM_{bkgnd} = Measured PM mass in dilution air
DF = Dilution factor

For NMOG emissions, the calculation was derived from the CFR, Title 40, Part 1066.635 NMOG Eq. 1066.635-1 equation:

$$NMOG_{mass} = NMHC_{mass} - \rho_{NMHC} \times \left(\frac{EtOH_{mass}}{\rho_{EtOH}} \times RF_{EtOH} + \frac{FormHO_{mass}}{\rho_{FormHO}} \times RF_{FormHO} + \frac{AcetHO_{mass}}{\rho_{AcetHO}} \times RF_{AcetHO}\right) + EtOH_{mass} + FormHO_{mass} + AcetHO_{mass}$$

Where,

$NMOG_{mass}$ = mass of non-methane organic gas
$NMHC_{mass}$ = mass of non-methane hydrocarbon
$EtOH_{mass}$ = mass of ethanol emissions
$FormHO_{mass}$ = mass of formaldehyde emissions
$AcetHO_{mass}$ = mass of acetaldehyde emissions
ρ_{NMHC} = effective C1-equivalent density of NMHC
ρ_{EtOH} = C^1 equivalent density of ethanol
ρ_{FromHO} = C^1 equivalent density of formaldehyde
ρ_{AcetHO} = C^1 equivalent density of acetaldehyde.
RF_{EtOH} = response factor of a THC-FID to ethanol relative to propane on a C^1 equivalent basis.
RF_{FormHO} = response factor of a THC-FID to formaldehyde relative to propane on a C^1 equivalent basis.
RF_{AcetHO} = response factor of a THC-FID to acetaldehyde relative to propane on a C^1 equivalent basis.

Response factors and C^1 equivalent densities for ethanol, formaldehyde, and acetaldehyde were provided by 40 CFR 1066.845 and 40 CFR 1066.1005 (f) and were utilized in the calculations. We excluded all other oxygenates compounds in the equation due to lack of information for the response factors and C^1 equivalent density of these species. Although acetone was detected, for some vehicles, in relatively high concentrations, it was decided to be neglected in the calculation of NMOG emissions due to acetone contamination during sample handling and analysis. This phenomenon has been reported in a previous study (Sluder and West, 2012).

Real-time soot mass or black carbon emissions were measured using an AVL Micro-Soot Sensor (MSS). The MSS 483 is an instrument that measures soot mass concentration at a frequency of one Hertz using a photo acoustic detection technique, where the light-absorbing PM components (such as soot particles) are exposed to laser light that is periodically modulated at an acoustical resonant frequency. Sampling for black carbon emissions was done from the CVS.

Solid particle number emissions were measured according to the European Particle Measurement Programme (PMP) from the CVS tunnel using a AVL Particle Counter (APC plus) with a cut-off particle diameter of 23 nm. The APC Plus consists of a volatile particle remover (VPR) and a particle number counter.

Carbonyl compounds (aldehydes and ketones) were sampled on 2,4-dinitrophenylhydrazine (DNPH) coated silica cartridges (Waters Corp., Milford, MA) from the main CVS tunnel using a mass flow controller to regulate the flow to 1 L/min through the cartridge. Organic carbonyl

compounds react with DNPH-coated silica gel cartridges in the presence of a strong acid to form a stable derivative. The DNPH cartridges were eluted with 2 mL of acetonitrile and analyzed with a high-performance liquid chromatography, HPLC, (Waters 2690 Alliance System with 996 Photodiode Array Detector) following the US EPA TO-11A method. A total of six (6) blanks were collected throughout the test campaign. For each vehicle, a cumulative sample was collected throughout the entire FTP cycle. A list of aldehydes and ketones analyzed is shown in Table 2-6.

Hydrocarbon species were collected using a 6 L specially prepared SUMMA passivated canister, which was connected to the CVS system. Analysis of the hydrocarbon species was conducted using a Gas Chromatography/Mass Spectrometry/Flame Ionization Detector (GC/MS/FID) analytical system according to the EPA TO-12/PAMS and EPA TO-15Amethods. A total of six (6) blanks were collected throughout the test campaign. For each vehicle, a cumulative sample was collected throughout the whole FTP cycle. Table 2-6 provides a list of species analyzed for this program.

Tunnel blanks for the carbonyl compounds and hydrocarbon species were treated and calculated in a similar manner as those of the PM mass samples described above. The major difference was that tunnel blank tests were performed during the entire duration of the FTP cycle. The calculation is shown below, following 40 CFR 1066.610:

$$Pollutants_{background\ corrected} = Pollutants_{dexh} - Pollutants_{bkgnd} \cdot (1 - \left(\frac{1}{DF}\right))$$

Where,
$Pollutants_{dexh}$ = Measured carbonyls and hydrocarbons mass in dilute exhaust
$Pollutants_{bkgnd}$ = Measured carbonyls and hydrocarbons mass in dilution air
DF = Dilution factor

We used weighted dilution factor (DF_w) as DF in the calculation.

$$DF_w = \left(\frac{t_1}{t_1 + t_2 + t_3}\right) \cdot DF_1 + \left(\frac{t_2}{t_1 + t_2 + t_3}\right) \cdot DF_2 + \left(\frac{t_3}{t_1 + t_2 + t_3}\right) \cdot DF_3$$

Where,

t_1, t_2, t_3 = Total time of each phase in FTP cycle
DF_w = Weighted dilution factor
DF_1 = Dilution factor over the first phase of FTP
DF_2 = Dilution factor over the second phase of FTP
DF_3 = Dilution factor over the third phase of FTP

Table 2-6 Carbonyl and Hydrocarbon Species Analysis Methods

Species	Analysis Methods
Formaldehyde Acetaldehyde	EPA TO-11A

Acetone Acrolein Propionaldehyde Crotonaldehyde Methacrolein Butyraldehyde Methyl Ethyl Ketone (MEK) Benzaldehyde Valeraldehyde m-Tolualdehyde Hexanaldehyde	(Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC))
Ethylene Acetylene Ethane Propylene Propane Isobutane 1-Butene 1,3-Butadiene n-Butane trans-2-Butene cis-2-Butene Isopentane 1-Pentene n-Pentane Isoprene trans-2-Pentene cis-2-Pentene 2,2-Dimethylbutane Cyclopentane 2,3-Dimethylbutane 2-Methylpentane 3-Methylpentane 1-Hexene n-Hexane Methylcyclopentane 2,4-Dimethylpentane Benzene Cyclohexane 2-Methylhexane 2,3-Dimethylpentane 3-Methylhexane 2,2,4-Trimethylpentane n-Heptane Methylcyclohexane 2,3,4-Trimethylpentane	EPA TO-12/PAMS (Method for the Determination of non-Methane Organic Compounds (NMOC) in Ambient Air using Cryogenic Preconcentration and Direct Flame Ionization Detection)

Toluene 2-Methylheptane 3-Methylheptane n-Octane Ethylbenzene m/p-Xylenes Styrene o-Xylene Nonane Isopropyl n-Propylbenzene m-Ethyltoluene p-Ethyltoluene 1,3,5-Trimethylbenzene o-Ethyltoluene 1,2,4-Trimethylbenzene n-Decane 1,2,3-Trimethylbenzene m-Diethylbenzene p-Diethylbenzene n-Undecane n-Dodecane	
Ethanol naphthalene	EPA TO-15A (Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (CGMS))

2.5 Statistical Analysis

Statistical analyses for each pollutant were run using the Mixed procedure in PC/SAS from SAS Institute, Inc. Mixed models are a type of model that include both fixed and random factors. The fuel type was treated in the model as a fixed factor, that is, the levels of this factor were the specific fuel types of interest. On the contrary, vehicles were included as a random factor, since the vehicles were chosen at random from a large population of possible models from different manufacturers made in different years. This allows the extrapolation of the results of the fuel effects onto a larger population of vehicle types, not just those that were used in the experiment. The mixed models were performed for each pollutant to determine the statistical significance of any fuel effect. The fixed effect included in the model was the fuel type and the random effect was vehicle.

The normality and homogeneity of variance of residuals were checked in the models for all regulated, particulate, and toxic emissions to determine if a transformation was necessary. QQ plot and residual plot were drawn to examine the normality and homogeneity of variance of residuals, respectively. QQ plot draws the correlation between the residuals and the normal distribution and

all the points should fall approximately along the reference line if residuals are normal distributed. If homogeneity of variance is satisfied, all points in the residual plot should be randomly dispersed without any pattern. Analyses using the logarithmic transform of the data in similar previous studies have shown that the emissions standard deviation is relatively constant as a percentage of the emission level. For example, vehicles with higher emission levels will tend to have a higher variability on an absolute basis than those with lower emissions levels. Examination of the current data revealed that this relationship between the emissions level and variability held true even for the very low emitting vehicles.

Most of the emissions were analyzed on the natural logarithm scale, with the exception of the weighted NMHC, phase 1, phase 3, and weighted CO, phase 1 NOx, phase 1 and weighted PM mass, *m/p*-xylenes, *o*-xylene, and ethylbenzene that were analyzed on the original scale. Fuel economy was analyzed in the inverse scale (i.e., gallons/mile). For emissions components that included zeros or negative values for individual bags or weighted emissions, a small constant was added prior to taking the logarithm to allow the analyses to be done in the logarithm scale. Any added constants were selected to be as small as possible, and in all cases did not exceed the background levels.

Statistical analysis results were considered to be statistically significant for $p \leq 0.05$, although we also note cases where $0.05 < p \leq 0.1$ as marginally statistically significant in the text. The results from the ln or inverse models were "back transformed" to provide least square means (LSMs) for all pollutants on each fuel. This provides an arithmetic measure to evaluate the magnitude of any statistically significant effects. Any constants added to facilitate the analysis in logarithm scale were subsequently subtracted from the least square means once the back transformation to the arithmetic scale was made.

3 Emissions Testing Results

This section outlines the experimental results of this program and discusses their statistical significance. Emissions of interest are NOx, CO, THC, NMHC, CH_4, CO_2, N_2O, NH_3, PM mass, solid particle number, black carbon, formaldehyde, acetaldehyde, 1,3-butadiene, benzene, toluene, ethylbenzene, m/p-xylenes, and o-xylene. All emissions reported in the following section are background corrected. The datapoints that were measured below detection limit or at negative values after background corrections have been zeroed. There was only one datapoint omitted as an outlier for ethanol emissions from the first FTP test of GDI #8 (2020 GMC Acadia) on E15. An outlier analysis (Grubbs' test or extreme studentized deviate method) was performed to determine that this single value was a significant outlier ($p<0.05$) from the rest.

The weighted FTP emission results for the testing of the twenty vehicles are presented in the figures in this section. The results for each test cycle/fuel combination represent the average of all test runs done on that combination. The error bars represent the standard deviation (STDEV.P) over the triplicate tests for each fuel. This same format is used for the figures throughout this section.

The percentage differences between fuels, where statistically significant differences were found, are provided in Table 3-1 and Table 3-2. These percentage differences were determined from the least square means from the statistical analysis. For the statistical analyses, results are considered to be statistically significant for $p \leq 0.05$ or marginally statistically significant for $0.05 < p \leq 0.1$ for this discussion.

The individual emissions test results for each vehicle are provided in Appendix B. The more detailed statistical analysis results are provided in Appendix C.

Table 3-1 Summary of Statistical Comparisons for E10 and E15 Fuels by Bag

	Bag 1 (Cold-start)		Bag 2 (Hot-running)		Bag 3 (Hot-start)	
NO_x	**Least Square Means**					
g/mi	E10	E15	E10	E15	E10	E15
	0.0230	0.0215	0.00271	0.00258	0.00411	0.00349
	Statistical Analysis					
	E15 7% lower than E10 Not Significant (p=0.315)		E15 5% lower than E10 Not Significant (p=0.603)		E15 15% lower than E10 Not Significant (p=0.462)	
THC	**Least Square Means**					
g/mi	E10	E15	E10	E15	E10	E15
	0.0621	0.0583	0.00178	0.00157	0.00646	0.00644
	Statistical Analysis					
	E15 6% lower than E10 Statistically Significant (p=0.0315)		E15 12% lower than E10 Not Significant (p=0.136)		E15 0.3% lower than E10 Not Significant (p=0.954)	
NMHC	**Least Square Means**					
g/mi	E10	E15	E10	E15	E10	E15
	0.0488	0.0456	0.000330	0.000280	0.00175	0.00148
	Statistical Analysis					
	E15 7% lower than E10 Statistically Significant (p=0.0340)		E15 15% lower than E10 Not Significant (p=0.567)		E15 15% lower than E10 Marginally Statistically Significant (p=0.0694)	
CO	**Least Square Means**					
g/mi	E10	E15	E10	E15	E10	E15
	1.08	0.954	0.00600	0.00576	0.292	0.214
	Statistical Analysis					
	E15 12% lower than E10 Statistically Significant (p=0.0113)		E15 4% lower than E10 Not Significant (p=0.893)		**E15 27% lower than E10 Statistically Significant (p=0.00450)**	
CO_2	**Least Square Means**					
g/mi	E10	E15	E10	E15	E10	E15
	363	361	352	355	311	310
	Statistical Analysis					
	E15 1% lower than E10 Not Significant (p=0.336)		E15 1% higher than E10 Not Significant (p=0.202)		E15 0.3% lower than E10 Marginally Statistically Significant (p=0.0746)	
PM Mass	**Least Square Means**					
mg/mi	E10	E15	E10	E15	E10	E15
	3.34	2.79	0.0293	0.0134	0.0727	0.0417

	Statistical Analysis		
	E15 16% lower than E10 Statistically Significant (p=0.0194)	**E15 54% lower than E10 Statistically Significant (p=0.0221)**	E15 43% lower than E10 Marginally Statistically Significant (p=0.0794)

Table 3-2 Summary of Statistical Comparisons for E10 and E15 Fuels for the Weighted and Cumulative Emissions

	Weighted	
NO_x g/mi	**Least Square Means**	
	E10	E15
	0.00737	0.00713
	Statistical Analysis	
	E15 3% lower than E10 Not Significant (p=0.500)	
THC g/mi	**Least Square Means**	
	E10	E15
	0.0161	0.0153
	Statistical Analysis	
	E15 5% lower than E10 Statistically Significant (p=0.0216)	
NMHC g/mi	**Least Square Means**	
	E10	E15
	0.0127	0.0116
	Statistical Analysis	
	E15 9% lower than E10 Marginally Statistically Significant (p=0.0875)	
CO g/mi	**Least Square Means**	
	E10	E15
	0.333	0.277
	Statistical Analysis	
	E15 17% lower than E10 Statistically Significant (p=0.0196)	
CO_2 g/mi	**Least Square Means**	
	E10	E15
	343	344
	Statistical Analysis	
	E15 0.3% higher than E10 Not Significant (p=0.779)	
Fuel Economy mpg	**Least Square Means**	
	E10	E15
	26.7	26.4
	Statistical Analysis	

	E15 1% lower than E10 Statistically Significant (p=0.00920)	
PM Mass mg/mi	**Least Square Means**	
	E10	E15
	0.858	0.700
	Statistical Analysis	
	E15 18% lower than E10 Statistically Significant (p=0.0275)	
SPN #/mile	**Least Square Means**	
	E10	E15
	9.58E+11	8.39E+11
	Statistical Analysis	
	E15 12% lower than E10 Statistically Significant (p=0.00690)	
1,3-Butadiene mg/mi	**Least Square Means**	
	E10	E15
	0.0251	0.0252
	Statistical Analysis	
	E15 0.4% higher than E10 Not Significant (p=0.919)	
Benzene mg/mi	**Least Square Means**	
	E10	E15
	0.871	0.874
	Statistical Analysis	
	E15 0.3% higher than E10 Not Significant (p=0.966)	
Toluene mg/mi	**Least Square Means**	
	E10	E15
	0.894	0.982
	Statistical Analysis	
	E15 10% higher than E10 Not Significant (p=0.551)	
Ethylbenzene mg/mi	**Least Square Means**	
	E10	E15
	0.231	0.205
	Statistical Analysis	
	E15 11% lower than E10 Statistically Significant (p=0.0498)	
m/p-xylenes mg/mi	**Least Square Means**	
	E10	E15
	0.739	0.666
	Statistical Analysis	
	E15 10% lower than E10 Marginally Statistically Significant (p=0.0649)	
o-xylene mg/mi	**Least Square Means**	
	E10	E15

	0.254	0.231
	Statistical Analysis	
	<u>E15 9% lower than E10 Marginally Statistically Significant (p=0.0504)</u>	
Ethanol mg/mi	**Least Square Means**	
	E10	E15
	0.468	0.828
	Statistical Analysis	
	E15 77% higher than E10 Statistically Significant (p=0.00870)	
Formaldehyde mg/mi	**Least Square Means**	
	E10	E15
	0.209	0.226
	Statistical Analysis	
	E15 8% higher than E10 Not Significant (p=0.439)	
Acetaldehyde mg/mi	**Least Square Means**	
	E10	E15
	0.284	0.373
	Statistical Analysis	
	E15 31% higher than E10 Statistically Significant (p<0.0001)	

***** Bold values are statistically significant $p \leq 0.05$; Underlined values are marginally statistically significant $0.05 < p \leq 0.10$

3.1 THC, NMHC and CH_4 Emissions

The weighted THC, NMHC and CH_4 emission results for the testing on the twenty vehicles are presented in Figure 3-1, Figure 3-2, and Figure 3-3, respectively.

Cold-start and weighted THC emissions showed statistically significant reductions of 6% and 5%, respectively, for E15 compared to E10. Results showed that the cold-start phase in THC emissions drove the statistics for the weighted THC emissions.

For the cold-start NMHC emissions, E15 showed a 7% statistically significant reduction compared to E10, while for the hot-start NMHC emissions, E15 showed a 15% marginally statistically significant reduction compared to E10. The weighted NMHC emissions showed a marginally statistically significant reduction of 9% for E15 compared to E10.

Emissions of CH_4 were not included in the comprehensive statistical analysis, but the results were analyzed using a two-sample equal variance t-test. For CH_4 emissions, PFI#1 and GDI#3 showed statistically significant reductions in weighted CH_4 emissions of 16% and 20%, respectively, for E15 compared to E10. For PFI+GDI#1, weighted CH_4 emissions showed an 8% increase for E15 compared to E10, whereas for GDI#11 the use of E15 showed a 7% reduction compared to E10, both at marginally statistically significant levels.

Overall, the use of E15 resulted in lower THC and NMHC emissions compared to E10. These reductions can be attributed to the higher oxygen content in the fuel, which likely increased the local oxygen in the fuel-rich regions leading to more complete combustion (Schifter et al., 2011; Liu et al., 2011; Catapano et al., 2014; Karavalakis et al., 2014).

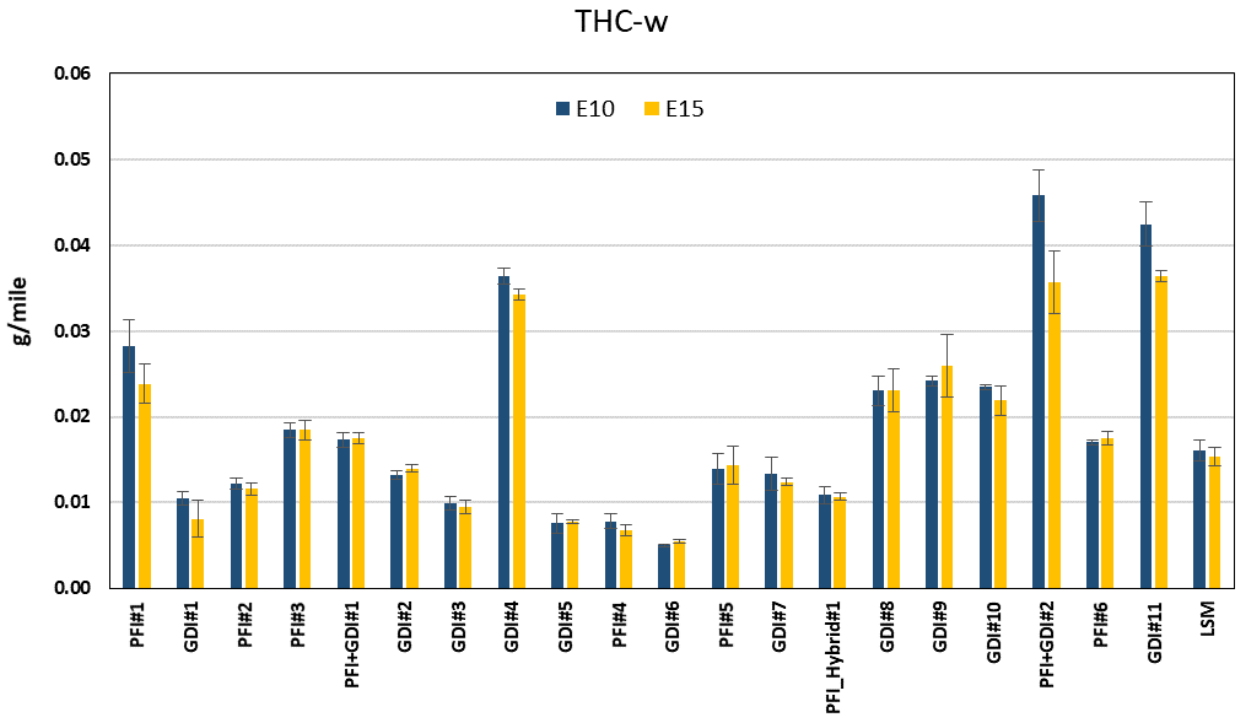

Figure 3-1. Average THC Weighted Emission Results

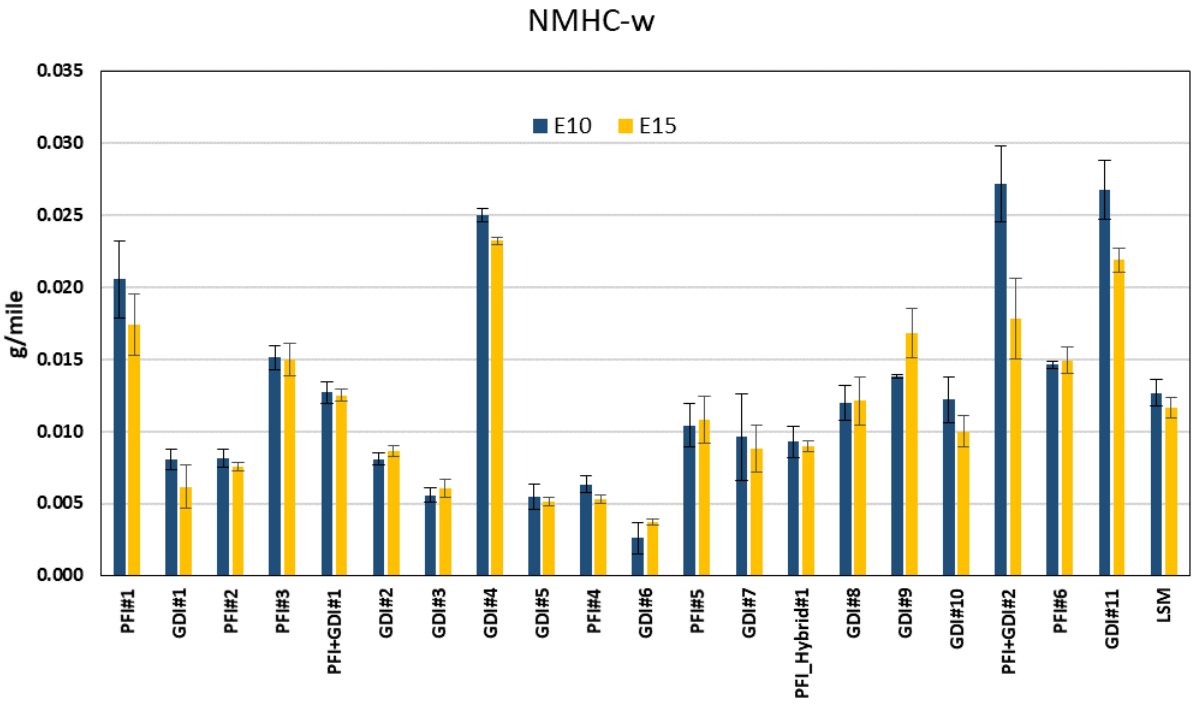

Figure 3-2. Average NMHC Weighted Emission Results

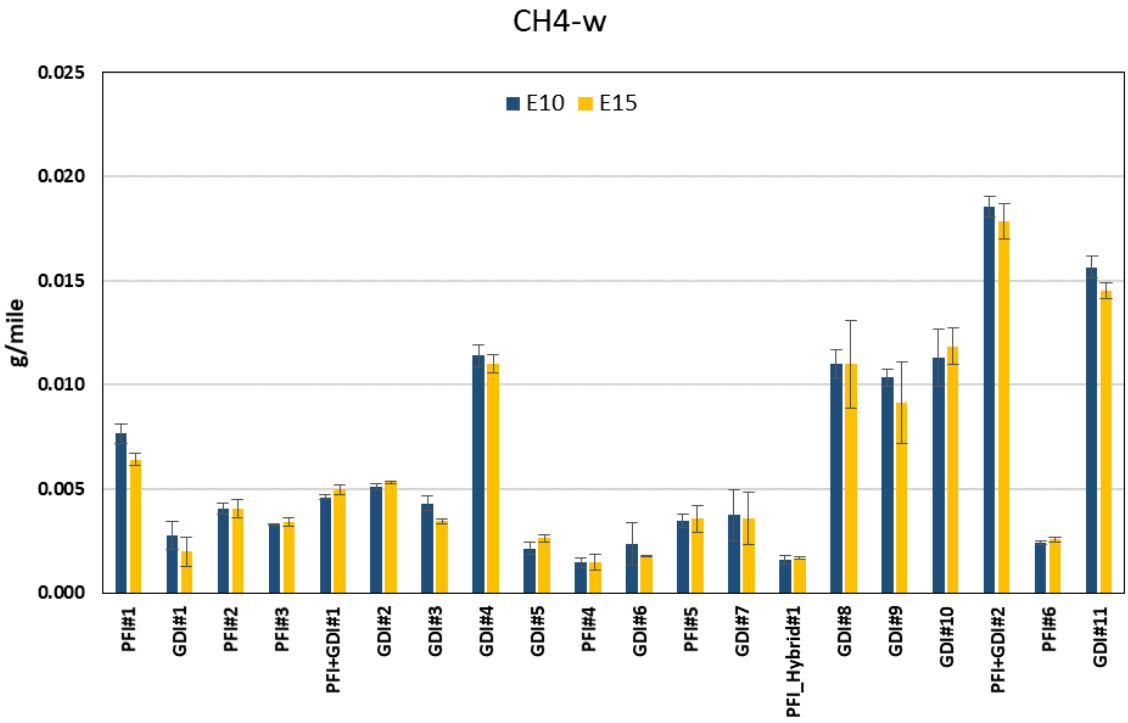

Figure 3-3. Average CH_4 Weighted Emission Results

3.2 CO Emissions

CO emission results for the twenty test vehicles are shown in Figure 3-4. Cold-start and hot-start CO emissions showed statistically significant reductions of 12% and 27%, respectively, for E15 compared to E10. The weighted CO emissions showed a statistically significant reduction of 17% for E15 compared to E10 across the fleet of 20 vehicles.

In previous studies with higher ethanol blends, CO emissions tend to decrease as the oxygen content increase in the fuel (Catapano et al., 2014; Karavalakis et al., 2014 Yang et al., 2019). The presence of oxygen in the fuel will improve the oxidation of CO to CO_2 in the fuel-rich regions of the combustion chamber, leading to a more complete combustion. Also, the lower C/H ratio for E15 was another contributing factor for the lower CO emissions for this fuel due to the lower carbon available to form CO during combustion (Najafi et al., 2009).

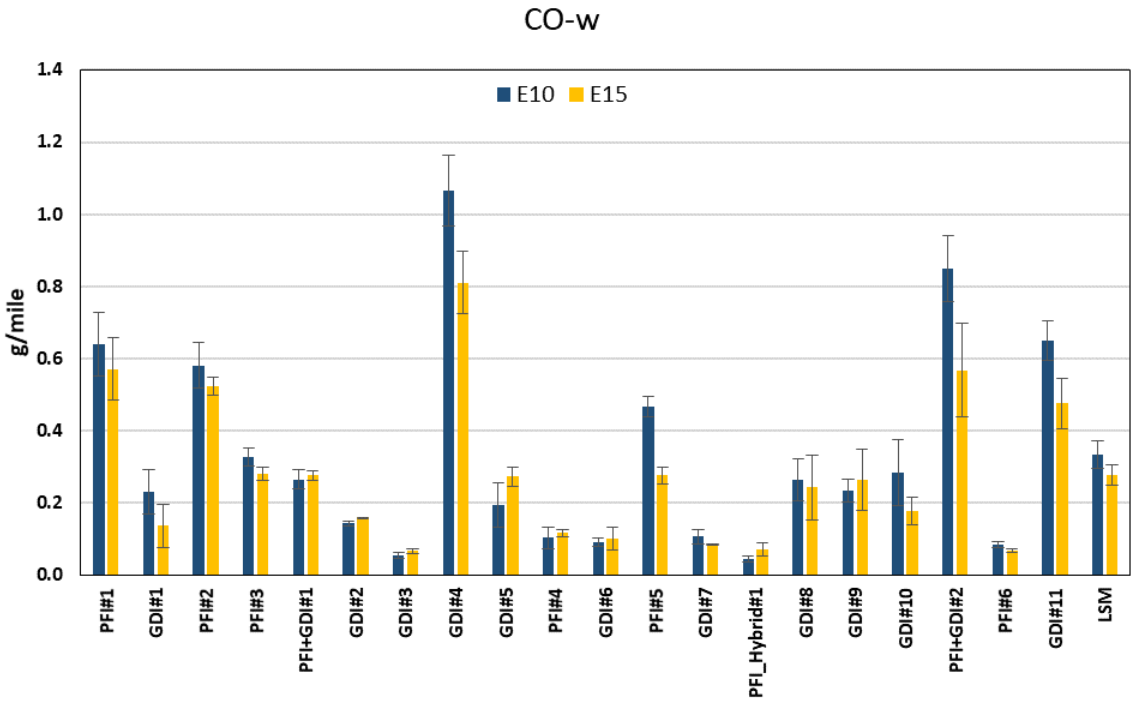

Figure 3-4. Average CO Weighted Emission Results

3.3 NOx Emissions

Weighted NO_x emission results for the twenty vehicles are presented in Figure 3-5. Overall, NOx emissions did not show any strong fuel differences across the twenty-vehicle fleet. The analysis showed that NOx emissions did not show any statistically significant difference between the fuels for the FTP and its individual FTP phase. However, it is worth noting that despite the non-statistically significant effect, NOx emissions trended 7%, 5%, 15%, and 3% lower for E15 compared to E10 over the cold-start, hot-running, hot-start, and weighted FTP, respectively.

Our results suggest that low ethanol content blends (i.e., below 20 vol %) will likely not have a strong effect on NOx emissions from Tier 3 PFI and GDI vehicles. These findings agree with those of Yang et al. (2019) that did not show any significant ethanol effects on NOx emissions from Tier 3 GDI vehicles.

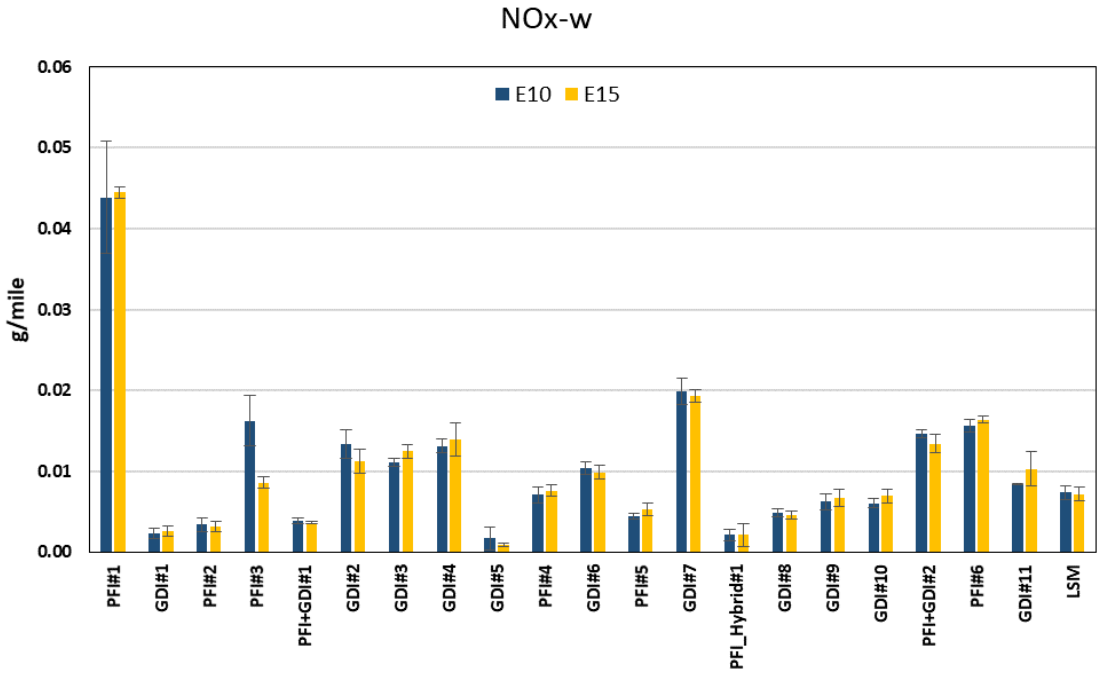

Figure 3-5. Average NOx Weighted Emission Results

3.4 CO_2 Emissions and Fuel Economy

Weighted CO_2 emission results for the twenty vehicles are presented in Figure 3-6. CO_2 emissions showed a marginally statistically significant reduction of 0.3% for E15 compared to E10 over the hot-start phase. No statistically significant differences in CO_2 emissions were seen for the weighted FTP.

From a theoretical standpoint, it might be expected that CO_2 emissions would trend with either the C/H ratio or carbon/energy content in the fuel. However, the difference between E10 and E15 may not be significant enough to yield a statistically significant CO_2 emissions difference between the two fuels.

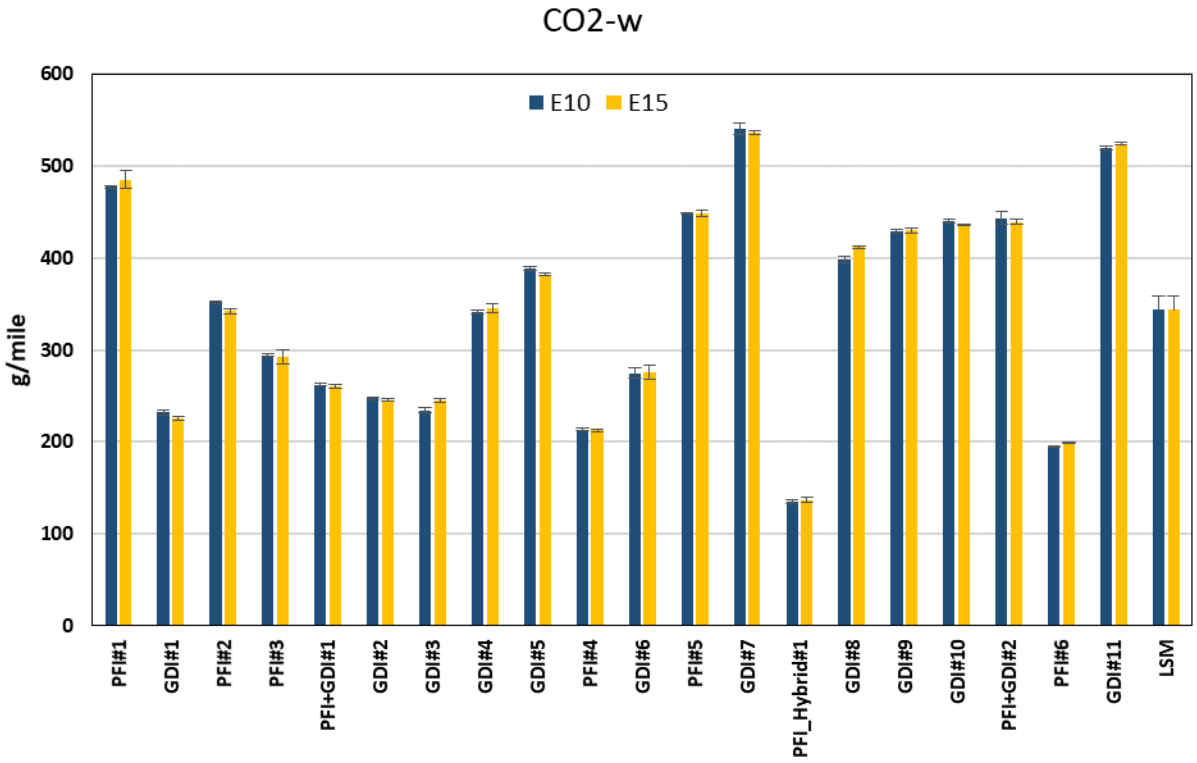

Figure 3-6. Average CO_2 Weighted Emission Results

The fuel economy results for the twenty test vehicles are presented in Figure 3-7. Fuel economy was calculated based on the carbon balance method. The carbon balance equation more directly accounts for the differences in energy content between different fuels, with the equation shown below. Carbon-balance weighted fuel economy showed a statistically significant reduction of 1% for E15 compared to E10 across the fleet of twenty vehicles.

$$Fuel\ economy\ (mpg) = \frac{CWF_{fuel} \times SG_{fuel} \times 3781.8}{(CWF_{HC} \times HC) + (0.429 \times CO) + (0.273 \times CO_2)}$$

HC: $HC\ Emission\ Rate\ \left(\frac{g}{mile}\right)$
CO: $CO\ Emission\ Rate\ \left(\frac{g}{mile}\right)$
CO_2 : $CO_2\ Emission\ Rate\ (\frac{g}{mile})$
CWF_{fuel}, CWF_{HC}: $Carbon\ Weight\ Fraction\ of\ the\ Test\ Fuel$
SG_{fuel}: $Specific\ Gravity\ of\ the\ Test\ Fuel$

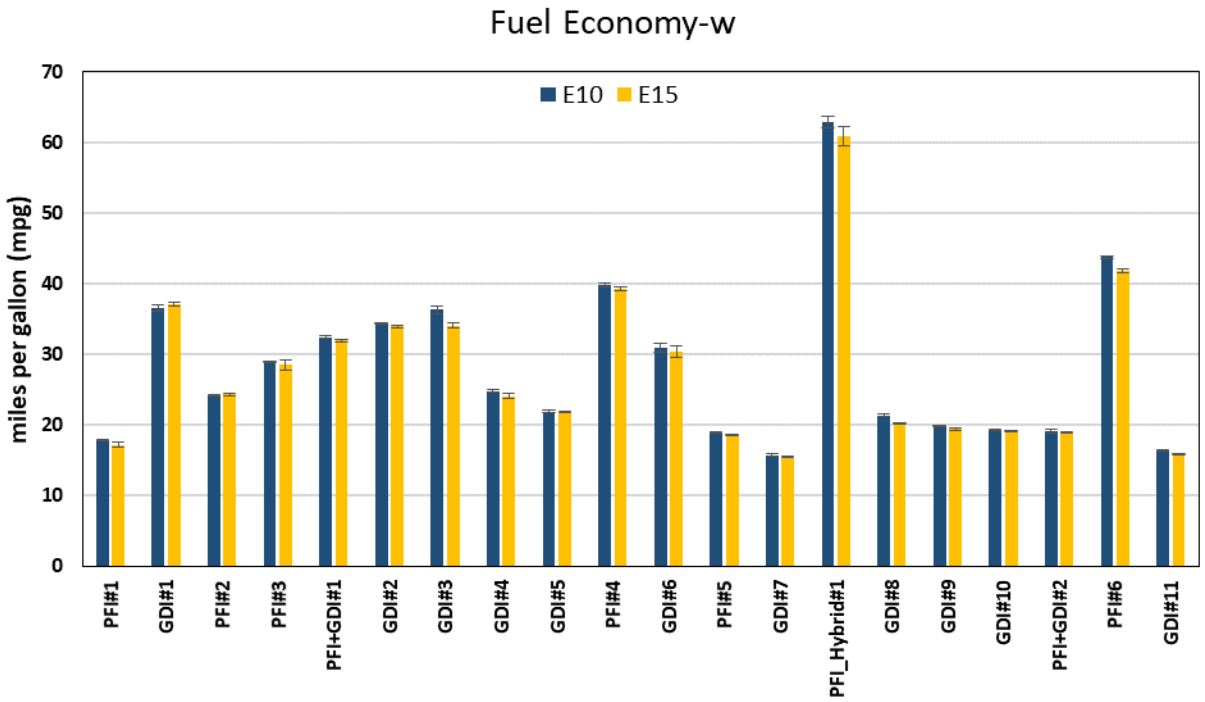

Figure 3-7. Average Fuel Economy Results Based on Carbon Balance Method

3.5 PM Mass, Particle Number and Black Carbon Emissions

Weighted PM mass, cold-start PM mass, hot-running PM mass, and hot-start PM mass emissions for all test vehicles are shown in Figure 3-8, Figure 3-9, Figure 3-10, and Figure 3-11, respectively. The PM mass showed strong, statistically significant fuel trends over the entire FTP cycle and each individual phase. For the cold-start and hot-running phases, PM mass emissions showed statistically significant reductions of 16 and 54%, respectively, for E15 compared to E10. Hot-start PM mass emissions were 43% lower for E15 compared to E10, at a marginally statistically significant level. The weighted PM mass emissions showed a statistically significant reduction of 18% for E15 compared to E10 across the fleet of 20 vehicles.

The cold-start period significantly contributed to the total PM mass emissions for all vehicle/fuel combinations. The higher PM emissions during the cold-start phase were due to poor fuel vaporization from the cold cylinder and piston surfaces, leading to insufficient fuel-air mixtures and pool burning, generating more soot emissions. Hot-running and hot-start PM emissions were significantly lower than cold-start. As the engine warmed up, the lower PM emissions were attributed to the warming of the engine and exhaust surfaces, as well as the less rich fuel-air mixtures during combustion and the improved fuel vaporization. In addition, the TWC being above its light-off temperature likely reduced the semi-volatile hydrocarbon species that contribute to PM mass.

Overall, the lower PM mass emissions for E15 compared to E10 suggests that the presence of oxygen and the dilution of aromatics (soot precursors) were the dominant factors for these observations. The availability of oxygen atoms in the fuel aids the oxidation of local fuel rich pockets (Fatouraie et al., 2015; Leach et al., 2018). Aromatics and polyaromatics have a higher sooting tendency than non-aromatic hydrocarbons. Diluting the aromatics in the fuel stream for E15 will lower the soot precursor formation and reduce the soot surface growth through the hydrogen abstraction acetylene addition (HACA) mechanism (Khosousi et al., 2015). Our results agree with the majority of the published literature showing a positive effect of ethanol on particulate emissions (Karavalakis et al., 2014; Maricq et al., 2012; Wang et al., 2014; Jin et al., 2017).

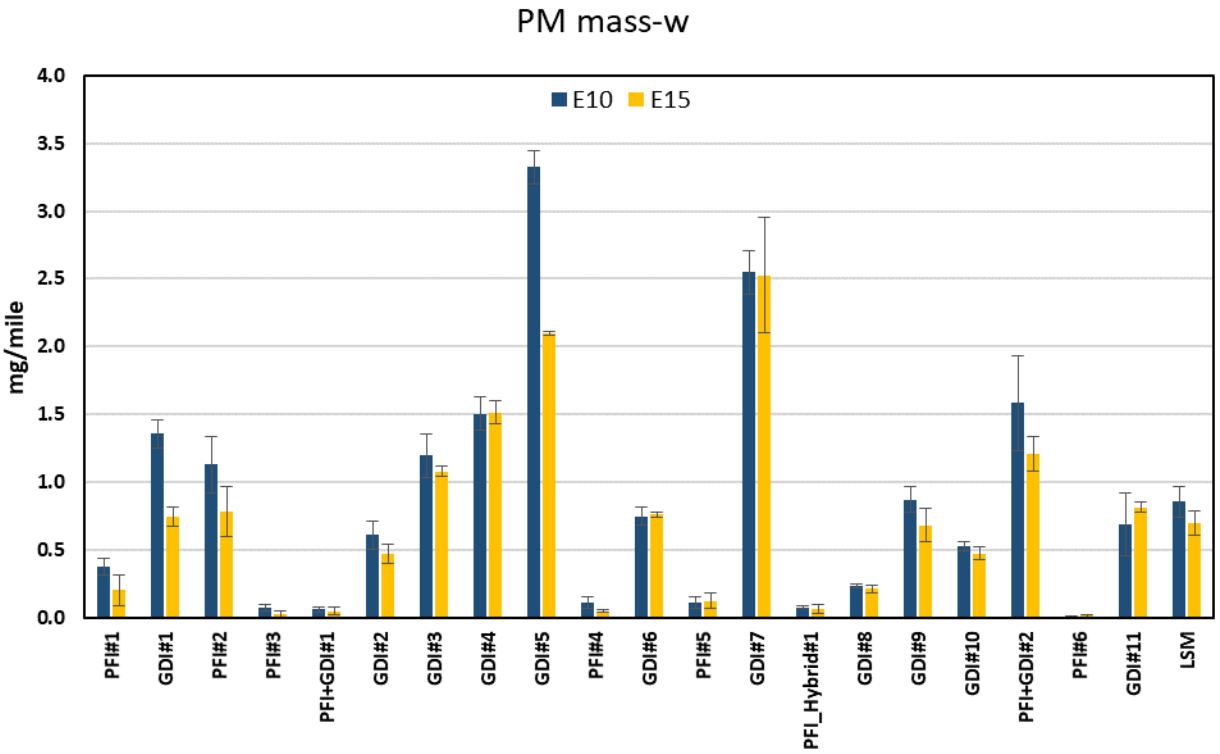

Figure 3-8. Average Weighted PM Mass Emissions Results

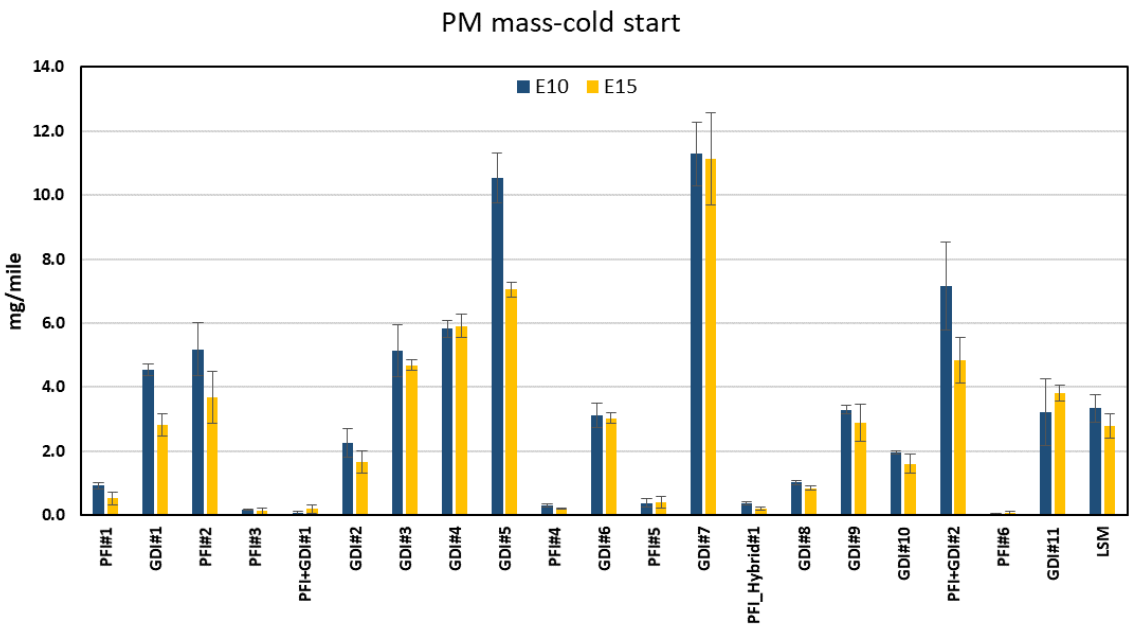

Figure 3-9. Average Cold-Start (Bag 1) PM Mass Emissions Results

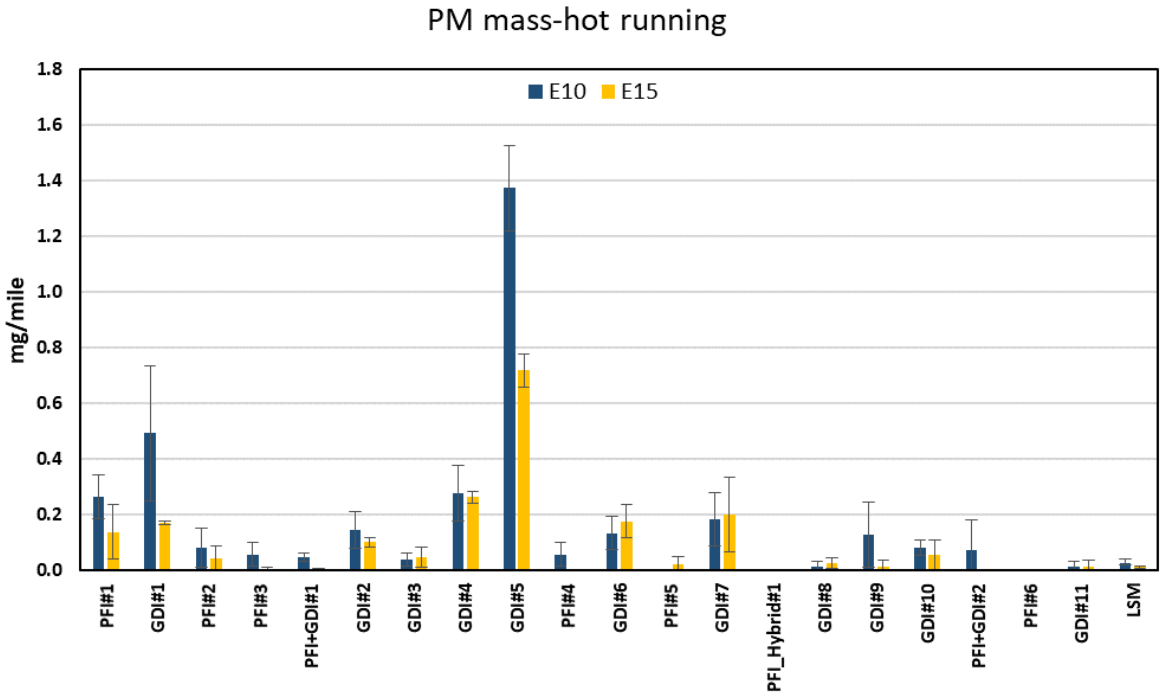

Figure 3-10. Average Hot-Running (Bag 2) PM Mass Emissions Results

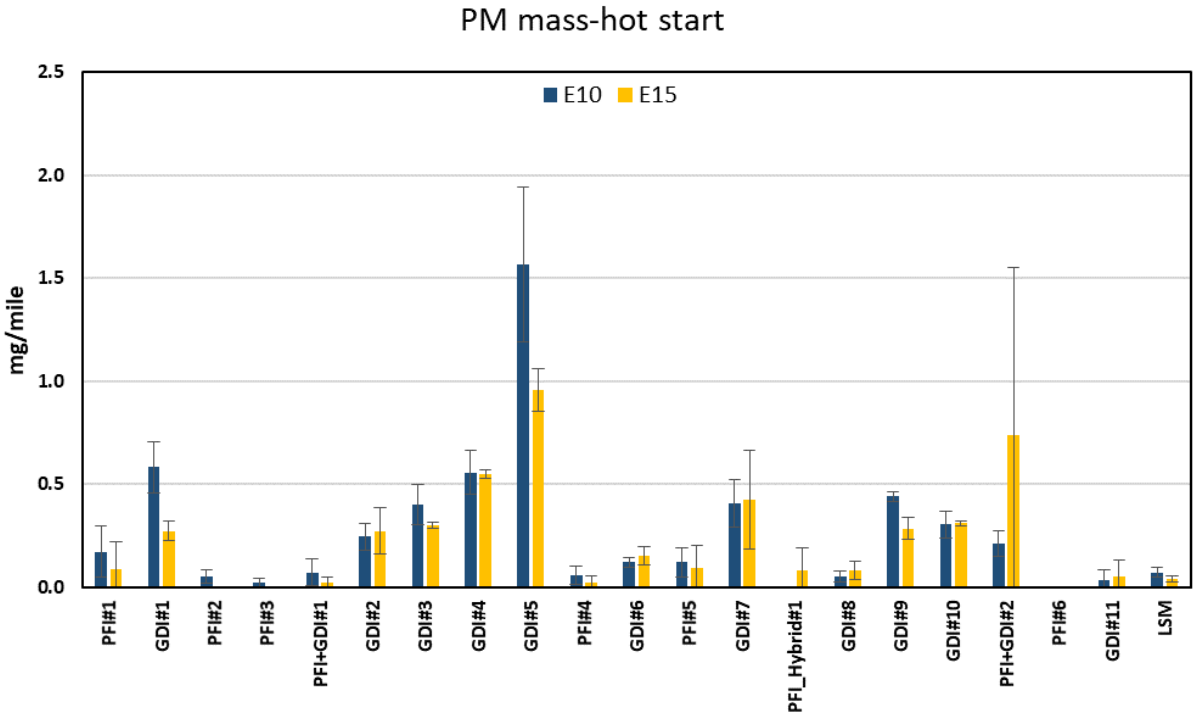

Figure 3-11. Average Hot-Start (Bag 3) PM Mass Emissions Results

As shown in Figure 3-12, PM mass emissions for the GDI vehicles were higher than those of their PFI counterparts. A number of previous studies have also shown that GDI engines have higher PM emissions than PFI engines (Karavalakis et al., 2014; Saliba et al., 2017; Chen et al., 2017). The higher PM emissions for GDI engines were largely due to diffusive combustion of the liquid fuel film (fuel impingement) on the piston crown or cylinder walls. Figure 3-13 shows a comparison of PM mass emissions as a function of vehicle emissions certification classification. The results as a function of certification classification do not show strong trends, which could be attributed to a mix of GDI and PFI vehicles being tested in the different certification categories.

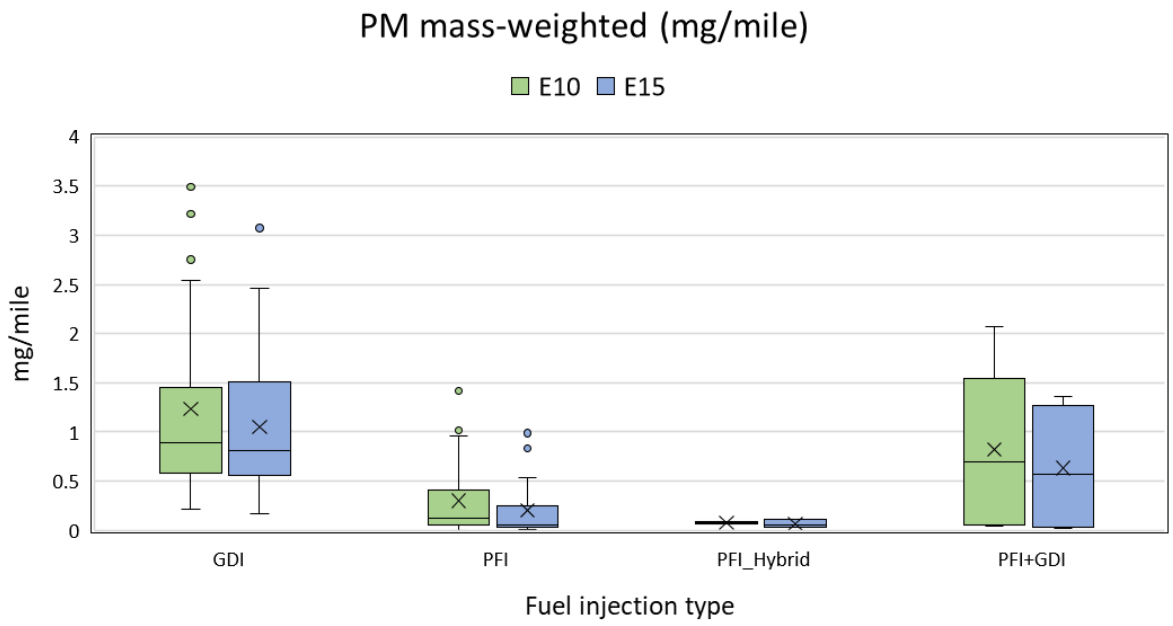

Figure 3-12. Fleet PM mass weighted emissions for different fuel injection types

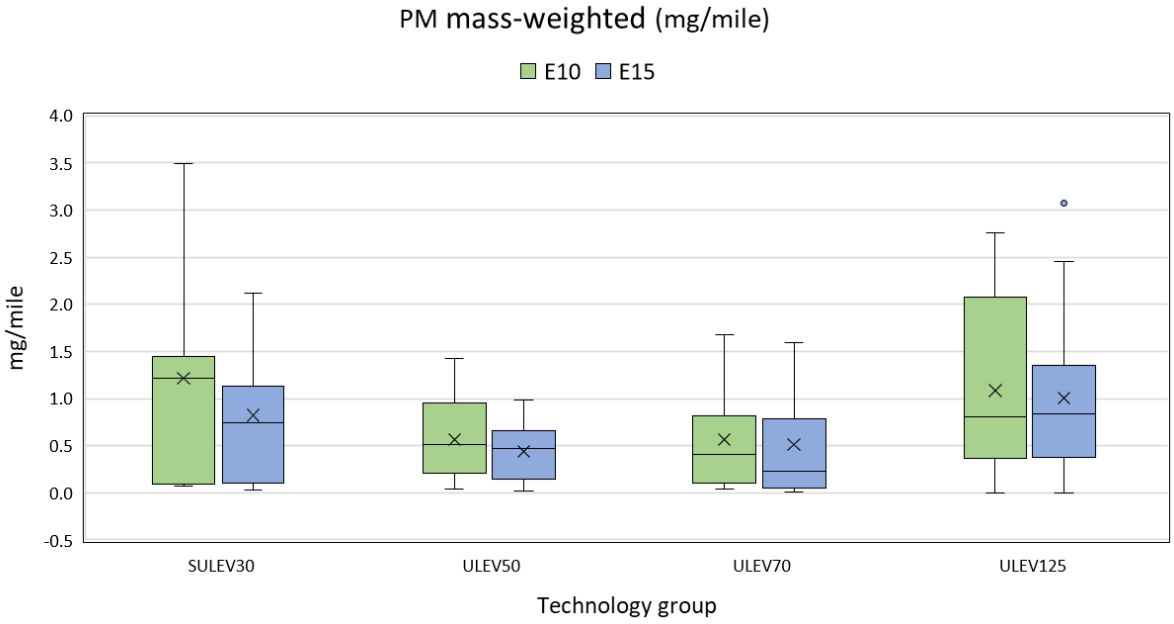

Figure 3-13. Fleet PM mass weighted emissions for different technology groups

Solid particle number (SPN>23 nm) emissions are shown in Figure 3-14. SPN emissions were measured according to the European PMP method. For the purpose of this program, only the weighted SPN emissions were included in the statistical analysis. Results showed that E15 was 12% lower than E10, at a statistically significant level.

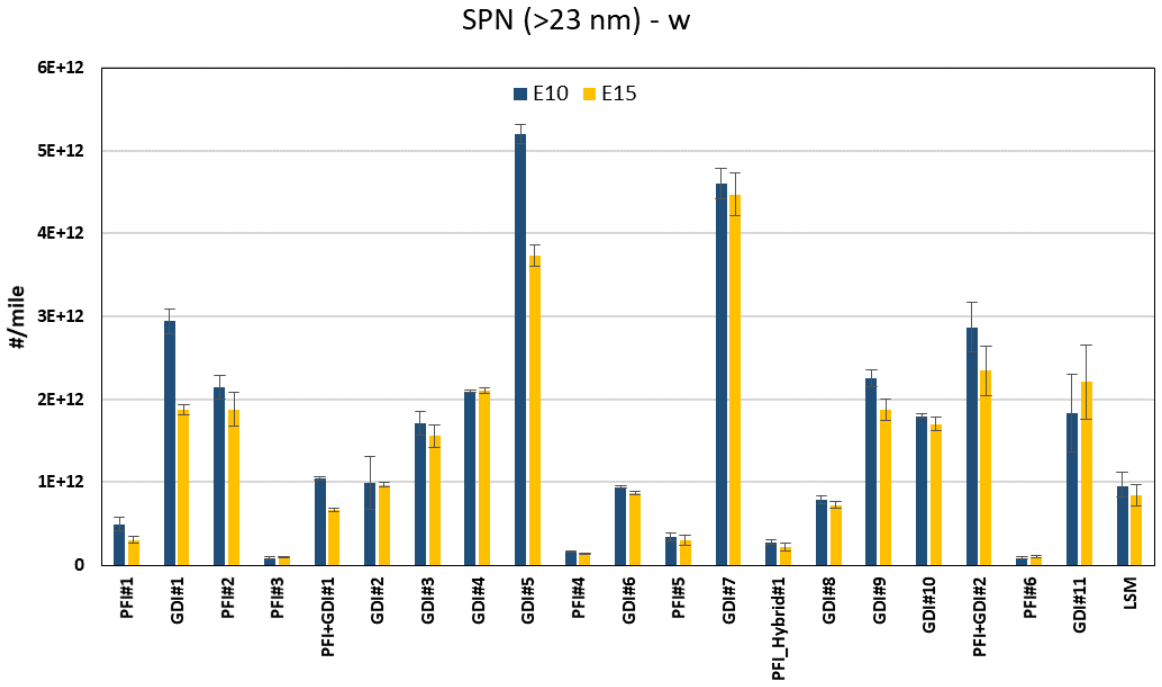

Figure 3-14. Average Solid Particle Number (>23 nm) Weighted Emissions Results

Black carbon (BC) is a ubiquitous component of ambient particulate matter, that is produced by the combustion of fossil fuels. BC emissions were not included in the comprehensive statistical analysis, but the fuel differences were analyzed with the use of a two-sample equal variance t-test. Weighted BC emission results are provided in Figure 3-15. For the weighted BC emissions, GDI#1, PFI+GDI#1, and GDI#5 showed statistically significant differences between E10 and E15. For GDI#1, PFI+GDI#1, and GDI#5, E15 showed reductions of 30%, 38%, and 39%, respectively, compared to E10. For PFI#4, PFI_Hybrid#1, and PFI+GDI#2, E15 showed marginally statistically significant reductions of 11%, 26%, and 33%, respectively, compared to E10.

For the cold-start BC emissions, GDI#1, GDI#5, and GDI#8 showed statistically significant reductions when tested with E15 compared to E10. The reductions in cold-start BC emissions were 34%, 35%, and 20% for GDI#1, GDI#5, and GDI#8, respectively. For PFI#1, PFI#4, and PFI+GDI#2, E15 showed marginally statistically significant reductions of 45%, 14%, and 33%, respectively, compared to E10.

For the hot-running BC emissions, GDI#1, PFI+GDI#1, GDI#4, GDI#5, GDI#6, and GDI#9 showed statistically reductions when tested with E15 compared to E10. For GDI#1, PFI+GDI#1, GDI#4, GDI#5, GDI#6, and GDI#9, the use of E15 showed reductions of 29%, 55%, 9%, 48%, 18%, and 39%, respectively, compared to E10. GDI#7 and GDI#11 showed marginally statistically significant reductions of 11% and 20%, respectively, compared to E10.

For the hot-start BC emissions, GDI#1, PFI+GDI#1, GDI#5, GDI#6, GDI#7, GDI#9 and PFI+GDI#2 showed statistically significant reductions with E15 compared to E10. The differences in hot-start BC emissions were 23%, 55%, 39%, 19%, 16%, 17%, and 47% for GDI#1, PFI+GDI#1, GDI#5, GDI#6, GDI#7, GDI#9, and PFI+GDI#2, respectively. For GDI#10, E15 showed a statistically significant increase of 35% compared to E10.

BC emissions reduced with the use of E15 across the vehicle fleet. The GDI vehicles produced significantly higher BC emissions than the PFI vehicles, indicating that PM emissions from GDI combustion were primarily BC or soot in nature.

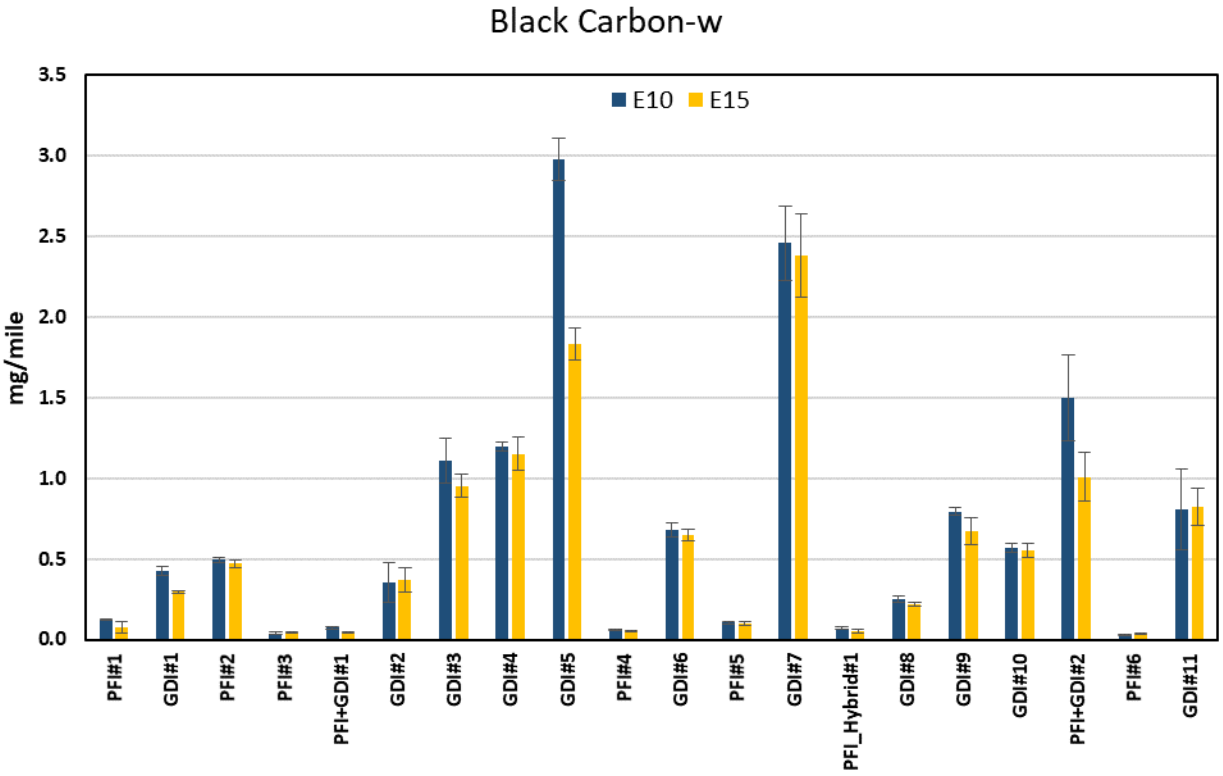

Figure 3-15. Average Black Carbon Weighted Emissions Results

3.6 Nitrous oxide (N_2O) and ammonia (NH_3) emissions

Nitrous oxide (N_2O) emissions in recent years have gained increased attention as an important GHG, along with CH_4 and CO_2. In fact, N_2O's global warming potential (GWP) is much higher than that of CO_2 or CH_4. Thus, N_2O is a significant contributor to total radiative forcing, despite its low concentration in the atmosphere. N_2O is primarily formed in the three-way catalyst (TWC), since precious metals present in the catalyst can promote its formation by reaction of NO and NH_3 or with hydrogen (Hoekman, 2020). Neither of these pollutants were included in the comprehensive statistical analysis. Under the present test conditions, N_2O emissions were seen in very low levels for all vehicles/fuel combinations and showed mixed results with both increases and decreases for E15 (Figure 3-16). Thirteen vehicles showed trends of lower N_2O emissions with E15. Only GDI#7 showed a statistically significant reduction of 37% for E15 compared to E10, however.

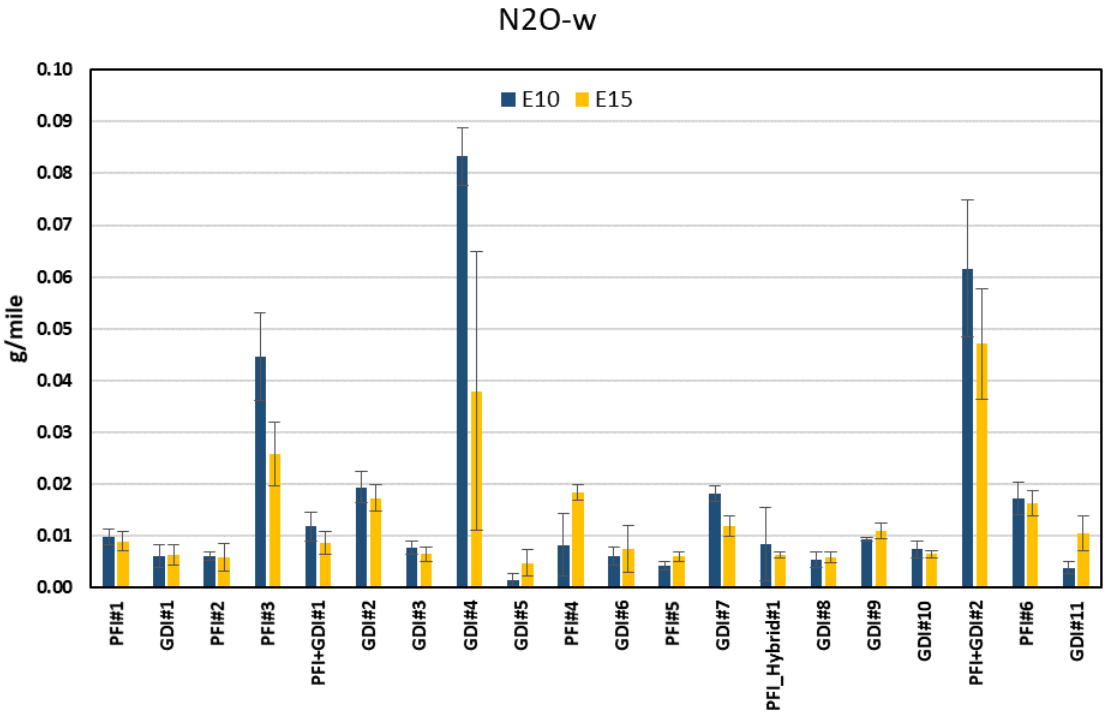

Figure 3-16. Average N_2O weighted Emissions Results

Ammonia (NH_3) emissions are shown in Figure 3-17. NH_3 is not a combustion by-product but it forms inside the TWC as a result of the reduction of NO by hydrogen, which is generated from CO and H_2O via the water-gas shift reaction or from hydrocarbons via steam reforming (Suarez-Bertoa et al., 2014). NH_3 emissions contribute significantly to the formation of secondary ambient PM. NH_3 emissions were detected in relatively low concentrations and did not show a clear fuel

trend. For GDI#5, PFI#4, GDI#10, and PFI+GDI#2, the use of E15 showed statistically significant increases of 180%, 188%, 42%, and 104%, respectively, compared to E10.

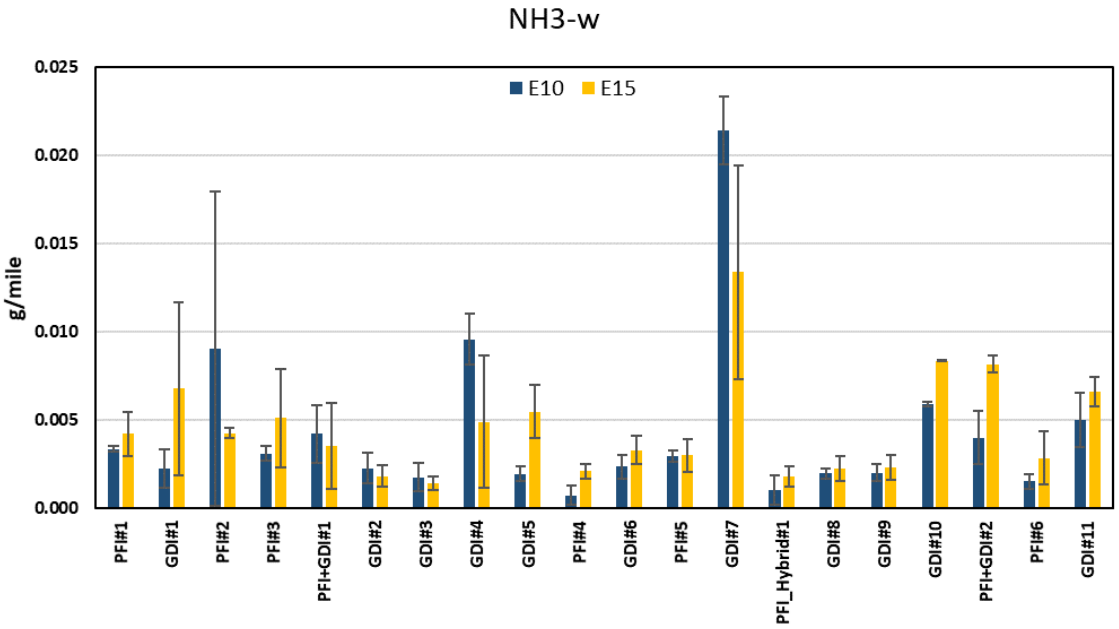

Figure 3-17. Average NH_3 weighted Emissions Results

3.7 Aromatic Hydrocarbon Species, 1,3-Butadiene, and Ethanol Emissions

Figure 3-18, Figure 3-19, Figure 3-20, Figure 3-21, Figure 3-22, Figure 3-23, and Figure 3-24 show the cumulative benzene, toluene, ethylbenzene, *m/p*-xylenes, *o*-xylene (commonly known as BTEX), 1,3-butadiene, and ethanol emission results, respectively. Naphthalene was found to be well below detection limit and no results are reported here.

For the cumulative BTEX emissions, only ethylbenzene, m/p-xylenes and o-xylene emissions showed statistically significant results between the fuels. For ethylbenzene emissions, E15 showed a statistically significant reduction of 11% compared to E10. For m/p-xylenes and o-xylene emissions, E15 showed marginally statistically significant reductions of 10% and 9%, respectively, compared to E10. Cumulative 1,3-butadiene emissions did not show any statistically significant difference between fuels.

Ethanol emissions showed a strong, statistically significant increase of 77% for E15 compared to E10. As expected, ethanol emissions were consistently higher for E15 compared to E10 for each individual vehicle.

The benzene, toluene, ethylbenzene, m/p xylenes, and o-xylene are reactive aromatic volatile organic compounds that contain a C=C bond. These species are highly reactive in the troposphere and have been recognized as important photochemical precursors for ozone and organic aerosols. They are also known as toxic and potentially carcinogenic compounds from vehicle exhaust. Benzene and toluene were the main BTEX in the exhaust followed by ethylbenzene and xylenes. Overall, BTEX species trended lower with E15, consistent with previous studies (Jin et al., 2017; Yang et al., 2019; Poulopoulos et al., 2001). The lower BTEX emissions for E15 can be attributed in part to the dilution of these compounds when more ethanol was added in E10. In addition, the higher oxygen content for E15 led to the more efficient oxidation of BTEX species during combustion.

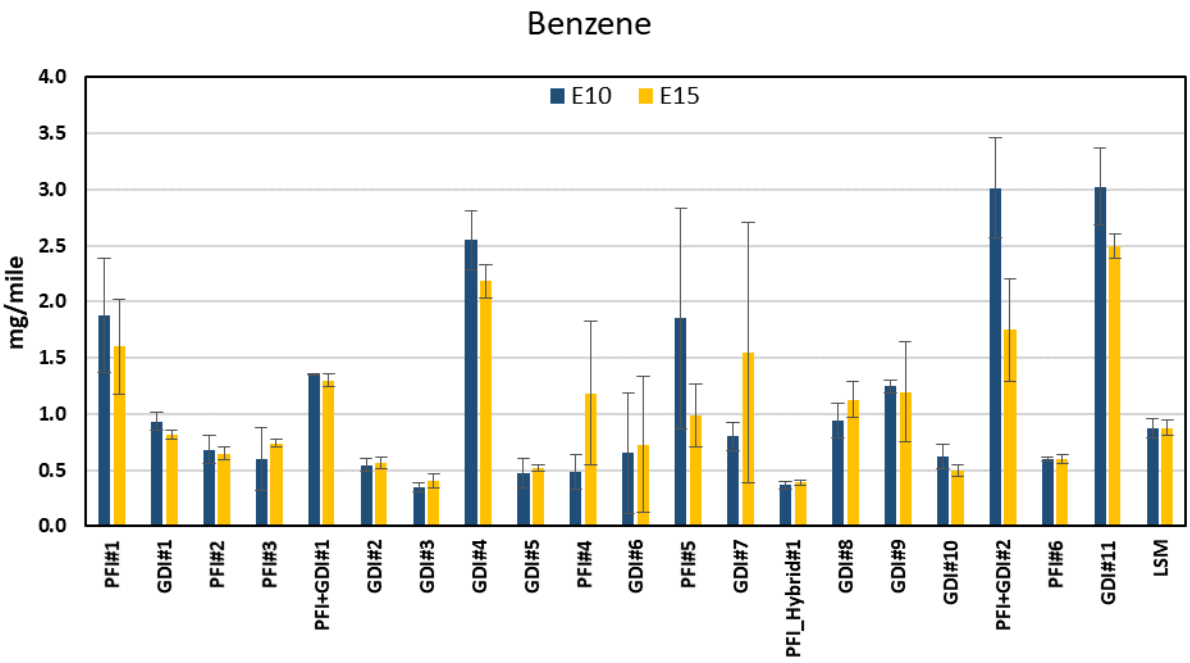

Figure 3-18. Average Benzene Cumulative Emissions Results

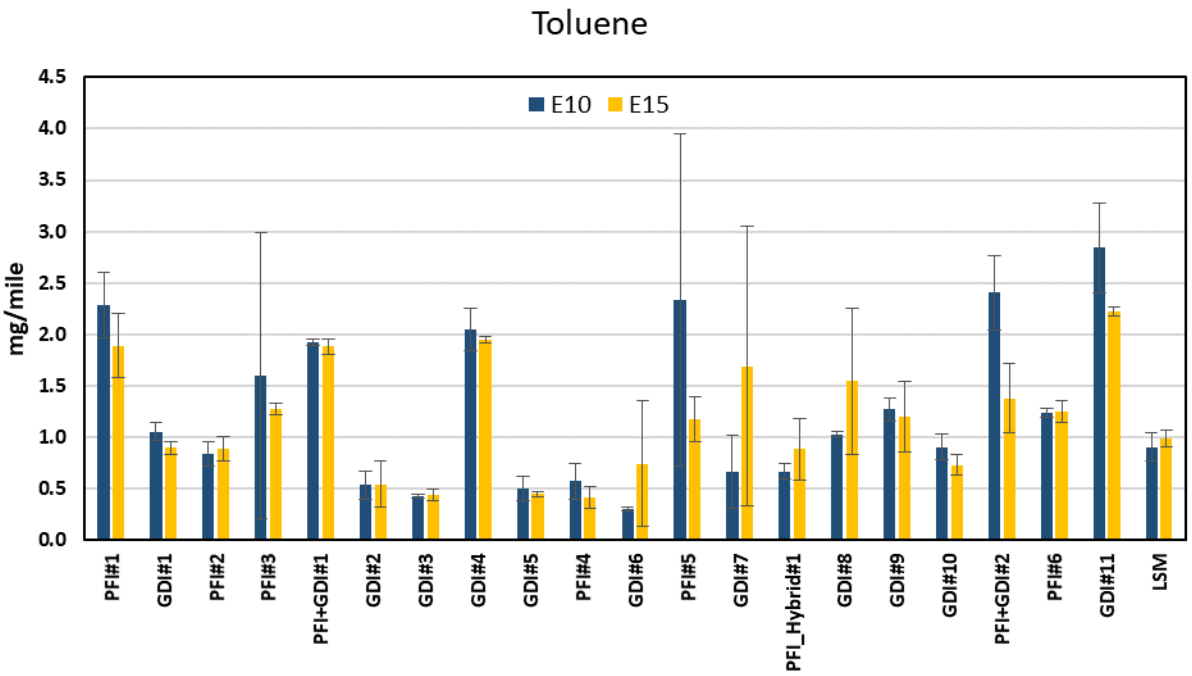

Figure 3-19. Average Toluene Cumulative Emissions Results

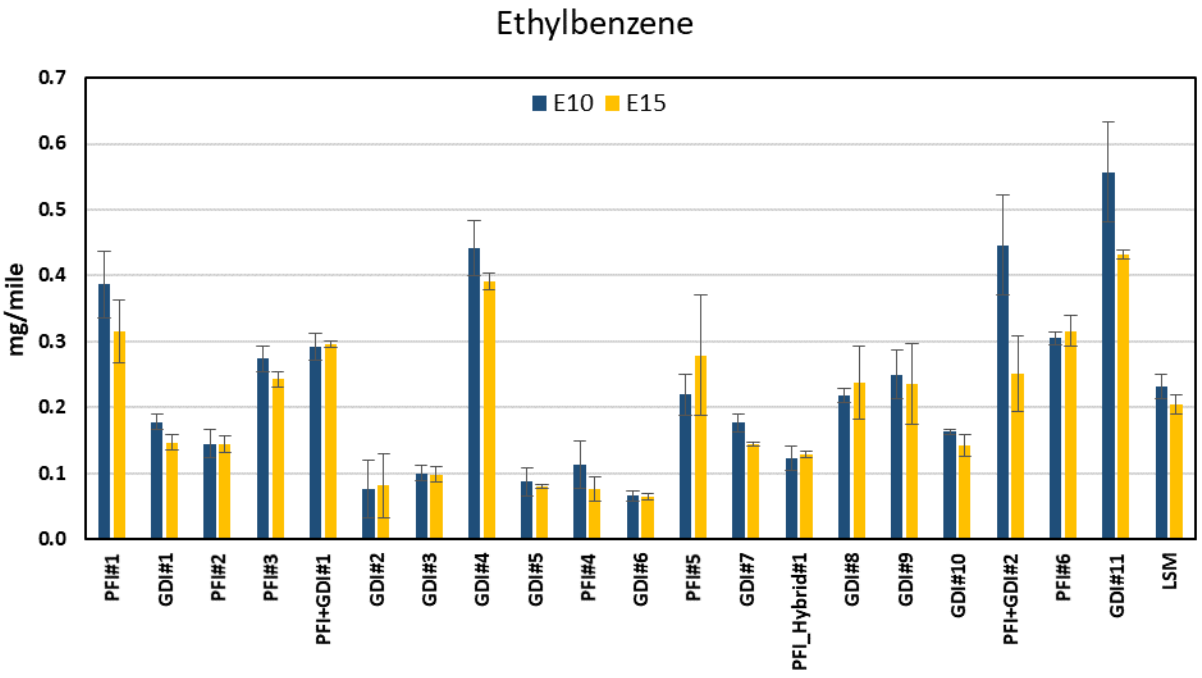

Figure 3-20. Average Ethylbenzene Cumulative Emissions Results

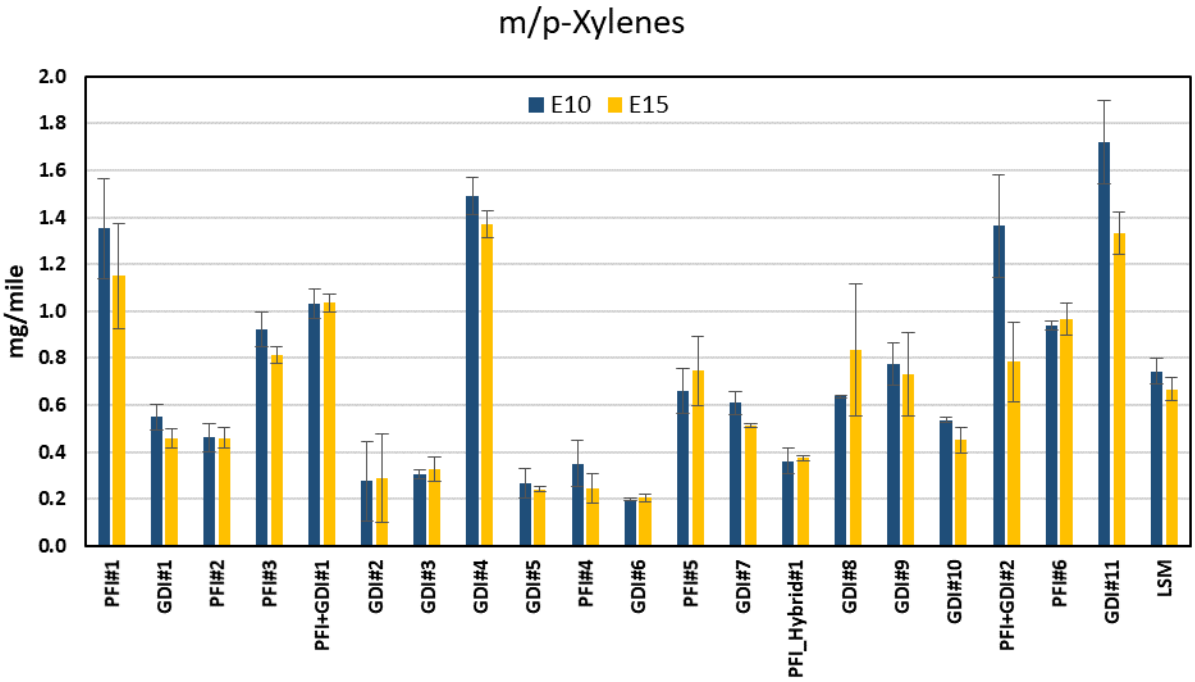

Figure 3-21. Average m/p-xylenes Cumulative Emissions Results

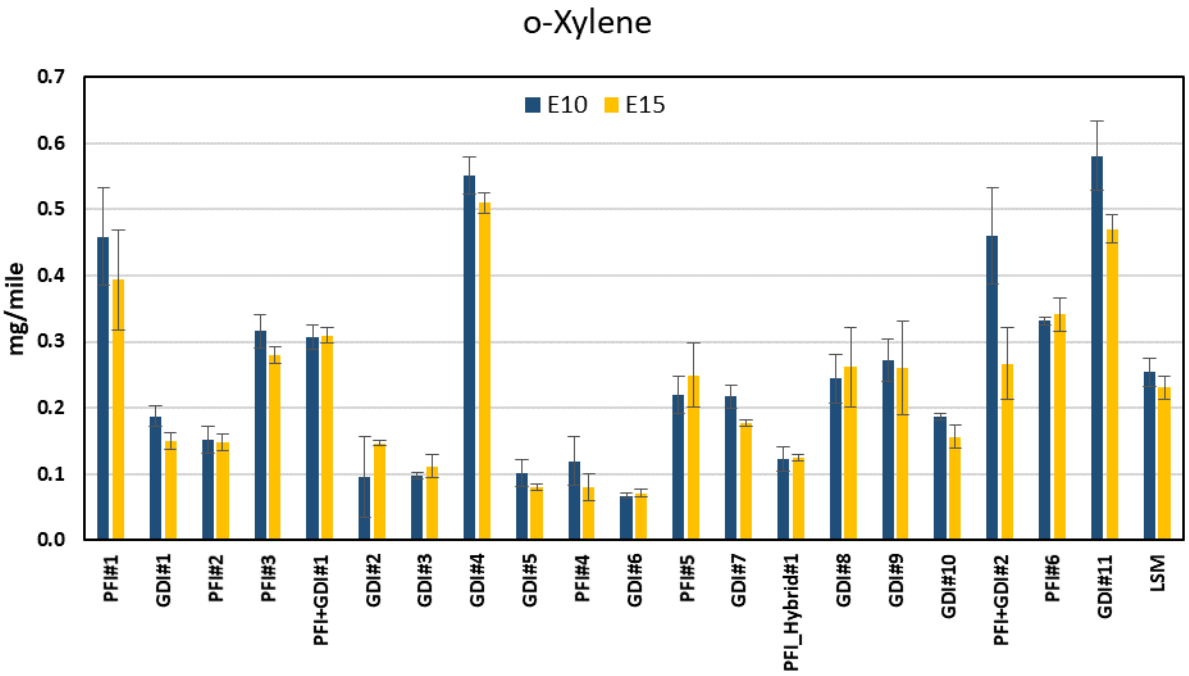

Figure 3-22. Average o-xylene Cumulative Emissions Results

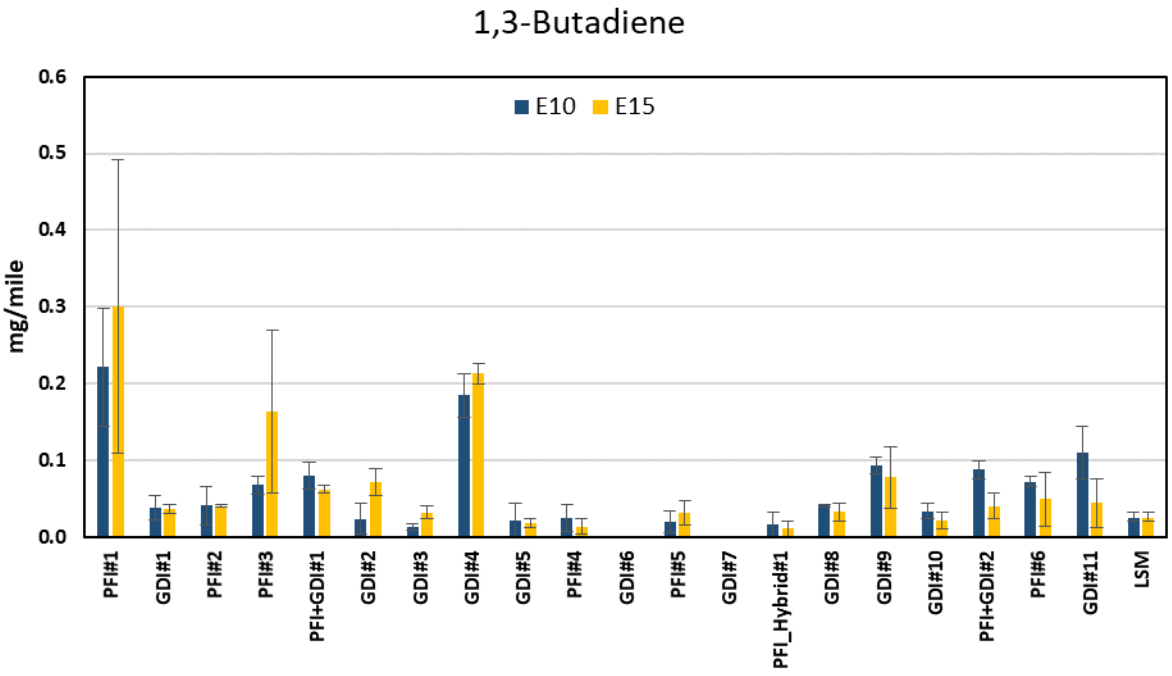

Figure 3-23. Average 1-3 Butadiene Cumulative Emissions Results

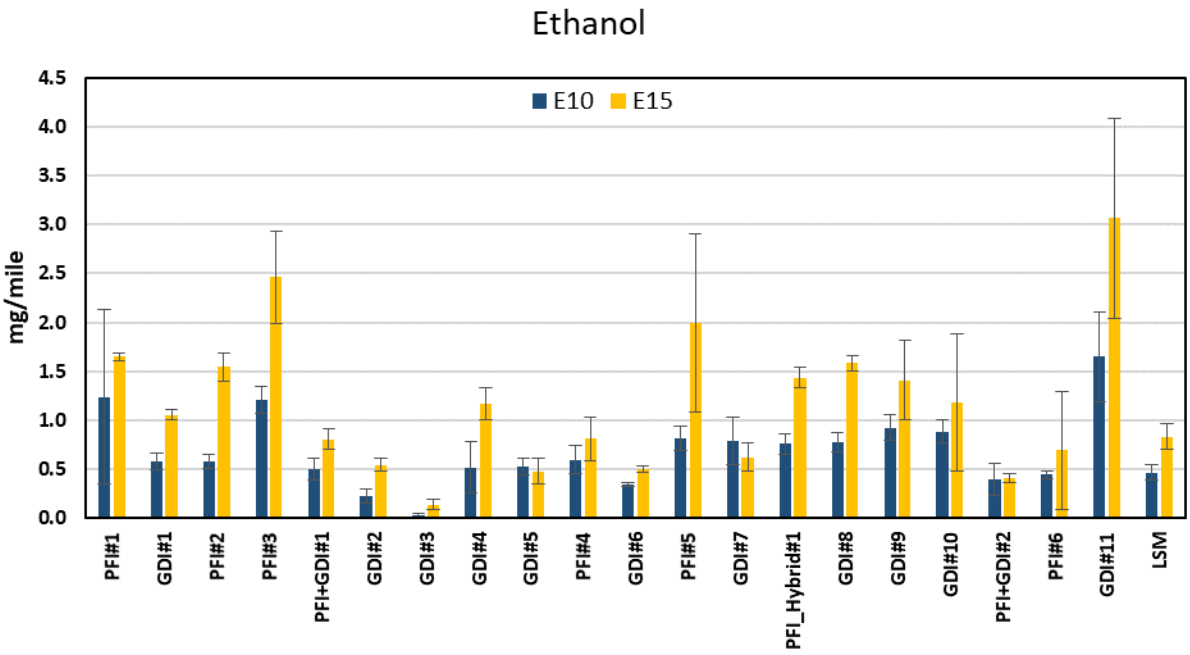

Figure 3-24. Average Ethanol Cumulative Emissions Results

3.8 Formaldehyde and Acetaldehyde Emissions

Cumulative formaldehyde and acetaldehyde emissions are shown in Figure 3-25 and Figure 3-26, respectively. These aldehydes are not present in the fuel, but are formed during combustion. Formaldehyde and acetaldehyde are classified as a human carcinogen or as probably carcinogenic, respectively, in terms of health impacts. While a number of aldehydes and ketones were measured from the tailpipe, the low molecular weight formaldehyde and acetaldehyde were the predominant aldehydes detected, with heavier compounds being below the limits of detection or below the CVS tunnel backgrounds.

Formaldehyde emissions did not show any statistically significant effects between E10 and E15. Acetaldehyde emissions showed a strong, statistically significant increase of 31% for E15 compared to E10 across the fleet of twenty vehicles. Acetaldehyde emissions are mainly a function of ethanol content and are attributed to the hydroxyl moiety in ethanol. Ethanol combustion will result in hydrogen abstraction, which will form radicals that either react with oxygen or unimolecularly decompose yielding acetaldehyde (Hass et al., 2009). Previous studies have shown elevated acetaldehyde emissions as a function of ethanol content (Storey et al., 2010; Karavalakis et al., 2014; Yang et al., 2019).

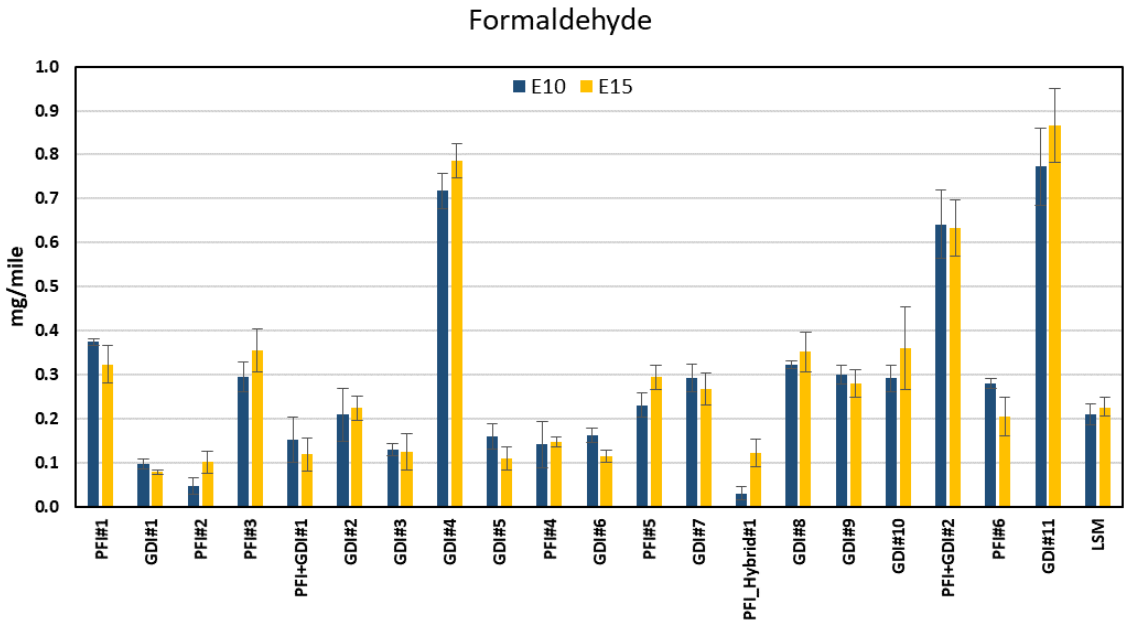

Figure 3-25. Average Formaldehyde Cumulative Emissions Results

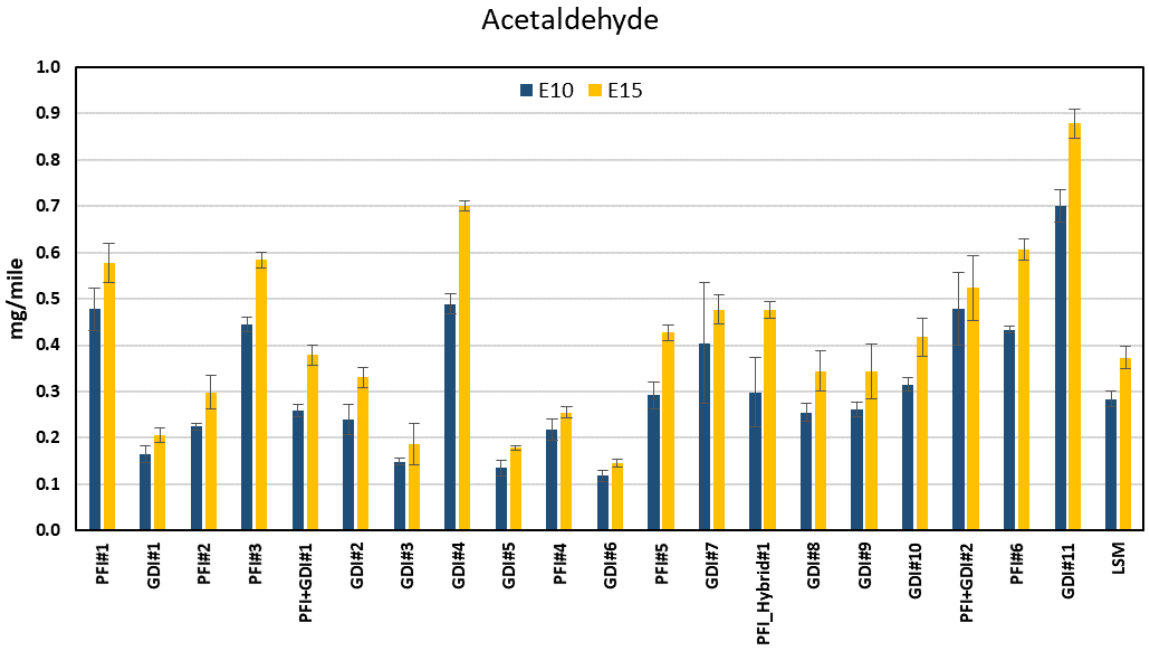

Figure 3-26. Average Acetaldehyde Cumulative Emissions Results

3.9 NMOG Emissions

The California and EPA LEV III and Tier 3 emissions standards have established a combined standard for non-methane organic gases (NMOG) + NOx emissions. The light-duty fleet average is required to be below 30 mg/mile over the certification FTP cycle by 2025. NMOG emissions are presented in Figure 3-27. It should be noted that NMOG emissions were not included in the statistical analysis, but were rather analyzed with the use of a two-sample equal variance t-test. Overall, NMOG emissions were below the 30 mg/mile standard for all test vehicles. For PFI+GDI#2, E15 showed a statistically significant reduction of 34% in NMOG emissions compared to E10. For GDI#4, E15 showed a statistically significant reduction of 5% compared to E10. For GDI #9, E15 showed a statistically significant increase of 22% compared to E10. For GDI#11, E15 showed a marginally statistically significant reduction of 14% compared to E10.

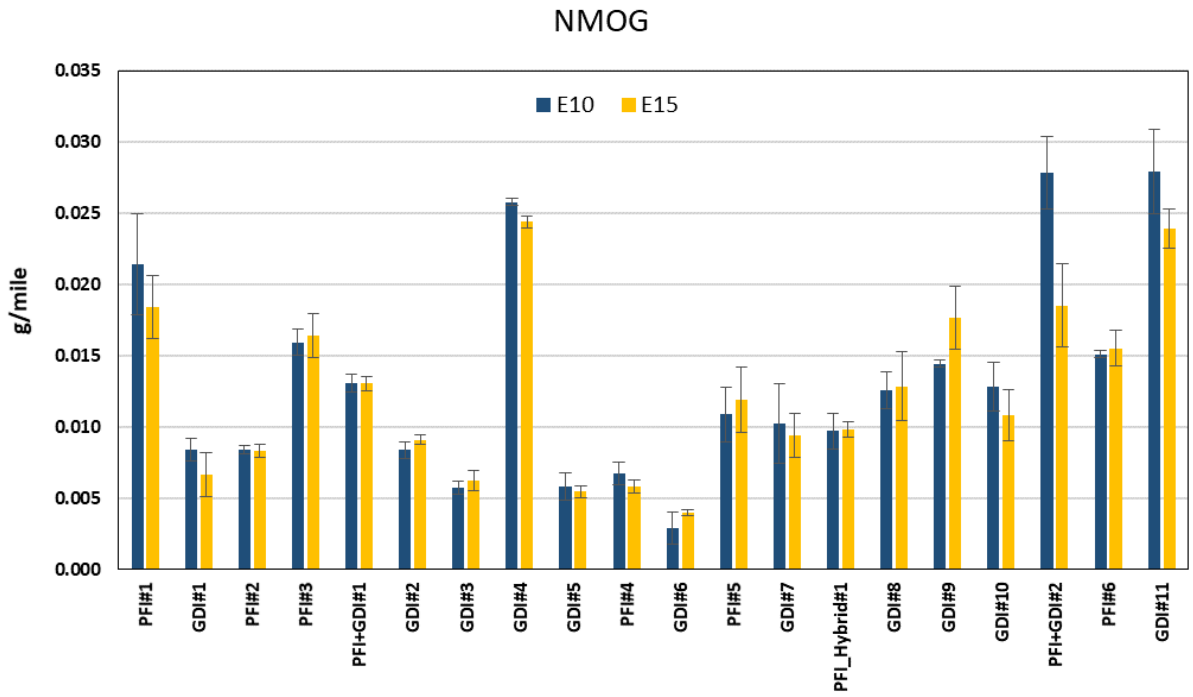

Figure 3-27. Average NMOG Emissions Results

3.10 Ozone Forming Potential

The ozone forming potential (OFP) for all vehicle/fuel combinations is shown in Figure 3-28. The OFP was calculated using the maximum incremental reactivity (MIR) factors for each individual exhaust species, and then summing these values. The calculation model is shown in the following equation:

$$OFP = \sum MIR_i \times E_i$$

Where,
OFP – Ozone forming potential, in mg O_3/mile
MIRi – maximum incremental reactivity of species i, in mg O_3/mg
Ei – mass emission rate of species I, in mg/mile

OFP data was not included in the comprehensive statistical analysis. This data was analyzed with the use of a two-sample equal variance t-test to identify fuel effects between vehicles. For GDI#1 and PFI+GDI#2, E15 showed statistically significant reductions of 23% and 33%, respectively, compared to E10. For GDI#4, E15 showed a marginally statistically significant reduction of 9% compared to E10.

Overall, the OFP for E15 trended lower compared to E10 across the vehicle fleet, indicating that the introduction of E15 in the California gasoline market will likely not contribute to increases in ozone formation. Previous studies have also shown reduced OFP with higher ethanol fuels (Costagliola et al., 2016; Wang et al., 2016; Yang et al., 2019).

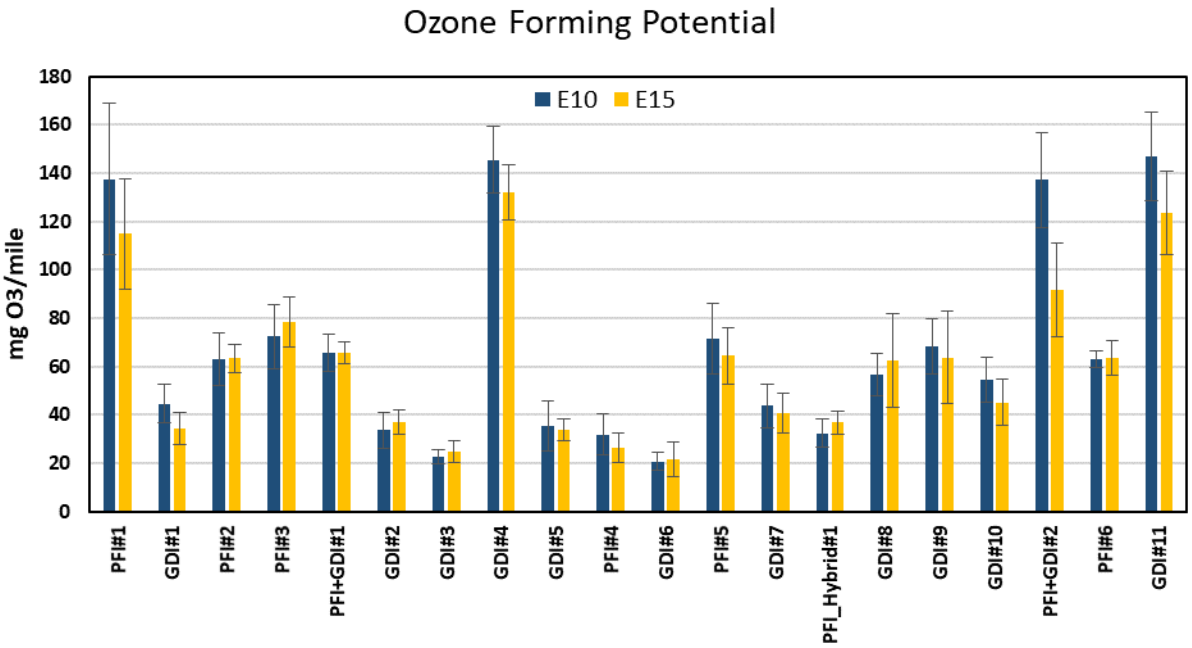

Figure 3-28. Ozone Forming Potential Test Results

4 Summary and Conclusions

The primary objective of this study was to characterize the impacts of changes in the ethanol contents in gasoline for current technology Tier 3 vehicles in California. For this study, two gasoline fuels, E10 and E15 (10% V/V and 15% V/V ethanol), that meet the specifications to be classified as a California Reformulated Gasoline (CaRFG) were tested in a fleet of twenty vehicles from four different technology groups (SULEV30, ULEV50, ULEV70 and ULEV125). Vehicles were tested over triplicate FTP cycles on each of the test fuels. Measurements included NOx, CO, THC, NMHC, CH_4, CO_2, N_2O, NH_3, fuel economy, SPN, BC, formaldehyde, acetaldehyde, 1,3-butadiene, and BTEX. The main findings of this study are summarized below.

- NOx emissions did not show any statistically significant effect between fuels for the weighted FTP and each individual phase. However, NOx emissions trended 7%, 5%, 15%, and 3% lower for E15 compared to E10 over the cold-start, hot-running, hot-start, and weighted FTP, respectively, but not at statistically significant levels.
- Statistically significant and marginally statistically significant reductions in THC and NMHC emissions were seen for E15 compared to E10.
- CO emissions showed statistically significant reductions for E15 for the weighted, cold-start, and hot-start FTP.
- CO_2 emissions showed a marginally statistically significant reduction of 0.3% for E15 compared to E10 over the hot-start phase. Carbon-balance weighted fuel economy showed a statistically significant reduction of 1% for E15 compared to E10 across the fleet of 20 vehicles.
- For the cold-start and hot-running phases, PM mass emissions showed statistically significant reductions of 16% and 54%, respectively, for E15 compared to E10. Hot-start PM mass emissions were 43% lower for E15 compared to E10, at a marginally statistically significant level. The weighted PM mass emissions showed a statistically significant reduction of 18% for E15 compared to E10 across the fleet of 20 vehicles.
- Weighted SPN emissions showed that E15 was 12% lower than E10, at a statistically significant level.
- For ethylbenzene emissions, E15 showed a statistically significant reduction of 11% compared to E10.
- For m/p-xylenes and o-xylene emissions, E15 showed marginally statistically significant reductions of 10% and 9%, respectively, compared to E10.
- Cumulative 1,3-butadiene, benzene, and toluene emissions did not show any statistically significant difference between fuels.
- Ethanol emissions showed a strong, statistically significant increase of 77% for E15 compared to E10.
- Formaldehyde emissions did not show any statistically significant difference between fuels. Acetaldehyde emissions showed a strong, statistically significant increase of 31% for E15 compared to E10 across the fleet of 20 vehicles.

- Calculated NMOG emissions were below the 30 mg/mile standard for all test vehicles. Statistically significant fuel effects were seen for some vehicles, but not for others. Overall, NMOG emissions trended lower for E15 compared to E10.
- The estimated OFP showed some statistically significant fuel effects for some vehicles, but not for others. Overall, a decreasing trend in OFP was observed with E15 compared to E10, indicating that the introduction of E15 in the California gasoline market will likely not contribute to increases in ozone formation.

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Appendix A
Vehicle Inspection Checklist

Vehicle Inspection Report

Veh. No.:_____ VIN:_____

ARRIVAL	ARRIVAL
AGENCY RELEASE	
DELIVERED BY:	

DEPARTURE	DEPARTURE
UCR ENGINEER	
RETURNED TO:	

Engine Compartment

			REMARKS
OIL LEVEL:	☐ FULL	☐ LOW	
COOLANT LEVEL:	☐ FULL	☐ LOW	
POWER STEERING FLUID:	☐ FULL	☐ LOW	
CONDITION OF BELTS:	☐ GOOD	☐ WORN	
CONDITION OF AIR FILTER:	☐ CLEAN	☐ DIRTY	
VISIBLE EXHAUST LEAKS:	☐ YES	☐ NO	
VISIBLE FLUID LEAKS:	☐ YES	☐ NO	
ENGINE APPEARANCE:	☐ CLEAN	☐ GREASY	

Equipment

SERVICE BRAKES:	☐ GOOD	☐ POOR	☐ TOUCHY	
PARKING BRAKES:	☐ GOOD	☐ POOR		
POWER DIVIDER:	☐ GOOD	☐ DEFECTIVE	☐ NOT EQUIPPED	
TRANSMISSION:	☐ NORMAL	☐ SHIFTS HARD	☐ NOISY	
LUG NUT COVERS:	☐ YES	☐ NO	NUMBER MISSING:	
TIRE CONDITIONS:	FRONT		REAR	
	☐ GOOD	☐ WORN	☐ GOOD	☐ WORN
REMARKS:				

Vehicle Interior

UPHOLSTERY:	☐ CLEAN	☐ DIRTY	☐ STAINED	☐ DAMAGED	REMARKS:
CARPET:	☐ CLEAN	☐ DIRTY	☐ STAINED	☐ DAMAGED	REMARKS:
GENERAL APPEARANCE:	☐ CLEAN	☐ DIRTY			REMARKS:
GAUGES AND CONTROLS:	☐ OPERATE PROPERLY	☐ DEFECTIVE			REMARKS:

Vehicle Exterior (describe the location and any dents, scratches, damaged lights, mirrors etc. when the vehicle was received by UCR):

_____

_____

Was this vehicle damaged while in UCR custody? ❒Yes ❒No. If Yes, explain:_____

_____

_____

_____

General Remarks

_____

_____

_____

_____

Appendix B

Individual Test Results for each Test Vehicle

2019MY Dodge Ram1500 – PFI #1

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
THC Emissions (g/mile)	THC-1	0.111	0.131	0.098	0.087	0.090	0.110
	THC-2	0.003	0.003	0.002	0.002	0.003	0.003
	THC-3	0.011	0.013	0.012	0.009	0.010	0.010
	3THC-w	0.028	0.032	0.025	0.022	0.023	0.027
NMHC Emissions (g/mile)	NMHC-1	0.090	0.106	0.078	0.069	0.071	0.087
	NMHC-2	0.001	0.002	0.000	0.001	0.001	0.002
	NMHC-3	0.004	0.004	0.005	0.003	0.003	0.004
	3NMHC-w	0.020	0.024	0.017	0.016	0.016	0.020
CH4 Emissions (g/mile)	CH4-1	0.021	0.025	0.020	0.018	0.019	0.022
	CH4-2	0.002	0.001	0.002	0.001	0.002	0.001
	CH4-3	0.007	0.009	0.007	0.006	0.007	0.006
	3CH4-W	0.007	0.008	0.007	0.006	0.007	0.007
CO Emissions (g/mile)	CO-1	2.243	2.976	2.115	1.921	2.398	2.583
	CO-2	0.003	0.000	0.000	0.000	0.009	0.000
	CO-3	0.433	0.543	0.488	0.191	0.474	0.351
	3CO-w	0.585	0.765	0.572	0.451	0.630	0.633
NOx Emissions (g/mile)	NOx-1	0.058	0.053	0.067	0.063	0.064	0.048
	NOx-2	0.030	0.040	0.046	0.045	0.040	0.050
	NOx-3	0.024	0.065	0.037	0.029	0.035	0.036
	3NOx-w	0.034	0.049	0.048	0.044	0.044	0.045
CO2 Emissions (g/mile)	CO2-1	513.974	506.210	495.645	487.620	498.982	503.044
	CO2-2	494.922	495.185	497.591	525.960	493.064	534.961
	CO2-3	424.093	422.677	418.638	411.412	413.241	420.420
	3CO2-w	479.488	477.607	475.553	486.578	472.420	496.893

Fuel economy-carbon balanced method (miles per gallon)	FE-1	16.440	16.651	17.052	17.005	16.595	16.451
	FE-2	17.201	17.192	17.109	15.871	16.929	15.604
	FE-3	20.041	20.099	20.297	20.274	20.162	19.828
	3FE-w	17.718	17.777	17.866	17.128	17.630	16.763

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.418	0.507	problematic (MSS not sampling)	0.364	0.175	0.232
	PM-soot 2	0.045	0.031	problematic (MSS not sampling)	0.073	0.004	0.020
	PM-soot 3	0.026	0.028	problematic (MSS not sampling)	0.053	0.004	0.021
	3PM-soot-w	0.117	0.129	problematic (MSS not sampling)	0.128	0.040	0.064
PM mass (mg/mile)	PM-1	1.011	0.974	0.785	0.725	0.577	0.276
	PM-2	0.154	0.303	0.337	0.206	0.208	0.000
	PM-3	0.000	0.282	0.243	0.277	0.000	0.000
	3PM mass-w	0.289	0.436	0.404	0.333	0.228	0.057

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	2.14E+12	2.21E+12	1.58E+12	1.56E+12	1.05E+12	1.30E+12
	SPN-2	6.01E+10	2.06E+10	2.61E+10	1.73E+10	1.64E+10	2.46E+10
	SPN-3	3.47E+11	2.51E+11	1.39E+11	7.03E+10	1.13E+11	8.01E+10
	3SPN-w	5.70E+11	5.37E+11	3.79E+11	3.51E+11	2.57E+11	3.05E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	3.606	3.042	2.188	2.020	2.148	2.506
Acetylene	1.322	1.119	0.766	0.685	0.542	0.718
Ethane	1.853	1.627	1.048	0.940	1.131	1.214
Propylene	1.994	2.142	1.512	1.346	1.433	1.858

Propane	0.431	0.661	0.000	0.000	0.000	0.069
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.416	0.385	0.299	0.261	0.291	0.349
1,3-Butadiene	0.259	0.290	0.114	0.233	0.561	0.108
n-Butane	0.226	0.254	0.199	0.198	0.309	0.308
trans-2-Butene	0.185	0.224	0.162	0.132	0.146	0.200
cis-2-Butene	0.223	0.295	0.238	0.146	0.176	0.217
Isopentane	1.689	1.632	0.951	1.059	0.922	1.050
1-Pentene	0.060	0.052	0.038	0.037	0.031	0.038
n-Pentane	0.650	0.622	0.408	0.427	0.395	0.401
Isoprene	0.058	0.048	0.031	0.019	0.030	0.038
trans-2-Pentene	0.093	0.087	0.055	0.055	0.050	0.060
cis-2-Pentene	0.055	0.052	0.034	0.033	0.030	0.036
2,2-Dimethylbutane	0.105	0.117	0.085	0.073	0.078	0.088
Cyclopentane	0.106	0.081	0.053	0.057	0.052	0.061
2,3-Dimethylbutane	0.306	0.295	0.198	0.201	0.189	0.217
2-Methylpentane	0.902	0.826	0.553	0.599	0.544	0.604
3-Methylpentane	0.534	0.514	0.353	0.353	0.224	0.394
1-Hexene	0.081	0.037	0.031	0.000	0.029	0.028
n-Hexane	0.480	0.430	0.305	0.288	0.286	0.326
Methylcyclopentane	0.511	0.615	0.347	0.330	0.330	0.396
2,4-Dimethylpentane	0.332	0.326	0.236	0.228	0.223	0.268
Benzene	1.613	2.597	1.425	1.148	1.486	2.162
Cyclohexane	0.168	0.168	0.119	0.110	0.113	0.134
2-Methylhexane	0.322	0.316	0.239	0.219	0.221	0.277
2,3-Dimethylpentane	0.498	0.509	0.367	0.353	0.361	0.411
3-Methylhexane	0.570	0.388	0.268	0.246	0.250	0.287
2,2,4-Trimethylpentane	0.742	0.747	0.576	0.535	0.569	0.641
n-Heptane	0.225	0.230	0.154	0.135	0.146	0.183
Methylcyclohexane	0.217	0.242	0.176	0.156	0.175	0.194
2,3,4-Trimethylpentane	0.237	0.230	0.188	0.168	0.170	0.205
Toluene	2.361	2.634	1.866	1.594	1.751	2.326
2-Methylheptane	0.200	0.186	0.160	0.144	0.154	0.184
3-Methylheptane	0.174	0.172	0.140	0.125	0.135	0.164

n-Octane	0.151	0.174	0.135	0.120	0.132	0.152
Ethylbenzene	0.416	0.430	0.316	0.279	0.286	0.382
m/p-Xylenes	1.422	1.572	1.064	0.966	1.021	1.467
Styrene	0.000	0.010	0.000	0.000	0.000	0.000
o-Xylene	0.483	0.533	0.358	0.339	0.341	0.500
Nonane	0.084	0.108	0.083	0.071	0.076	0.093
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.046	0.047	0.033	0.030	0.033	0.038
m-Ethyltoluene	0.334	0.362	0.249	0.238	0.237	0.335
p-Ethyltoluene	0.157	0.165	0.112	0.111	0.116	0.148
1,3,5-Trimethylbenzene	0.300	0.266	0.194	0.173	0.194	0.241
o-Ethyltoluene	0.055	0.124	0.288	0.078	0.080	0.138
1,2,4-Trimethylbenzene	0.455	0.514	0.313	0.277	0.283	0.467
n-Decane	0.009	0.031	0.028	0.000	0.008	0.008
1,2,3-Trimethylbenzene	1.517	0.528	0.688	0.650	0.907	0.394
m-Diethylbenzene	2.337	0.721	1.023	1.064	1.423	0.572
p-Diethylbenzene	0.101	0.085	0.051	0.127	0.067	0.026
n-Undecane	0.000	0.212	0.000	0.000	0.000	0.000
n-Dodecane	0.082	0.037	0.072	0.028	0.033	0.000
Ethanol	1.652	2.063	0.000	1.694	1.644	1.609
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.377	0.382	0.364	0.296	0.290	0.383
Acetaldehyde	0.510	0.511	0.412	0.545	0.551	0.638
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.035	0.035	0.035	0.000	0.000	0.000
MEK & Butyraldehyde	0.021	0.016	0.016	0.004	0.008	0.012
Benzaldehyde	0.056	0.041	0.051	0.043	0.039	0.043

Valeraldehyde	0.042	0.000	0.041	0.000	0.000	0.000
m-Tolualdehyde	0.061	0.045	0.000	0.036	0.000	0.000
Hexaldehyde	0.460	0.119	0.236	0.172	0.238	0.089

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.021	0.025	0.018	0.017	0.017	0.021

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.033	0.035	0.032	0.021	0.035	0.033
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.005	0.016	0.010	0.008	0.014	0.008
	3N2O-w	0.008	0.012	0.010	0.007	0.011	0.009
NH3	NH3-1	0.007	0.008	0.005	0.005	0.007	0.018
	NH3-2	0.002	0.002	0.002	0.002	0.004	0.002
	NH3-3	0.003	0.003	0.004	0.002	0.003	0.002
	3NH3-w	0.004	0.003	0.003	0.003	0.005	0.006

OFP

	E10	E15
Total OFP (mg O3/mile)	137.434 ± 31.347	114.908 ± 22.752

2018MY Honda Fit

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.051	0.044	0.041	0.039	0.043	0.013
	THC-2	0.001	0.001	0.001	0.001	0.001	0.003

	THC-3	0.002	0.002	0.003	0.003	0.002	0.002
	3THC-w	0.012	0.010	0.010	0.009	0.010	0.005
NMHC Emissions (g/mile)	NMHC-1	0.042	0.037	0.035	0.032	0.036	0.011
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.003
	NMHC-3	0.001	0.001	0.001	0.001	0.001	0.001
	3NMHC-w	0.009	0.008	0.007	0.007	0.008	0.004
CH4 Emissions (g/mile)	CH4-1	0.008	0.007	0.007	0.007	0.007	0.002
	CH4-2	0.003	0.001	0.001	0.001	0.001	0.000
	CH4-3	0.001	0.001	0.002	0.001	0.001	0.001
	3CH4-W	0.004	0.002	0.002	0.003	0.002	0.001
CO Emissions (g/mile)	CO-1	0.719	0.676	0.719	0.576	0.657	0.102
	CO-2	0.013	0.057	0.208	0.019	0.039	0.024
	CO-3	0.021	0.181	0.191	0.125	0.126	0.072
	3CO-w	0.161	0.219	0.309	0.163	0.191	0.053
NOx Emissions (g/mile)	NOx-1	0.006	0.009	0.012	0.014	0.012	0.007
	NOx-2	0.000	0.000	0.000	0.000	0.000	0.000
	NOx-3	0.001	0.002	0.001	0.001	0.001	0.001
	3NOx-w	0.002	0.003	0.003	0.003	0.003	0.002
CO2 Emissions (g/mile)	CO2-1	249.365	252.123	258.992	240.084	249.881	247.426
	CO2-2	232.468	227.173	235.202	222.212	224.522	225.845
	CO2-3	219.245	214.070	218.064	210.693	212.091	212.994
	3CO2-w	232.337	228.758	235.444	222.759	226.364	226.788
Fuel economy-carbon balanced method (miles per gallon)	FE-1	33.966	33.608	32.713	34.622	33.252	33.710
	FE-2	36.618	37.460	36.146	37.560	37.169	36.954
	FE-3	38.824	39.715	38.986	39.581	39.320	39.170
	3FE-w	36.597	37.155	36.080	37.426	36.823	36.792

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.978	0.901	0.863	0.543	0.650	0.623

	PM-soot 2	0.377	0.319	0.323	0.261	0.208	0.252
	PM-soot 3	0.242	0.221	0.207	0.180	0.158	0.175
	3PM-soot-w	0.464	0.413	0.403	0.297	0.286	0.308
PM mass (mg/mile)	PM-1	4.772	4.489	4.348	2.354	3.208	2.873
	PM-2	0.157	0.600	0.725	0.169	0.179	0.167
	PM-3	0.531	0.757	0.463	0.317	0.297	0.209
	3PM mass-w	1.215	1.449	1.404	0.662	0.839	0.739

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	6.82E+12	6.62E+12	6.41E+12	4.52E+12	5.08E+12	4.70E+12
	SPN-2	2.52E+12	2.04E+12	2.27E+12	1.17E+12	1.04E+12	1.30E+12
	SPN-3	1.54E+12	1.35E+12	1.37E+12	9.23E+11	1.12E+12	1.08E+12
	3SPN-w	3.14E+12	2.80E+12	2.88E+12	1.79E+12	1.90E+12	1.94E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.149	0.946	0.815	0.930	0.980	0.910
Acetylene	0.667	0.399	0.420	0.469	0.503	0.431
Ethane	0.400	0.242	0.223	0.280	0.253	0.276
Propylene	0.873	0.696	0.652	0.640	0.692	0.639
Propane	0.142	0.000	0.000	0.132	0.006	0.055
Isobutane	0.000	0.000	0.000	0.000	0.056	0.072
1-Butene	0.146	0.148	0.121	0.122	0.125	0.127
1,3-Butadiene	0.059	0.022	0.034	0.029	0.041	0.041
n-Butane	0.097	0.070	0.100	0.077	0.057	0.062
trans-2-Butene	0.077	0.068	0.065	0.065	0.068	0.064
cis-2-Butene	0.064	0.062	0.054	0.056	0.056	0.057
Isopentane	0.401	0.353	0.359	0.311	0.329	0.287
1-Pentene	0.019	0.017	0.016	0.015	0.015	0.013
n-Pentane	0.168	0.157	0.175	0.144	0.134	0.113

Isoprene	0.031	0.020	0.020	0.013	0.019	0.016
trans-2-Pentene	0.029	0.026	0.025	0.022	0.025	0.023
cis-2-Pentene	0.017	0.016	0.015	0.013	0.015	0.014
2,2-Dimethylbutane	0.037	0.035	0.029	0.029	0.032	0.027
Cyclopentane	0.029	0.025	0.025	0.024	0.024	0.021
2,3-Dimethylbutane	0.103	0.097	0.094	0.079	0.089	0.075
2-Methylpentane	0.307	0.276	0.264	0.224	0.255	0.214
3-Methylpentane	0.192	0.180	0.171	0.145	0.164	0.139
1-Hexene	0.000	0.011	0.000	0.000	0.000	0.000
n-Hexane	0.164	0.153	0.135	0.125	0.138	0.118
Methylcyclopentane	0.213	0.191	0.181	0.156	0.177	0.151
2,4-Dimethylpentane	0.150	0.140	0.131	0.109	0.129	0.105
Benzene	1.047	0.892	0.860	0.784	0.869	0.787
Cyclohexane	0.076	0.067	0.069	0.054	0.062	0.052
2-Methylhexane	0.179	0.163	0.154	0.122	0.151	0.117
2,3-Dimethylpentane	0.248	0.237	0.228	0.183	0.215	0.171
3-Methylhexane	0.184	0.169	0.163	0.127	0.153	0.113
2,2,4-Trimethylpentane	0.382	0.375	0.370	0.290	0.337	0.265
n-Heptane	0.120	0.112	0.106	0.080	0.102	0.075
Methylcyclohexane	0.114	0.107	0.090	0.081	0.092	0.070
2,3,4-Trimethylpentane	0.132	0.129	0.123	0.098	0.115	0.088
Toluene	1.178	1.009	0.972	0.852	0.981	0.855
2-Methylheptane	0.113	0.108	0.125	0.082	0.098	0.075
3-Methylheptane	0.100	0.096	0.695	0.075	0.087	0.067
n-Octane	0.086	0.084	0.074	0.075	0.076	0.057
Ethylbenzene	0.194	0.172	0.170	0.135	0.162	0.143
m/p-Xylenes	0.624	0.522	0.501	0.420	0.512	0.438
Styrene	0.021	0.005	0.000	0.000	0.007	0.000
o-Xylene	0.209	0.177	0.175	0.140	0.168	0.141
Nonane	0.040	0.039	0.030	0.028	0.034	0.023
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.018	0.017	0.000	0.012	0.014	0.012
m-Ethyltoluene	0.132	0.118	0.082	0.086	0.107	0.087
p-Ethyltoluene	0.056	0.054	0.025	0.038	0.047	0.037

1,3,5-Trimethylbenzene	0.090	0.080	0.063	0.057	0.068	0.048
o-Ethyltoluene	0.048	0.037	0.027	0.028	0.033	0.040
1,2,4-Trimethylbenzene	0.157	0.131	0.123	0.092	0.119	0.091
n-Decane	0.008	0.016	0.000	0.025	0.018	0.014
1,2,3-Trimethylbenzene	0.100	0.108	0.072	0.076	0.037	0.023
m-Diethylbenzene	0.104	0.142	0.058	0.078	0.003	0.000
p-Diethylbenzene	0.006	0.009	0.000	0.002	0.001	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.012	0.000	0.000	0.000	0.000	0.012
Ethanol	0.694	0.481	0.563	1.091	1.089	0.990
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.104	0.081	0.108	0.074	0.075	0.087
Acetaldehyde	0.190	0.155	0.148	0.185	0.222	0.212
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.254	0.276	0.301	0.313	0.307	0.171
Propionaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.019	0.014	0.006	0.009	0.014	0.003
Benzaldehyde	0.015	0.000	0.000	0.000	0.000	0.000
Valeraldehyde	0.017	0.023	0.000	0.000	0.021	0.017
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.017	0.023	0.009	0.013	0.002	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.009	0.008	0.008	0.007	0.008	0.005

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.013	0.020	0.021	0.030	0.032	0.011
	N2O-2	0.000	0.001	0.000	0.000	0.000	0.000
	N2O-3	0.001	0.013	0.010	0.003	0.005	0.005
	3N2O-w	0.003	0.008	0.007	0.007	0.008	0.004
NH3	NH3-1	0.002	0.002	0.001	0.001	0.001	0.001
	NH3-2	0.001	0.001	0.005	0.002	0.003	0.005
	NH3-3	0.003	0.002	0.003	0.005	0.043	0.004
	3NH3-w	0.002	0.001	0.004	0.003	0.014	0.004

OFP

	E10	E15
Total OFP (mg O3/mile)	44.525 ± 8.004	34.386 ± 6.682

2020MY Jeep Compass

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.052	0.053	0.047	0.044	0.051	0.051
	THC-2	0.002	0.001	0.001	0.001	0.002	0.001
	THC-3	0.005	0.003	0.003	0.003	0.004	0.003
	3THC-w	0.013	0.012	0.011	0.011	0.012	0.012
NMHC Emissions (g/mile)	NMHC-1	0.039	0.038	0.034	0.034	0.036	0.037
	NMHC-2	0.001	0.000	0.001	0.000	0.000	0.000
	NMHC-3	0.001	0.000	0.000	0.000	0.001	0.000
	3NMHC-w	0.009	0.008	0.008	0.007	0.008	0.008
CH4 Emissions (g/mile)	CH4-1	0.013	0.015	0.013	0.010	0.014	0.014
	CH4-2	0.001	0.001	0.001	0.001	0.001	0.001
	CH4-3	0.003	0.003	0.003	0.003	0.003	0.003
	3CH4-W	0.004	0.004	0.004	0.003	0.005	0.004

CO Emissions (g/mile)	CO-1	1.691	2.294	1.687	1.283	1.731	1.741
	CO-2	0.131	0.148	0.138	0.244	0.190	0.218
	CO-3	0.560	0.404	0.315	0.355	0.307	0.253
	3CO-w	0.572	0.662	0.508	0.490	0.541	0.543
NOx Emissions (g/mile)	NOx-1	0.007	0.010	0.004	0.004	0.009	0.003
	NOx-2	0.002	0.002	0.001	0.002	0.002	0.002
	NOx-3	0.005	0.004	0.003	0.005	0.003	0.002
	3NOx-w	0.004	0.004	0.002	0.003	0.004	0.002
CO2 Emissions (g/mile)	CO2-1	371.188	393.442	383.242	355.765	367.147	364.265
	CO2-2	361.352	360.932	363.457	354.474	360.273	358.772
	CO2-3	312.558	309.694	307.007	296.342	301.201	299.135
	3CO2-w	349.976	353.598	352.056	338.776	345.489	343.534
Fuel economy-carbon balanced method (miles per gallon)	FE-1	22.763	21.433	22.054	23.323	22.560	22.736
	FE-2	23.546	23.572	23.409	23.523	23.151	23.245
	FE-3	27.160	27.433	27.685	28.115	27.669	27.868
	3FE-w	24.261	24.003	24.125	24.582	24.100	24.236

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run 2	Run 3	Run1	Run 1	Run 2
Black carbon (mg/mile)	PM-soot 1	problematic (MSS not operating, fuse burned)	1.099	1.067	problematic (secondary dilution not operating)	1.095	0.840
	PM-soot 2	problematic (MSS not operating, fuse burned)	0.356	0.422	problematic (secondary dilution not operating)	0.390	0.396
	PM-soot 3	problematic (MSS not operating, fuse burned)	0.229	0.262	problematic (secondary dilution not operating)	0.240	0.243
	3PM-soot-w	problematic (MSS not operating, fuse burned)	0.474	0.512	problematic (secondary dilution not operating)	0.495	0.446
PM mass (mg/mile)	PM-1	6.299	4.890	4.353	2.578	4.516	3.956
	PM-2	0.170	0.000	0.082	0.000	0.106	0.022
	PM-3	0.101	0.029	0.036	0.000	0.000	0.000

	3PM mass-w	1.422	1.019	0.954	0.534	0.988	0.830

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	9.34E+12	8.14E+12	7.52E+12	5.24E+12	7.20E+12	6.41E+12
	SPN-2	6.01E+11	4.91E+11	7.56E+11	4.85E+11	6.84E+11	6.00E+11
	SPN-3	3.59E+11	4.18E+11	3.39E+11	2.29E+11	2.03E+11	1.93E+11
	3SPN-w	2.35E+12	2.05E+12	2.04E+12	1.40E+12	1.90E+12	1.69E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.025	0.638	0.895	0.801	0.917	0.923
Acetylene	0.295	0.238	0.362	0.266	0.625	0.514
Ethane	0.558	0.338	0.451	0.280	0.556	0.434
Propylene	0.844	0.527	0.728	0.578	0.709	0.693
Propane	0.151	0.100	0.159	0.000	0.174	0.187
Isobutane	0.000	0.000	0.000	0.000	0.000	0.071
1-Butene	0.138	0.080	0.112	0.101	0.116	0.103
1,3-Butadiene	0.011	0.072	0.041	0.038	0.044	0.040
n-Butane	0.147	0.137	0.135	0.159	0.166	0.135
trans-2-Butene	0.085	0.053	0.071	0.062	0.071	0.066
cis-2-Butene	0.067	0.041	0.057	0.052	0.057	0.052
Isopentane	0.531	0.649	0.466	0.623	0.589	0.772
1-Pentene	0.020	0.000	0.000	0.000	0.000	0.019
n-Pentane	0.237	0.246	0.225	0.272	0.259	0.296
Isoprene	0.014	0.011	0.016	0.013	0.017	0.017
trans-2-Pentene	0.034	0.035	0.031	0.038	0.034	0.042
cis-2-Pentene	0.019	0.020	0.000	0.022	0.020	0.024
2,2-Dimethylbutane	0.045	0.048	0.040	0.046	0.044	0.050
Cyclopentane	0.034	0.037	0.031	0.038	0.037	0.044
2,3-Dimethylbutane	0.117	0.120	0.105	0.126	0.118	0.135

2-Methylpentane	0.330	0.324	0.293	0.352	0.328	0.371
3-Methylpentane	0.210	0.261	0.182	0.219	0.207	0.229
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.170	0.156	0.149	0.176	0.166	0.179
Methylcyclopentane	0.214	0.188	0.188	0.219	0.207	0.225
2,4-Dimethylpentane	0.143	0.126	0.124	0.139	0.135	0.139
Benzene	0.826	0.527	0.694	0.569	0.684	0.690
Cyclohexane	0.072	0.060	0.062	0.071	0.068	0.072
2-Methylhexane	0.136	0.105	0.113	0.126	0.128	0.126
2,3-Dimethylpentane	0.208	0.176	0.182	0.200	0.197	0.197
3-Methylhexane	0.137	0.098	0.127	0.119	0.135	0.117
2,2,4-Trimethylpentane	0.320	0.262	0.277	0.292	0.302	0.289
n-Heptane	0.078	0.048	0.063	0.061	0.075	0.068
Methylcyclohexane	0.091	0.050	0.073	0.080	0.079	0.075
2,3,4-Trimethylpentane	0.100	0.077	0.086	0.088	0.094	0.088
Toluene	0.968	0.675	0.874	0.773	1.050	0.844
2-Methylheptane	0.090	0.067	0.075	0.074	0.082	0.075
3-Methylheptane	0.079	0.060	0.073	0.065	0.073	0.066
n-Octane	0.078	0.058	0.073	0.066	0.081	0.071
Ethylbenzene	0.167	0.117	0.152	0.127	0.156	0.150
m/p-Xylenes	0.526	0.380	0.481	0.399	0.497	0.481
Styrene	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	0.174	0.125	0.158	0.131	0.159	0.154
Nonane	0.035	0.030	0.032	0.027	0.032	0.029
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
m-Ethyltoluene	0.117	0.090	0.106	0.087	0.103	0.101
p-Ethyltoluene	0.053	0.042	0.055	0.042	0.049	0.047
1,3,5-Trimethylbenzene	0.082	0.044	0.063	0.052	0.061	0.055
o-Ethyltoluene	0.043	0.029	0.159	0.024	0.033	0.031
1,2,4-Trimethylbenzene	0.125	0.096	0.117	0.088	0.106	0.106
n-Decane	0.023	0.004	0.020	0.026	0.046	0.044
1,2,3-Trimethylbenzene	0.269	0.031	0.216	0.251	0.191	0.141
m-Diethylbenzene	0.423	0.000	0.264	0.381	0.213	0.185

p-Diethylbenzene	0.026	0.000	0.011	0.018	0.004	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.022	0.000	0.034	0.000	0.019	0.023
Ethanol	0.000	0.506	0.649	1.335	1.632	1.666
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.064	0.020	0.055	0.111	0.125	0.066
Acetaldehyde	0.214	0.233	0.225	0.279	0.348	0.268
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.097	0.196	0.347	0.440	0.625	0.165
Propionaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.005	0.000	0.011	0.000	0.007	0.000
Benzaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.058	0.003	0.050	0.067	0.051	0.025

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.009	0.008	0.008	0.008	0.009	0.009

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.023	0.021	0.024	0.012	0.038	0.025
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.003	0.004	0.008	0.001	0.005	0.001
	3N2O-w	0.006	0.005	0.007	0.003	0.009	0.006

NH3	NH3-1	0.004	0.004	0.004	0.005	0.007	0.012
	NH3-2	0.001	0.035	0.002	0.002	0.002	0.003
	NH3-3	0.001	0.009	0.006	0.007	0.007	0.002
	3NH3-w	0.002	0.022	0.004	0.004	0.005	0.004

OFP

	E10	E15
Total OFP (mg O3/mile)	63.072 ± 10.961	63.407 ± 5.860

2016MY Nissan Rogue

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.070	0.075	0.080	0.081	0.071	0.069
	THC-2	0.001	0.001	0.001	0.002	0.001	0.001
	THC-3	0.008	0.008	0.009	0.008	0.009	0.008
	3THC-w	0.017	0.018	0.019	0.020	0.018	0.017
NMHC Emissions (g/mile)	NMHC-1	0.063	0.067	0.071	0.073	0.062	0.062
	NMHC-2	0.000	0.001	0.000	0.001	0.000	0.000
	NMHC-3	0.004	0.004	0.004	0.004	0.005	0.004
	3NMHC-w	0.014	0.015	0.016	0.017	0.014	0.014
CH4 Emissions (g/mile)	CH4-1	0.008	0.008	0.009	0.008	0.009	0.008
	CH4-2	0.001	0.001	0.000	0.001	0.001	0.001
	CH4-3	0.004	0.004	0.005	0.004	0.005	0.004
	3CH4-W	0.003	0.003	0.003	0.003	0.004	0.003
CO Emissions (g/mile)	CO-1	0.680	0.831	0.809	0.766	0.791	0.610
	CO-2	0.049	0.109	0.024	0.023	0.010	0.000
	CO-3	0.468	0.462	0.543	0.452	0.439	0.472

	3CO-w	0.296	0.355	0.329	0.295	0.290	0.256
NOx Emissions (g/mile)	NOx-1	0.055	0.060	0.082	0.041	0.037	0.046
	NOx-2	0.000	0.001	0.000	0.000	0.000	0.000
	NOx-3	0.004	0.011	0.011	0.000	0.000	0.000
	3NOx-w	0.013	0.016	0.020	0.009	0.008	0.010
CO2 Emissions (g/mile)	CO2-1	316.785	313.073	317.639	306.398	314.439	323.699
	CO2-2	299.331	296.412	294.582	289.652	300.738	305.213
	CO2-3	273.936	273.423	269.372	250.764	271.512	272.936
	3CO2-w	295.968	293.557	292.445	282.439	295.544	300.170
Fuel economy-carbon balanced method (miles per gallon)	FE-1	27.116	26.425	25.696	26.766	27.061	26.675
	FE-2	28.815	27.755	27.350	28.434	28.705	28.896
	FE-3	33.191	30.664	30.499	30.992	31.051	31.502
	3FE-w	29.501	28.196	27.767	28.714	28.940	29.054

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.099	0.066	0.120	0.090	0.087	0.141
	PM-soot 2	0.027	0.018	0.033	0.031	0.036	0.023
	PM-soot 3	0.024	0.019	0.028	0.030	0.031	0.024
	3PM-soot-w	0.041	0.028	0.050	0.043	0.045	0.048
PM mass (mg/mile)	PM-1	0.212	0.176	0.169	0.016	0.256	0.115
	PM-2	0.079	0.097	0.000	0.000	0.016	0.000
	PM-3	0.000	0.051	0.024	0.001	0.000	0.000
	3PM mass-w	0.085	0.101	0.042	0.004	0.061	0.024

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	4.68E+11	3.16E+11	3.89E+11	3.55E+11	3.46E+11	4.86E+11
	SPN-2	8.57E+09	4.43E+09	9.30E+09	1.40E+10	2.69E+10	1.28E+10
	SPN-3	1.39E+10	1.24E+10	1.56E+10	1.91E+10	2.75E+10	2.19E+10

	3SPN-w	1.06E+11	7.12E+10	8.98E+10	8.64E+10	9.33E+10	1.14E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.377	1.304	1.530	1.327	1.286	1.328
Acetylene	1.101	1.235	0.784	0.927	1.082	0.858
Ethane	0.686	0.538	0.658	0.688	0.539	0.558
Propylene	1.038	0.999	1.161	0.925	0.895	0.978
Propane	0.133	0.000	0.043	0.251	0.000	0.025
Isobutane	0.000	0.000	0.000	0.000	0.383	0.146
1-Butene	0.162	0.153	0.181	0.145	0.143	0.151
1,3-Butadiene	0.056	0.000	0.080	0.101	0.076	0.312
n-Butane	0.121	0.093	0.108	0.276	0.261	0.242
trans-2-Butene	0.078	0.079	0.090	0.077	0.074	0.082
cis-2-Butene	0.058	0.060	0.068	0.059	0.059	0.059
Isopentane	1.204	1.263	1.371	1.908	1.249	1.177
1-Pentene	0.037	0.035	0.038	0.049	0.036	0.038
n-Pentane	0.488	0.445	0.502	0.686	0.524	0.422
Isoprene	0.060	0.037	0.074	0.055	0.051	0.056
trans-2-Pentene	0.057	0.057	0.063	0.091	0.056	0.056
cis-2-Pentene	0.033	0.033	0.037	0.052	0.032	0.033
2,2-Dimethylbutane	0.098	0.083	0.111	0.137	0.102	0.097
Cyclopentane	0.073	0.075	0.078	0.099	0.072	0.070
2,3-Dimethylbutane	0.261	0.179	0.300	0.373	0.275	0.259
2-Methylpentane	0.715	0.418	0.827	1.011	0.747	0.829
3-Methylpentane	0.455	0.276	0.528	0.637	0.475	0.492
1-Hexene	0.000	0.000	0.000	0.024	0.020	0.000
n-Hexane	0.357	0.131	0.416	0.494	0.375	0.359
Methylcyclopentane	0.443	0.387	0.519	0.614	0.462	0.472
2,4-Dimethylpentane	0.312	0.045	0.359	0.398	0.316	0.303
Benzene	0.754	0.200	0.842	0.691	0.752	0.771
Cyclohexane	0.148	0.130	0.173	0.200	0.157	0.150
2-Methylhexane	0.339	0.000	0.401	0.435	0.347	0.334

2,3-Dimethylpentane	0.496	0.029	0.580	0.625	0.512	0.478
3-Methylhexane	0.343	0.000	0.403	0.479	0.369	0.401
2,2,4-Trimethylpentane	0.712	0.032	0.834	0.858	0.737	0.726
n-Heptane	0.199	0.000	0.239	0.277	0.214	0.198
Methylcyclohexane	0.191	0.000	0.230	0.276	0.231	0.201
2,3,4-Trimethylpentane	0.230	0.000	0.266	0.270	0.243	0.230
Toluene	3.382	0.000	1.415	1.353	1.256	1.220
2-Methylheptane	0.167	0.000	0.210	0.208	0.188	0.195
3-Methylheptane	0.162	0.000	0.187	0.184	0.171	0.164
n-Octane	0.129	0.000	0.149	0.160	0.166	0.140
Ethylbenzene	0.254	0.000	0.294	0.259	0.232	0.237
m/p-Xylenes	0.850	0.000	0.995	0.863	0.778	0.798
Styrene	0.012	0.000	0.016	0.000	0.000	0.001
o-Xylene	0.290	0.000	0.341	0.298	0.266	0.276
Nonane	0.058	0.000	0.068	0.063	0.056	0.063
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.032	0.000	0.038	0.035	0.031	0.031
m-Ethyltoluene	0.209	0.000	0.250	0.200	0.182	0.190
p-Ethyltoluene	0.102	0.000	0.123	0.098	0.093	0.096
1,3,5-Trimethylbenzene	0.120	0.000	0.148	0.150	0.138	0.116
o-Ethyltoluene	0.062	0.000	0.064	0.052	0.047	0.048
1,2,4-Trimethylbenzene	0.249	0.000	0.300	0.221	0.200	0.219
n-Decane	0.036	0.000	0.030	0.051	0.105	0.063
1,2,3-Trimethylbenzene	0.047	0.000	0.047	0.529	0.496	0.156
m-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
p-Diethylbenzene	0.000	0.000	0.000	0.066	0.070	0.015
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.000	0.000	0.032	0.000	0.043	0.000
Ethanol	1.039	1.223	1.370	3.121	2.222	2.039
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3

Formaldehyde	0.337	0.254	0.297	0.300	0.419	0.349
Acetaldehyde	0.451	0.423	0.459	0.592	0.561	0.600
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.339	0.058	0.045	0.524	0.290	0.315
Propionaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.028	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.022	0.007	0.004	0.003	0.000	0.000
Benzaldehyde	0.038	0.036	0.040	0.026	0.028	0.031
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.027	0.000	0.106	0.076	0.004

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.015	0.016	0.017	0.018	0.016	0.015

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.134	0.130	0.217	0.153	0.101	0.083
	N2O-2	0.011	0.003	0.000	0.000	0.000	0.000
	N2O-3	0.019	0.035	0.042	0.010	0.000	0.017
	3N2O-w	0.039	0.038	0.057	0.034	0.021	0.022
NH3	NH3-1	0.001	0.006	0.002	0.007	0.014	0.005
	NH3-2	0.003	0.001	0.004	0.001	0.001	0.001
	NH3-3	0.004	0.003	0.006	0.025	0.002	0.002
	3NH3-w	0.003	0.003	0.004	0.009	0.004	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	72.396 ± 13.385	78.596 ± 10.443

2019MY Toyota Rav4

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.068	0.071	0.075	0.068	0.073	0.073
	THC-2	0.001	0.002	0.002	0.002	0.002	0.002
	THC-3	0.006	0.005	0.007	0.006	0.007	0.007
	3THC-w	0.017	0.017	0.018	0.017	0.018	0.018
NMHC Emissions (g/mile)	NMHC-1	0.056	0.058	0.061	0.056	0.059	0.059
	NMHC-2	0.000	0.000	0.001	0.000	0.000	0.000
	NMHC-3	0.002	0.001	0.003	0.002	0.002	0.002
	3NMHC-w	0.012	0.012	0.014	0.012	0.013	0.013
CH4 Emissions (g/mile)	CH4-1	0.012	0.012	0.014	0.012	0.014	0.014
	CH4-2	0.001	0.002	0.001	0.002	0.002	0.002
	CH4-3	0.005	0.004	0.005	0.004	0.005	0.005
	3CH4-W	0.004	0.005	0.005	0.005	0.005	0.005
CO Emissions (g/mile)	CO-1	1.122	1.268	1.449	1.255	1.259	1.278
	CO-2	0.000	0.000	0.000	0.018	0.000	0.000
	CO-3	0.000	0.000	0.000	0.081	0.000	0.036
	3CO-w	0.233	0.263	0.300	0.291	0.261	0.275
NOx Emissions (g/mile)	NOx-1	0.006	0.006	0.006	0.007	0.006	0.005
	NOx-2	0.003	0.004	0.003	0.003	0.004	0.004
	NOx-3	0.002	0.005	0.002	0.002	0.002	0.002
	3NOx-w	0.004	0.004	0.004	0.004	0.004	0.004
CO2 Emissions (g/mile)	CO2-1	278.183	276.321	274.536	271.206	274.465	274.590
	CO2-2	269.736	269.301	265.573	263.781	268.712	267.625
	CO2-3	242.529	240.782	239.129	238.280	238.709	239.592
	3CO2-w	264.012	262.914	260.179	258.323	261.655	261.372
Fuel economy-carbon balanced method (miles per gallon)	FE-1	30.389	30.566	30.730	30.535	30.173	30.156
	FE-2	31.562	31.613	32.056	31.642	31.065	31.191
	FE-3	35.100	35.355	35.599	35.011	34.967	34.830

	3FE-w	32.196	32.324	32.655	32.251	31.847	31.878

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.116	0.099	0.108	0.103	0.115	0.102
	PM-soot 2	0.079	0.074	0.068	0.033	0.030	0.037
	PM-soot 3	0.058	0.037	0.040	0.019	0.017	0.024
	3PM-soot-w	0.081	0.069	0.069	0.044	0.044	0.047
PM mass (mg/mile)	PM-1	0.041	0.148	0.062	0.362	0.052	0.195
	PM-2	0.063	0.026	0.056	0.000	0.012	0.000
	PM-3	0.000	0.062	0.161	0.060	0.000	0.012
	3PM mass-w	0.041	0.061	0.086	0.092	0.017	0.044

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	9.45E+11	9.35E+11	1.12E+12	9.87E+11	1.05E+12	9.00E+11
	SPN-2	1.30E+12	1.29E+12	1.22E+12	6.91E+11	7.17E+11	7.42E+11
	SPN-3	7.40E+11	5.86E+11	6.63E+11	2.71E+11	2.90E+11	4.34E+11
	3SPN-w	1.07E+12	1.02E+12	1.05E+12	6.37E+11	6.69E+11	6.90E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	2.518	2.580	2.744	2.612	1.871	2.579
Acetylene	0.971	1.013	0.879	0.942	0.945	0.958
Ethane	0.615	0.598	0.828	0.743	0.296	0.643
Propylene	1.484	1.531	1.610	1.429	1.515	1.516
Propane	0.037	0.000	0.244	0.261	0.000	0.032
Isobutane	0.226	0.109	0.000	0.000	0.000	0.000
1-Butene	0.275	0.264	0.278	0.269	0.265	0.256
1,3-Butadiene	0.072	0.105	0.063	0.059	0.070	0.057

n-Butane	0.181	0.156	0.040	0.056	0.022	0.074
trans-2-Butene	0.199	0.210	0.240	0.208	0.203	0.207
cis-2-Butene	0.181	0.183	0.212	0.196	0.180	0.183
Isopentane	0.394	0.450	0.429	0.368	0.400	0.440
1-Pentene	0.022	0.023	0.023	0.021	0.000	0.023
n-Pentane	0.160	0.182	0.156	0.171	0.158	0.188
Isoprene	0.024	0.029	0.026	0.022	0.024	0.026
trans-2-Pentene	0.035	0.039	0.042	0.035	0.036	0.038
cis-2-Pentene	0.021	0.023	0.024	0.021	0.022	0.023
2,2-Dimethylbutane	0.038	0.041	0.042	0.033	0.040	0.041
Cyclopentane	0.035	0.039	0.036	0.029	0.031	0.036
2,3-Dimethylbutane	0.094	0.108	0.106	0.085	0.104	0.106
2-Methylpentane	0.263	0.310	0.294	0.246	0.289	0.292
3-Methylpentane	0.169	0.197	0.194	0.169	0.185	0.192
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.154	0.167	0.169	0.173	0.165	0.165
Methylcyclopentane	0.184	0.202	0.203	0.178	0.198	0.201
2,4-Dimethylpentane	0.128	0.151	0.147	0.119	0.145	0.142
Benzene	1.359	1.355	1.361	1.233	1.364	1.300
Cyclohexane	0.068	0.084	0.074	0.063	0.071	0.072
2-Methylhexane	0.126	0.160	0.148	0.115	0.145	0.142
2,3-Dimethylpentane	0.199	0.229	0.226	0.179	0.218	0.218
3-Methylhexane	0.143	0.164	0.148	0.103	0.136	0.138
2,2,4-Trimethylpentane	0.324	0.357	0.364	0.299	0.358	0.356
n-Heptane	0.073	0.089	0.092	0.059	0.090	0.087
Methylcyclohexane	0.086	0.093	0.103	0.076	0.082	0.097
2,3,4-Trimethylpentane	0.105	0.115	0.120	0.099	0.117	0.116
Toluene	1.890	1.911	1.967	1.773	1.918	1.948
2-Methylheptane	0.099	0.214	0.108	0.091	0.104	0.103
3-Methylheptane	0.089	0.157	0.096	0.081	0.094	0.092
n-Octane	0.090	0.135	0.095	0.084	0.083	0.087
Ethylbenzene	0.280	0.277	0.322	0.290	0.295	0.301
m/p-Xylenes	1.012	0.971	1.117	0.981	1.050	1.075
Styrene	0.016	0.006	0.021	0.016	0.018	0.029

o-Xylene	0.300	0.289	0.333	0.293	0.314	0.320
Nonane	0.038	0.032	0.039	0.036	0.040	0.042
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.024	0.000	0.027	0.021	0.023	0.024
m-Ethyltoluene	0.191	0.167	0.222	0.195	0.203	0.208
p-Ethyltoluene	0.095	0.082	0.109	0.095	0.098	0.099
1,3,5-Trimethylbenzene	0.112	0.065	0.132	0.110	0.109	0.120
o-Ethyltoluene	0.072	0.043	0.054	0.042	0.066	0.136
1,2,4-Trimethylbenzene	0.235	0.170	0.271	0.231	0.249	0.269
n-Decane	0.052	0.000	0.071	0.058	0.025	0.035
1,2,3-Trimethylbenzene	0.177	0.000	0.225	0.174	0.030	0.083
m-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
p-Diethylbenzene	0.020	0.000	0.031	0.021	0.000	0.006
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.024	0.000	0.029	0.000	0.021	0.000
Ethanol	0.642	0.492	0.377	0.726	0.735	0.960
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.215	0.152	0.090	0.117	0.074	0.165
Acetaldehyde	0.246	0.276	0.256	0.353	0.377	0.406
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.234	0.513	0.000	0.130	0.029	0.129
Propionaldehyde	0.000	0.028	0.000	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.016	0.000	0.000	0.003	0.000
Benzaldehyde	0.031	0.032	0.065	0.033	0.034	0.025
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.034	0.029	0.000	0.004

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.013	0.013	0.014	0.012	0.013	0.013

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.075	0.037	0.052	0.038	0.027	0.052
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.000	0.004	0.002	0.004	0.001	0.002
	3N2O-w	0.016	0.009	0.011	0.009	0.006	0.011
NH3	NH3-1	0.019	0.010	0.006	0.002	0.012	0.006
	NH3-2	0.003	0.002	0.001	0.001	0.007	0.001
	NH3-3	0.003	0.003	0.002	0.001	0.004	0.002
	3NH3-w	0.006	0.004	0.002	0.001	0.007	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	65.692 ± 7.465	65.705 ± 4.458

2018MY Honda Civic

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.056	0.050	0.052	0.055	0.057	0.058
	THC-2	0.002	0.002	0.002	0.002	0.002	0.002

	THC-3	0.005	0.005	0.005	0.005	0.005	0.005
	3THC-w	0.014	0.013	0.013	0.014	0.014	0.014
NMHC Emissions (g/mile)	NMHC-1	0.042	0.036	0.038	0.040	0.042	0.043
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.001	0.000	0.000	0.000	0.000	0.001
	3NMHC-w	0.009	0.008	0.008	0.008	0.009	0.009
CH4 Emissions (g/mile)	CH4-1	0.014	0.014	0.014	0.015	0.015	0.015
	CH4-2	0.002	0.002	0.002	0.002	0.002	0.002
	CH4-3	0.004	0.004	0.004	0.005	0.005	0.004
	3CH4-W	0.005	0.005	0.005	0.005	0.005	0.005
CO Emissions (g/mile)	CO-1	0.551	0.564	0.547	0.576	0.594	0.671
	CO-2	0.000	0.004	0.000	0.051	0.019	0.000
	CO-3	0.137	0.087	0.075	0.055	0.096	0.076
	3CO-w	0.152	0.143	0.134	0.161	0.159	0.159
NOx Emissions (g/mile)	NOx-1	0.033	0.040	0.029	0.021	0.033	0.027
	NOx-2	0.008	0.012	0.009	0.007	0.008	0.011
	NOx-3	0.004	0.006	0.005	0.004	0.004	0.005
	3NOx-w	0.012	0.016	0.012	0.009	0.012	0.012
CO2 Emissions (g/mile)	CO2-1	249.307	246.154	250.288	251.998	247.922	243.396
	CO2-2	259.711	266.573	259.234	258.285	259.830	257.230
	CO2-3	217.897	217.610	222.404	218.164	221.817	220.333
	3CO2-w	246.056	248.902	247.297	245.979	246.973	244.301
Fuel economy-carbon balanced method (miles per gallon)	FE-1	32.986	33.521	34.124	34.007	34.441	33.877
	FE-2	32.309	32.123	32.451	32.780	31.935	32.840
	FE-3	38.245	37.604	37.863	39.030	39.095	38.257
	3FE-w	33.896	33.760	34.128	34.560	34.168	34.391

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	1.996	1.373	0.540	1.930	1.207	1.061

	PM-soot 2	0.083	0.124	0.084	0.082	0.087	0.093
	PM-soot 3	0.099	0.173	0.112	0.116	0.198	0.106
	3PM-soot-w	0.484	0.396	0.186	0.474	0.348	0.296
PM mass (mg/mile)	PM-1	2.460	1.653	2.671	2.113	1.559	1.302
	PM-2	0.079	0.121	0.236	0.080	0.103	0.123
	PM-3	0.166	0.324	0.252	0.241	0.426	0.156
	3PM mass-w	0.596	0.494	0.744	0.545	0.492	0.375

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	4.69E+12	3.48E+12	1.30E+12	3.55E+12	3.15E+12	3.06E+12
	SPN-2	3.96E+11	6.29E+11	3.50E+11	3.63E+11	4.20E+11	3.96E+11
	SPN-3	3.46E+11	4.51E+11	3.24E+11	2.72E+11	3.74E+11	3.41E+11
	3SPN-w	1.27E+12	1.17E+12	5.39E+11	9.98E+11	9.70E+11	9.31E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.301	0.980	0.687	0.832	0.729	0.786
Acetylene	0.342	0.201	0.303	0.395	0.425	0.445
Ethane	0.691	0.511	0.462	0.466	0.386	0.469
Propylene	0.528	0.375	0.489	0.573	0.487	0.528
Propane	0.132	0.000	0.221	0.021	0.000	0.065
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.081	0.053	0.066	0.087	0.071	0.080
1,3-Butadiene	0.049	0.000	0.023	0.096	0.068	0.054
n-Butane	0.058	0.043	0.050	0.066	0.055	0.059
trans-2-Butene	0.047	0.036	0.042	0.050	0.045	0.048
cis-2-Butene	0.037	0.028	0.033	0.040	0.036	0.039
Isopentane	0.890	0.817	0.755	0.813	0.883	0.812
1-Pentene	0.016	0.012	0.011	0.016	0.015	0.014
n-Pentane	0.307	0.289	0.268	0.284	0.317	0.286

Isoprene	0.019	0.007	0.013	0.020	0.016	0.014
trans-2-Pentene	0.026	0.020	0.022	0.026	0.026	0.024
cis-2-Pentene	0.015	0.011	0.012	0.015	0.015	0.014
2,2-Dimethylbutane	0.072	0.069	0.066	0.068	0.075	0.068
Cyclopentane	0.043	0.040	0.037	0.046	0.044	0.041
2,3-Dimethylbutane	0.183	0.168	0.164	0.164	0.189	0.173
2-Methylpentane	0.488	0.445	0.437	0.441	0.502	0.465
3-Methylpentane	0.313	0.284	0.280	0.277	0.321	0.297
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.240	0.216	0.221	0.208	0.251	0.231
Methylcyclopentane	0.287	0.258	0.258	0.255	0.296	0.273
2,4-Dimethylpentane	0.214	0.160	0.191	0.171	0.223	0.202
Benzene	0.602	0.461	0.576	0.505	0.567	0.622
Cyclohexane	0.097	0.087	0.087	0.087	0.101	0.093
2-Methylhexane	0.237	0.144	0.209	0.159	0.250	0.228
2,3-Dimethylpentane	0.358	0.238	0.317	0.253	0.369	0.337
3-Methylhexane	0.238	0.137	0.218	0.153	0.256	0.234
2,2,4-Trimethylpentane	0.530	0.236	0.468	0.307	0.549	0.503
n-Heptane	0.151	0.061	0.130	0.071	0.156	0.143
Methylcyclohexane	0.141	0.095	0.115	0.092	0.136	0.131
2,3,4-Trimethylpentane	0.176	0.044	0.150	0.065	0.181	0.165
Toluene	0.665	0.342	0.591	0.223	0.678	0.717
2-Methylheptane	0.132	0.017	0.111	0.031	0.132	0.121
3-Methylheptane	0.119	0.018	0.099	0.027	0.119	0.108
n-Octane	0.097	0.000	0.081	0.000	0.091	0.087
Ethylbenzene	0.122	0.016	0.092	0.013	0.115	0.117
m/p-Xylenes	0.444	0.044	0.343	0.020	0.430	0.415
Styrene	0.003	0.000	0.000	0.000	0.000	0.000
o-Xylene	0.156	0.012	0.118	0.000	0.151	0.143
Nonane	0.045	0.000	0.032	0.000	0.043	0.038
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.013	0.000	0.000	0.000	0.012	0.011
m-Ethyltoluene	0.097	0.000	0.061	0.000	0.082	0.077
p-Ethyltoluene	0.047	0.000	0.029	0.000	0.039	0.038

1,3,5-Trimethylbenzene	0.086	0.000	0.053	0.000	0.073	0.063
o-Ethyltoluene	0.028	0.000	0.026	0.000	0.023	0.019
1,2,4-Trimethylbenzene	0.138	0.000	0.089	0.000	0.126	0.104
n-Decane	0.035	0.000	0.025	0.000	0.017	0.019
1,2,3-Trimethylbenzene	0.138	0.000	0.008	0.000	0.009	0.037
m-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
p-Diethylbenzene	0.025	0.000	0.000	0.000	0.000	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.000	0.000	0.020	0.000	0.000	0.000
Ethanol	0.316	0.141	0.219	0.621	0.459	0.548
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.286	0.140	0.202	0.242	0.184	0.245
Acetaldehyde	0.278	0.198	0.245	0.325	0.307	0.358
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.009	0.000	0.000	0.024	0.000	0.000
Propionaldehyde	0.019	0.016	0.017	0.018	0.000	0.020
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.017	0.016	0.016	0.000	0.000	0.000
MEK & Butyraldehyde	0.020	0.016	0.010	0.010	0.001	0.011
Benzaldehyde	0.024	0.015	0.016	0.019	0.021	0.020
Valeraldehyde	0.000	0.000	0.017	0.000	0.000	0.016
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.008	0.010	0.000	0.000	0.000	0.011

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.009	0.008	0.008	0.009	0.009	0.010

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.081	0.084	0.113	0.100	0.078	0.072
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.001	0.001	0.001	0.000	0.000	0.000
	3N2O-w	0.017	0.018	0.024	0.021	0.016	0.015
NH3	NH3-1	0.004	0.002	0.006	0.002	0.004	0.001
	NH3-2	0.002	0.001	0.003	0.003	0.002	0.001
	NH3-3	0.002	0.001	0.002	0.001	0.001	0.001
	3NH3-w	0.002	0.001	0.003	0.002	0.002	0.001

OFP

	E10	E15
Total OFP (mg O3/mile)	33.625 ± 7.251	36.910 ± 5.066

2016MY Mazda3

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.029	0.035	0.038	0.030	0.038	0.039
	THC-2	0.001	0.001	0.001	0.001	0.000	0.001
	THC-3	0.008	0.008	0.009	0.007	0.005	0.007
	3THC-w	0.009	0.010	0.011	0.009	0.010	0.010
NMHC Emissions (g/mile)	NMHC-1	0.021	0.026	0.028	0.023	0.029	0.031
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.001	0.001	0.001	0.001	0.001	0.001

	3NMHC-w	0.005	0.006	0.006	0.005	0.006	0.007
CH4 Emissions (g/mile)	CH4-1	0.008	0.009	0.010	0.006	0.009	0.008
	CH4-2	0.001	0.001	0.001	0.001	0.001	0.001
	CH4-3	0.007	0.006	0.008	0.006	0.004	0.005
	3CH4-W	0.004	0.004	0.005	0.003	0.004	0.004
CO Emissions (g/mile)	CO-1	0.196	0.250	0.259	0.187	0.343	0.316
	CO-2	0.000	0.000	0.000	0.021	0.000	0.000
	CO-3	0.001	0.025	0.023	0.031	0.005	0.007
	3CO-w	0.041	0.059	0.060	0.058	0.072	0.067
NOx Emissions (g/mile)	NOx-1	0.014	0.016	0.015	0.022	0.015	0.012
	NOx-2	0.009	0.010	0.010	0.013	0.012	0.011
	NOx-3	0.010	0.012	0.011	0.009	0.010	0.014
	3NOx-w	0.010	0.012	0.011	0.014	0.012	0.012
CO2 Emissions (g/mile)	CO2-1	242.479	258.155	253.165	259.585	267.505	258.679
	CO2-2	235.109	238.981	238.463	249.290	255.458	251.715
	CO2-3	210.566	219.706	220.153	217.975	218.215	218.668
	3CO2-w	229.902	237.663	236.480	242.835	247.729	244.091
Fuel economy-carbon balanced method (miles per gallon)	FE-1	32.110	31.129	32.194	35.052	32.915	33.559
	FE-2	33.481	32.677	33.162	36.210	35.623	35.701
	FE-3	38.284	38.250	38.169	40.426	38.738	38.659
	3FE-w	34.359	33.677	34.180	37.016	35.803	35.981

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	3.814	4.910	5.643	4.303	4.575	3.869
	PM-soot 2	0.059	0.071	0.105	0.062	0.071	0.046
	PM-soot 3	0.377	0.330	0.150	0.216	0.155	0.100
	3PM-soot-w	0.923	1.144	1.264	0.982	1.027	0.852
PM mass (mg/mile)	PM-1	4.057	5.338	6.026	4.714	4.876	4.469
	PM-2	0.020	0.028	0.073	0.000	0.071	0.076

	PM-3	0.453	0.488	0.269	0.307	0.317	0.285
	3PM mass-w	0.974	1.254	1.359	1.060	1.134	1.043

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	5.07E+12	6.60E+12	7.11E+12	6.09E+12	7.01E+12	5.87E+12
	SPN-2	2.94E+11	3.15E+11	4.05E+11	2.48E+11	2.45E+11	1.82E+11
	SPN-3	1.13E+12	9.83E+11	5.23E+11	6.63E+11	4.99E+11	2.89E+11
	3SPN-w	1.51E+12	1.80E+12	1.82E+12	1.57E+12	1.72E+12	1.39E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.727	0.473	0.518	0.470	0.458	0.992
Acetylene	0.217	0.245	0.361	0.159	0.216	0.241
Ethane	0.399	0.217	0.351	0.195	0.256	0.456
Propylene	0.302	0.350	0.387	0.345	0.369	0.382
Propane	0.057	0.000	0.035	0.000	0.107	0.036
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.049	0.055	0.060	0.055	0.060	0.062
1,3-Butadiene	0.011	0.009	0.020	0.024	0.040	0.000
n-Butane	0.020	0.010	0.014	0.010	0.014	0.020
trans-2-Butene	0.031	0.035	0.037	0.035	0.039	0.041
cis-2-Butene	0.021	0.025	0.026	0.023	0.028	0.030
Isopentane	0.356	0.380	0.425	0.395	0.372	0.431
1-Pentene	0.011	0.012	0.013	0.012	0.013	0.014
n-Pentane	0.138	0.139	0.141	0.142	0.127	0.177
Isoprene	0.000	0.004	0.006	0.002	0.002	0.004
trans-2-Pentene	0.016	0.020	0.021	0.019	0.019	0.022
cis-2-Pentene	0.000	0.011	0.012	0.000	0.011	0.012
2,2-Dimethylbutane	0.030	0.036	0.040	0.035	0.035	0.038
Cyclopentane	0.016	0.021	0.022	0.021	0.021	0.023
2,3-Dimethylbutane	0.084	0.091	0.101	0.090	0.093	0.099

2-Methylpentane	0.224	0.243	0.270	0.235	0.248	0.265
3-Methylpentane	0.145	0.154	0.175	0.151	0.160	0.170
1-Hexene	0.029	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.108	0.121	0.137	0.118	0.127	0.136
Methylcyclopentane	0.139	0.143	0.159	0.139	0.153	0.165
2,4-Dimethylpentane	0.102	0.115	0.129	0.111	0.125	0.128
Benzene	0.296	0.367	0.387	0.309	0.438	0.449
Cyclohexane	0.041	0.049	0.055	0.047	0.053	0.057
2-Methylhexane	0.101	0.121	0.135	0.111	0.139	0.140
2,3-Dimethylpentane	0.163	0.190	0.214	0.180	0.213	0.219
3-Methylhexane	0.098	0.118	0.138	0.113	0.152	0.144
2,2,4-Trimethylpentane	0.262	0.307	0.343	0.289	0.345	0.351
n-Heptane	0.055	0.073	0.083	0.064	0.087	0.091
Methylcyclohexane	0.079	0.065	0.085	0.063	0.080	0.098
2,3,4-Trimethylpentane	0.090	0.109	0.124	0.103	0.130	0.129
Toluene	0.407	0.427	0.457	0.371	0.453	0.494
2-Methylheptane	0.060	0.083	0.093	0.076	0.098	0.102
3-Methylheptane	0.084	0.076	0.085	0.069	0.089	0.091
n-Octane	0.075	0.068	0.091	0.060	0.074	0.082
Ethylbenzene	0.116	0.089	0.097	0.084	0.099	0.114
m/p-Xylenes	0.329	0.284	0.302	0.265	0.320	0.394
Styrene	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	0.091	0.098	0.104	0.092	0.108	0.135
Nonane	0.024	0.033	0.037	0.032	0.041	0.043
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.000	0.011	0.013	0.000	0.011	0.015
m-Ethyltoluene	0.067	0.077	0.084	0.078	0.085	0.109
p-Ethyltoluene	0.034	0.035	0.041	0.041	0.041	0.055
1,3,5-Trimethylbenzene	0.056	0.062	0.077	0.057	0.069	0.100
o-Ethyltoluene	0.000	0.018	0.022	0.034	0.024	0.032
1,2,4-Trimethylbenzene	0.069	0.094	0.098	0.087	0.101	0.132
n-Decane	0.018	0.027	0.067	0.022	0.017	0.034
1,2,3-Trimethylbenzene	0.147	0.028	0.168	0.067	0.004	0.242
m-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000

p-Diethylbenzene	0.022	0.002	0.026	0.006	0.000	0.041
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.019	0.000	0.032	0.000	0.000	0.023
Ethanol	0.055	0.007	0.037	0.073	0.139	0.208
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.145	0.111	0.133	0.117	0.077	0.177
Acetaldehyde	0.146	0.143	0.158	0.204	0.127	0.232
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.016	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.000	0.015	0.016	0.000	0.000	0.017
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.014	0.015	0.000	0.000
MEK & Butyraldehyde	0.006	0.007	0.007	0.004	0.003	0.012
Benzaldehyde	0.017	0.016	0.015	0.016	0.000	0.018
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.019	0.000	0.024	0.009	0.000	0.030

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.005	0.006	0.006	0.005	0.006	0.007

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.022	0.032	0.025	0.016	0.014	0.027
	N2O-2	0.001	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.005	0.007	0.012	0.006	0.011	0.009

	3N2O-w	0.006	0.009	0.009	0.005	0.006	0.008
NH3	NH3-1	0.001	0.006	0.004	0.001	0.002	0.003
	NH3-2	0.001	0.002	0.001	0.001	0.002	0.001
	NH3-3	0.001	0.002	0.001	0.001	0.002	0.001
	3NH3-w	0.001	0.003	0.002	0.001	0.002	0.001

OFP

	E10	E15
Total OFP (mg O3/mile)	22.569 ± 3.004	24.787 ± 4.746

2020MY Ford Fusion

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.138	0.142	0.142	0.139	0.128	0.133
	THC-2	0.003	0.004	0.003	0.004	0.003	0.004
	THC-3	0.018	0.017	0.024	0.015	0.019	0.019
	3THC-w	0.035	0.036	0.038	0.035	0.033	0.035
NMHC Emissions (g/mile)	NMHC-1	0.111	0.110	0.110	0.106	0.100	0.103
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.006	0.006	0.010	0.005	0.008	0.006
	3NMHC-w	0.025	0.025	0.026	0.024	0.023	0.023
CH4 Emissions (g/mile)	CH4-1	0.027	0.032	0.032	0.033	0.028	0.029
	CH4-2	0.004	0.004	0.003	0.004	0.003	0.003
	CH4-3	0.012	0.011	0.014	0.010	0.011	0.013
	3CH4-W	0.011	0.011	0.012	0.011	0.010	0.011

CO Emissions (g/mile)	CO-1	1.892	3.089	3.011	2.766	2.010	2.055
	CO-2	0.006	0.022	0.000	0.000	0.000	0.028
	CO-3	2.150	1.280	2.118	0.724	1.137	1.780
	3CO-w	0.985	1.005	1.205	0.772	0.729	0.929
NOx Emissions (g/mile)	NOx-1	0.039	0.037	0.041	0.038	0.040	0.042
	NOx-2	0.005	0.008	0.006	0.005	0.006	0.005
	NOx-3	0.007	0.010	0.003	0.003	0.017	0.013
	3NOx-w	0.013	0.014	0.013	0.011	0.016	0.015
CO2 Emissions (g/mile)	CO2-1	362.250	361.791	371.797	374.556	370.648	365.181
	CO2-2	354.885	352.294	356.649	364.319	358.537	351.843
	CO2-3	296.953	296.538	299.016	308.313	298.918	297.969
	3CO2-w	340.514	338.931	343.962	351.070	344.679	339.817
Fuel economy-carbon balance method (miles per gallon)	FE-1	22.007	22.309	22.634	23.283	23.192	22.584
	FE-2	22.912	23.282	23.722	23.988	24.163	23.870
	FE-3	26.971	27.755	27.749	28.342	28.511	28.152
	3FE-w	23.689	24.131	24.452	24.881	24.994	24.607

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	4.401	4.625	4.672	3.711	4.727	4.729
	PM-soot 2	0.299	0.278	0.285	0.257	0.267	0.264
	PM-soot 3	0.347	0.368	0.417	0.362	0.407	0.382
	3PM-soot-w	1.162	1.206	1.230	1.002	1.230	1.222
PM mass (mg/mile)	PM-1	5.494	5.852	6.142	5.410	6.209	6.134
	PM-2	0.255	0.167	0.410	0.240	0.294	0.259
	PM-3	0.453	0.523	0.701	0.546	0.577	0.528
	3PM mass-w	1.395	1.446	1.677	1.396	1.598	1.551

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3

SPN (#/mile)	SPN-1	7.81E+12	7.78E+12	7.88E+12	7.84E+12	8.01E+12	8.23E+12
	SPN-2	5.76E+11	5.49E+11	5.65E+11	5.38E+11	5.33E+11	5.31E+11
	SPN-3	6.33E+11	6.40E+11	6.81E+11	6.08E+11	6.24E+11	6.21E+11
	3SPN-w	2.09E+12	2.08E+12	2.11E+12	2.07E+12	2.11E+12	2.15E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	2.039	1.618	1.980	1.719	1.697	1.644
Acetylene	0.684	0.995	0.818	0.562	0.752	0.772
Ethane	0.944	0.852	0.992	0.851	0.830	0.786
Propylene	1.882	1.643	1.822	1.540	1.557	1.652
Propane	0.037	0.045	0.046	0.032	0.062	0.074
Isobutane	0.000	0.000	0.000	0.016	0.000	0.000
1-Butene	0.349	0.243	0.260	0.233	0.230	0.242
1,3-Butadiene	0.209	0.201	0.143	0.198	0.211	0.229
n-Butane	0.084	0.086	0.099	0.154	0.118	0.110
trans-2-Butene	0.173	0.132	0.141	0.126	0.123	0.128
cis-2-Butene	0.151	0.102	0.106	0.095	0.091	0.095
Isopentane	1.374	1.419	1.542	1.449	1.245	1.281
1-Pentene	0.055	0.047	0.051	0.048	0.049	0.049
n-Pentane	0.463	0.472	0.523	0.504	0.439	0.447
Isoprene	0.078	0.071	0.006	0.076	0.078	0.084
trans-2-Pentene	0.073	0.060	0.064	0.062	0.059	0.061
cis-2-Pentene	0.043	0.036	0.038	0.037	0.035	0.036
2,2-Dimethylbutane	0.116	0.119	0.128	0.117	0.107	0.109
Cyclopentane	0.067	0.066	0.073	0.070	0.061	0.064
2,3-Dimethylbutane	0.302	0.304	0.332	0.298	0.271	0.278
2-Methylpentane	0.821	0.847	0.904	0.826	0.752	0.773
3-Methylpentane	0.529	0.526	0.572	0.514	0.474	0.484
1-Hexene	0.032	0.024	0.026	0.028	0.027	0.027
n-Hexane	0.424	0.418	0.453	0.411	0.385	0.389
Methylcyclopentane	0.524	0.522	0.558	0.506	0.460	0.481
2,4-Dimethylpentane	0.407	0.396	0.425	0.385	0.355	0.368

Benzene	2.348	2.383	2.921	2.376	2.153	2.019
Cyclohexane	0.183	0.177	0.190	0.177	0.165	0.170
2-Methylhexane	0.511	0.499	0.541	0.486	0.449	0.465
2,3-Dimethylpentane	0.708	0.697	0.764	0.682	0.628	0.647
3-Methylhexane	0.538	0.530	0.568	0.522	0.476	0.496
2,2,4-Trimethylpentane	1.099	1.081	1.169	1.057	0.977	1.009
n-Heptane	0.353	0.342	0.381	0.332	0.312	0.328
Methylcyclohexane	0.325	0.308	0.338	0.309	0.283	0.304
2,3,4-Trimethylpentane	0.399	0.391	0.418	0.383	0.349	0.369
Toluene	2.233	1.761	2.141	1.915	1.931	1.992
2-Methylheptane	0.300	0.301	0.309	0.287	0.292	0.289
3-Methylheptane	0.300	0.293	0.310	0.287	0.267	0.272
n-Octane	0.248	0.241	0.255	0.238	0.232	0.232
Ethylbenzene	0.499	0.400	0.427	0.392	0.375	0.405
m/p-Xylenes	1.588	1.393	1.497	1.377	1.296	1.435
Styrene	0.122	0.113	0.104	0.112	0.109	0.128
o-Xylene	0.585	0.516	0.553	0.491	0.510	0.529
Nonane	0.138	0.136	0.141	0.132	0.122	0.129
Isopropylbenzene	0.012	0.011	0.010	0.010	0.011	0.011
n-Propylbenzene	0.060	0.048	0.054	0.052	0.050	0.052
m-Ethyltoluene	0.442	0.366	0.396	0.358	0.285	0.320
p-Ethyltoluene	0.199	0.164	0.186	0.154	0.144	0.155
1,3,5-Trimethylbenzene	0.323	0.297	0.325	0.307	0.281	0.303
o-Ethyltoluene	0.137	0.110	0.124	0.112	0.111	0.128
1,2,4-Trimethylbenzene	0.558	0.489	0.528	0.508	0.440	0.521
n-Decane	0.060	0.058	0.059	0.077	0.088	0.060
1,2,3-Trimethylbenzene	0.120	0.093	0.110	0.257	0.322	0.168
m-Diethylbenzene	0.027	0.000	0.009	0.239	0.387	0.110
p-Diethylbenzene	0.145	0.088	0.106	0.106	0.089	0.170
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.015	0.000	0.000	0.028	0.032	0.011
Ethanol	0.744	0.667	0.152	1.406	1.076	1.039
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.662	0.735	0.756	0.839	0.749	0.767
Acetaldehyde	0.462	0.491	0.514	0.687	0.711	0.703
Acrolein	0.052	0.059	0.066	0.063	0.074	0.071
Acetone	0.012	0.000	0.000	0.065	0.021	0.000
Propionaldehyde	0.043	0.034	0.036	0.037	0.039	0.038
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.041	0.041	0.045	0.044	0.051	0.050
MEK & Butyraldehyde	0.032	0.018	0.018	0.023	0.027	0.022
Benzaldehyde	0.058	0.058	0.064	0.061	0.066	0.065
Valeraldehyde	0.018	0.000	0.000	0.000	0.018	0.020
m-Tolualdehyde	0.018	0.019	0.024	0.022	0.020	0.021
Hexaldehyde	0.001	0.000	0.000	0.001	0.008	0.003

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.025	0.026	0.026	0.025	0.024	0.024

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.217	0.197	0.213	Instrument problematic	0.184	0.140
	N2O-2	0.005	0.005	0.005	Instrument problematic	0.003	0.003
	N2O-3	0.112	0.135	0.161	Instrument problematic	0.070	0.087
	3N2O-w	0.078	0.081	0.091	Instrument problematic	0.059	0.055
NH3	NH3-1	0.005	0.006	0.002	Instrument problematic	0.003	0.004
	NH3-2	0.010	0.014	0.016	Instrument problematic	0.005	0.014
	NH3-3	0.005	0.006	0.008	Instrument problematic	0.008	0.005
	3NH3-w	0.008	0.010	0.011	Instrument problematic	0.006	0.009

OFP

	E10	E15
Total OFP (mg O3/mile)	145.504 ± 13.766	132.095 ± 11.178

2019MY Chevrolet Impala

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.029	0.028	0.040	0.033	0.032	0.031
	THC-2	0.001	0.001	0.001	0.001	0.001	0.001
	THC-3	0.002	0.002	0.002	0.003	0.003	0.003
	3THC-w	0.007	0.007	0.009	0.008	0.008	0.008
NMHC Emissions (g/mile)	NMHC-1	0.023	0.021	0.031	0.025	0.023	0.023
	NMHC-2	0.001	0.000	0.000	0.000	0.000	0.001
	NMHC-3	0.000	0.000	0.000	0.000	0.000	0.000
	3NMHC-w	0.005	0.005	0.007	0.005	0.005	0.005
CH4 Emissions (g/mile)	CH4-1	0.006	0.007	0.010	0.007	0.009	0.008
	CH4-2	0.000	0.000	0.000	0.001	0.001	0.000
	CH4-3	0.002	0.002	0.002	0.002	0.003	0.003
	3CH4-W	0.002	0.002	0.003	0.003	0.003	0.003
CO Emissions (g/mile)	CO-1	0.429	0.767	1.022	0.801	1.156	1.054
	CO-2	0.000	0.000	0.018	0.020	0.035	0.029
	CO-3	0.113	0.133	0.172	0.216	0.157	0.178
	3CO-w	0.120	0.195	0.268	0.236	0.301	0.282
NOx Emissions (g/mile)	NOx-1	0.017	0.003	0.003	0.004	0.004	0.003
	NOx-2	0.000	0.000	0.000	0.000	0.000	0.000
	NOx-3	0.001	0.000	0.001	0.001	0.001	0.000
	3NOx-w	0.004	0.001	0.001	0.001	0.001	0.001
CO2 Emissions (g/mile)	CO2-1	396.787	398.541	395.511	387.665	389.675	393.421
	CO2-2	414.801	413.452	408.632	407.259	402.723	405.805
	CO2-3	336.365	338.320	334.046	331.860	328.988	333.710
	3CO2-w	389.517	389.767	385.463	382.472	379.770	383.487
Fuel economy-carbon balanced method (miles per gallon)	FE-1	21.415	21.293	21.431	21.458	21.317	21.124
	FE-2	20.524	20.591	20.832	20.495	20.725	20.568
	FE-3	25.296	25.148	25.465	25.128	25.354	24.993

	3FE-w	21.845	21.824	22.061	21.803	21.952	21.741

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	8.211	10.085	9.414	6.016	6.306	5.654
	PM-soot 2	1.320	1.482	1.200	0.771	0.743	0.584
	PM-soot 3	1.734	1.113	1.243	0.823	0.841	0.816
	3PM-soot-w	2.862	3.162	2.912	1.872	1.923	1.697
PM mass (mg/mile)	PM-1	9.459	11.288	10.840	6.906	7.381	6.856
	PM-2	1.392	1.552	1.179	0.797	0.657	0.704
	PM-3	2.097	1.267	1.332	0.991	0.821	1.067
	3PM mass-w	3.257	3.490	3.221	2.116	2.096	2.077

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	1.34E+13	1.51E+13	1.48E+13	1.12E+13	1.13E+13	1.08E+13
	SPN-2	2.80E+12	3.03E+12	2.49E+12	1.85E+12	1.72E+12	1.49E+12
	SPN-3	3.27E+12	2.39E+12	2.78E+12	2.04E+12	2.02E+12	2.00E+12
	3SPN-w	5.12E+12	5.36E+12	5.12E+12	3.84E+12	3.80E+12	3.55E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.306	0.391	0.606	0.496	0.472	0.488
Acetylene	0.280	0.063	0.146	0.060	0.057	0.072
Ethane	0.103	0.146	0.187	0.123	0.149	0.148
Propylene	0.201	0.360	0.553	0.428	0.397	0.398
Propane	0.000	0.014	0.061	0.000	0.000	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.027	0.055	0.100	0.068	0.076	0.072
1,3-Butadiene	0.000	0.013	0.051	0.026	0.012	0.015
n-Butane	0.046	0.015	0.029	0.013	0.009	0.007
trans-2-Butene	0.000	0.033	0.064	0.039	0.044	0.041
cis-2-Butene	0.000	0.024	0.046	0.028	0.033	0.031
Isopentane	0.356	0.318	0.526	0.459	0.373	0.337
1-Pentene	0.000	0.013	0.024	0.015	0.014	0.012
n-Pentane	0.149	0.131	0.199	0.165	0.130	0.119
Isoprene	0.000	0.008	0.017	0.011	0.005	0.008
trans-2-Pentene	0.000	0.021	0.033	0.028	0.024	0.022
cis-2-Pentene	0.000	0.012	0.019	0.016	0.013	0.013
2,2-Dimethylbutane	0.027	0.025	0.039	0.034	0.029	0.027
Cyclopentane	0.021	0.020	0.030	0.026	0.023	0.021
2,3-Dimethylbutane	0.066	0.070	0.110	0.095	0.078	0.074
2-Methylpentane	0.187	0.194	0.303	0.261	0.214	0.205
3-Methylpentane	0.120	0.124	0.195	0.167	0.137	0.130
1-Hexene	0.000	0.000	0.081	0.000	0.000	0.000
n-Hexane	0.098	0.101	0.241	0.130	0.107	0.103
Methylcyclopentane	0.109	0.123	0.200	0.165	0.132	0.128
2,4-Dimethylpentane	0.075	0.084	0.132	0.108	0.090	0.086
Benzene	0.347	0.416	0.649	0.486	0.520	0.547
Cyclohexane	0.036	0.041	0.067	0.054	0.043	0.042
2-Methylhexane	0.069	0.078	0.140	0.108	0.085	0.086
2,3-Dimethylpentane	0.109	0.124	0.207	0.165	0.134	0.130
3-Methylhexane	0.080	0.084	0.153	0.119	0.088	0.081
2,2,4-Trimethylpentane	0.169	0.180	0.290	0.226	0.197	0.192

n-Heptane	0.041	0.041	0.079	0.057	0.044	0.044
Methylcyclohexane	0.035	0.051	0.086	0.067	0.046	0.046
2,3,4-Trimethylpentane	0.051	0.058	0.095	0.072	0.061	0.060
Toluene	0.427	0.407	0.664	0.479	0.438	0.427
2-Methylheptane	0.043	0.048	0.076	0.056	0.048	0.041
3-Methylheptane	0.038	0.042	0.067	0.050	0.043	0.044
n-Octane	0.041	0.046	0.060	0.045	0.037	0.039
Ethylbenzene	0.072	0.073	0.118	0.084	0.078	0.079
m/p-Xylenes	0.225	0.220	0.356	0.256	0.232	0.233
Styrene	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	0.092	0.083	0.131	0.088	0.076	0.080
Nonane	0.021	0.017	0.021	0.016	0.016	0.016
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.000	0.000	0.011	0.000	0.000	0.000
m-Ethyltoluene	0.026	0.049	0.063	0.041	0.047	0.050
p-Ethyltoluene	0.022	0.026	0.030	0.022	0.022	0.025
1,3,5-Trimethylbenzene	0.036	0.051	0.054	0.038	0.029	0.033
o-Ethyltoluene	0.012	0.017	0.027	0.018	0.014	0.017
1,2,4-Trimethylbenzene	0.047	0.063	0.090	0.057	0.053	0.059
n-Decane	0.025	0.049	0.025	0.021	0.011	0.018
1,2,3-Trimethylbenzene	0.238	0.332	0.183	0.142	0.049	0.086
m-Diethylbenzene	0.422	0.460	0.238	0.227	0.064	0.120
p-Diethylbenzene	0.026	0.067	0.034	0.028	0.008	0.016
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.025	0.072	0.026	0.000	0.000	0.000
Ethanol	0.598	0.410	0.581	0.623	0.299	0.522
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.200	0.135	0.143	0.075	0.138	0.117
Acetaldehyde	0.130	0.118	0.158	0.180	0.185	0.171
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.000	0.000	0.015	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.006	0.005	0.006	0.002	0.003
Benzaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.018	0.033	0.019	0.015	0.000	0.004

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.006	0.005	0.007	0.006	0.005	0.005

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.016	0.002	0.004	0.039	0.020	0.009
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.000	0.000	0.000	0.000	0.001	0.000
	3N2O-w	0.003	0.000	0.001	0.008	0.004	0.002
NH3	NH3-1	0.002	0.002	0.003	0.020	0.025	0.009
	NH3-2	0.001	0.001	0.002	0.002	0.002	0.002
	NH3-3	0.002	0.002	0.004	0.002	0.004	0.003
	3NH3-w	0.002	0.002	0.003	0.006	0.007	0.004

OFP

	E10	E15
Total OFP (mg O3/mile)	35.645 ± 10.360	33.882 ± 4.475

2021MY Chevrolet Spark

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.027	0.036	0.037	0.027	0.030	0.032
	THC-2	0.001	0.001	0.001	0.000	0.000	0.000
	THC-3	0.002	0.002	0.002	0.002	0.002	0.002
	3THC-w	0.007	0.008	0.009	0.006	0.007	0.008
NMHC Emissions (g/mile)	NMHC-1	0.024	0.030	0.031	0.026	0.025	0.028
	NMHC-2	0.001	0.000	0.001	0.000	0.000	0.000
	NMHC-3	0.001	0.000	0.001	0.000	0.000	0.000
	3NMHC-w	0.006	0.007	0.007	0.005	0.005	0.006
CH4 Emissions (g/mile)	CH4-1	0.003	0.005	0.005	0.002	0.005	0.005
	CH4-2	0.000	0.000	0.000	0.000	0.000	0.001
	CH4-3	0.001	0.001	0.002	0.002	0.002	0.002
	3CH4-W	0.001	0.002	0.002	0.001	0.002	0.002
CO Emissions (g/mile)	CO-1	0.253	0.581	0.578	0.447	0.475	0.492
	CO-2	0.000	0.000	0.000	0.049	0.028	0.000
	CO-3	0.030	0.009	0.016	0.036	0.025	0.000
	3CO-w	0.061	0.123	0.124	0.128	0.120	0.102
NOx Emissions (g/mile)	NOx-1	0.023	0.014	0.013	0.011	0.014	0.014
	NOx-2	0.005	0.006	0.004	0.006	0.008	0.006
	NOx-3	0.004	0.003	0.005	0.006	0.005	0.006
	3NOx-w	0.008	0.007	0.006	0.007	0.009	0.007
CO2 Emissions (g/mile)	CO2-1	227.279	231.951	230.156	227.089	230.557	226.510
	CO2-2	210.859	214.497	211.781	209.421	213.663	213.241
	CO2-3	205.812	204.756	202.196	199.515	202.229	203.110
	3CO2-w	212.875	215.439	212.957	210.358	214.025	213.204
Fuel economy-carbon balanced method (miles per gallon)	FE-1	37.379	36.543	36.827	36.633	36.076	36.712
	FE-2	40.375	39.690	40.199	39.846	39.061	39.146
	FE-3	41.354	41.574	42.098	41.827	41.269	41.097

	3FE-w	39.971	39.477	39.936	39.642	38.965	39.120

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.220	0.257	0.221	0.208	0.201	0.189
	PM-soot 2	0.020	0.021	0.021	0.020	0.023	0.023
	PM-soot 3	0.019	0.019	0.020	0.016	0.018	0.019
	3PM-soot-w	0.061	0.069	0.062	0.058	0.059	0.056
PM mass (mg/mile)	PM-1	0.384	0.256	0.320	0.189	0.236	0.209
	PM-2	0.095	0.000	0.080	0.000	0.000	0.000
	PM-3	0.081	0.000	0.097	0.000	0.000	0.074
	3PM mass-w	0.151	0.053	0.135	0.039	0.049	0.063

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	7.41E+11	7.59E+11	7.45E+11	6.59E+11	6.74E+11	6.00E+11
	SPN-2	8.79E+09	9.19E+09	1.10E+10	8.76E+09	9.36E+09	9.35E+09
	SPN-3	1.30E+10	1.46E+10	1.54E+10	1.22E+10	9.01E+09	9.87E+09
	3SPN-w	1.62E+11	1.66E+11	1.64E+11	1.44E+11	1.47E+11	1.32E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.370	0.713	0.737	0.329	0.581	0.682
Acetylene	0.025	0.339	0.164	0.023	0.153	0.294
Ethane	0.124	0.277	0.346	0.097	0.228	0.283
Propylene	0.252	0.483	0.530	0.198	0.368	0.397
Propane	0.000	0.026	0.057	0.000	0.000	0.013
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.040	0.080	0.097	0.040	0.064	0.066
1,3-Butadiene	0.001	0.038	0.037	0.000	0.023	0.018

n-Butane	0.040	0.034	0.039	0.004	0.034	0.041
trans-2-Butene	0.028	0.053	0.063	0.025	0.041	0.045
cis-2-Butene	0.020	0.041	0.061	0.026	0.032	0.034
Isopentane	0.805	0.727	0.677	0.391	0.598	0.718
1-Pentene	0.017	0.019	0.018	0.010	0.016	0.018
n-Pentane	0.279	0.254	0.255	0.122	0.194	0.252
Isoprene	0.007	0.015	0.013	0.001	0.010	0.009
trans-2-Pentene	0.041	0.040	0.039	0.022	0.032	0.038
cis-2-Pentene	0.023	0.022	0.025	0.012	0.018	0.021
2,2-Dimethylbutane	0.050	0.046	0.044	0.027	0.038	0.045
Cyclopentane	0.037	0.034	0.032	0.021	0.029	0.037
2,3-Dimethylbutane	0.130	0.119	0.113	0.068	0.099	0.119
2-Methylpentane	0.346	0.322	0.327	0.182	0.266	0.319
3-Methylpentane	0.212	0.199	0.188	0.114	0.164	0.192
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.156	0.149	0.154	0.085	0.127	0.148
Methylcyclopentane	0.185	0.177	0.181	0.100	0.148	0.174
2,4-Dimethylpentane	0.116	0.114	0.117	0.065	0.098	0.113
Benzene	0.273	0.525	0.649	1.104	2.012	0.444
Cyclohexane	0.056	0.056	0.064	0.031	0.047	0.055
2-Methylhexane	0.098	0.102	0.100	0.047	0.084	0.099
2,3-Dimethylpentane	0.159	0.160	0.158	0.087	0.136	0.157
3-Methylhexane	0.102	0.106	0.121	0.041	0.082	0.099
2,2,4-Trimethylpentane	0.215	0.225	0.245	0.127	0.197	0.221
n-Heptane	0.047	0.052	0.060	0.016	0.039	0.051
Methylcyclohexane	0.052	0.052	0.053	0.017	0.041	0.048
2,3,4-Trimethylpentane	0.063	0.068	0.069	0.038	0.059	0.066
Toluene	0.349	0.594	0.770	0.269	0.479	0.508
2-Methylheptane	0.040	0.046	0.052	0.028	0.045	0.049
3-Methylheptane	0.038	0.045	0.048	0.026	0.041	0.044
n-Octane	0.041	0.041	0.051	0.022	0.042	0.040
Ethylbenzene	0.071	0.113	0.158	0.051	0.091	0.090
m/p-Xylenes	0.225	0.358	0.464	0.159	0.293	0.286
Styrene	0.000	0.002	0.016	0.000	0.000	0.000

o-Xylene	0.077	0.118	0.165	0.052	0.096	0.092
Nonane	0.016	0.020	0.025	0.011	0.019	0.018
Isopropylbenzene	0.000	0.000	0.013	0.000	0.000	0.000
n-Propylbenzene	0.000	0.011	0.036	0.000	0.000	0.000
m-Ethyltoluene	0.061	0.091	0.110	0.041	0.080	0.073
p-Ethyltoluene	0.031	0.042	0.059	0.019	0.039	0.036
1,3,5-Trimethylbenzene	0.045	0.053	0.078	0.016	0.043	0.042
o-Ethyltoluene	0.022	0.030	0.046	0.009	0.027	0.017
1,2,4-Trimethylbenzene	0.070	0.106	0.140	0.050	0.095	0.085
n-Decane	0.029	0.012	0.044	0.004	0.032	0.020
1,2,3-Trimethylbenzene	0.196	0.078	0.079	0.000	0.046	0.074
m-Diethylbenzene	0.274	0.104	0.081	0.000	0.045	0.103
p-Diethylbenzene	0.049	0.020	0.008	0.000	0.010	0.017
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.029	0.000	0.031	0.000	0.000	0.000
Ethanol	0.467	0.533	0.793	0.499	0.900	1.034
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.075	0.145	0.205	0.157	0.155	0.132
Acetaldehyde	0.186	0.231	0.239	0.237	0.262	0.265
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.000	0.020	0.016	0.016	0.015	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.009	0.002	0.003	0.000	0.001
Benzaldehyde	0.000	0.014	0.019	0.000	0.017	0.015
Valeraldehyde	0.000	0.025	0.000	0.000	0.000	0.016
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.009	0.033	0.000	0.000	0.000	0.004

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.006	0.007	0.007	0.005	0.006	0.006

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	Instrument problematic	0.027	0.024	0.030	0.027	0.031
	N2O-2	Instrument problematic	0.000	0.000	0.001	0.001	0.001
	N2O-3	Instrument problematic	0.031	0.020	0.047	0.039	0.047
	3N2O-w	Instrument problematic	0.014	0.011	0.019	0.016	0.020
NH3	NH3-1	Instrument problematic	0.003	0.001	0.001	0.001	0.001
	NH3-2	Instrument problematic	0.001	0.001	0.004	0.003	0.002
	NH3-3	Instrument problematic	0.001	0.001	0.001	0.001	0.001
	3NH3-w	Instrument problematic	0.001	0.001	0.002	0.002	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	31.919 ± 8.573	26.611 ± 6.099

2020MY KIA Optima

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.020	0.023	0.021	0.022	0.021	0.023
	THC-2	0.001	0.000	0.000	0.000	0.000	0.000
	THC-3	0.002	0.001	0.002	0.002	0.004	0.004
	3THC-w	0.005	0.005	0.005	0.005	0.005	0.006
NMHC Emissions (g/mile)	NMHC-1	0.015	0.017	0.016	0.016	0.016	0.017
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.000	0.000	0.000	0.000	0.002	0.002
	3NMHC-w	0.001	0.004	0.003	0.003	0.004	0.004
CH4 Emissions (g/mile)	CH4-1	0.005	0.006	0.006	0.006	0.005	0.006
	CH4-2	0.005	0.000	0.000	0.000	0.000	0.000
	CH4-3	0.001	0.001	0.001	0.002	0.002	0.002
	3CH4-W	0.004	0.002	0.002	0.002	0.002	0.002
CO Emissions (g/mile)	CO-1	0.398	0.308	0.362	0.535	0.234	0.361
	CO-2	0.000	0.035	0.000	0.000	0.000	0.050
	CO-3	0.082	0.036	0.010	0.056	0.026	0.079
	3CO-w	0.105	0.092	0.078	0.126	0.056	0.122
NOx Emissions (g/mile)	NOx-1	0.011	0.013	0.014	0.011	0.010	0.012
	NOx-2	0.014	0.010	0.010	0.012	0.011	0.013
	NOx-3	0.008	0.007	0.006	0.005	0.005	0.006
	3NOx-w	0.011	0.010	0.010	0.010	0.009	0.011
CO2 Emissions (g/mile)	CO2-1	287.652	290.619	274.798	288.802	280.969	304.688
	CO2-2	290.067	288.694	278.685	282.358	280.274	297.623
	CO2-3	251.777	250.230	238.856	242.858	236.027	249.825
	3CO2-w	279.058	278.517	266.938	272.834	268.232	285.964
Fuel economy-carbon balanced method (miles per gallon)	FE-1	29.526	29.238	30.909	28.814	29.664	27.340
	FE-2	29.350	29.484	30.549	29.564	29.784	28.040
	FE-3	33.795	34.014	35.640	34.359	35.359	33.396

	3FE-w	30.488	30.549	31.877	30.572	31.109	29.170

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	2.576	3.024	2.597	2.500	2.646	2.931
	PM-soot 2	0.168	0.154	0.157	0.129	0.129	0.133
	PM-soot 3	0.118	0.125	0.113	0.102	0.097	0.090
	3PM-soot-w	0.653	0.741	0.651	0.614	0.642	0.699
PM mass (mg/mile)	PM-1	2.731	3.635	2.993	2.841	2.993	3.249
	PM-2	0.135	0.062	0.210	0.210	0.227	0.097
	PM-3	0.109	0.104	0.154	0.196	0.173	0.096
	3PM mass-w	0.666	0.814	0.771	0.752	0.786	0.748

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	2.80E+12	3.08E+12	2.81E+12	2.73E+12	2.90E+12	3.06E+12
	SPN-2	5.10E+11	4.68E+11	5.05E+11	3.78E+11	3.97E+11	3.49E+11
	SPN-3	3.22E+11	3.24E+11	3.14E+11	2.74E+11	2.68E+11	2.17E+11
	3SPN-w	9.33E+11	9.70E+11	9.30E+11	8.38E+11	8.81E+11	8.76E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.334	0.341	0.355	0.320	0.383	0.426
Acetylene	0.147	0.263	0.205	0.253	0.230	0.237
Ethane	0.113	0.170	0.155	0.142	0.214	0.169
Propylene	0.241	0.260	0.259	0.244	0.281	0.267
Propane	0.000	0.061	0.000	0.029	0.031	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.036	0.041	0.044	0.038	0.043	0.044
1,3-Butadiene	0.000	0.000	0.000	0.000	0.000	0.000

n-Butane	0.008	0.017	0.011	0.006	0.004	0.001
trans-2-Butene	0.022	0.023	0.024	0.022	0.023	0.025
cis-2-Butene	0.015	0.017	0.018	0.016	0.017	0.018
Isopentane	0.270	0.312	0.295	0.284	0.290	0.370
1-Pentene	0.000	0.011	0.012	0.000	0.000	0.012
n-Pentane	0.104	0.109	0.091	0.094	0.102	0.114
Isoprene	0.003	0.005	0.005	0.004	0.000	0.005
trans-2-Pentene	0.015	0.016	0.016	0.015	0.015	0.017
cis-2-Pentene	0.000	0.000	0.000	0.000	0.000	0.000
2,2-Dimethylbutane	0.022	0.024	0.023	0.023	0.024	0.028
Cyclopentane	0.016	0.018	0.019	0.019	0.017	0.028
2,3-Dimethylbutane	0.054	0.061	0.059	0.058	0.061	0.068
2-Methylpentane	0.145	0.164	0.159	0.156	0.164	0.187
3-Methylpentane	0.092	0.103	0.100	0.098	0.104	0.119
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.078	0.086	0.081	0.079	0.083	0.095
Methylcyclopentane	0.089	0.101	0.096	0.096	0.150	0.126
2,4-Dimethylpentane	0.065	0.073	0.070	0.071	0.071	0.085
Benzene	0.273	0.274	1.411	0.274	1.585	0.320
Cyclohexane	0.031	0.035	0.033	0.033	0.034	0.037
2-Methylhexane	0.055	0.064	0.062	0.063	0.067	0.081
2,3-Dimethylpentane	0.098	0.113	0.110	0.107	0.116	0.134
3-Methylhexane	0.060	0.062	0.069	0.058	0.075	0.078
2,2,4-Trimethylpentane	0.153	0.174	0.170	0.170	0.180	0.204
n-Heptane	0.024	0.031	0.028	0.030	0.032	0.040
Methylcyclohexane	0.028	0.037	0.029	0.030	0.035	0.035
2,3,4-Trimethylpentane	0.052	0.060	0.056	0.057	0.060	0.068
Toluene	0.281	0.331	0.300	0.290	1.604	0.323
2-Methylheptane	0.038	0.044	0.041	0.043	0.046	0.052
3-Methylheptane	0.034	0.040	0.038	0.038	0.041	0.045
n-Octane	0.028	0.040	0.033	0.033	0.043	0.035
Ethylbenzene	0.077	0.063	0.059	0.058	0.064	0.072
m/p-Xylenes	0.194	0.204	0.191	0.191	0.196	0.224
Styrene	0.000	0.000	0.000	0.000	0.000	0.000

o-Xylene	0.064	0.072	0.066	0.066	0.069	0.079
Nonane	0.018	0.016	0.016	0.017	0.019	0.017
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
m-Ethyltoluene	0.043	0.050	0.048	0.047	0.051	0.059
p-Ethyltoluene	0.021	0.024	0.023	0.020	0.026	0.026
1,3,5-Trimethylbenzene	0.031	0.038	0.024	0.024	0.031	0.029
o-Ethyltoluene	0.031	0.000	0.011	0.013	0.019	0.019
1,2,4-Trimethylbenzene	0.058	0.064	0.055	0.056	0.054	0.068
n-Decane	0.038	0.036	0.016	0.012	0.037	0.000
1,2,3-Trimethylbenzene	0.118	0.155	0.009	0.000	0.081	0.000
m-Diethylbenzene	0.219	0.251	0.000	0.000	0.135	0.000
p-Diethylbenzene	0.032	0.035	0.000	0.000	0.016	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.038	0.016	0.000	0.000	0.000	0.000
Ethanol	0.324	0.373	0.331	0.491	0.544	0.477
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.166	0.181	0.141	0.097	0.131	0.119
Acetaldehyde	0.100	0.128	0.127	0.154	0.151	0.134
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.015
Propionaldehyde	0.000	0.000	0.014	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.005	0.005	0.003	0.003	0.002
Benzaldehyde	0.000	0.016	0.016	0.000	0.016	0.015
Valeraldehyde	0.000	0.000	0.000	0.000	0.016	0.015
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.006	0.014	0.000	0.000	0.015	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.001	0.004	0.003	0.004	0.004	0.004

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.037	0.013	0.025	0.066	0.014	0.018
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.004	0.006	0.000	0.000	0.005	0.002
	3N2O-w	0.009	0.005	0.005	0.014	0.004	0.004
NH3	NH3-1	0.003	0.001	0.003	0.012	0.005	0.003
	NH3-2	0.001	0.002	0.004	0.002	0.001	0.003
	NH3-3	0.002	0.002	0.002	0.003	0.002	0.004
	3NH3-w	0.002	0.002	0.003	0.004	0.002	0.003

OFP

	E10	E15
Total OFP (mg O3/mile)	20.668 ± 3.805	21.726 ± 7.057

2020MY Jeep Cherokee

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.056	0.048	0.063	0.047	0.065	0.063

	THC-2	0.001	0.000	0.001	0.001	0.001	0.001
	THC-3	0.007	0.005	0.009	0.003	0.008	0.007
	3THC-w	0.015	0.011	0.016	0.011	0.016	0.016
NMHC Emissions (g/mile)	NMHC-1	0.049	0.041	0.054	0.040	0.055	0.053
	NMHC-2	0.000	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.003	0.001	0.004	0.001	0.003	0.002
	3NMHC-w	0.011	0.008	0.012	0.009	0.012	0.012
CH4 Emissions (g/mile)	CH4-1	0.008	0.007	0.009	0.008	0.009	0.010
	CH4-2	0.001	0.001	0.001	0.001	0.001	0.002
	CH4-3	0.004	0.004	0.005	0.002	0.005	0.004
	3CH4-W	0.003	0.003	0.004	0.003	0.004	0.004
CO Emissions (g/mile)	CO-1	0.650	0.756	0.764	0.548	0.597	0.663
	CO-2	0.434	0.402	0.264	0.191	0.184	0.156
	CO-3	0.416	0.473	0.482	0.106	0.290	0.245
	3CO-w	0.474	0.495	0.428	0.242	0.299	0.286
NOx Emissions (g/mile)	NOx-1	0.009	0.008	0.006	0.010	0.008	0.006
	NOx-2	0.004	0.004	0.004	0.007	0.004	0.005
	NOx-3	0.003	0.003	0.003	0.003	0.004	0.003
	3NOx-w	0.005	0.004	0.004	0.006	0.005	0.005
CO2 Emissions (g/mile)	CO2-1	452.021	452.090	449.603	459.204	452.041	448.486
	CO2-2	475.150	472.891	469.293	477.659	469.795	466.034
	CO2-3	399.279	403.428	403.561	400.960	405.138	400.606
	3CO2-w	449.493	449.549	447.188	452.775	448.383	444.442
Fuel economy-carbon balanced method (miles per gallon)	FE-1	18.785	18.776	18.877	18.139	18.420	18.562
	FE-2	17.891	17.979	18.125	17.465	17.757	17.902
	FE-3	21.286	21.063	21.055	20.810	20.580	20.816
	3FE-w	18.907	18.904	19.007	18.420	18.596	18.761

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2

Black carbon (mg/mile)	PM-soot 1	0.314	0.326	0.290	0.343	0.291	0.179
	PM-soot 2	0.047	0.032	0.048	0.049	0.044	0.056
	PM-soot 3	0.085	0.046	0.068	0.066	0.050	0.070
	3PM-soot-w	0.113	0.097	0.104	0.115	0.097	0.085
PM mass (mg/mile)	PM-1	0.565	0.297	0.276	0.624	0.441	0.186
	PM-2	0.000	0.000	0.000	0.059	0.000	0.016
	PM-3	0.213	0.044	0.110	0.044	0.246	0.000
	3PM mass-w	0.176	0.074	0.088	0.172	0.159	0.047

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	1.18E+12	1.64E+12	1.41E+12	1.23E+12	1.61E+12	8.69E+11
	SPN-2	1.47E+10	1.20E+10	1.40E+10	1.69E+10	1.20E+10	1.53E+10
	SPN-3	9.65E+10	1.38E+11	1.85E+11	1.37E+11	1.32E+11	1.43E+11
	3SPN-w	2.78E+11	3.84E+11	3.51E+11	3.01E+11	3.77E+11	2.27E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.245	0.973	0.975	1.131	1.493	1.634
Acetylene	0.051	0.049	0.094	0.120	0.047	0.091
Ethane	0.526	0.464	0.703	0.655	0.665	0.664
Propylene	0.987	0.800	1.214	0.804	1.198	1.257
Propane	0.000	0.000	0.091	0.150	0.000	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.204	0.168	0.257	0.155	0.237	0.271
1,3-Butadiene	0.024	0.000	0.035	0.009	0.037	0.047
n-Butane	0.020	0.000	0.003	0.005	0.023	0.022
trans-2-Butene	0.133	0.117	0.156	0.104	0.156	0.181
cis-2-Butene	0.091	0.067	0.121	0.060	0.108	0.140
Isopentane	0.747	0.673	0.794	0.676	0.825	0.845
1-Pentene	0.029	0.024	0.032	0.024	0.030	0.034

n-Pentane	0.280	0.238	0.270	0.274	0.312	0.270
Isoprene	0.024	0.000	0.025	0.018	0.027	0.029
trans-2-Pentene	0.045	0.041	0.049	0.039	0.048	0.056
cis-2-Pentene	0.026	0.023	0.029	0.022	0.026	0.033
2,2-Dimethylbutane	0.057	0.053	0.064	0.055	0.067	0.064
Cyclopentane	0.042	0.040	0.046	0.036	0.046	0.047
2,3-Dimethylbutane	0.145	0.137	0.164	0.141	0.173	0.166
2-Methylpentane	0.401	0.385	0.454	0.383	0.477	0.462
3-Methylpentane	0.253	0.241	0.292	0.246	0.306	0.299
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.210	0.199	0.236	0.198	0.252	0.244
Methylcyclopentane	0.258	0.246	0.296	0.241	0.305	0.311
2,4-Dimethylpentane	0.175	0.164	0.199	0.167	0.210	0.199
Benzene	1.020	3.229	1.308	0.591	1.189	1.180
Cyclohexane	0.089	0.084	0.101	0.080	0.102	0.101
2-Methylhexane	0.178	0.168	0.206	0.164	0.227	0.218
2,3-Dimethylpentane	0.269	0.260	0.299	0.258	0.337	0.309
3-Methylhexane	0.184	0.167	0.205	0.175	0.241	0.221
2,2,4-Trimethylpentane	0.407	0.394	0.454	0.395	0.509	0.465
n-Heptane	0.100	0.093	0.113	0.092	0.141	0.121
Methylcyclohexane	0.104	0.091	0.115	0.086	0.129	0.101
2,3,4-Trimethylpentane	0.131	0.124	0.144	0.125	0.163	0.141
Toluene	1.121	4.612	1.274	0.863	1.316	1.331
2-Methylheptane	0.110	0.103	0.119	0.100	0.125	0.106
3-Methylheptane	0.099	0.095	0.107	0.090	0.122	0.095
n-Octane	0.089	0.099	0.095	0.080	0.126	0.093
Ethylbenzene	0.227	0.179	0.253	0.180	0.402	0.256
m/p-Xylenes	0.695	0.531	0.753	0.554	0.917	0.765
Styrene	0.006	0.000	0.001	0.000	0.012	0.006
o-Xylene	0.231	0.182	0.247	0.186	0.301	0.261
Nonane	0.044	0.039	0.042	0.044	0.115	0.051
Isopropylbenzene	0.000	0.000	0.000	0.933	0.000	0.000
n-Propylbenzene	0.023	0.018	0.022	0.023	0.046	0.024
m-Ethyltoluene	0.176	0.143	0.184	0.139	0.221	0.176

p-Ethyltoluene	0.077	0.071	0.087	0.064	0.106	0.077
1,3,5-Trimethylbenzene	0.094	0.074	0.088	0.068	0.122	0.079
o-Ethyltoluene	0.107	0.043	0.054	0.057	0.146	0.156
1,2,4-Trimethylbenzene	0.227	0.150	0.199	0.149	0.336	0.293
n-Decane	0.039	0.094	0.065	0.018	0.209	0.020
1,2,3-Trimethylbenzene	0.111	0.019	0.000	0.000	0.011	0.000
m-Diethylbenzene	0.159	0.013	0.000	0.000	0.000	0.000
p-Diethylbenzene	0.023	0.004	0.000	0.000	0.115	0.015
n-Undecane	0.000	0.000	0.000	0.037	0.362	0.000
n-Dodecane	0.000	0.000	0.000	0.038	0.259	0.000
Ethanol	0.692	0.000	0.944	1.040	1.722	3.225
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.269	0.205	0.217	0.256	0.319	0.309
Acetaldehyde	0.304	0.253	0.319	0.416	0.449	0.415
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.008	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.037	0.028	0.033	0.000	0.028	0.028
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.015	0.000	0.005	0.000	0.000	0.000
Benzaldehyde	0.000	0.000	0.029	0.000	0.000	0.000
Valeraldehyde	0.000	0.025	0.027	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.001	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.012	0.009	0.012	0.009	0.013	0.013

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.017	0.017	0.025	0.022	0.031	0.028
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.000	0.000	0.000	0.001	0.003	0.000
	3N2O-w	0.004	0.004	0.005	0.005	0.007	0.006
NH3	NH3-1	0.005	0.002	0.003	0.002	0.010	0.003
	NH3-2	0.002	0.003	0.003	0.003	0.003	0.002
	NH3-3	0.002	0.005	0.002	0.002	0.002	0.002
	3NH3-w	0.003	0.003	0.003	0.003	0.004	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	71.637 ± 14.645	64.424 ± 11.575

2020MY Nissan Armada

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.045	0.073	0.060	0.054	0.056	0.060
	THC-2	0.003	0.000	0.000	0.000	0.000	0.000
	THC-3	0.002	0.002	0.002	0.002	0.002	0.002
	3THC-w	0.011	0.016	0.013	0.012	0.012	0.013
NMHC Emissions (g/mile)	NMHC-1	0.031	0.069	0.042	0.040	0.041	0.057
	NMHC-2	0.001	0.000	0.000	0.000	0.000	0.000
	NMHC-3	0.000	0.000	0.000	0.000	0.000	0.000
	3NMHC-w	0.007	0.014	0.008	0.008	0.008	0.011

CH4 Emissions (g/mile)	CH4-1	0.013	0.003	0.018	0.014	0.015	0.003
	CH4-2	0.002	0.001	0.001	0.001	0.002	0.000
	CH4-3	0.003	0.003	0.002	0.003	0.003	0.003
	3CH4-W	0.004	0.002	0.005	0.004	0.005	0.002
CO Emissions (g/mile)	CO-1	0.383	0.553	0.580	0.414	0.404	0.413
	CO-2	0.000	0.000	0.000	0.000	0.000	0.000
	CO-3	0.000	0.000	0.016	0.000	0.000	0.000
	3CO-w	0.079	0.115	0.125	0.086	0.084	0.086
NOx Emissions (g/mile)	NOx-1	0.037	0.044	0.038	0.039	0.039	0.040
	NOx-2	0.015	0.017	0.014	0.014	0.017	0.017
	NOx-3	0.010	0.016	0.014	0.012	0.013	0.007
	3NOx-w	0.018	0.022	0.019	0.018	0.020	0.019
CO2 Emissions (g/mile)	CO2-1	580.244	557.360	559.782	558.826	565.093	564.438
	CO2-2	567.168	555.821	562.981	556.381	556.637	559.132
	CO2-3	490.962	475.311	478.217	472.993	479.494	477.803
	3CO2-w	548.958	534.040	539.038	533.982	537.246	537.932
Fuel economy-carbon balanced method (miles per gallon)	FE-1	14.916	14.751	14.768	14.654	15.245	15.179
	FE-2	15.003	14.996	14.930	15.010	15.317	15.122
	FE-3	17.648	17.409	17.471	17.340	17.911	17.801
	3FE-w	15.628	15.533	15.513	15.504	15.935	15.787

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	9.071	11.588	11.131	8.889	10.364	11.901
	PM-soot 2	0.272	0.294	0.310	0.263	0.241	0.272
	PM-soot 3	0.414	0.388	0.380	0.330	0.329	0.339
	3PM-soot-w	2.134	2.663	2.575	2.071	2.362	2.704
PM mass (mg/mile)	PM-1	9.964	12.317	11.558	9.337	11.154	12.868
	PM-2	0.265	0.240	0.053	0.132	0.087	0.390
	PM-3	0.546	0.270	0.411	0.164	0.378	0.737

	3PM mass-w	2.352	2.753	2.538	2.050	2.458	3.075

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	1.62E+13	1.79E+13	1.82E+13	1.56E+13	1.74E+13	1.85E+13
	SPN-2	1.01E+12	1.08E+12	1.16E+12	9.55E+11	1.06E+12	1.04E+12
	SPN-3	1.79E+12	1.43E+12	1.55E+12	1.37E+12	1.44E+12	1.34E+12
	3SPN-w	4.36E+12	4.67E+12	4.80E+12	4.12E+12	4.55E+12	4.75E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.706	0.709	0.713	0.627	0.656	0.738
Acetylene	0.065	0.122	0.058	0.045	0.065	0.065
Ethane	0.295	0.441	0.359	0.218	0.292	0.276
Propylene	0.571	0.541	0.564	0.498	0.515	0.498
Propane	0.000	0.074	0.000	0.000	0.000	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.110	0.095	0.102	0.083	0.081	0.087
1,3-Butadiene	0.000	0.000	0.000	0.000	0.000	0.000
n-Butane	0.090	0.000	0.000	0.000	0.000	0.001
trans-2-Butene	0.068	0.063	0.072	0.054	0.054	0.057
cis-2-Butene	0.050	0.043	0.049	0.037	0.039	0.041
Isopentane	1.553	0.797	0.892	0.835	0.883	0.826
1-Pentene	0.038	0.000	0.000	0.026	0.000	0.000
n-Pentane	0.534	0.247	0.313	0.245	0.283	0.281
Isoprene	0.000	0.000	0.000	0.000	0.000	0.000
trans-2-Pentene	0.058	0.037	0.039	0.038	0.037	0.036
cis-2-Pentene	0.034	0.000	0.000	0.000	0.000	0.000
2,2-Dimethylbutane	0.122	0.067	0.074	0.067	0.073	0.063
Cyclopentane	0.061	0.044	0.045	0.045	0.046	0.048
2,3-Dimethylbutane	0.282	0.151	0.178	0.163	0.180	0.149
2-Methylpentane	0.737	0.422	0.464	0.431	0.469	0.392

3-Methylpentane	0.464	0.279	0.297	0.270	0.289	0.248
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.347	0.284	0.227	0.213	0.226	0.196
Methylcyclopentane	0.372	0.238	0.264	0.246	0.265	0.230
2,4-Dimethylpentane	0.307	0.252	0.213	0.196	0.213	0.177
Benzene	0.892	0.622	0.884	0.693	0.770	3.187
Cyclohexane	0.129	0.077	0.090	0.083	0.090	0.080
2-Methylhexane	0.277	0.161	0.196	0.177	0.196	0.153
2,3-Dimethylpentane	0.472	0.332	0.340	0.298	0.324	0.273
3-Methylhexane	0.346	0.137	0.203	0.163	0.180	0.134
2,2,4-Trimethylpentane	0.718	0.274	0.553	0.491	0.532	0.442
n-Heptane	0.165	0.018	0.104	0.088	0.099	0.073
Methylcyclohexane	0.148	0.118	0.092	0.079	0.089	0.068
2,3,4-Trimethylpentane	0.237	0.042	0.184	0.167	0.181	0.150
Toluene	0.997	0.168	0.830	0.705	0.747	3.620
2-Methylheptane	0.155	0.000	0.125	0.122	0.133	0.108
3-Methylheptane	0.149	0.000	0.122	0.112	0.122	0.098
n-Octane	0.128	0.000	0.107	0.101	0.111	0.082
Ethylbenzene	0.191	0.000	0.162	0.143	0.147	0.141
m/p-Xylenes	0.660	0.000	0.556	0.513	0.523	0.502
Styrene	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	0.235	0.000	0.199	0.177	0.183	0.171
Nonane	0.072	0.000	0.055	0.049	0.053	0.044
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.025	0.000	0.000	0.000	0.000	0.000
m-Ethyltoluene	0.153	0.000	0.133	0.129	0.136	0.124
p-Ethyltoluene	0.070	0.000	0.060	0.066	0.068	0.050
1,3,5-Trimethylbenzene	0.093	0.000	0.080	0.074	0.082	0.070
o-Ethyltoluene	0.245	0.000	0.147	0.035	0.028	0.032
1,2,4-Trimethylbenzene	0.209	0.000	0.183	0.163	0.169	0.162
n-Decane	0.028	0.000	0.014	0.048	0.074	0.018
1,2,3-Trimethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
m-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
p-Diethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000

n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.000	0.000	0.033	0.000	0.000	0.000
Ethanol	1.079	0.489	0.793	0.826	0.520	0.522
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.267	0.335	0.275	0.231	0.254	0.317
Acetaldehyde	0.583	0.355	0.275	0.485	0.511	0.434
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.025
Propionaldehyde	0.039	0.000	0.000	0.039	0.036	0.036
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.035	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.015	0.001	0.000	0.008	0.001	0.000
Benzaldehyde	0.000	0.000	0.000	0.038	0.000	0.036
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.008	0.014	0.009	0.008	0.008	0.012

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.078	0.068	0.086	0.052	0.070	0.049
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.001	0.022	0.000	0.000	0.000	0.000
	3N2O-w	0.016	0.020	0.018	0.011	0.015	0.010
NH3	NH3-1	0.009	0.007	0.012	0.007	0.016	0.003

	NH3-2	0.030	0.035	0.034	0.005	0.027	0.027
	NH3-3	0.005	0.008	0.014	0.004	0.005	0.006
	3NH3-w	0.019	0.022	0.024	0.005	0.019	0.016

OFP

	E10	E15
Total OFP (mg O3/mile)	43.717 ± 8.843	40.857 ± 8.123

2020MY Toyota Prius

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.034	0.047	0.040	0.041	0.039	0.043
	THC-2	0.001	0.001	0.001	0.001	0.001	0.001
	THC-3	0.007	0.007	0.008	0.006	0.006	0.007
	3THC-w	0.010	0.012	0.011	0.010	0.010	0.011
NMHC Emissions (g/mile)	NMHC-1	0.029	0.042	0.035	0.036	0.035	0.038
	NMHC-2	0.001	0.001	0.001	0.000	0.001	0.001
	NMHC-3	0.006	0.006	0.006	0.004	0.004	0.005
	3NMHC-w	0.008	0.011	0.009	0.009	0.009	0.010
CH4 Emissions (g/mile)	CH4-1	0.005	0.005	0.005	0.005	0.005	0.005
	CH4-2	0.001	0.000	0.001	0.000	0.000	0.001
	CH4-3	0.002	0.001	0.002	0.002	0.002	0.002
	3CH4-W	0.002	0.001	0.002	0.002	0.002	0.002
CO Emissions (g/mile)	CO-1	0.109	0.199	0.200	0.228	0.249	0.277
	CO-2	0.000	0.000	0.004	0.000	0.046	0.000
	CO-3	0.031	0.036	0.026	0.019	0.080	0.022
	3CO-w	0.031	0.051	0.051	0.052	0.097	0.063
NOx Emissions (g/mile)	NOx-1	0.011	0.011	0.004	0.015	0.002	0.002
	NOx-2	0.000	0.000	0.000	0.000	0.000	0.000
	NOx-3	0.001	0.002	0.001	0.003	0.005	0.001
	3NOx-w	0.003	0.003	0.001	0.004	0.002	0.001
CO2 Emissions (g/mile)	CO2-1	198.531	181.795	196.567	197.760	171.716	173.158
	CO2-2	100.932	96.746	94.331	102.027	100.912	112.271
	CO2-3	158.790	164.381	167.952	161.413	164.350	167.206
	3CO2-w	137.105	133.039	135.708	138.173	132.932	139.907
Fuel economy-carbon balanced method (miles per gallon)	FE-1	42.823	46.713	43.215	42.108	48.469	48.052
	FE-2	84.346	87.995	90.240	81.815	82.660	74.350
	FE-3	53.591	51.767	50.670	51.701	50.747	49.907

	3FE-w	62.059	63.936	62.681	60.364	62.709	59.608

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.286	0.335	0.271	0.288	0.155	0.190
	PM-soot 2	0.010	0.013	0.011	0.010	0.012	0.013
	PM-soot 3	0.012	0.008	0.016	0.008	0.010	0.010
	3PM-soot-w	0.068	0.079	0.066	0.067	0.041	0.049
PM mass (mg/mile)	PM-1	0.323	0.374	0.437	0.274	0.132	0.208
	PM-2	0.000	0.000	0.000	0.000	0.000	0.000
	PM-3	0.000	0.000	0.004	0.000	0.013	0.235
	3PM mass-w	0.067	0.078	0.092	0.057	0.031	0.107

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	1.30E+12	1.34E+12	1.07E+12	1.28E+12	7.18E+11	8.50E+11
	SPN-2	2.52E+10	4.94E+10	2.70E+10	2.35E+10	3.91E+10	5.18E+10
	SPN-3	1.77E+10	2.30E+10	1.37E+10	1.00E+10	1.51E+10	1.51E+10
	3SPN-w	2.87E+11	3.09E+11	2.40E+11	2.80E+11	1.73E+11	2.07E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.595	0.823	0.737	0.794	0.763	0.748
Acetylene	0.023	0.183	0.015	0.041	0.036	0.039
Ethane	0.546	0.487	0.618	0.615	0.551	0.483
Propylene	0.446	0.558	0.547	0.580	0.515	0.568
Propane	0.000	0.022	0.375	0.227	0.125	0.037
Isobutane	0.000	0.000	0.000	0.000	0.000	0.156
1-Butene	0.090	0.107	0.115	0.114	0.110	0.117
1,3-Butadiene	0.000	0.039	0.009	0.005	0.003	0.026

n-Butane	0.054	0.072	0.044	0.063	0.083	0.122
trans-2-Butene	0.068	0.057	0.077	0.085	0.072	0.072
cis-2-Butene	0.040	0.039	0.042	0.047	0.040	0.043
Isopentane	1.095	1.382	1.035	1.102	1.232	1.374
1-Pentene	0.014	0.027	0.018	0.017	0.021	0.023
n-Pentane	0.361	0.485	0.352	0.373	0.417	0.453
Isoprene	0.000	0.017	0.010	0.011	0.010	0.016
trans-2-Pentene	0.038	0.059	0.040	0.040	0.047	0.055
cis-2-Pentene	0.020	0.032	0.022	0.021	0.025	0.030
2,2-Dimethylbutane	0.083	0.098	0.082	0.079	0.088	0.090
Cyclopentane	0.048	0.061	0.049	0.049	0.053	0.061
2,3-Dimethylbutane	0.196	0.249	0.202	0.199	0.211	0.230
2-Methylpentane	0.525	0.679	0.546	0.543	0.577	0.619
3-Methylpentane	0.327	0.419	0.351	0.336	0.353	0.383
1-Hexene	0.000	0.012	0.000	0.000	0.000	0.012
n-Hexane	0.251	0.326	0.274	0.261	0.268	0.295
Methylcyclopentane	0.289	0.386	0.321	0.302	0.315	0.353
2,4-Dimethylpentane	0.203	0.262	0.234	0.219	0.222	0.242
Benzene	0.325	0.396	0.371	0.416	0.376	0.373
Cyclohexane	0.096	0.127	0.111	0.102	0.105	0.119
2-Methylhexane	0.209	0.279	0.256	0.232	0.231	0.255
2,3-Dimethylpentane	0.319	0.410	0.377	0.345	0.345	0.375
3-Methylhexane	0.222	0.293	0.275	0.244	0.245	0.261
2,2,4-Trimethylpentane	0.467	0.584	0.558	0.514	0.500	0.536
n-Heptane	0.126	0.165	0.155	0.143	0.134	0.150
Methylcyclohexane	0.114	0.155	0.151	0.128	0.125	0.141
2,3,4-Trimethylpentane	0.135	0.175	0.172	0.156	0.150	0.161
Toluene	0.557	0.715	0.727	1.304	0.642	0.697
2-Methylheptane	0.087	0.111	0.115	0.107	0.098	0.107
3-Methylheptane	0.085	0.110	0.111	0.101	0.095	0.101
n-Octane	0.070	0.086	0.089	0.078	0.073	0.077
Ethylbenzene	0.097	0.134	0.137	0.124	0.126	0.135
m/p-Xylenes	0.282	0.400	0.398	0.371	0.361	0.389
Styrene	0.000	0.000	0.000	0.000	0.000	0.000

o-Xylene	0.096	0.135	0.135	0.123	0.120	0.130
Nonane	0.031	0.032	0.040	0.031	0.030	0.031
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.000	0.013	0.013	0.011	0.012	0.013
m-Ethyltoluene	0.052	0.077	0.081	0.076	0.070	0.076
p-Ethyltoluene	0.027	0.036	0.038	0.036	0.032	0.036
1,3,5-Trimethylbenzene	0.038	0.045	0.052	0.047	0.038	0.040
o-Ethyltoluene	0.024	0.028	0.033	0.033	0.025	0.024
1,2,4-Trimethylbenzene	0.060	0.083	0.086	0.090	0.078	0.083
n-Decane	0.024	0.017	0.030	0.013	0.008	0.003
1,2,3-Trimethylbenzene	0.077	0.030	0.091	0.000	0.000	0.000
m-Diethylbenzene	0.095	0.014	0.123	0.000	0.000	0.000
p-Diethylbenzene	0.017	0.010	0.026	0.000	0.000	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.064	0.016	0.018	0.021	0.020	0.000
Ethanol	0.708	0.908	0.655	1.406	1.320	1.573
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.009	0.040	0.041	0.099	0.100	0.165
Acetaldehyde	0.225	0.400	0.270	0.460	0.469	0.502
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.000	0.017	0.000	0.018	0.016	0.017
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.002	0.000	0.002	0.000	0.000
Benzaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.008	0.011	0.010	0.010	0.009	0.010

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	Instrument problematic	0.076	0.033	0.030	0.027	0.024
	N2O-2	Instrument problematic	0.003	0.002	0.000	0.002	0.001
	N2O-3	Instrument problematic	0.000	0.000	0.000	0.002	0.000
	3N2O-w	Instrument problematic	0.017	0.008	0.006	0.007	0.006
NH3	NH3-1	Instrument problematic	0.001	0.001	0.001	0.001	0.001
	NH3-2	Instrument problematic	0.001	0.003	0.001	0.001	0.001
	NH3-3	Instrument problematic	0.001	0.001	0.001	0.006	0.006
	3NH3-w	Instrument problematic	0.001	0.002	0.001	0.002	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	32.401 ± 5.702	36.924 ± 4.718

2020MY GMC Acadia

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.064	0.075	0.076	0.061	0.067	0.074
	THC-2	0.007	0.007	0.006	0.005	0.006	0.008
	THC-3	0.014	0.018	0.020	0.016	0.025	0.023
	3THC-w	0.021	0.024	0.024	0.020	0.024	0.026
NMHC Emissions (g/mile)	NMHC-1	0.044	0.050	0.052	0.043	0.045	0.045
	NMHC-2	0.001	0.001	0.003	0.001	0.003	0.002
	NMHC-3	0.002	0.004	0.003	0.004	0.013	0.006
	3NMHC-w	0.010	0.012	0.013	0.010	0.014	0.012
CH4 Emissions (g/mile)	CH4-1	0.019	0.025	0.024	0.019	0.022	0.029
	CH4-2	0.006	0.006	0.003	0.004	0.003	0.007
	CH4-3	0.012	0.013	0.016	0.012	0.012	0.017
	3CH4-W	0.010	0.012	0.011	0.009	0.010	0.014
CO Emissions (g/mile)	CO-1	0.892	1.250	1.137	0.696	1.011	1.300
	CO-2	0.000	0.000	0.074	0.000	0.000	0.000
	CO-3	0.000	0.073	0.183	0.000	0.033	0.343
	3CO-w	0.185	0.279	0.324	0.145	0.219	0.364
NOx Emissions (g/mile)	NOx-1	0.012	0.015	0.017	0.017	0.014	0.017
	NOx-2	0.002	0.002	0.002	0.001	0.002	0.000
	NOx-3	0.004	0.003	0.003	0.004	0.003	0.001
	3NOx-w	0.004	0.005	0.006	0.005	0.005	0.004
CO2 Emissions (g/mile)	CO2-1	398.102	408.478	412.806	409.569	412.903	419.143
	CO2-2	424.237	421.584	426.903	434.551	443.539	439.229
	CO2-3	340.962	341.819	349.636	360.981	354.153	360.670
	3CO2-w	395.974	397.031	402.802	409.121	412.634	413.456
Fuel economy-carbon balanced method (miles per gallon)	FE-1	20.318	20.130	19.809	21.300	20.731	20.523
	FE-2	19.209	18.820	19.004	20.067	20.193	19.936
	FE-3	23.122	23.562	23.106	24.966	24.894	24.325

	3FE-w	20.389	20.210	20.158	21.481	21.415	21.105

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.737	0.743	0.715	0.811	1.009	0.933
	PM-soot 2	0.083	0.072	0.060	0.062	0.063	0.076
	PM-soot 3	0.131	0.114	0.096	0.094	0.095	0.107
	3PM-soot-w	0.232	0.223	0.205	0.226	0.268	0.262
PM mass (mg/mile)	PM-1	0.928	0.762	0.838	0.964	1.126	0.988
	PM-2	0.040	0.000	0.045	0.041	0.000	0.000
	PM-3	0.057	0.042	0.144	0.081	0.065	0.020
	3PM mass-w	0.229	0.169	0.236	0.243	0.251	0.210

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	2.31E+12	2.68E+12	2.60E+12	2.35E+12	2.25E+12	2.21E+12
	SPN-2	2.46E+11	2.46E+11	3.23E+11	2.78E+11	2.62E+11	2.14E+11
	SPN-3	4.38E+11	4.47E+11	4.64E+11	5.01E+11	4.79E+11	3.61E+11
	3SPN-w	7.26E+11	8.05E+11	8.33E+11	7.70E+11	7.33E+11	6.68E+11

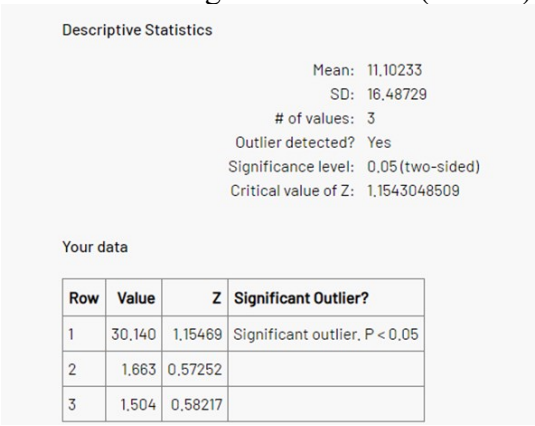
Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.116	1.381	1.057	0.942	1.312	1.049
Acetylene	0.831	1.046	0.739	0.654	0.912	0.908
Ethane	0.564	0.675	0.653	0.623	0.713	0.630
Propylene	0.707	0.836	0.690	0.604	0.897	0.748
Propane	0.000	0.045	0.019	6.290	0.317	1.323
Isobutane	0.000	0.000	0.000	0.008	0.000	0.105
1-Butene	0.105	0.167	0.124	0.084	0.125	0.121
1,3-Butadiene	0.039	0.042	0.041	0.017	0.045	0.037

n-Butane	0.029	0.003	0.054	0.038	0.025	0.047
trans-2-Butene	0.061	0.079	0.066	0.045	0.074	0.064
cis-2-Butene	0.049	0.092	0.062	0.037	0.058	0.050
Isopentane	0.823	0.822	1.345	1.044	0.870	0.792
1-Pentene	0.027	0.033	0.034	0.031	0.026	0.025
n-Pentane	0.300	0.347	0.415	0.383	0.294	0.262
Isoprene	0.020	0.020	0.021	0.015	0.020	0.020
trans-2-Pentene	0.043	0.047	0.062	0.070	0.043	0.040
cis-2-Pentene	0.026	0.028	0.037	0.039	0.026	0.024
2,2-Dimethylbutane	0.060	0.061	0.084	0.073	0.066	0.059
Cyclopentane	0.042	0.043	0.063	0.056	0.045	0.039
2,3-Dimethylbutane	0.148	0.159	0.215	0.219	0.174	0.148
2-Methylpentane	0.400	0.432	0.578	0.594	0.466	0.396
3-Methylpentane	0.251	0.270	0.358	0.381	0.301	0.254
1-Hexene	0.000	0.018	0.000	0.000	0.000	0.000
n-Hexane	0.206	0.223	0.279	0.361	0.241	0.205
Methylcyclopentane	0.248	0.274	0.348	0.464	0.304	0.248
2,4-Dimethylpentane	0.176	0.193	0.233	0.286	0.206	0.176
Benzene	0.801	1.160	0.859	1.040	1.355	0.992
Cyclohexane	0.086	0.095	0.119	0.123	0.100	0.086
2-Methylhexane	0.169	0.197	0.237	0.277	0.214	0.178
2,3-Dimethylpentane	0.272	0.305	0.363	0.491	0.332	0.280
3-Methylhexane	0.182	0.203	0.237	0.298	0.249	0.185
2,2,4-Trimethylpentane	0.408	0.452	0.516	0.654	0.500	0.427
n-Heptane	0.095	0.108	0.128	0.216	0.126	0.097
Methylcyclohexane	0.093	0.108	0.128	0.176	0.122	0.093
2,3,4-Trimethylpentane	0.135	0.151	0.168	0.222	0.167	0.143
Toluene	0.998	1.022	1.061	2.545	1.113	0.969
2-Methylheptane	0.083	0.097	0.107	0.144	0.119	0.100
3-Methylheptane	0.091	0.103	0.110	0.125	0.117	0.097
n-Octane	0.079	0.087	0.088	0.138	0.097	0.081
Ethylbenzene	0.232	0.216	0.206	0.316	0.199	0.197
m/p-Xylenes	0.644	0.635	0.632	1.234	0.670	0.602
Styrene	0.000	0.000	0.000	0.000	0.000	0.000

o-Xylene	0.296	0.217	0.219	0.345	0.236	0.205
Nonane	0.055	0.043	0.043	0.052	0.052	0.045
Isopropylbenzene	0.020	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.042	0.027	0.027	0.038	0.025	0.026
m-Ethyltoluene	0.155	0.162	0.156	0.192	0.153	0.152
p-Ethyltoluene	0.063	0.073	0.068	0.094	0.069	0.072
1,3,5-Trimethylbenzene	0.131	0.095	0.093	0.118	0.106	0.084
o-Ethyltoluene	0.089	0.059	0.058	0.070	0.080	0.051
1,2,4-Trimethylbenzene	0.238	0.199	0.193	0.276	0.213	0.194
n-Decane	0.118	0.035	0.009	0.264	0.035	0.029
1,2,3-Trimethylbenzene	0.077	0.085	0.000	0.161	0.079	0.005
m-Diethylbenzene	0.128	0.125	0.000	0.210	0.082	0.000
p-Diethylbenzene	0.031	0.028	0.017	0.047	0.028	0.005
n-Undecane	0.194	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.070	0.025	0.000	0.030	0.132	0.000
Ethanol	0.800	0.651	0.879	Outlier*	1.663	1.504
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

*Outlier: Ethanol emissions for this datapoint were calculated at 30.14 mg/mile. While no analytical issue was reported, this value was removed from the dataset as an outlier. Additional analysis detected this value as a significant outlier (P<0.05).



Descriptive Statistics

Mean: 11,10233
SD: 16,48729
# of values: 3
Outlier detected? Yes
Significance level: 0,05 (two-sided)
Critical value of Z: 1,1543048509

Your data

Row	Value	Z	Significant Outlier?
1	30,140	1,15469	Significant outlier, P < 0,05
2	1,663	0,57252	
3	1,504	0,58217	

Carbonyls

Pollutants (mg/mile)	E10	E15

	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.314	0.317	0.334	0.300	0.348	0.410
Acetaldehyde	0.229	0.267	0.270	0.295	0.399	0.340
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.000	0.075	0.000	0.000	0.000
Propionaldehyde	0.000	0.031	0.033	0.000	0.025	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.001	0.001	0.000	0.000	0.000
Benzaldehyde	0.000	0.000	0.025	0.000	0.000	0.000
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.011	0.013	0.014	0.011	0.015	0.013

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.020	0.015	0.017	0.019	0.025	0.024
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.012	0.003	0.005	0.001	0.007	0.004
	3N2O-w	0.007	0.004	0.005	0.004	0.007	0.006
NH3	NH3-1	0.003	0.003	0.002	0.002	0.009	0.002
	NH3-2	0.001	0.001	0.003	0.001	0.002	0.001
	NH3-3	0.002	0.002	0.002	0.002	0.002	0.003
	3NH3-w	0.002	0.002	0.002	0.002	0.003	0.002

OFP

	E10	E15
Total OFP (mg O3/mile)	56.448 ± 8.818	62.567 ± 19.504

2020MY Buick Enclave

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.081	0.081	0.082	0.112	0.073	0.073
	THC-2	0.006	0.005	0.006	0.007	0.007	0.006
	THC-3	0.017	0.015	0.018	0.016	0.018	0.016
	3THC-w	0.024	0.023	0.025	0.031	0.024	0.023
NMHC Emissions (g/mile)	NMHC-1	0.059	0.059	0.059	0.085	0.051	0.070
	NMHC-2	0.000	0.000	0.000	0.001	0.002	0.000
	NMHC-3	0.006	0.005	0.006	0.005	0.016	0.004
	3NMHC-w	0.014	0.014	0.014	0.019	0.016	0.016
CH4 Emissions (g/mile)	CH4-1	0.022	0.022	0.022	0.028	0.022	0.004
	CH4-2	0.005	0.005	0.006	0.006	0.006	0.006
	CH4-3	0.011	0.010	0.012	0.012	0.003	0.012
	3CH4-W	0.011	0.010	0.011	0.012	0.008	0.007
CO Emissions (g/mile)	CO-1	0.972	0.959	1.325	1.717	0.966	0.969
	CO-2	0.000	0.000	0.000	0.043	0.000	0.000
	CO-3	0.046	0.038	0.018	0.028	0.019	0.000
	3CO-w	0.214	0.209	0.279	0.385	0.206	0.200
NOx Emissions (g/mile)	NOx-1	0.023	0.021	0.012	0.019	0.026	0.017
	NOx-2	0.002	0.002	0.002	0.002	0.002	0.002
	NOx-3	0.006	0.005	0.005	0.004	0.007	0.005
	3NOx-w	0.007	0.006	0.005	0.006	0.008	0.006

CO2 Emissions (g/mile)	CO2-1	417.458	424.235	420.868	429.026	420.920	420.380
	CO2-2	461.154	462.185	465.925	468.223	463.922	459.892
	CO2-3	366.043	370.518	370.953	373.602	370.430	369.195
	3CO2-w	426.051	429.222	430.581	434.171	429.381	426.812
Fuel economy-carbon balanced method (miles per gallon)	FE-1	20.307	19.985	20.117	19.321	19.750	19.775
	FE-2	18.460	18.419	18.271	17.825	17.993	18.150
	FE-3	23.250	22.971	22.945	22.338	22.530	22.607
	3FE-w	19.963	19.816	19.748	19.196	19.423	19.540

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	2.920	2.857	2.921	3.105	2.339	2.216
	PM-soot 2	0.180	0.135	0.154	0.106	0.100	0.082
	PM-soot 3	0.452	0.382	0.402	0.319	0.345	0.363
	3PM-soot-w	0.821	0.765	0.794	0.785	0.632	0.601
PM mass (mg/mile)	PM-1	3.496	3.177	3.224	3.692	2.529	2.418
	PM-2	0.282	0.101	0.000	0.050	0.000	0.000
	PM-3	0.473	0.437	0.414	0.252	0.244	0.362
	3PM mass-w	0.999	0.829	0.780	0.859	0.591	0.600

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	7.11E+12	7.02E+12	6.98E+12	7.34E+12	6.17E+12	5.74E+12
	SPN-2	9.25E+11	6.85E+11	6.91E+11	4.79E+11	4.45E+11	4.12E+11
	SPN-3	1.63E+12	1.42E+12	1.32E+12	1.03E+12	1.12E+12	1.27E+12
	3SPN-w	2.40E+12	2.20E+12	2.16E+12	2.05E+12	1.82E+12	1.75E+12

Hydrocarbon species

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.476	1.448	1.595	2.297	1.107	1.108

Acetylene	1.274	1.270	1.167	1.970	0.813	0.873
Ethane	0.652	0.650	0.672	0.772	0.641	0.577
Propylene	0.862	0.890	1.094	1.208	0.647	0.642
Propane	0.000	0.001	0.004	0.000	0.105	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.133	0.143	0.211	0.240	0.113	0.111
1,3-Butadiene	0.088	0.108	0.082	0.135	0.046	0.053
n-Butane	0.056	0.048	0.058	0.057	0.030	0.072
trans-2-Butene	0.070	0.071	0.137	0.107	0.056	0.056
cis-2-Butene	0.056	0.058	0.134	0.121	0.048	0.046
Isopentane	1.368	1.214	1.342	0.000	0.882	1.125
1-Pentene	0.037	0.036	0.039	0.044	0.026	0.032
n-Pentane	0.488	0.392	0.452	0.479	0.292	0.363
Isoprene	0.034	0.036	0.033	0.046	0.022	0.023
trans-2-Pentene	0.061	0.054	0.069	0.074	0.037	0.053
cis-2-Pentene	0.036	0.032	0.041	0.043	0.022	0.030
2,2-Dimethylbutane	0.086	0.082	0.086	0.096	0.065	0.076
Cyclopentane	0.065	0.056	0.059	0.069	0.041	0.050
2,3-Dimethylbutane	0.219	0.209	0.218	0.258	0.161	0.194
2-Methylpentane	0.671	0.564	0.672	0.700	0.430	0.520
3-Methylpentane	0.371	0.357	0.425	0.444	0.272	0.330
1-Hexene	0.000	0.000	0.020	0.025	0.000	0.000
n-Hexane	0.293	0.288	0.303	0.350	0.217	0.254
Methylcyclopentane	0.358	0.353	0.359	0.433	0.265	0.308
2,4-Dimethylpentane	0.240	0.249	0.246	0.291	0.195	0.215
Benzene	1.211	1.199	1.330	1.823	0.886	0.877
Cyclohexane	0.123	0.123	0.127	0.147	0.092	0.104
2-Methylhexane	0.258	0.264	0.285	0.319	0.202	0.217
2,3-Dimethylpentane	0.379	0.399	0.393	0.463	0.316	0.340
3-Methylhexane	0.264	0.310	0.328	0.330	0.216	0.234
2,2,4-Trimethylpentane	0.544	0.585	0.577	0.673	0.483	0.500
n-Heptane	0.142	0.159	0.159	0.190	0.116	0.215
Methylcyclohexane	0.142	0.154	0.148	0.187	0.112	0.115
2,3,4-Trimethylpentane	0.179	0.197	0.191	0.224	0.169	0.167

Toluene	1.178	1.209	1.431	1.688	0.926	0.978
2-Methylheptane	0.123	0.132	0.136	0.162	0.113	0.110
3-Methylheptane	0.123	0.138	0.135	0.160	0.116	0.112
n-Octane	0.102	0.125	0.145	0.134	0.099	0.094
Ethylbenzene	0.212	0.237	0.301	0.322	0.193	0.192
m/p-Xylenes	0.684	0.747	0.898	0.981	0.608	0.606
Styrene	0.006	0.018	0.037	0.038	0.000	0.000
o-Xylene	0.239	0.260	0.315	0.360	0.212	0.209
Nonane	0.052	0.081	0.138	0.069	0.056	0.049
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.027	0.032	0.043	0.039	0.027	0.024
m-Ethyltoluene	0.169	0.194	0.197	0.242	0.162	0.157
p-Ethyltoluene	0.077	0.087	0.082	0.107	0.070	0.073
1,3,5-Trimethylbenzene	0.114	0.131	0.157	0.157	0.112	0.096
o-Ethyltoluene	0.076	0.075	0.147	0.078	0.057	0.061
1,2,4-Trimethylbenzene	0.228	0.243	1.043	0.299	0.220	0.192
n-Decane	0.045	0.108	0.106	0.041	0.042	0.027
1,2,3-Trimethylbenzene	0.103	0.149	0.128	0.147	0.114	0.040
m-Diethylbenzene	0.209	0.381	0.302	0.281	0.244	0.103
p-Diethylbenzene	0.016	0.039	0.041	0.044	0.024	0.015
n-Undecane	0.000	0.071	0.057	0.000	0.000	0.000
n-Dodecane	0.035	0.052	0.067	0.025	0.024	0.027
Ethanol	0.937	0.765	1.077	1.961	1.003	1.261
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.329	0.295	0.276	0.323	0.252	0.262
Acetaldehyde	0.284	0.254	0.247	0.426	0.306	0.299
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.026	0.040	0.030	0.000	0.000	0.060
Propionaldehyde	0.026	0.000	0.000	0.025	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

Methacrolein	0.000	0.000	0.000	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.001	0.002	0.008	0.000	0.005
Benzaldehyde	0.000	0.031	0.033	0.039	0.032	0.030
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.025
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.002	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.014	0.014	0.015	0.020	0.016	0.016

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.043	0.046	0.037	0.047	0.045	0.038
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.001	0.001	0.005	0.003	0.013	0.006
	3N2O-w	0.009	0.010	0.009	0.011	0.013	0.009
NH3	NH3-1	0.002	0.001	0.005	0.002	0.002	0.008
	NH3-2	0.002	0.002	0.002	0.001	0.002	0.002
	NH3-3	0.002	0.002	0.002	0.002	0.002	0.003
	3NH3-w	0.002	0.002	0.003	0.002	0.002	0.003

OFP

	E10	E15
Total OFP (mg O3/mile)	68.385 ± 11.518	63.742 ± 19.072

2021MY Chevrolet Colorado

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.070	0.066	0.075	0.059	0.070	0.072
	THC-2	0.009	0.008	0.008	0.009	0.008	0.010
	THC-3	0.016	0.020	0.014	0.012	0.011	0.014
	3THC-w	0.024	0.023	0.024	0.020	0.022	0.024
NMHC Emissions (g/mile)	NMHC-1	0.050	0.044	0.053	0.038	0.048	0.050
	NMHC-2	0.006	0.000	0.001	0.001	0.001	0.001
	NMHC-3	0.002	0.006	0.002	0.001	0.001	0.001
	3NMHC-w	0.014	0.011	0.012	0.008	0.011	0.011
CH4 Emissions (g/mile)	CH4-1	0.021	0.022	0.023	0.021	0.023	0.022
	CH4-2	0.003	0.008	0.008	0.008	0.007	0.009
	CH4-3	0.014	0.013	0.012	0.010	0.010	0.013
	3CH4-W	0.009	0.013	0.012	0.011	0.011	0.013
CO Emissions (g/mile)	CO-1	0.299	0.479	0.452	0.278	0.372	0.426
	CO-2	0.072	0.331	0.275	0.174	0.074	0.193
	CO-3	0.215	0.364	0.308	0.094	0.055	0.134
	3CO-w	0.158	0.371	0.321	0.173	0.131	0.225
NOx Emissions (g/mile)	NOx-1	0.026	0.025	0.031	0.036	0.028	0.028
	NOx-2	0.000	0.000	0.000	0.000	0.001	0.000
	NOx-3	0.001	0.001	0.001	0.002	0.002	0.001
	3NOx-w	0.006	0.006	0.007	0.008	0.006	0.006
CO2 Emissions (g/mile)	CO2-1	470.886	468.653	460.672	457.292	462.624	457.924
	CO2-2	450.877	448.778	446.871	446.160	448.569	445.511
	CO2-3	405.707	401.313	404.843	399.865	397.560	399.121
	3CO2-w	442.618	439.870	438.212	435.734	437.482	435.359
Fuel economy-carbon balanced method (miles per gallon)	FE-1	18.053	18.129	18.443	18.230	18.013	18.194
	FE-2	18.876	18.947	19.032	18.697	18.604	18.723
	FE-3	20.964	21.181	21.002	20.866	20.991	20.902

	3FE-w	19.220	19.326	19.402	19.143	19.069	19.155

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	1.643	1.846	1.809	1.362	1.797	1.412
	PM-soot 2	0.195	0.197	0.218	0.196	0.217	0.210
	PM-soot 3	0.320	0.343	0.389	0.448	0.466	0.506
	3PM-soot-w	0.529	0.579	0.595	0.507	0.613	0.540
PM mass (mg/mile)	PM-1	2.006	1.883	1.962	1.317	2.015	1.507
	PM-2	0.048	0.086	0.118	0.126	0.047	0.000
	PM-3	0.262	0.258	0.397	0.322	0.300	Problematic (PM filter damaged)
	3PM mass-w	0.512	0.506	0.577	0.427	0.524	Problematic (No results due to no phase 3 PM mass data)

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	4.70E+12	4.86E+12	4.83E+12	4.20E+12	4.82E+12	4.19E+12
	SPN-2	8.07E+11	8.27E+11	8.87E+11	8.05E+11	8.15E+11	7.53E+11
	SPN-3	1.32E+12	1.39E+12	1.33E+12	1.38E+12	1.43E+12	1.34E+12
	3SPN-w	1.75E+12	1.82E+12	1.82E+12	1.67E+12	1.81E+12	1.62E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	0.861	0.904	0.766	0.823	0.931	0.843
Acetylene	0.311	0.234	0.248	0.311	0.344	0.238
Ethane	0.606	0.652	0.539	0.593	0.614	0.572
Propylene	0.600	0.623	0.570	0.503	0.615	0.575
Propane	0.017	0.000	0.000	0.091	0.005	0.000
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.097	0.105	0.101	0.080	0.100	0.125
1,3-Butadiene	0.048	0.027	0.026	0.019	0.036	0.010

n-Butane	0.095	0.072	0.030	0.000	0.019	0.048
trans-2-Butene	0.056	0.059	0.056	0.043	0.055	0.056
cis-2-Butene	0.041	0.047	0.044	0.031	0.044	0.052
Isopentane	1.439	1.243	1.247	0.763	0.982	1.180
1-Pentene	0.039	0.034	0.035	0.024	0.031	0.036
n-Pentane	0.458	0.400	0.508	0.317	0.313	0.389
Isoprene	0.025	0.020	0.020	0.016	0.024	0.016
trans-2-Pentene	0.065	0.050	0.060	0.035	0.047	0.057
cis-2-Pentene	0.037	0.029	0.035	0.021	0.028	0.044
2,2-Dimethylbutane	0.097	0.088	0.097	0.064	0.074	0.082
Cyclopentane	0.062	0.053	0.059	0.037	0.046	0.051
2,3-Dimethylbutane	0.244	0.215	0.244	0.158	0.186	0.206
2-Methylpentane	0.684	0.568	0.654	0.415	0.497	0.628
3-Methylpentane	0.401	0.354	0.416	0.272	0.309	0.344
1-Hexene	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.309	0.272	0.314	0.203	0.239	0.275
Methylcyclopentane	0.368	0.332	0.374	0.239	0.286	0.337
2,4-Dimethylpentane	0.252	0.237	0.262	0.174	0.204	0.206
Benzene	0.550	0.774	0.535	0.422	0.541	0.520
Cyclohexane	0.124	0.113	0.121	0.079	0.094	0.103
2-Methylhexane	0.263	0.236	0.261	0.163	0.197	0.222
2,3-Dimethylpentane	0.401	0.372	0.404	0.270	0.313	0.327
3-Methylhexane	0.296	0.252	0.265	0.172	0.201	0.251
2,2,4-Trimethylpentane	0.561	0.551	0.587	0.408	0.468	0.475
n-Heptane	0.138	0.130	0.140	0.084	0.103	0.119
Methylcyclohexane	0.133	0.123	0.129	0.079	0.099	0.102
2,3,4-Trimethylpentane	0.178	0.177	0.182	0.131	0.147	0.147
Toluene	0.777	0.853	1.076	0.592	0.773	0.826
2-Methylheptane	0.109	0.110	0.110	0.077	0.089	0.090
3-Methylheptane	0.113	0.115	0.114	0.081	0.093	0.094
n-Octane	0.096	0.097	0.091	0.066	0.074	0.093
Ethylbenzene	0.161	0.159	0.169	0.119	0.150	0.159
m/p-Xylenes	0.520	0.538	0.550	0.376	0.479	0.495
Styrene	0.000	0.000	0.000	0.000	0.000	0.000

o-Xylene	0.184	0.183	0.193	0.132	0.166	0.171
Nonane	0.042	0.045	0.045	0.032	0.034	0.044
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.024	0.021	0.023	0.000	0.021	0.023
m-Ethyltoluene	0.134	0.132	0.137	0.094	0.120	0.119
p-Ethyltoluene	0.061	0.060	0.063	0.041	0.055	0.057
1,3,5-Trimethylbenzene	0.078	0.087	0.079	0.056	0.069	0.058
o-Ethyltoluene	0.000	0.055	0.050	0.034	0.045	0.050
1,2,4-Trimethylbenzene	0.189	0.174	0.174	0.113	0.154	0.141
n-Decane	0.039	0.038	0.013	0.009	0.009	0.041
1,2,3-Trimethylbenzene	0.015	0.000	0.000	0.092	0.035	0.000
m-Diethylbenzene	0.061	0.000	0.000	0.208	0.097	0.000
p-Diethylbenzene	0.011	0.000	0.000	0.028	0.011	0.000
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.043
n-Dodecane	0.067	0.033	0.000	0.023	0.000	0.000
Ethanol	0.899	0.730	1.020	0.497	0.909	2.138
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

	E10			E15		
Pollutants (mg/mile)	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.318	0.308	0.248	0.230	0.442	0.409
Acetaldehyde	0.335	0.300	0.310	0.384	0.475	0.393
Acrolein	0.000	0.000	0.000	0.000	0.000	0.000
Acetone	0.000	0.063	0.109	0.000	0.000	0.000
Propionaldehyde	0.000	0.027	0.028	0.000	0.000	0.000
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.000	0.000	0.027	0.000	0.000	0.000
MEK & Butyraldehyde	0.000	0.002	0.016	0.000	0.000	0.001
Benzaldehyde	0.026	0.000	0.029	0.000	0.027	0.026
Valeraldehyde	0.000	0.000	0.000	0.000	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.015	0.011	0.012	0.009	0.011	0.012

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.023	0.025	0.038	0.032	0.032	0.027
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.004	0.007	0.007	0.001	0.001	0.000
	3N2O-w	0.006	0.007	0.010	0.007	0.007	0.006
NH3	NH3-1	0.002	0.002	0.007	0.019	0.019	0.007
	NH3-2	0.006	0.006	0.005	0.005	0.005	0.008
	NH3-3	0.008	0.009	0.008	0.007	0.007	0.010
	3NH3-w	0.006	0.006	0.006	0.008	0.008	0.008

OFP

	E10	E15
Total OFP (mg O3/mile)	54.634 ± 9.262	45.182 ± 9.458

2017MY Ford F150

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.137	0.172	0.142	0.081	0.119	0.101
	THC-2	0.013	0.012	0.012	0.012	0.014	0.012
	THC-3	0.028	0.030	0.032	0.029	0.030	0.032

	3THC-w	0.043	0.050	0.045	0.031	0.040	0.036
NMHC Emissions (g/mile)	NMHC-1	0.104	0.133	0.108	0.055	0.087	0.071
	NMHC-2	0.001	0.001	0.002	0.001	0.001	0.000
	NMHC-3	0.008	0.010	0.012	0.008	0.009	0.011
	3NMHC-w	0.024	0.031	0.027	0.014	0.021	0.018
CH4 Emissions (g/mile)	CH4-1	0.033	0.039	0.034	0.026	0.032	0.030
	CH4-2	0.012	0.011	0.010	0.011	0.013	0.011
	CH4-3	0.020	0.019	0.020	0.021	0.021	0.021
	3CH4-W	0.019	0.019	0.018	0.017	0.019	0.018
CO Emissions (g/mile)	CO-1	2.331	3.045	3.022	1.094	1.749	2.166
	CO-2	0.033	0.083	0.000	0.000	0.000	0.000
	CO-3	0.851	1.028	0.828	0.603	0.869	0.944
	3CO-w	0.735	0.957	0.855	0.393	0.603	0.707
NOx Emissions (g/mile)	NOx-1	0.029	0.033	0.032	0.026	0.027	0.026
	NOx-2	0.009	0.011	0.010	0.009	0.009	0.009
	NOx-3	0.016	0.009	0.009	0.007	0.010	0.018
	3NOx-w	0.015	0.015	0.014	0.012	0.013	0.015
CO2 Emissions (g/mile)	CO2-1	471.522	503.339	489.589	485.108	478.680	473.469
	CO2-2	432.414	442.780	442.569	441.396	442.360	435.580
	CO2-3	407.016	424.720	420.541	408.434	411.756	404.156
	3CO2-w	433.548	450.376	446.280	441.419	441.492	434.814
Fuel economy-carbon balanced method (miles per gallon)	FE-1	17.900	16.737	17.207	17.138	17.327	17.494
	FE-2	19.684	19.220	19.235	18.910	18.869	19.163
	FE-3	20.844	19.965	20.177	20.386	20.202	20.574
	3FE-w	19.579	18.834	19.013	18.880	18.862	19.144

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	5.891	8.257	5.411	3.641	5.263	4.240
	PM-soot 2	0.118	0.160	0.128	0.086	0.124	0.134

	PM-soot 3	0.223	0.297	0.305	0.132	0.173	0.135
	3PM-soot-w	1.346	1.876	1.274	0.838	1.205	0.984
PM mass (mg/mile)	PM-1	6.386	9.077	6.011	4.017	5.751	4.797
	PM-2	0.000	0.225	0.000	0.000	0.000	0.000
	PM-3	0.127	0.283	0.229	1.890	0.143	0.189
	3PM mass-w	1.361	2.076	1.312	1.356	1.235	1.045

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	1.18E+13	1.43E+13	1.10E+13	8.84E+12	1.13E+13	1.13E+13
	SPN-2	3.06E+11	3.74E+11	3.10E+11	2.38E+11	3.57E+11	3.57E+11
	SPN-3	4.31E+11	5.02E+11	5.32E+11	3.14E+11	3.96E+11	3.96E+11
	3SPN-w	2.74E+12	3.29E+12	2.59E+12	2.05E+12	2.64E+12	2.64E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	2.797	3.994	3.451	1.293	2.281	2.391
Acetylene	0.973	1.148	1.134	0.409	0.654	0.854
Ethane	1.241	1.565	1.268	0.845	0.984	1.153
Propylene	1.577	2.287	1.881	0.807	1.272	1.366
Propane	0.014	0.176	0.240	0.030	0.084	0.053
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.282	0.472	0.366	0.122	0.228	0.247
1,3-Butadiene	0.078	0.105	0.082	0.022	0.035	0.064
n-Butane	0.140	0.118	0.104	0.103	0.088	0.120
trans-2-Butene	0.162	0.251	0.206	0.085	0.136	0.142
cis-2-Butene	0.154	0.273	0.238	0.069	0.145	0.136
Isopentane	2.188	2.215	1.981	1.812	1.627	1.877
1-Pentene	0.043	0.050	0.047	0.036	0.034	0.039
n-Pentane	0.702	0.735	0.665	0.795	0.577	0.707
Isoprene	0.036	0.044	0.043	0.025	0.026	0.037

trans-2-Pentene	0.071	0.089	0.081	0.053	0.058	0.064
cis-2-Pentene	0.042	0.052	0.048	0.031	0.034	0.037
2,2-Dimethylbutane	0.169	0.179	0.154	0.151	0.134	0.153
Cyclopentane	0.095	0.098	0.083	0.059	0.069	0.080
2,3-Dimethylbutane	0.414	0.451	0.385	0.290	0.299	0.355
2-Methylpentane	1.099	1.210	1.087	0.763	0.789	0.935
3-Methylpentane	0.705	0.773	0.653	0.466	0.500	0.590
1-Hexene	0.023	0.026	0.024	0.000	0.000	0.019
n-Hexane	0.538	0.619	0.518	0.341	0.386	0.455
Methylcyclopentane	0.637	0.726	0.605	0.478	0.469	0.568
2,4-Dimethylpentane	0.474	0.532	0.452	0.292	0.333	0.400
Benzene	2.506	3.586	2.948	1.108	1.996	2.138
Cyclohexane	0.220	0.253	0.202	0.225	0.171	0.213
2-Methylhexane	0.535	0.628	0.507	0.306	0.360	0.443
2,3-Dimethylpentane	0.783	0.901	0.741	0.476	0.540	0.658
3-Methylhexane	0.586	0.693	0.572	0.350	0.388	0.466
2,2,4-Trimethylpentane	1.154	1.329	1.096	0.712	0.812	0.976
n-Heptane	0.351	0.408	0.315	0.174	0.214	0.272
Methylcyclohexane	0.310	0.374	0.284	0.166	0.202	0.252
2,3,4-Trimethylpentane	0.383	0.443	0.365	0.229	0.269	0.322
Toluene	1.933	2.813	2.464	0.912	1.519	1.703
2-Methylheptane	0.288	0.298	0.241	0.134	0.175	0.202
3-Methylheptane	0.258	0.319	0.252	0.130	0.178	0.217
n-Octane	0.207	0.270	0.218	0.117	0.146	0.186
Ethylbenzene	0.355	0.540	0.444	0.174	0.273	0.309
m/p-Xylenes	1.122	1.652	1.319	0.555	0.843	0.952
Styrene	0.029	0.054	0.053	0.000	0.000	0.025
o-Xylene	0.382	0.556	0.443	0.193	0.284	0.322
Nonane	0.101	0.135	0.101	0.057	0.073	0.087
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.033	0.048	0.039	0.020	0.027	0.030
m-Ethyltoluene	0.246	0.406	0.318	0.142	0.201	0.230
p-Ethyltoluene	0.112	0.198	0.152	0.065	0.100	0.110
1,3,5-Trimethylbenzene	0.215	0.290	0.223	0.095	0.139	0.171

o-Ethyltoluene	0.085	0.185	0.091	0.046	0.059	0.074
1,2,4-Trimethylbenzene	0.326	0.512	0.373	0.198	0.247	0.303
n-Decane	0.037	0.109	0.124	0.019	0.035	0.052
1,2,3-Trimethylbenzene	0.156	0.042	0.117	0.000	0.000	0.015
m-Diethylbenzene	0.200	0.000	0.232	0.000	0.000	0.000
p-Diethylbenzene	0.045	0.090	0.061	0.003	0.005	0.026
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.000	0.000	0.018	0.000	0.000	0.000
Ethanol	0.563	0.172	0.467	0.364	0.407	0.471
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.541	0.654	0.730	0.542	0.672	0.684
Acetaldehyde	0.369	0.540	0.527	0.427	0.589	0.554
Acrolein	0.025	0.032	0.025	0.028	0.033	0.029
Acetone	0.000	0.000	0.000	0.154	0.068	0.000
Propionaldehyde	0.033	0.044	0.041	0.033	0.044	0.043
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.027	0.030	0.027	0.028	0.030	0.028
MEK & Butyraldehyde	0.005	0.010	0.007	0.001	0.007	0.008
Benzaldehyde	0.046	0.053	0.052	0.034	0.053	0.042
Valeraldehyde	0.000	0.000	0.000	0.026	0.030	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.025	0.031	0.027	0.015	0.022	0.019

N2O and NH3

Pollutants (g/mile)	Phase	E10	E15

		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.138	0.126	0.055	0.058	0.097	0.052
	N2O-2	0.004	0.005	0.003	0.000	0.002	0.001
	N2O-3	0.099	0.184	0.125	0.073	0.133	0.145
	3N2O-w	0.058	0.079	0.047	0.032	0.058	0.051
NH3	NH3-1	0.003	0.005	0.013	0.012	0.021	0.019
	NH3-2	0.002	0.003	0.004	0.006	0.006	0.006
	NH3-3	0.003	0.005	0.005	0.007	0.004	0.005
	3NH3-w	0.002	0.004	0.006	0.008	0.009	0.008

OFP

	E10	E15
Total OFP (mg O3/mile)	137.135 ± 19.783	91.661 ± 19.293

2021MY Hyundai Accent

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.075	0.073	0.070	0.078	0.070	0.079
	THC-2	0.001	0.002	0.004	0.002	0.002	0.002
	THC-3	0.003	0.003	0.003	0.003	0.003	0.003
	3THC-w	0.017	0.017	0.017	0.018	0.016	0.018
NMHC Emissions (g/mile)	NMHC-1	0.069	0.067	0.063	0.071	0.063	0.072
	NMHC-2	0.000	0.001	0.003	0.001	0.000	0.001
	NMHC-3	0.001	0.001	0.001	0.001	0.001	0.001
	3NMHC-w	0.014	0.015	0.015	0.016	0.014	0.015

CH4 Emissions (g/mile)	CH4-1	0.006	0.007	0.007	0.007	0.007	0.007
	CH4-2	0.001	0.001	0.001	0.001	0.001	0.001
	CH4-3	0.002	0.002	0.002	0.002	0.002	0.002
	3CH4-W	0.002	0.002	0.003	0.002	0.003	0.003
CO Emissions (g/mile)	CO-1	0.298	0.411	0.405	0.297	0.354	0.334
	CO-2	0.000	0.006	0.000	0.000	0.000	0.000
	CO-3	0.040	0.018	0.000	0.000	0.000	0.003
	3CO-w	0.073	0.093	0.084	0.061	0.074	0.070
NOx Emissions (g/mile)	NOx-1	0.022	0.023	0.022	0.022	0.022	0.023
	NOx-2	0.020	0.017	0.018	0.020	0.019	0.020
	NOx-3	0.005	0.004	0.006	0.006	0.005	0.006
	3NOx-w	0.016	0.015	0.016	0.017	0.016	0.017
CO2 Emissions (g/mile)	CO2-1	213.806	211.330	209.496	217.305	214.539	214.163
	CO2-2	194.357	192.420	190.772	199.524	199.875	196.364
	CO2-3	185.190	184.181	187.461	189.204	188.933	186.661
	3CO2-w	195.866	194.077	193.736	200.369	199.913	197.388
Fuel economy-carbon balanced method (miles per gallon)	FE-1	38.291	38.771	38.840	39.690	40.121	40.474
	FE-2	41.836	41.763	42.510	43.802	44.241	44.623
	FE-3	44.117	44.181	44.717	45.954	46.214	45.412
	3FE-w	41.630	41.722	42.255	43.429	43.821	43.902

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	0.099	0.080	0.070	0.103	0.076	0.122
	PM-soot 2	0.018	0.014	0.020	0.020	0.017	0.017
	PM-soot 3	0.013	0.012	0.015	0.014	0.013	0.012
	3PM-soot-w	0.033	0.027	0.029	0.036	0.028	0.037
PM mass (mg/mile)	PM-1	0.063	0.010	0.000	0.014	0.054	0.136
	PM-2	0.000	0.000	0.000	0.000	0.000	0.000
	PM-3	0.000	0.000	0.000	0.000	0.000	0.000

	3PM mass-w	0.013	0.002	0.000	0.003	0.011	0.028

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	4.71E+11	3.94E+11	3.15E+11	4.88E+11	3.80E+11	5.73E+11
	SPN-2	2.89E+09	3.35E+09	2.80E+09	2.75E+09	2.51E+09	2.46E+09
	SPN-3	2.34E+09	2.31E+09	2.24E+09	1.85E+09	1.86E+09	1.85E+09
	3SPN-w	9.95E+10	8.41E+10	6.73E+10	1.03E+11	8.07E+10	1.20E+11

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	1.399	1.386	1.327	1.469	1.245	1.485
Acetylene	0.045	0.119	0.103	0.098	0.101	0.108
Ethane	0.449	0.478	0.452	0.437	0.376	0.447
Propylene	1.135	1.096	1.072	1.148	1.028	1.189
Propane	0.031	0.085	0.037	0.000	0.129	0.000
Isobutane	0.000	0.007	0.020	0.000	0.000	0.000
1-Butene	0.272	0.252	0.248	0.279	0.244	0.272
1,3-Butadiene	0.063	0.076	0.077	0.082	0.067	0.000
n-Butane	0.093	0.093	0.127	0.072	0.048	0.062
trans-2-Butene	0.163	0.148	0.147	0.157	0.146	0.169
cis-2-Butene	0.210	0.199	0.206	0.198	0.189	0.209
Isopentane	1.536	1.321	1.397	1.454	1.108	1.402
1-Pentene	0.041	0.037	0.038	0.042	0.032	0.042
n-Pentane	0.508	0.439	0.475	0.490	0.370	0.472
Isoprene	0.034	0.037	0.034	0.037	0.032	0.000
trans-2-Pentene	0.083	0.068	0.068	0.080	0.063	0.078
cis-2-Pentene	0.049	0.041	0.042	0.047	0.037	0.046
2,2-Dimethylbutane	0.106	0.092	0.092	0.100	0.079	0.099
Cyclopentane	0.071	0.060	0.062	0.068	0.053	0.066
2,3-Dimethylbutane	0.288	0.242	0.236	0.276	0.214	0.270
2-Methylpentane	0.783	0.659	0.643	0.744	0.582	0.736

3-Methylpentane	0.483	0.410	0.401	0.458	0.362	0.458
1-Hexene	0.019	0.019	0.018	0.020	0.017	0.000
n-Hexane	0.383	0.330	0.323	0.367	0.295	0.365
Methylcyclopentane	0.475	0.405	0.400	0.454	0.360	0.451
2,4-Dimethylpentane	0.319	0.276	0.270	0.306	0.247	0.300
Benzene	0.615	0.596	0.583	0.624	0.548	0.633
Cyclohexane	0.154	0.136	0.139	0.149	0.120	0.147
2-Methylhexane	0.360	0.314	0.307	0.341	0.275	0.342
2,3-Dimethylpentane	0.507	0.441	0.434	0.484	0.394	0.486
3-Methylhexane	0.370	0.321	0.322	0.349	0.279	0.361
2,2,4-Trimethylpentane	0.712	0.639	0.628	0.684	0.570	0.689
n-Heptane	0.223	0.195	0.187	0.213	0.171	0.213
Methylcyclohexane	0.210	0.183	0.181	0.205	0.160	0.205
2,3,4-Trimethylpentane	0.242	0.216	0.212	0.229	0.191	0.226
Toluene	1.303	1.193	1.219	1.287	1.111	1.354
2-Methylheptane	0.161	0.144	0.142	0.159	0.128	0.151
3-Methylheptane	0.167	0.152	0.149	0.166	0.137	0.164
n-Octane	0.142	0.128	0.128	0.149	0.118	0.138
Ethylbenzene	0.317	0.306	0.293	0.326	0.285	0.338
m/p-Xylenes	0.960	0.943	0.913	0.993	0.873	1.036
Styrene	0.016	0.027	0.017	0.023	0.012	0.000
o-Xylene	0.339	0.330	0.324	0.353	0.306	0.364
Nonane	0.072	0.066	0.068	0.072	0.060	0.095
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.045	0.046	0.043	0.044	0.036	0.050
m-Ethyltoluene	0.292	0.279	0.267	0.286	0.249	0.296
p-Ethyltoluene	0.140	0.132	0.129	0.126	0.112	0.134
1,3,5-Trimethylbenzene	0.175	0.167	0.167	0.191	0.153	0.181
o-Ethyltoluene	0.089	0.084	0.077	0.086	0.078	0.092
1,2,4-Trimethylbenzene	0.353	0.346	0.326	0.358	0.308	0.354
n-Decane	0.072	0.054	0.046	0.046	0.044	0.048
1,2,3-Trimethylbenzene	0.077	0.045	0.055	0.106	0.059	0.049
m-Diethylbenzene	0.061	0.000	0.046	0.131	0.051	0.000
p-Diethylbenzene	0.079	0.068	0.076	0.135	0.091	0.075

n-Undecane	0.000	0.000	0.000	0.000	0.000	0.015
n-Dodecane	0.000	0.000	0.000	0.012	0.015	0.000
Ethanol	0.421	0.414	0.495	1.470	0.605	0.000
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.297	0.269	0.275	0.266	0.167	0.182
Acetaldehyde	0.438	0.439	0.423	0.631	0.575	0.614
Acrolein	0.000	0.000	0.000	0.031	0.000	0.000
Acetone	0.000	0.000	0.000	0.000	0.000	0.000
Propionaldehyde	0.035	0.030	0.030	0.038	0.031	0.032
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.015	0.000	0.015	0.000	0.000	0.016
MEK & Butyraldehyde	0.013	0.008	0.008	0.017	0.007	0.009
Benzaldehyde	0.024	0.022	0.021	0.030	0.024	0.025
Valeraldehyde	0.000	0.014	0.000	0.023	0.000	0.000
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.027	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.015	0.015	0.015	0.017	0.014	0.016

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.090	0.090	0.058	0.063	0.069	0.091
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.003	0.003	0.002	0.003	0.003	0.002
	3N2O-w	0.019	0.019	0.013	0.014	0.015	0.020

NH3	NH3-1	0.001	0.001	0.001	0.001	0.001	0.002
	NH3-2	0.002	0.002	0.001	0.004	0.001	0.007
	NH3-3	0.002	0.002	0.001	0.002	0.001	0.002
	3NH3-w	0.002	0.002	0.001	0.003	0.001	0.005

OFP

	E10	E15
Total OFP (mg O3/mile)	62.971 ± 3.438	63.476 ± 7.141

2018MY Chevrolet Suburban

Gaseous and fuel economy

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
THC Emissions (g/mile)	THC-1	0.175	0.153	0.180	0.141	0.144	0.142
	THC-2	0.007	0.006	0.007	0.005	0.007	0.006
	THC-3	0.017	0.014	0.013	0.014	0.014	0.013
	3THC-w	0.044	0.039	0.044	0.036	0.037	0.036
NMHC Emissions (g/mile)	NMHC-1	0.135	0.114	0.137	0.104	0.107	0.102
	NMHC-2	0.000	0.000	0.000	0.000	0.001	0.000
	NMHC-3	0.002	0.002	0.001	0.001	0.002	0.000
	3NMHC-w	0.028	0.024	0.028	0.021	0.023	0.021
CH4 Emissions (g/mile)	CH4-1	0.040	0.039	0.042	0.036	0.037	0.040
	CH4-2	0.007	0.007	0.008	0.006	0.007	0.006
	CH4-3	0.015	0.012	0.012	0.013	0.012	0.013
	3CH4-W	0.016	0.015	0.016	0.014	0.014	0.015
CO Emissions (g/mile)	CO-1	2.900	1.983	2.397	1.834	1.811	2.033
	CO-2	0.073	0.119	0.159	0.190	0.000	0.000

	CO-3	0.189	0.358	0.369	0.316	0.063	0.166
	3CO-w	0.692	0.571	0.681	0.566	0.393	0.467
NOx Emissions (g/mile)	NOx-1	0.017	0.021	0.017	0.018	0.029	0.038
	NOx-2	0.006	0.006	0.007	0.005	0.006	0.007
	NOx-3	0.006	0.004	0.004	0.005	0.005	0.004
	3NOx-w	0.008	0.009	0.008	0.008	0.010	0.013
CO2 Emissions (g/mile)	CO2-1	542.531	557.435	548.138	556.535	555.002	560.452
	CO2-2	526.540	531.994	527.903	533.860	529.141	534.759
	CO2-3	481.678	478.386	478.093	482.482	485.296	483.005
	3CO2-w	517.520	522.521	518.404	524.431	522.459	525.874
Fuel economy-carbon balanced method (miles per gallon)	FE-1	14.911	14.952	14.799	15.546	15.175	15.410
	FE-2	15.627	15.775	15.609	16.164	15.997	16.119
	FE-3	17.282	17.196	17.272	17.662	17.774	17.784
	3FE-w	15.887	15.955	15.848	16.412	16.261	16.384

PM mass and black carbon

Pollutants	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run1	Run2
Black carbon (mg/mile)	PM-soot 1	1.677	3.865	4.269	3.606	2.652	3.954
	PM-soot 2	0.176	0.222	0.214	0.179	0.153	0.160
	PM-soot 3	0.078	0.089	0.120	0.103	0.121	0.095
	3PM-soot-w	0.461	0.941	1.031	0.870	0.662	0.928
PM mass (mg/mile)	PM-1	1.752	4.131	3.790	3.899	3.468	4.090
	PM-2	0.000	0.003	0.044	0.047	0.000	0.000
	PM-3	0.000	0.105	0.000	0.000	0.165	0.000
	3PM mass-w	0.364	0.887	0.810	0.833	0.765	0.848

SPN

Pollutant	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
SPN (#/mile)	SPN-1	6.98E+12	5.49E+12	9.00E+12	9.31E+12	1.07E+13	5.64E+12
	SPN-2	6.60E+11	1.38E+11	8.51E+11	7.19E+11	5.22E+11	5.81E+11

	SPN-3	2.68E+11	1.35E+11	3.07E+11	4.25E+11	4.41E+11	4.35E+11
	3SPN-w	1.86E+12	1.25E+12	2.39E+12	2.42E+12	2.61E+12	1.59E+12

Hydrocarbon species and ethanol

Pollutants (mg/mile)	E10			E15		
	Run1	Run2	Run3	Run1	Run2	Run3
Ethylene	4.812	3.608	21.551	3.264	3.005	3.191
Acetylene	1.612	1.081	1.840	1.160	0.966	0.897
Ethane	1.668	1.578	8.103	1.309	1.301	1.254
Propylene	2.869	2.046	2.628	1.696	1.893	1.896
Propane	0.105	0.001	0.013	0.078	0.104	0.011
Isobutane	0.000	0.000	0.000	0.000	0.000	0.000
1-Butene	0.527	0.348	0.485	0.295	0.334	0.326
1,3-Butadiene	0.107	0.070	0.154	0.000	0.070	0.062
n-Butane	0.122	0.110	0.132	0.371	0.133	0.111
trans-2-Butene	0.396	0.226	0.300	0.138	0.206	0.213
cis-2-Butene	0.360	0.187	0.265	0.131	0.170	0.178
Isopentane	2.171	2.124	2.649	1.977	2.449	2.022
1-Pentene	0.066	0.059	0.081	0.000	0.072	0.054
n-Pentane	0.964	0.824	1.017	0.904	1.158	0.983
Isoprene	0.113	0.072	0.110	0.016	0.070	0.103
trans-2-Pentene	0.130	0.099	0.151	0.058	0.101	0.092
cis-2-Pentene	0.073	0.058	0.086	0.034	0.060	0.053
2,2-Dimethylbutane	0.229	0.207	0.240	0.207	0.224	0.224
Cyclopentane	0.100	0.090	0.136	0.082	0.094	0.087
2,3-Dimethylbutane	0.489	0.480	0.589	0.382	0.428	0.466
2-Methylpentane	1.233	1.229	1.532	0.982	1.073	1.140
3-Methylpentane	0.785	0.778	0.961	0.622	0.679	0.720
1-Hexene	0.035	0.031	0.041	0.000	0.031	0.028
n-Hexane	0.561	0.554	0.706	0.453	0.504	0.497
Methylcyclopentane	0.872	0.782	0.991	0.695	0.784	0.827
2,4-Dimethylpentane	0.471	0.465	0.583	0.383	0.432	0.423
Benzene	3.339	2.550	3.184	2.570	2.343	2.585
Cyclohexane	0.360	0.296	0.362	0.308	0.366	0.360

2-Methylhexane	0.506	0.511	0.632	0.400	0.462	0.451
2,3-Dimethylpentane	0.742	0.775	0.918	0.623	0.695	0.679
3-Methylhexane	0.537	0.534	0.653	0.433	0.493	0.472
2,2,4-Trimethylpentane	1.131	1.169	1.325	0.961	1.053	1.044
n-Heptane	0.308	0.307	0.382	0.242	0.277	0.270
Methylcyclohexane	0.344	0.326	0.405	0.238	0.271	0.308
2,3,4-Trimethylpentane	0.373	0.391	0.421	0.305	0.351	0.346
Toluene	3.242	2.239	3.042	2.213	2.164	2.274
2-Methylheptane	0.247	0.248	0.276	2.442	0.231	0.218
3-Methylheptane	0.258	0.258	0.289	0.210	0.236	0.234
n-Octane	0.209	0.204	0.231	0.177	0.192	0.193
Ethylbenzene	0.631	0.453	0.587	0.441	0.428	0.425
m/p-Xylenes	1.896	1.478	1.785	1.206	1.384	1.406
Styrene	0.017	0.014	0.027	0.000	0.007	0.002
o-Xylene	0.630	0.507	0.605	0.442	0.479	0.490
Nonane	0.106	0.106	0.107	0.086	0.098	0.101
Isopropylbenzene	0.000	0.000	0.000	0.000	0.000	0.000
n-Propylbenzene	0.058	0.054	0.061	0.048	0.051	0.051
m-Ethyltoluene	0.449	0.374	0.418	0.301	0.346	0.361
p-Ethyltoluene	0.207	0.174	0.193	0.151	0.156	0.163
1,3,5-Trimethylbenzene	0.256	0.243	0.242	0.152	0.236	0.238
o-Ethyltoluene	0.134	0.119	0.142	0.094	0.097	0.117
1,2,4-Trimethylbenzene	0.529	0.496	0.522	0.351	0.495	0.517
n-Decane	0.023	0.026	0.051	0.061	0.040	0.045
1,2,3-Trimethylbenzene	0.000	0.000	0.000	0.057	0.000	0.000
m-Diethylbenzene	0.000	0.000	0.000	0.171	0.000	0.000
p-Diethylbenzene	0.063	0.043	0.066	0.048	0.060	0.061
n-Undecane	0.000	0.000	0.000	0.000	0.000	0.000
n-Dodecane	0.000	0.000	0.000	0.000	0.000	0.000
Ethanol	1.195	0.000	2.112	4.425	2.801	1.972
Naphthalene	0.000	0.000	0.000	0.000	0.000	0.000

Carbonyls

Pollutants (mg/mile)	E10	E15

	Run1	Run2	Run3	Run1	Run2	Run3
Formaldehyde	0.865	0.655	0.801	0.938	0.911	0.750
Acetaldehyde	0.713	0.653	0.737	0.917	0.877	0.840
Acrolein	0.058	0.065	0.000	0.057	0.062	0.052
Acetone	0.597	0.329	0.365	5.538	0.282	0.914
Propionaldehyde	0.065	0.056	0.000	0.068	0.061	0.060
Crotonaldehyde	0.000	0.000	0.000	0.000	0.000	0.000
Methacrolein	0.043	0.044	0.047	0.043	0.041	0.039
MEK & Butyraldehyde	0.024	0.023	0.021	0.014	0.014	0.015
Benzaldehyde	0.068	0.070	0.076	0.067	0.068	0.058
Valeraldehyde	0.040	0.036	0.045	0.000	0.042	0.039
m-Tolualdehyde	0.000	0.000	0.000	0.000	0.000	0.000
Hexaldehyde	0.000	0.000	0.000	0.000	0.000	0.000

NMOG

	E10			E15		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
NMOG (g/mile)	0.030	0.024	0.030	0.024	0.025	0.023

N2O and NH3

Pollutants (g/mile)	Phase	E10			E15		
		Run1	Run2	Run3	Run1	Run2	Run3
N2O	N2O-1	0.014	0.026	0.016	0.057	0.055	0.027
	N2O-2	0.000	0.000	0.000	0.000	0.000	0.000
	N2O-3	0.000	0.000	0.000	0.005	0.004	0.000
	3N2O-w	0.003	0.005	0.003	0.013	0.013	0.006
NH3	NH3-1	0.003	0.003	0.003	0.008	0.010	0.004
	NH3-2	0.005	0.011	0.004	0.009	0.007	0.006
	NH3-3	0.004	0.003	0.003	0.004	0.004	0.005
	3NH3-w	0.005	0.007	0.003	0.007	0.007	0.005

OFP

E10	E15

Total OFP (mg O3/mile)	146.866 ± 18.323	123.465 ± 17.128

Appendix C

Detailed Statistical Analysis Results for the Twenty Vehicles

1 THC

1) THC_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	4.76	0.0315

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-2.7787	0.1187	99	-23.41	<.0001
Fuel	E15	-2.8416	0.1187	99	-23.94	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.06292	0.02884	99	2.18	0.0315	Tukey-Kramer	0.0315

2) THC_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	2.25	0.1364

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-6.2750	0.2545	99	-24.66	<.0001
Fuel	E15	-6.3948	0.2545	99	-25.13	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.1198	0.07977	99	1.50	0.1364	Tukey-Kramer	0.1364

3) THC_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.00	0.9538

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-5.0422	0.1931	19	-26.11	<.0001

Fuel	E15	-5.0451	0.1931	19	-26.13	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.002979	0.05070	19	0.06	0.9538	Tukey-Kramer	0.9538

4) THC_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	5.45	0.0216

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-4.1307	0.1295	99	-31.89	<.0001
Fuel	E15	-4.1800	0.1295	99	-32.27	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.04935	0.02114	99	2.33	0.0216	Tukey-Kramer	0.0216

2 NMHC

1) NMHC_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	4.62	0.0340

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-3.0197	0.1179	99	-25.61	<.0001
Fuel	E15	-3.0871	0.1179	99	-26.18	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.06746	0.03137	99	2.15	0.0340	Tukey-Kramer	0.0340

2) NMHC_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	0.33	0.5674

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-6.6219	0.08004	99	-82.74	<.0001

Fuel	E15	-6.6592	0.08004	99	-83.20	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.03734	0.06507	99	0.57	0.5674	Tukey-Kramer	0.5674

3) NMHC_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	3.37	0.0694

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-6.0988	0.2111	99	-28.89	<.0001
Fuel	E15	-6.2236	0.2111	99	-29.48	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.1249	0.06802	99	1.84	0.0694	Tukey-Kramer	0.0694

4) NMHC_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	3.25	0.0875

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.01267	0.001443	19	8.79	<.0001
Fuel	E15	0.01164	0.001443	19	8.07	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.001033	0.000573	19	1.80	0.0875	Tukey-Kramer	0.0875

3 CO

1) CO_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	6.66	0.0113

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	1.0847	0.1724	99	6.29	<.0001

Fuel	E15	0.9537	0.1724	99	5.53	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.1310	0.05076	99	2.58	0.0113	Tukey-Kramer	0.0113

2) CO_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	0.02	0.8934

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-4.9612	0.4107	99	-12.08	<.0001
Fuel	E15	-4.9975	0.4107	99	-12.17	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.03627	0.2700	99	0.13	0.8934	Tukey-Kramer	0.8934

3) CO_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	8.44	0.0045

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.2919	0.08372	99	3.49	0.0007
Fuel	E15	0.2142	0.08372	99	2.56	0.0120

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.07768	0.02674	99	2.91	0.0045	Tukey-Kramer	0.0045

4) CO_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	6.49	0.0196

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.3334	0.05590	19	5.96	<.0001
Fuel	E15	0.2770	0.05590	19	4.95	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.05643	0.02215	19	2.55	0.0196	Tukey-Kramer	0.0196

4 NOx

1) NOx_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	1.07	0.3148

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.02302	0.003585	19	6.42	<.0001
Fuel	E15	0.02153	0.003585	19	6.01	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.001492	0.001445	19	1.03	0.3148	Tukey-Kramer	0.3148

2) NOx_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.28	0.6028

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-5.8745	0.4036	19	-14.55	<.0001
Fuel	E15	-5.9202	0.4036	19	-14.67	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.04567	0.08629	19	0.53	0.6028	Tukey-Kramer	0.6028

3) NOx_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.56	0.4619

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-5.4955	0.2577	19	-21.33	<.0001
Fuel	E15	-5.6566	0.2577	19	-21.95	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.1611	0.2145	19	0.75	0.4619	Tukey-Kramer	0.4619

4) NOx_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.47	0.4997

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-4.9107	0.1989	19	-24.68	<.0001
Fuel	E15	-4.9441	0.1989	19	-24.85	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.03337	0.04849	19	0.69	0.4997	Tukey-Kramer	0.4997

5 CO2

1) CO2_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.97	0.3360

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	363.11	26.1488	19	13.89	<.0001
Fuel	E15	361.39	26.1488	19	13.82	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	1.7188	1.7413	19	0.99	0.3360	Tukey-Kramer	0.3360

2) CO2_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	1.75	0.2015

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	352.37	28.5271	19	12.35	<.0001
Fuel	E15	354.63	28.5271	19	12.43	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-2.2637	1.7109	19	-1.32	0.2015	Tukey-Kramer	0.2015

3) CO2_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	99	3.25	0.0746

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	311.49	22.2356	99	14.01	<.0001
Fuel	E15	309.89	22.2356	99	13.94	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	1.6012	0.8885	99	1.80	0.0746	Tukey-Kramer	0.0746

4) CO2_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.08	0.7793

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	343.38	26.1706	19	13.12	<.0001
Fuel	E15	343.75	26.1706	19	13.13	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.3678	1.2938	19	-0.28	0.7793	Tukey-Kramer	0.7793

6 PM

1) PM_1

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	6.52	0.0194

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	3.3414	0.7024	19	4.76	0.0001
Fuel	E15	2.7860	0.7024	19	3.97	0.0008

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.5554	0.2175	19	2.55	0.0194	Tukey-Kramer	0.0194

2) PM_2

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	6.21	0.0221

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-3.4967	0.4714	19	-7.42	<.0001
Fuel	E15	-4.2422	0.4714	19	-9.00	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.7455	0.2991	19	2.49	0.0221	Tukey-Kramer	0.0221

3) PM_3

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	3.44	0.0794

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-2.6081	0.4880	19	-5.34	<.0001
Fuel	E15	-3.1283	0.4888	19	-6.40	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.5202	0.2806	19	1.85	0.0794	Tukey-Kramer	0.0794

4) PM_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	5.70	0.0275

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.8576	0.1788	19	4.80	0.0001
Fuel	E15	0.6958	0.1789	19	3.89	0.0010

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P

Fuel	E10	E15	0.1617	0.06772	19	2.39	0.0275	Tukey-Kramer	0.0275

6 FEw

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	8.40	0.0092

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	3.2846	0.08353	19	39.32	<.0001
Fuel	E15	3.2728	0.08353	19	39.18	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.01184	0.004086	19	2.90	0.0092	Tukey-Kramer	0.0092

7 SPN_w

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	9.16	0.0069

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	27.5886	0.2710	19	101.81	<.0001
Fuel	E15	27.4552	0.2710	19	101.32	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.1335	0.04409	19	3.03	0.0069	Tukey-Kramer	0.0069

8 1,3-Butadiene

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.01	0.9192

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-3.6269	0.3324	19	-10.91	<.0001
Fuel	E15	-3.6464	0.3324	19	-10.97	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.01949	0.1896	19	0.10	0.9192	Tukey-Kramer	0.9192

9 Benzene

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.00	0.9658

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-0.1380	0.1400	19	-0.99	0.3365
Fuel	E15	-0.1350	0.1400	19	-0.96	0.3469

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.00300	0.06908	19	-0.04	0.9658	Tukey-Kramer	0.9658

10 Toluene

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	0.37	0.5508

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-0.1115	0.1557	19	-0.72	0.4825
Fuel	E15	-0.01816	0.1557	19	-0.12	0.9084

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.09337	0.1537	19	-0.61	0.5508	Tukey-Kramer	0.5508

11 Ethylbenzene

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	4.39	0.0498

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.2312	0.02798	19	8.26	<.0001
Fuel	E15	0.2053	0.02795	19	7.34	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.02588	0.01236	19	2.09	0.0498	Tukey-Kramer	0.0498

12 m/p-Xylenes

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	3.84	0.0649

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.7400	0.09193	19	8.05	<.0001
Fuel	E15	0.6660	0.09185	19	7.25	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.07402	0.03778	19	1.96	0.0649	Tukey-Kramer	0.0649

13 o-Xylene

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	4.36	0.0504

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	0.2543	0.03186	19	7.98	<.0001
Fuel	E15	0.2291	0.03184	19	7.19	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	0.02521	0.01207	19	2.09	0.0504	Tukey-Kramer	0.0504

14 Ethanol

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	8.56	0.0087

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-0.7293	0.2028	19	-3.60	0.0019
Fuel	E15	-0.1815	0.2012	19	-0.90	0.3783

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.5478	0.1872	19	-2.93	0.0087	Tukey-Kramer	0.0087

15 Formaldehyde

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F

Fuel	1	19	0.62	0.4393

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-1.5663	0.1762	19	-8.89	<.0001
Fuel	E15	-1.4883	0.1762	19	-8.44	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.07799	0.09872	19	-0.79	0.4393	Tukey-Kramer	0.4393

16 Acetaldehyde

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
Fuel	1	19	131.48	<.0001

Least Squares Means						
Effect	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|
Fuel	E10	-1.2593	0.1084	19	-11.62	<.0001
Fuel	E15	-0.9852	0.1084	19	-9.09	<.0001

Differences of Least Squares Means									
Effect	Fuel	Fuel	Estimate	Standard Error	DF	t Value	Pr > |t|	Adjustment	Adj P
Fuel	E10	E15	-0.2741	0.02390	19	-11.47	<.0001	Tukey-Kramer	<.0001

Appendix D
Detailed Hydrocarbon Analysis Summary

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 8:41:20 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF
Acquired: 10/30/20 23:25:35
Sample: ODDB:54925
Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.892	8.847	8.108
I-Paraffins:	39.668	43.130	35.978
Olefins:	4.191	4.507	4.542
Naphthenes:	12.216	11.784	10.854
Aromatics:	23.326	19.661	18.791
Total C14+:	0.325	0.313	0.144
Total Unknowns:	1.756	1.846	1.289

Oxygenates:

Total:	10.625(Mass%)	9.912(Vol%)
Total Oxygen Content:	3.690(Mass%)	
Multisubstituted Aromatics:	14.821(Mass%)	12.526(Vol%)

Average Molecular Weight: 87.989

Relative Density: 0.736

Vapor Pressure :

Calculated Octane Number: 85.9

Motor Octane Number (Jenkins Calculation): 78.1

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	210.63	334.04	449.60
BP by Vol (Deg F)	31.10	173.30	210.63	334.04	423.50

Percent Carbon: 83.879
Percent Hydrogen: 12.431
Bromine Number (Calc): 7.861
Particulate Matter Index: 1.145

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 8:42:17 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF
Acquired: 10/30/20 23:25:35
Sample: ODDB:54925
Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	10.625	3.690	9.912

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 8:42:17 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF
Acquired: 10/30/20 23:25:35
Sample: ODDB:54925
Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.511	0.106	0.048	0.000	0.000	0.000	0.666
C5	2.499	7.035	1.802	0.341	0.000	0.001	11.678
C6	1.895	7.933	1.199	3.285	0.724	0.045	15.082
C7	1.389	8.657	0.758	3.943	4.742	0.007	19.496
C8	0.835	9.936	0.073	2.873	7.622	0.209	21.548
C9	0.391	3.401	0.203	1.390	5.871	0.191	11.447
C10	0.207	1.784	0.073	0.315	3.587	0.304	6.269
C11	0.108	0.542	0.021	0.065	0.392	0.361	1.489
C12	0.046	0.265	0.006	0.005	0.388	0.326	1.037
C13	0.010	0.008	0.007	0.000	0.000	0.311	0.336
Total:	7.892	39.668	4.191	12.216	23.326	1.756	87.294

Oxygenates	10.625	Total C14+:	0.325
Total Unknowns:	1.756	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.650	0.141	0.058	0.000	0.000	0.000	0.849
C5	2.938	8.357	2.012	0.337	0.000	0.001	13.645
C6	2.115	8.879	1.255	3.199	0.607	0.048	16.103
C7	1.495	9.302	0.787	3.841	4.026	0.007	19.458
C8	0.874	10.378	0.074	2.744	6.467	0.220	20.757
C9	0.401	3.481	0.215	1.310	4.961	0.200	10.568
C10	0.209	1.787	0.073	0.289	2.971	0.320	5.647
C11	0.107	0.537	0.021	0.059	0.309	0.380	1.413
C12	0.045	0.259	0.006	0.004	0.321	0.343	0.979
C13	0.009	0.008	0.007	0.000	0.000	0.327	0.352
Total:	8.847	43.130	4.507	11.784	19.661	1.846	87.928

Oxygenates	9.912	Total C14+:	0.313
Total Unknowns:	1.846	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 8:42:17 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF
Acquired: 10/30/20 23:25:35
Sample: ODDB:54925
Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.004
C4	0.773	0.161	0.076	0.000	0.000	0.001	1.011
C5	3.048	8.579	2.265	0.428	0.000	0.001	14.321
C6	1.935	8.100	1.259	3.434	0.816	0.121	15.666
C7	1.219	7.602	0.678	3.534	4.528	0.008	17.569
C8	0.643	7.653	0.057	2.253	6.317	0.166	17.089
C9	0.268	2.333	0.142	0.969	4.298	0.170	8.180
C10	0.128	1.103	0.046	0.197	2.386	0.219	4.079
C11	0.061	0.305	0.012	0.037	0.235	0.242	0.893
C12	0.024	0.137	0.003	0.002	0.210	0.192	0.569
C13	0.005	0.004	0.004	0.000	0.000	0.169	0.181
Total:	8.108	35.978	4.542	10.854	18.791	1.289	78.274

Oxygenates	20.293	Total C14+:	0.144	
Total Unknowns:	1.289	Grand Total:	100.000	

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 8:42:18 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
13.031	481.390	O5	1,4-pentadiene	0.001	0.001	0.001
14.848	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.010
16.186	527.940	O5	1t,3-pentadiene	0.008	0.008	0.010
16.885	538.200	O5	cyclopentadiene	0.005	0.006	0.007
20.390	581.020	O6	1,5-hexadiene	0.000	0.000	0.000
21.989	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.273	632.930	O7	cyclic diolefin or triolefin-[1]	0.002	0.003	0.003
25.835	638.570	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007
28.352	661.940	O6	diolefin (hexadiene)	0.003	0.003	0.003
30.166	677.180	O7	1,6-heptadiene	0.000	0.000	0.000
36.537	720.920	N8	1,1,3-trimethylcyclopentane	0.179	0.176	0.141

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 8:42:18 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.434	100.000	P1	methane	0.000	0.000	0.000	-258.700	-161.500
6.620	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.114	293.470	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.176	300.000	P3	propane	0.002	0.003	0.003	-43.672	-42.040
8.191	366.090	I4	i-butane	0.106	0.141	0.161	10.904	-11.720
8.342	372.490	--	unknown	0.000	0.000	0.001	32.000	0.000
8.848	390.710	O4	butene-1	0.002	0.003	0.004	20.750	-6.250
8.879	391.700	O4	isobutylene	0.003	0.004	0.005	20.750	-6.250
9.154	400.000	P4	n-butane	0.511	0.650	0.773	31.100	-0.500
9.544	412.290	O4	t-butene-2	0.018	0.022	0.029	33.584	0.880
9.642	415.120	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.873	421.510	--	unknown	0.001	0.001	0.001	32.000	0.000
10.130	428.120	O4	c-butene-2	0.025	0.029	0.038	38.696	3.720
11.668	460.090	X2	ethanol	10.625	9.912	20.293	173.300	78.500
11.710	460.820	O5	3-methylbutene-1	0.058	0.068	0.073	68.090	20.050
12.774	477.730	I5	i-pentane	7.032	8.353	8.575	82.112	27.840
13.031	481.390	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.746	490.870	O5	pentene-1	0.124	0.142	0.155	85.928	29.960
14.222	496.680	O5	2-methylbutene-1	0.287	0.324	0.360	88.070	31.150
14.507	500.000	P5	n-pentane	2.499	2.938	3.048	96.908	36.060
14.848	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.010	93.308	34.060
15.095	510.400	O5	t-pentene-2	0.374	0.424	0.469	97.412	36.340
15.466	516.590	O5	3,3-dimethylbutene-1	0.005	0.006	0.006	106.232	41.240
15.636	519.350	O5	c-pentene-2	0.207	0.233	0.260	98.474	36.930
15.794	521.870	--	unknown	0.000	0.000	0.001	32.000	0.000
15.974	524.690	O5	2-methylbutene-2	0.624	0.694	0.783	101.408	38.560
16.186	527.940	O5	1t,3-pentadiene	0.008	0.008	0.010	107.636	42.020
16.306	529.750	--	unknown	0.001	0.001	0.001	32.000	0.000
16.885	538.200	O5	cyclopentadiene	0.005	0.006	0.007	32.000	0.000
17.014	540.010	I6	2,2-dimethylbutane	0.447	0.507	0.457	121.514	49.730
18.312	557.140	O5	cyclopentene	0.102	0.097	0.131	111.614	44.230

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
18.678	561.640	O6	4-methylpentene-1	0.024	0.026	0.025	128.948	53.860
18.747	562.470	O6	3-methylpentene-1	0.035	0.039	0.037	129.506	54.170
18.837	563.550	--	unknown	0.002	0.002	0.002	32.000	0.000
19.105	566.710	N5	cyclopentane	0.341	0.337	0.428	120.650	49.250
19.291	568.870	I6	2,3-dimethylbutane	1.360	1.513	1.389	136.364	57.980
19.447	570.660	--	unknown	0.043	0.045	0.118	32.000	0.000
19.562	571.960	O6	2,3-dimethylbutene-1	0.014	0.015	0.015	132.098	55.610
19.706	573.570	I6	2-methylpentane	3.777	4.257	3.856	140.468	60.260
19.836	575.010	O6	4-methyl-t-pentene-2	0.069	0.075	0.072	137.480	58.600
20.390	581.020	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.811	585.420	I6	3-methylpentane	2.349	2.602	2.398	145.886	63.270
21.261	589.980	O6	2-methylpentene-1	0.114	0.123	0.120	143.780	62.100
21.351	590.880	O6	hexene-1	0.049	0.053	0.051	146.246	63.470
21.989	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.297	600.000	P6	n-hexane	1.895	2.115	1.935	155.714	68.730
22.521	602.680	O6	t-hexene-3	0.074	0.080	0.078	152.744	67.080
22.587	603.460	O6	c-hexene-3	0.025	0.026	0.026	151.592	66.440
22.739	605.260	O6	t-hexene-2	0.146	0.158	0.153	154.184	67.880
22.943	607.630	O6	2-methylpentene-2	0.186	0.198	0.194	153.140	67.300
23.022	608.550	O6	4-methylcyclopentene	0.050	0.048	0.054	148.820	64.900
23.184	610.410	O6	3-methyl-c-pentene-2	0.113	0.119	0.118	153.842	67.690
23.307	611.810	O6	3-methylcyclopentene	0.027	0.026	0.029	149.000	65.000
23.416	613.040	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.547	614.520	O6	c-hexene-2	0.079	0.084	0.083	155.984	68.880
23.784	617.160	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.112	620.750	O7	3,3-dimethylpentene-1	0.174	0.183	0.156	171.446	77.470
24.268	622.430	--	unknown	0.001	0.001	0.003	32.000	0.000
24.408	623.920	I7	2,2-dimethylpentane	0.105	0.114	0.092	174.542	79.190
24.625	626.230	N6	methylcyclopentane	2.455	2.414	2.567	161.240	71.800
25.037	630.510	I7	2,4-dimethylpentane	1.539	1.683	1.351	176.882	80.490
25.273	632.930	O7	cyclic diolefin or triolefin-[1]	0.002	0.003	0.003	32.000	0.000

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 8:42:18 PM

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
25.456	634.780	I7	2,2,3-trimethylbutane	0.049	0.052	0.043	177.584	80.880
25.622	636.450	--	unknown	0.002	0.002	0.002	32.000	0.000
25.835	638.570	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007	32.000	0.000
26.173	641.870	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.285	642.950	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.656	646.500	O7	4,4-dimethyl-c-pentene-2	0.008	0.009	0.007	176.756	80.420
26.802	647.880	O7	2,4-dimethylpentene-1	0.008	0.009	0.007	178.880	81.600
26.903	648.840	O6	1-methylcyclopentene	0.188	0.178	0.202	167.864	75.480
27.104	650.700	A6	benzene	0.724	0.607	0.816	176.162	80.090
27.286	652.380	O7	2-methyl-c-hexene-3	0.004	0.005	0.004	186.800	86.000
27.501	654.350	I7	3,3-dimethylpentane	0.098	0.104	0.086	186.908	86.060
27.602	655.270	O7	5-methylhexene-1	0.010	0.011	0.009	185.558	85.310
27.794	657.000	--	unknown	0.004	0.004	0.003	32.000	0.000
27.928	658.200	N6	cyclohexane	0.830	0.785	0.868	177.296	80.720
28.223	660.810	O7	2-methyl-t-hexene-3	0.017	0.018	0.015	186.620	85.900
28.352	661.940	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.444	662.750	O7	2-ethyl-3-methylbutene-1	0.006	0.007	0.006	187.448	86.360
28.571	663.850	O7	4-methylhexene-1	0.014	0.015	0.013	188.114	86.730
28.867	666.400	O7	4-methyl-t/c-hexene-2	0.020	0.021	0.018	187.358	86.310
29.043	667.890	I7	2-methylhexane	2.024	2.196	1.777	194.090	90.050
29.206	669.270	I7	2,3-dimethylpentane	2.599	2.752	2.282	193.604	89.780
29.488	671.630	N7	1,1-dimethylcyclopentane	0.076	0.074	0.068	189.464	87.480
29.808	674.270	O7	5-methyl-t-hexene-2	0.023	0.025	0.021	190.598	88.110
30.024	676.040	I7	3-methylhexane	2.053	2.199	1.803	197.330	91.850
30.166	677.180	O7	1,6-heptadiene	0.000	0.000	0.000	205.106	96.170
30.452	679.480	O7	3,4-dimethyl-c-pentene-2	0.013	0.013	0.012	192.650	89.250
30.759	681.910	N7	1c,3-dimethylcyclopentane	0.699	0.691	0.626	195.386	90.770
31.112	684.680	N7	1t,3-dimethylcyclopentane	0.621	0.611	0.557	197.096	91.720
31.290	686.050	I7	3-ethylpentane	0.191	0.201	0.168	200.246	93.470
31.480	687.510	N7	1t,2-dimethylcyclopentane	0.609	0.596	0.546	197.366	91.870
31.662	688.900	I8	2,2,4-trimethylpentane	2.857	3.039	2.200	210.632	99.240

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
32.211	693.030	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.450	694.800	O7	3-methyl-c-hexene-3	0.022	0.022	0.020	203.720	95.400
32.722	696.790	--	unknown	0.000	0.000	0.000	32.000	0.000
32.986	698.710	O7	t-heptene-3	0.079	0.083	0.071	204.206	95.670
33.165	700.000	P7	n-heptane	1.389	1.495	1.219	209.156	98.420
33.461	701.940	O7	2-methyl-2-hexene	0.082	0.085	0.074	203.738	95.410
33.616	702.940	O7	3-methyl-t-hexene-3	0.032	0.034	0.029	200.372	93.540
33.861	704.520	O7	t-heptene-2	0.031	0.032	0.028	208.310	97.950
34.090	705.980	O7	3-ethylpentene-2	0.021	0.021	0.019	204.818	96.010
34.220	706.810	--	unknown	0.000	0.000	0.000	32.000	0.000
34.580	709.080	O7	c-heptene-2	0.078	0.081	0.070	209.138	98.410
34.766	710.240	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.096	712.280	O7	2,3-dimethylpentene-2	0.033	0.034	0.030	207.320	97.400
35.324	713.680	O7	3-ethylcyclopentene	0.004	0.004	0.004	207.986	97.770
35.435	714.350	--	unknown	0.000	0.000	0.000	32.000	0.000
35.719	716.070	O7	O7-[3]	0.006	0.007	0.006	32.000	0.000
35.986	717.670	N7	1c,2-dimethylcyclopentane	0.278	0.279	0.249	211.154	99.530
36.113	718.420	N7	methylcyclohexane	1.310	1.253	1.174	213.674	100.930
36.427	720.280	I8	2,2-dimethylhexane	0.041	0.043	0.031	224.312	106.840
36.537	720.920	N8	1,1,3-trimethylcyclopentane	0.179	0.176	0.141	220.802	104.890
36.876	722.890	O7	O7-[4]	0.004	0.005	0.004	32.000	0.000
36.955	723.350	--	unknown	0.002	0.002	0.002	32.000	0.000
37.147	724.460	O7	O7-[5]	0.005	0.005	0.004	32.000	0.000
37.259	725.100	--	unknown	0.001	0.001	0.001	32.000	0.000
37.508	726.510	O7	O7-[6]	0.006	0.006	0.006	32.000	0.000
38.003	729.300	N7	ethylcyclopentane	0.350	0.336	0.313	218.246	103.470
38.130	730.000	I8	2,5-dimethylhexane	0.578	0.614	0.445	228.398	109.110
38.318	731.050	I8	2,2,3-trimethylpentane	0.115	0.118	0.088	229.730	109.850
38.468	731.870	I8	2,4-dimethylhexane	0.672	0.706	0.517	228.974	109.430
38.603	732.610	--	unknown	0.010	0.011	0.008	32.000	0.000
38.822	733.810	--	unknown	0.002	0.002	0.001	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
38.921	734.340	O7	O7-[7]	0.002	0.002	0.002	32.000	0.000
39.162	735.650	O7	O7-[8]	0.002	0.002	0.001	32.000	0.000
39.476	737.330	N8	1c,2t,4-trimethylcyclopentane	0.294	0.283	0.230	242.132	116.740
39.691	738.470	I8	3,3-dimethylhexane	0.058	0.060	0.045	233.546	111.970
40.176	741.020	O7	O7-[9]	0.003	0.003	0.003	32.000	0.000
40.484	742.620	O7	O7-[10]	0.002	0.002	0.002	32.000	0.000
40.644	743.450	O7	O7-[11]	0.005	0.005	0.005	32.000	0.000
40.841	744.460	N8	1t,2c,3-trimethylcyclopentane	0.213	0.204	0.167	230.738	110.410
41.380	747.200	I8	2,3,4-trimethylpentane	1.257	1.287	0.968	236.246	113.470
41.597	748.290	I8	I8-[1]	0.080	0.082	0.061	236.246	113.470
41.893	749.770	O7	O7-[12]	0.021	0.021	0.016	32.000	0.000
42.202	751.300	I8	2,3,3-trimethylpentane	1.191	1.207	0.917	238.586	114.770
42.635	753.420	A7	toluene	4.742	4.026	4.528	231.134	110.630
42.744	753.940	O8	O8-[1]	0.005	0.005	0.004	32.000	0.000
43.084	755.590	O8	O8-[2]	0.007	0.007	0.006	32.000	0.000
43.616	758.130	I8	2,3-dimethylhexane	0.560	0.579	0.431	240.098	115.610
43.795	758.970	I8	2-methyl-3-ethylpentane	0.069	0.071	0.053	240.098	115.610
44.089	760.360	N8	1,1,2-trimethylcyclopentane	0.011	0.010	0.008	236.714	113.730
44.534	762.420	O8	O8-[3]	0.029	0.029	0.023	32.000	0.000
44.941	764.300	I8	2-methylheptane	0.936	0.987	0.721	243.770	117.650
45.253	765.720	I8	4-methylheptane	0.357	0.373	0.275	243.878	117.710
45.509	766.880	I8	3-methyl-3-ethylpentane	0.077	0.080	0.060	240.098	115.610
45.625	767.400	I8	3,4-dimethylhexane	0.085	0.087	0.066	243.914	117.730
46.248	770.180	N8	1c,3-dimethylcyclohexane	0.114	0.110	0.089	246.848	119.360
46.658	771.980	I8	3-methylheptane	0.895	0.934	0.690	246.074	118.930
46.922	773.140	--	unknown	0.181	0.190	0.139	32.000	0.000
47.014	773.530	N8	1c,2t,3-trimethylcyclopentane	0.428	0.409	0.336	243.500	117.500
47.176	774.230	I8	3-ethylhexane	0.109	0.112	0.084	245.372	118.540
47.448	775.410	N8	1t,4-dimethylcyclohexane	0.197	0.190	0.154	246.848	119.360
47.889	777.290	--	unknown	0.002	0.002	0.006	32.000	0.000
48.281	778.950	--	unknown	0.001	0.001	0.002	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
48.425	779.560	O8	O8-[4]	0.001	0.001	0.001	32.000	0.000
48.773	781.010	N8	1,1-dimethylcyclohexane	0.035	0.033	0.027	247.190	119.550
49.236	782.930	I9	2,2,5-trimethylhexane	0.635	0.661	0.436	255.362	124.090
49.667	784.690	N8	3c-ethylmethylcyclopentane	0.215	0.206	0.169	249.980	121.100
49.877	785.550	O9	2,6-dimethylheptene-1	0.003	0.003	0.002	32.000	0.000
50.210	786.890	N8	3t-ethylmethylcyclopentane	0.183	0.175	0.143	249.980	121.100
50.542	788.220	N8	2t-ethylmethylcyclopentane	0.166	0.159	0.130	250.160	121.200
50.999	790.040	O8	O8-[5]	0.007	0.007	0.005	32.000	0.000
51.128	790.550	N8	1,1-methylethylcyclopentane	0.022	0.021	0.017	250.754	121.530
51.816	793.240	N8	1t,2-dimethylcyclohexane	0.192	0.183	0.151	254.174	123.430
52.015	794.010	O8	t-octene-4	0.009	0.009	0.007	252.068	122.260
52.422	795.580	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.794	797.000	--	unknown	0.010	0.011	0.007	32.000	0.000
52.886	797.350	N8	1c,2c,3-trimethylcyclopentane	0.022	0.021	0.017	253.400	123.000
53.589	800.000	P8	n-octane	0.835	0.874	0.643	258.224	125.680
53.867	801.040	N8	1c,4-dimethylcyclohexane	0.270	0.254	0.212	255.794	124.330
54.737	804.260	O8	t-octene-2	0.008	0.009	0.007	32.000	0.000
54.960	805.080	--	unknown	0.005	0.005	0.014	32.000	0.000
55.334	806.450	I9	I9-[1]	0.039	0.040	0.027	32.000	0.000
55.435	806.810	--	unknown	0.017	0.018	0.012	32.000	0.000
55.831	808.240	N8	i-propylcyclopentane	0.085	0.081	0.067	259.574	126.430
56.489	810.590	--	unknown	0.004	0.004	0.010	32.000	0.000
57.017	812.460	--	unknown	0.009	0.010	0.025	32.000	0.000
57.125	812.840	O8	c-octene-2	0.004	0.004	0.003	32.000	0.000
57.331	813.560	--	unknown	0.001	0.001	0.001	32.000	0.000
57.696	814.830	N8	N8-[1]	0.014	0.014	0.011	32.000	0.000
58.064	816.100	O8	O8-[6]	0.002	0.002	0.002	32.000	0.000
58.446	817.400	I9	2,2,3,4-tetramethylpentane	0.127	0.127	0.087	271.454	133.030
59.086	819.580	I9	2,3,4-trimethylhexane	0.072	0.071	0.049	282.308	139.060
59.385	820.580	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.645	821.450	O9	O9-[1]	0.031	0.032	0.022	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
60.051	822.800	N8	N8-[3]	0.001	0.001	0.001	32.000	0.000
60.499	824.280	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.041	826.050	N8	1c,2-dimethylcyclohexane	0.190	0.176	0.149	265.532	129.740
61.235	826.680	--	unknown	0.023	0.024	0.018	32.000	0.000
61.631	827.960	I9	2,3,5-trimethylhexane	0.007	0.007	0.005	268.430	131.350
61.943	828.960	I9	2,2-dimethylheptane	0.013	0.014	0.009	270.860	132.700
62.836	831.790	N9	1,1,4-trimethylcyclohexane	0.341	0.325	0.237	275.000	135.000
63.400	833.560	I9	2,2,3-trimethylhexane	0.161	0.166	0.110	271.220	132.900
63.985	835.380	I9	2,4-dimethylheptane	0.034	0.035	0.024	271.220	132.900
64.726	837.650	I9	4,4-dimethylheptane	0.196	0.202	0.135	271.220	132.900
65.027	838.560	N8	ethylcyclohexane	0.001	0.001	0.001	269.222	131.790
65.627	840.370	N8	n-propylcyclopentane	0.033	0.031	0.026	267.728	130.960
65.832	840.990	I9	2,5-dimethylheptane	0.266	0.273	0.182	276.800	136.000
66.295	842.370	I9	3,3-&3,5-dimethylheptane	0.062	0.063	0.042	278.636	137.020
66.702	843.570	I9	3,5-dimethylheptane	0.042	0.043	0.029	276.800	136.000
67.179	844.970	I9	2,6-dimethylheptane	0.073	0.075	0.050	275.396	135.220
67.806	846.800	N9	1,1,3-trimethylcyclohexane	0.049	0.046	0.034	295.862	146.590
68.300	848.220	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
68.846	849.780	N8	N8-[4]	0.001	0.001	0.001	32.000	0.000
69.092	850.480	N8	N8-[5]	0.003	0.003	0.003	32.000	0.000
69.408	851.370	N9	1c,2t,4t-trimethylcyclohexane	0.020	0.019	0.014	32.000	0.000
70.264	853.770	A8	ethylbenzene	1.243	1.055	1.030	277.160	136.200
70.637	854.800	N9	1c,3c,5c-trimethylcyclohexane	0.129	0.122	0.090	32.000	0.000
71.461	857.070	O9	2-methyloctene-1	0.020	0.022	0.014	32.000	0.000
71.896	858.250	I9	I9-[2]	0.004	0.004	0.003	32.000	0.000
72.360	859.510	O9	2-methyloctene-2	0.030	0.033	0.021	32.000	0.000
74.123	864.200	A8	1,3-dimethylbenzene	3.352	2.855	2.778	282.416	139.120
74.448	865.050	A8	1,4-dimethylbenzene	1.355	1.158	1.123	281.048	138.360
75.059	866.640	I9	3,4-dimethylheptane	0.034	0.034	0.023	285.080	140.600
75.384	867.470	I9	3,4 -dimethylheptane	0.064	0.064	0.044	285.080	140.600
75.918	868.840	N9	N9-[1]	0.030	0.028	0.021	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
76.367	869.990	I9	I9-[3]	0.079	0.079	0.054	32.000	0.000
77.262	872.250	I9	4-ethylheptane	0.003	0.003	0.002	288.392	142.440
77.569	873.020	I9	4-methyloctane	0.276	0.282	0.189	288.392	142.440
77.965	874.000	I9	2-methyloctane	0.339	0.349	0.232	289.904	143.280
78.568	875.490	N9	N9-[2]	0.038	0.036	0.026	32.000	0.000
79.424	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.041	0.040	0.028	304.160	151.200
79.736	878.350	I9	3-ethylheptane	0.079	0.080	0.054	289.400	143.000
80.250	879.590	I9	3-methyloctane	0.436	0.445	0.299	291.614	144.230
80.568	880.350	I9	3,3-diethylpentane	0.021	0.021	0.015	270.842	132.690
81.010	881.410	--	unknown	0.067	0.070	0.046	32.000	0.000
81.299	882.090	N9	1c,2t,4c-trimethylcyclohexane	0.018	0.017	0.013	275.000	135.000
81.666	882.960	N9	1,1,2-trimethylcyclohexane	0.031	0.028	0.021	293.360	145.200
82.032	883.820	A8	1,2-dimethylbenzene	1.672	1.398	1.386	291.974	144.430
82.558	885.060	I9	I9-[4]	0.028	0.029	0.019	32.000	0.000
82.921	885.900	I9	I9-[5]	0.106	0.107	0.073	32.000	0.000
83.657	887.600	N9	N9-[3]	0.090	0.085	0.063	32.000	0.000
83.922	888.210	N9	N9-[4]	0.113	0.107	0.079	32.000	0.000
84.051	888.510	--	unknown	0.040	0.042	0.028	32.000	0.000
84.424	889.360	O9	nonene-1	0.006	0.005	0.004	274.100	134.500
84.609	889.780	I9	I9-[6]	0.062	0.062	0.042	32.000	0.000
85.014	890.700	N9	N9-[5]	0.160	0.151	0.111	32.000	0.000
85.555	891.910	I9	I9-[7]	0.017	0.017	0.011	32.000	0.000
86.009	892.930	N9	i-butylcyclopentane	0.033	0.031	0.023	298.346	147.970
86.219	893.400	N9	N9-[6]	0.022	0.021	0.016	32.000	0.000
87.066	895.280	--	unknown	0.001	0.001	0.001	32.000	0.000
87.435	896.090	N9	N9-[7]	0.015	0.014	0.011	32.000	0.000
87.738	896.750	N9	N9-[8]	0.009	0.008	0.006	32.000	0.000
88.031	897.390	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.250	897.870	O9	t-nonene-3	0.021	0.022	0.015	32.000	0.000
88.667	898.770	I9	I9-[8]	0.128	0.129	0.088	32.000	0.000
88.823	899.110	--	unknown	0.024	0.026	0.017	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
89.237	900.000	P9	n-nonane	0.391	0.401	0.268	303.476	150.820
89.598	901.750	N9	1,1-methylethylcyclohexane	0.094	0.086	0.065	305.924	152.180
90.170	904.510	N9	N9-[9]	0.010	0.009	0.007	32.000	0.000
90.421	905.710	N9	N9-[10]	0.027	0.025	0.019	32.000	0.000
90.690	907.000	O10	t-2,2,5,5-tetramethylhexene-3	0.004	0.005	0.003	32.000	0.000
90.801	907.530	--	unknown	0.003	0.003	0.002	32.000	0.000
91.585	911.260	N9	N9-[11]	0.006	0.006	0.004	32.000	0.000
92.009	913.250	A9	i-propylbenzene	0.066	0.056	0.048	306.338	152.410
92.371	914.950	O9	c-nonene-3	0.075	0.081	0.052	32.000	0.000
92.516	915.630	--	unknown	0.020	0.021	0.014	32.000	0.000
92.931	917.570	I10	I10-[1]	0.012	0.013	0.008	32.000	0.000
93.033	918.040	N9	i-propylcyclohexane	0.022	0.021	0.016	310.622	154.790
93.178	918.710	--	unknown	0.006	0.007	0.004	32.000	0.000
93.771	921.460	I10	I10-[2]	0.114	0.114	0.070	32.000	0.000
94.167	923.280	I10	2,2-dimethyloctane	0.037	0.037	0.023	314.420	156.900
94.443	924.540	I10	2,4-dimethyloctane	0.055	0.055	0.034	312.620	155.900
94.875	926.520	N9	N9-[12]	0.007	0.007	0.005	32.000	0.000
95.307	928.480	N9	N9-[13]	0.023	0.022	0.016	32.000	0.000
95.916	931.230	I10	2,6-dimethyloctane	0.092	0.093	0.057	320.738	160.410
96.274	932.830	I10	2,5-dimethyloctane	0.083	0.084	0.051	317.300	158.500
96.528	933.970	--	unknown	0.003	0.003	0.002	32.000	0.000
97.127	936.640	N9	n-butylcyclopentane	0.062	0.058	0.043	313.916	156.620
97.342	937.590	I10	I10-[3]	0.033	0.034	0.021	32.000	0.000
97.491	938.250	N10	N10-[1]	0.038	0.035	0.024	32.000	0.000
97.755	939.420	--	unknown	0.006	0.006	0.004	32.000	0.000
98.004	940.520	I10	I10-[4]	0.022	0.022	0.014	32.000	0.000
98.460	942.510	I10	3,3-dimethyloctane	0.147	0.146	0.091	322.160	161.200
98.772	943.880	N10	N10-[2]	0.025	0.023	0.016	32.000	0.000
98.985	944.800	--	unknown	0.020	0.021	0.012	32.000	0.000
99.156	945.550	--	unknown	0.026	0.027	0.016	32.000	0.000
99.548	947.250	A9	n-propylbenzene	0.371	0.317	0.272	318.632	159.240

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Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
99.844	948.520	I10	3,6-dimethyloctane	0.028	0.028	0.017	321.440	160.800
100.102	949.630	I10	3-methyl-5-ethylheptane	0.049	0.049	0.030	316.760	158.200
100.251	950.270	--	unknown	0.006	0.007	0.004	32.000	0.000
100.566	951.630	N10	N10-[3]	0.029	0.027	0.018	32.000	0.000
101.194	954.300	--	unknown	0.026	0.028	0.017	32.000	0.000
101.502	955.610	A9	1,3-methylethylbenzene	1.312	1.117	0.961	322.394	161.330
101.888	957.240	A9	1,4-methylethylbenzene	0.563	0.481	0.412	323.618	162.010
102.197	958.540	N10	N10-[4]	0.032	0.029	0.020	32.000	0.000
102.370	959.270	--	unknown	0.003	0.003	0.002	32.000	0.000
102.742	960.830	--	unknown	0.002	0.002	0.001	32.000	0.000
102.946	961.680	--	unknown	0.011	0.012	0.031	32.000	0.000
103.232	962.870	A9	1,3,5-trimethylbenzene	0.700	0.595	0.512	328.532	164.740
103.497	963.970	I10	I10-[5]	0.044	0.044	0.027	32.000	0.000
103.764	965.080	N10	N10-[5]	0.019	0.017	0.012	32.000	0.000
103.956	965.870	--	unknown	0.006	0.007	0.004	32.000	0.000
104.193	966.850	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.509	968.150	I10	5-methylnonane	0.054	0.055	0.034	329.180	165.100
104.915	969.810	I10	4-methylnonane	0.447	0.445	0.277	32.000	0.000
105.258	971.210	A9	1,2-methylethylbenzene	0.417	0.349	0.305	329.324	165.180
105.444	971.970	I10	2-methylnonane	0.128	0.130	0.079	332.654	167.030
105.574	972.500	--	unknown	0.013	0.014	0.008	32.000	0.000
105.865	973.680	--	unknown	0.012	0.013	0.007	32.000	0.000
106.099	974.620	I10	3-ethyloctane	0.028	0.028	0.017	331.700	166.500
106.180	974.950	--	unknown	0.015	0.015	0.009	32.000	0.000
106.469	976.110	N10	N10-[6]	0.025	0.023	0.015	32.000	0.000
106.803	977.450	I10	3-methylnonane	0.157	0.157	0.097	334.040	167.800
107.004	978.260	--	unknown	0.007	0.008	0.004	32.000	0.000
107.359	979.680	N10	N10-[7]	0.003	0.003	0.002	32.000	0.000
107.542	980.410	I10	I10-[7]	0.100	0.100	0.062	32.000	0.000
107.816	981.500	I10	I10-[8]	0.008	0.008	0.005	32.000	0.000
108.103	982.640	--	unknown	0.011	0.012	0.007	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
108.564	984.460	A9	1,2,4-trimethylbenzene	2.041	1.715	1.494	336.884	169.380
108.795	985.370	--	unknown	0.008	0.009	0.006	32.000	0.000
108.961	986.020	I10	I10-[9]	0.009	0.009	0.006	32.000	0.000
109.078	986.480	N10	i-butylcyclohexane	0.038	0.035	0.024	340.340	171.300
109.271	987.240	--	unknown	0.030	0.032	0.019	32.000	0.000
109.386	987.690	I10	I10-[10]	0.046	0.046	0.028	32.000	0.000
109.668	988.790	I10	I10-[11]	0.020	0.019	0.012	32.000	0.000
109.809	989.340	I10	I10-[12]	0.013	0.013	0.008	32.000	0.000
110.162	990.710	N10	N10-[8]	0.024	0.022	0.015	32.000	0.000
110.376	991.540	--	unknown	0.002	0.003	0.002	32.000	0.000
110.766	993.050	O10	decene-1	0.002	0.002	0.002	339.080	170.600
110.926	993.660	N10	1t-methyl-2-n-propylcyclohexane	0.012	0.011	0.007	339.800	171.000
111.051	994.150	O10	2,3-dimethyloctene-2	0.066	0.066	0.041	32.000	0.000
111.168	994.600	I10	I10-[13]	0.016	0.016	0.010	32.000	0.000
111.461	995.720	A10	i-butylbenzene	0.004	0.003	0.002	343.022	172.790
111.606	996.280	--	unknown	0.058	0.061	0.038	32.000	0.000
111.842	997.180	I10	I10-[14]	0.040	0.040	0.025	32.000	0.000
112.119	998.240	A10	sec-butylbenzene	0.038	0.032	0.025	344.012	173.340
112.368	999.180	--	unknown	0.009	0.009	0.006	32.000	0.000
112.582	1000.000	P10	n-decane	0.207	0.209	0.128	345.470	174.150
112.824	1001.520	I11	I11-[1]	0.029	0.029	0.016	32.000	0.000
113.182	1003.780	N10	N10-[9]	0.018	0.017	0.011	32.000	0.000
113.581	1006.290	--	unknown	0.005	0.006	0.003	32.000	0.000
113.825	1007.820	A9	1,2,3-trimethylbenzene	0.400	0.329	0.293	349.016	176.120
113.987	1008.830	--	unknown	0.009	0.009	0.006	32.000	0.000
114.271	1010.610	A10	1,3-methyl-i-propylbenzene	0.044	0.038	0.029	347.144	175.080
114.716	1013.370	--	unknown	0.010	0.011	0.028	32.000	0.000
114.832	1014.090	A10	1,4-methyl-i-propylbenzene	0.026	0.022	0.017	350.834	177.130
114.995	1015.100	--	unknown	0.003	0.003	0.002	32.000	0.000
115.299	1016.980	I11	I11-[2]	0.028	0.028	0.016	32.000	0.000
115.570	1018.650	I11	I11-[3]	0.013	0.013	0.007	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
115.863	1020.460	A10	2-3-dihydroindene	0.278	0.212	0.207	352.130	177.850
116.229	1022.700	--	unknown	0.020	0.021	0.015	32.000	0.000
116.475	1024.210	N10	sec-butylcyclohexane	0.043	0.039	0.027	354.812	179.340
116.710	1025.640	I11	I11-[4]	0.009	0.009	0.005	32.000	0.000
117.056	1027.740	A10	1,2-methyl-i-propylbenzene	0.075	0.063	0.049	352.724	178.180
117.232	1028.820	I11	3-ethylnonane	0.006	0.006	0.003	32.000	0.000
117.334	1029.430	--	unknown	0.003	0.004	0.002	32.000	0.000
117.628	1031.210	--	unknown	0.068	0.072	0.038	32.000	0.000
117.851	1032.560	N11	N11-[1]	0.047	0.044	0.027	32.000	0.000
118.092	1034.010	I11	I11-[5]	0.017	0.017	0.010	32.000	0.000
118.243	1034.920	--	unknown	0.003	0.003	0.002	32.000	0.000
118.602	1037.070	I11	I11-[6]	0.032	0.029	0.018	32.000	0.000
118.768	1038.070	--	unknown	0.034	0.036	0.020	32.000	0.000
119.211	1040.710	A10	1,3-diethylbenzene	0.141	0.121	0.093	358.052	181.140
119.411	1041.900	--	unknown	0.065	0.069	0.043	32.000	0.000
119.659	1043.380	A10	1,3-methyl-n-propylbenzene	0.288	0.246	0.189	359.618	182.010
119.834	1044.410	I11	I11-[7]	0.024	0.024	0.014	32.000	0.000
120.116	1046.080	A10	1,4-diethylbenzene	0.012	0.010	0.008	362.822	183.790
120.297	1047.150	A10	1,4-methyl-n-propylbenzene	0.179	0.154	0.118	362.156	183.420
120.470	1048.170	A10	n-butylbenzene	0.086	0.074	0.057	361.940	183.300
120.880	1050.590	A10	1,3-dimethyl-5-ethylbenzene	0.302	0.252	0.198	362.516	183.620
121.202	1052.470	A10	1,2-diethylbenzene	0.032	0.027	0.021	362.228	183.460
121.345	1053.310	I11	I11-[8]	0.018	0.018	0.010	32.000	0.000
121.574	1054.650	N10	t-decahydronaphthalene	0.009	0.009	0.005	368.960	187.200
121.824	1056.110	N11	N11-[2]	0.017	0.016	0.010	32.000	0.000
122.104	1057.740	--	unknown	0.014	0.014	0.008	32.000	0.000
122.245	1058.560	A10	1,2-methyl-n-propylbenzene	0.099	0.083	0.065	364.946	184.970
122.636	1060.820	I11	I11-[9]	0.012	0.012	0.007	32.000	0.000
122.755	1061.510	I11	I11-[10]	0.072	0.071	0.040	32.000	0.000
122.961	1062.700	I11	I11-[11]	0.049	0.048	0.027	32.000	0.000
123.311	1064.710	--	unknown	0.004	0.004	0.002	32.000	0.000

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Hold

Components Listed in Chromatographic Order

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123.473	1065.640	I11	I11-[12]	0.048	0.048	0.027	32.000	0.000
123.730	1067.120	--	unknown	0.009	0.010	0.005	32.000	0.000
124.018	1068.770	A10	1,4,dimethyl-2-ethylbenzene	0.219	0.184	0.143	368.366	186.870
124.291	1070.330	A10	1,3-dimethyl-4-ethylbenzene	0.274	0.235	0.180	370.832	188.240
124.562	1071.870	I11	I11-[13]	0.003	0.003	0.002	32.000	0.000
124.863	1073.580	--	unknown	0.008	0.009	0.005	32.000	0.000
125.122	1075.050	I11	I11-[14]	0.151	0.150	0.085	32.000	0.000
125.289	1075.990	A10	1,2-dimethyl-4-ethylbenzene	0.301	0.253	0.197	373.136	189.520
125.602	1077.760	--	unknown	0.009	0.010	0.006	32.000	0.000
125.890	1079.380	--	unknown	0.014	0.014	0.009	32.000	0.000
125.978	1079.880	I11	I11-[15]	0.005	0.004	0.003	32.000	0.000
126.264	1081.480	A10	1,3-dimethyl-2-ethylbenzene	0.051	0.042	0.033	374.090	190.050
126.418	1082.350	I11	I11-[16]	0.018	0.018	0.010	32.000	0.000
126.747	1084.190	--	unknown	0.018	0.019	0.010	32.000	0.000
126.946	1085.300	I11	I11-[17]	0.009	0.009	0.005	32.000	0.000
127.175	1086.580	--	unknown	0.016	0.017	0.009	32.000	0.000
127.509	1088.430	--	unknown	0.009	0.009	0.005	32.000	0.000
127.584	1088.850	--	unknown	0.012	0.013	0.007	32.000	0.000
127.858	1090.360	O11	undecene-1	0.021	0.021	0.012	378.860	192.700
128.193	1092.220	A11	1,4-methyl-t-butylbenzene	0.038	0.033	0.022	32.000	0.000
128.469	1093.740	A10	1,2-dimethyl-3-ethylbenzene	0.084	0.069	0.055	381.110	193.950
128.811	1095.620	--	unknown	0.007	0.007	0.005	32.000	0.000
129.084	1097.120	--	unknown	0.014	0.015	0.009	32.000	0.000
129.165	1097.560	A11	1,2-ethyl-i-propylbenzene	0.009	0.008	0.005	32.000	0.000
129.334	1098.490	--	unknown	0.007	0.007	0.004	32.000	0.000
129.610	1100.000	P11	n-undecane	0.108	0.107	0.061	384.620	195.900
129.737	1100.950	--	unknown	0.010	0.011	0.006	32.000	0.000
129.915	1102.280	A11	1,4-ethyl-i-propylbenzene	0.003	0.002	0.002	32.000	0.000
130.344	1105.480	A10	1,2,4,5-tetramethylbenzene	0.176	0.146	0.115	386.312	196.840
130.732	1108.380	--	unknown	0.008	0.009	0.005	32.000	0.000
130.886	1109.520	A10	1,2,3,5-tetramethylbenzene	0.233	0.193	0.153	388.472	198.040

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Hold

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131.041	1110.670	--	unknown	0.006	0.006	0.004	32.000	0.000
131.377	1113.160	--	unknown	0.012	0.013	0.008	32.000	0.000
131.571	1114.590	--	unknown	0.008	0.008	0.005	32.000	0.000
131.875	1116.830	--	unknown	0.022	0.023	0.015	32.000	0.000
132.320	1120.110	--	unknown	0.015	0.016	0.010	32.000	0.000
132.477	1121.260	--	unknown	0.016	0.017	0.010	32.000	0.000
132.962	1124.810	A11	1,2-methyl-t-butylbenzene	0.007	0.005	0.004	32.000	0.000
133.117	1125.940	--	unknown	0.013	0.013	0.008	32.000	0.000
133.429	1128.220	A10	5-methylindan	0.207	0.171	0.138	32.000	0.000
133.774	1130.720	I12	I12-[1]	0.050	0.049	0.026	421.340	216.300
134.179	1133.660	--	unknown	0.008	0.008	0.004	32.000	0.000
134.295	1134.500	A10	4-methylindan	0.051	0.042	0.034	32.000	0.000
134.562	1136.430	--	unknown	0.011	0.012	0.008	32.000	0.000
134.675	1137.240	A11	1,2-ethyl-n-propylbenzene	0.060	0.049	0.035	32.000	0.000
134.928	1139.060	A10	2-methylindan	0.198	0.161	0.132	368.600	187.000
135.139	1140.570	A11	1,3-methyl-n-butylbenzene	0.010	0.008	0.006	390.200	199.000
135.389	1142.370	--	unknown	0.006	0.006	0.003	32.000	0.000
135.543	1143.470	A12	1,3-di-i-propylbenzene	0.067	0.055	0.036	397.760	203.200
135.756	1145.000	A11	s-pentylbenzene	0.061	0.051	0.036	401.000	205.000
135.929	1146.230	--	unknown	0.002	0.002	0.001	32.000	0.000
136.341	1149.170	--	unknown	0.019	0.020	0.011	32.000	0.000
136.439	1149.860	A11	n-pentylbenzene	0.051	0.042	0.030	401.720	205.400
136.519	1150.430	--	unknown	0.023	0.024	0.014	32.000	0.000
136.798	1152.420	N12	1t-M-2-(4-MP)cyclopentane	0.005	0.004	0.002	32.000	0.000
136.995	1153.810	A12	1,2-di-i-propylbenzene	0.029	0.024	0.016	399.200	204.000
137.142	1154.850	--	unknown	0.028	0.029	0.015	32.000	0.000
137.627	1158.270	--	unknown	0.041	0.043	0.022	32.000	0.000
137.871	1159.990	A12	1,4-di-i-propylbenzene	0.051	0.042	0.027	410.540	210.300
138.176	1162.130	--	unknown	0.007	0.007	0.004	32.000	0.000
138.348	1163.340	A10	tetrahydronaphthalene	0.018	0.014	0.012	405.716	207.620
138.495	1164.360	--	unknown	0.008	0.008	0.005	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
138.741	1166.080	--	unknown	0.004	0.005	0.003	32.000	0.000
138.883	1167.080	I12	I12-[2]	0.055	0.054	0.028	421.340	216.300
139.183	1169.170	A10	naphthalene	0.170	0.122	0.117	424.382	217.990
139.507	1171.420	A12	1-t-butyl-3,5-dimethylbenzene	0.004	0.003	0.002	32.000	0.000
139.849	1173.790	A12	1,4-ethyl-t-butylbenzene	0.077	0.064	0.042	32.000	0.000
140.252	1176.580	--	unknown	0.028	0.029	0.015	32.000	0.000
140.543	1178.590	I12	I12-[3]	0.057	0.056	0.030	421.340	216.300
140.773	1180.180	I12	I12-[4]	0.033	0.032	0.017	421.340	216.300
141.116	1182.530	--	unknown	0.007	0.007	0.004	32.000	0.000
141.353	1184.160	I12	I12-[5]	0.034	0.034	0.018	421.340	216.300
141.603	1185.870	--	unknown	0.012	0.013	0.006	32.000	0.000
141.897	1187.870	I12	I12-[6]	0.035	0.034	0.018	421.340	216.300
142.095	1189.230	A12	1,3-di-n-propylbenzene	0.041	0.034	0.022	32.000	0.000
142.337	1190.870	A12	A12-[1]	0.025	0.021	0.014	32.000	0.000
142.554	1192.340	O12	dodecene-1	0.006	0.006	0.003	416.120	213.400
142.914	1194.780	--	unknown	0.007	0.008	0.004	32.000	0.000
143.254	1197.080	--	unknown	0.005	0.005	0.003	32.000	0.000
143.556	1199.130	A12	A12-[2]	0.021	0.017	0.011	32.000	0.000
143.685	1200.000	P12	n-dodecane	0.046	0.045	0.024	421.340	216.300
143.948	1202.210	--	unknown	0.003	0.004	0.002	32.000	0.000
144.225	1204.540	--	unknown	0.013	0.014	0.007	32.000	0.000
144.318	1205.320	--	unknown	0.004	0.005	0.002	32.000	0.000
144.762	1209.040	--	unknown	0.012	0.013	0.006	32.000	0.000
144.988	1210.930	--	unknown	0.006	0.006	0.003	32.000	0.000
145.187	1212.590	A12	1,3,5-triethylbenzene	0.003	0.003	0.002	420.800	216.000
145.373	1214.140	--	unknown	0.008	0.008	0.004	32.000	0.000
145.717	1217.000	--	unknown	0.022	0.024	0.012	32.000	0.000
145.891	1218.450	--	unknown	0.013	0.014	0.007	32.000	0.000
146.207	1221.070	--	unknown	0.003	0.003	0.002	32.000	0.000
146.498	1223.470	--	unknown	0.018	0.019	0.010	32.000	0.000
146.737	1225.450	--	unknown	0.017	0.018	0.009	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
146.811	1226.060	--	unknown	0.008	0.008	0.004	32.000	0.000
147.121	1228.610	--	unknown	0.005	0.005	0.003	32.000	0.000
147.205	1229.300	--	unknown	0.013	0.013	0.007	32.000	0.000
147.509	1231.800	A12	1,2,4-triethylbenzene	0.013	0.011	0.007	423.500	217.500
147.729	1233.610	--	unknown	0.005	0.005	0.003	32.000	0.000
148.092	1236.580	--	unknown	0.004	0.004	0.002	32.000	0.000
148.233	1237.730	--	unknown	0.012	0.013	0.007	32.000	0.000
148.465	1239.620	--	unknown	0.002	0.002	0.001	32.000	0.000
148.803	1242.370	A12	1,4-methyl-n-pentylbenzene	0.036	0.030	0.020	32.000	0.000
149.086	1244.670	--	unknown	0.010	0.010	0.005	32.000	0.000
149.242	1245.940	--	unknown	0.004	0.004	0.002	32.000	0.000
149.380	1247.050	--	unknown	0.003	0.003	0.002	32.000	0.000
149.668	1249.380	--	unknown	0.004	0.005	0.002	32.000	0.000
149.952	1251.680	--	unknown	0.006	0.007	0.003	32.000	0.000
150.149	1253.260	--	unknown	0.008	0.009	0.004	32.000	0.000
150.536	1256.380	A12	n-hexylbenzene	0.020	0.016	0.011	32.000	0.000
150.626	1257.100	--	unknown	0.021	0.022	0.011	32.000	0.000
150.997	1260.070	--	unknown	0.011	0.012	0.006	32.000	0.000
151.256	1262.140	--	unknown	0.005	0.005	0.003	32.000	0.000
151.501	1264.100	--	unknown	0.005	0.005	0.003	32.000	0.000
151.660	1265.370	--	unknown	0.003	0.004	0.002	32.000	0.000
151.869	1267.030	--	unknown	0.006	0.007	0.003	32.000	0.000
151.921	1267.450	--	unknown	0.009	0.010	0.005	32.000	0.000
152.209	1269.740	--	unknown	0.011	0.011	0.006	32.000	0.000
152.638	1273.140	I13	I13-[1]	0.008	0.008	0.004	455.720	235.400
152.827	1274.630	A11	1,2,3,4,5-pentamethylbenzene	0.024	0.017	0.014	449.600	232.000
153.058	1276.460	--	unknown	0.009	0.010	0.006	32.000	0.000
153.571	1280.500	--	unknown	0.006	0.006	0.004	32.000	0.000
153.925	1283.280	A11	2-methylnaphthalene	0.093	0.067	0.057	465.890	241.050
154.414	1287.110	--	unknown	0.010	0.010	0.006	32.000	0.000
154.564	1288.290	--	unknown	0.002	0.002	0.001	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\102F0201.D\102F0201.CDF Acquired: 10/30/20 23:25:35
Sample: ODDB:54925 Analyzed: 11/2/2020 8:40:44 PM
Processed 630 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
154.703	1289.370	--	unknown	0.003	0.003	0.002	32.000	0.000
154.907	1290.960	O13	tridecene-1	0.007	0.007	0.004	451.040	232.800
155.340	1294.340	--	unknown	0.002	0.002	0.001	32.000	0.000
155.495	1295.540	--	unknown	0.003	0.003	0.001	32.000	0.000
155.565	1296.080	--	unknown	0.002	0.002	0.001	32.000	0.000
155.878	1298.510	A11	1-methylnaphthalene	0.037	0.027	0.023	472.352	244.640
156.070	1300.000	P13	n-tridecane	0.010	0.009	0.005	455.720	235.400
156.190	1301.080	+	C14+ (Summarized)	0.325	0.313	0.144	455.720	235.400

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 9:02:09 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF
Acquired: 10/31/20 02:46:24
Sample: ODDB:54926
Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.877	8.829	8.094
I-Paraffins:	39.610	43.071	35.943
Olefins:	4.171	4.486	4.526
Naphthenes:	12.182	11.755	10.839
Aromatics:	23.377	19.708	18.847
Total C14+:	0.400	0.386	0.178
Total Unknowns:	1.761	1.852	1.259

Oxygenates:

Total: 10.624(Mass%) 9.913(Vol%)

Total Oxygen Content: 3.689(Mass%)

Multisubstituted Aromatics: 14.865(Mass%) 12.567(Vol%)

Average Molecular Weight: 88.091

Relative Density: 0.736

Vapor Pressure :

Calculated Octane Number: 85.9

Motor Octane Number (Jenkins Calculation): 78.1

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	210.63	336.88	465.89
BP by Vol (Deg F)	31.10	173.30	210.63	336.88	465.89

Percent Carbon: 83.881 Percent Hydrogen: 12.429

Bromine Number (Calc): 7.831 Particulate Matter Index: 1.158

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF
Sample: ODDB:54926
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:

Acquired: 10/31/20 02:46:24
Analyzed: 11/2/2020 8:59:33 PM

Normalized to 100.000%

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	10.624	3.689	9.913

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF
Acquired: 10/31/20 02:46:24
Sample: ODDB:54926
Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.505	0.105	0.048	0.000	0.000	0.000	0.659
C5	2.488	6.997	1.788	0.340	0.000	0.001	11.614
C6	1.891	7.911	1.197	3.278	0.723	0.046	15.046
C7	1.387	8.635	0.764	3.933	4.743	0.008	19.469
C8	0.834	9.929	0.070	2.872	7.625	0.205	21.536
C9	0.392	3.399	0.198	1.394	5.889	0.185	11.457
C10	0.207	1.815	0.073	0.316	3.607	0.279	6.296
C11	0.111	0.544	0.022	0.043	0.400	0.387	1.506
C12	0.048	0.267	0.005	0.005	0.391	0.327	1.043
C13	0.010	0.009	0.007	0.000	0.000	0.323	0.349
Total:	7.877	39.610	4.171	12.182	23.377	1.761	87.216

Oxygenates	10.624	Total C14+:	0.400
Total Unknowns:	1.761	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.643	0.139	0.058	0.000	0.000	0.000	0.840
C5	2.926	8.315	1.996	0.336	0.000	0.001	13.573
C6	2.112	8.857	1.253	3.193	0.606	0.048	16.068
C7	1.493	9.280	0.794	3.833	4.028	0.008	19.436
C8	0.875	10.374	0.071	2.743	6.471	0.216	20.750
C9	0.402	3.480	0.209	1.315	4.977	0.195	10.578
C10	0.209	1.818	0.072	0.290	2.987	0.293	5.671
C11	0.110	0.538	0.021	0.040	0.316	0.407	1.432
C12	0.047	0.261	0.004	0.004	0.324	0.344	0.985
C13	0.010	0.008	0.007	0.000	0.000	0.340	0.365
Total:	8.829	43.071	4.486	11.755	19.708	1.852	87.849

Oxygenates	9.913	Total C14+:	0.386
Total Unknowns:	1.852	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF
Acquired: 10/31/20 02:46:24
Sample: ODDB:54926
Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.004
C4	0.766	0.159	0.075	0.000	0.000	0.001	1.001
C5	3.038	8.543	2.250	0.427	0.000	0.001	14.260
C6	1.933	8.086	1.259	3.431	0.816	0.121	15.647
C7	1.219	7.591	0.685	3.528	4.534	0.009	17.566
C8	0.643	7.657	0.055	2.254	6.326	0.164	17.100
C9	0.269	2.334	0.138	0.973	4.316	0.140	8.171
C10	0.128	1.124	0.046	0.198	2.402	0.201	4.099
C11	0.063	0.307	0.012	0.025	0.240	0.254	0.901
C12	0.025	0.138	0.002	0.002	0.212	0.193	0.573
C13	0.005	0.004	0.003	0.000	0.000	0.176	0.188
Total:	8.094	35.943	4.526	10.839	18.847	1.259	78.250

Oxygenates	20.314	Total C14+:	0.178	
Total Unknowns:	1.259	Grand Total:	100.000	

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
13.030	481.390	O5	1,4-pentadiene	0.001	0.001	0.001
14.847	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.009
16.185	527.950	O5	1t,3-pentadiene	0.008	0.008	0.010
16.885	538.190	O5	cyclopentadiene	0.005	0.006	0.007
20.390	581.030	O6	1,5-hexadiene	0.000	0.000	0.000
21.989	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.273	632.940	O7	cyclic diolefin or triolefin-[1]	0.003	0.003	0.003
25.835	638.580	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007
28.353	661.960	O6	diolefin (hexadiene)	0.003	0.003	0.003
30.171	677.230	O7	1,6-heptadiene	0.000	0.000	0.000
36.538	720.930	N8	1,1,3-trimethylcyclopentane	0.174	0.171	0.136

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.435	100.000	P1	methane	0.000	0.000	0.000	-258.700	-161.500
6.620	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.114	293.490	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.176	300.000	P3	propane	0.002	0.002	0.003	-43.672	-42.040
8.191	366.100	I4	i-butane	0.105	0.139	0.159	10.904	-11.720
8.341	372.460	--	unknown	0.000	0.000	0.001	32.000	0.000
8.847	390.700	O4	butene-1	0.002	0.003	0.004	20.750	-6.250
8.878	391.710	O4	isobutylene	0.003	0.004	0.005	20.750	-6.250
9.154	400.000	P4	n-butane	0.505	0.643	0.766	31.100	-0.500
9.544	412.290	O4	t-butene-2	0.018	0.022	0.029	33.584	0.880
9.642	415.120	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.875	421.560	--	unknown	0.001	0.001	0.001	32.000	0.000
10.130	428.120	O4	c-butene-2	0.024	0.029	0.038	38.696	3.720
11.669	460.120	X2	ethanol	10.624	9.913	20.314	173.300	78.500
11.715	460.920	O5	3-methylbutene-1	0.051	0.060	0.064	68.090	20.050
12.773	477.730	I5	i-pentane	6.994	8.311	8.539	82.112	27.840
13.030	481.390	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.746	490.870	O5	pentene-1	0.123	0.142	0.155	85.928	29.960
14.221	496.680	O5	2-methylbutene-1	0.285	0.323	0.358	88.070	31.150
14.507	500.000	P5	n-pentane	2.488	2.926	3.038	96.908	36.060
14.847	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.009	93.308	34.060
15.095	510.390	O5	t-pentene-2	0.372	0.423	0.467	97.412	36.340
15.466	516.600	O5	3,3-dimethylbutene-1	0.005	0.006	0.006	106.232	41.240
15.635	519.350	O5	c-pentene-2	0.207	0.232	0.259	98.474	36.930
15.794	521.880	--	unknown	0.000	0.000	0.001	32.000	0.000
15.973	524.680	O5	2-methylbutene-2	0.622	0.691	0.781	101.408	38.560
16.185	527.950	O5	1t,3-pentadiene	0.008	0.008	0.010	107.636	42.020
16.305	529.750	--	unknown	0.001	0.001	0.001	32.000	0.000
16.885	538.190	O5	cyclopentadiene	0.005	0.006	0.007	32.000	0.000
17.014	540.010	I6	2,2-dimethylbutane	0.446	0.506	0.456	121.514	49.730
18.312	557.140	O5	cyclopentene	0.101	0.097	0.131	111.614	44.230

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
18.678	561.640	O6	4-methylpentene-1	0.024	0.026	0.025	128.948	53.860
18.747	562.470	O6	3-methylpentene-1	0.035	0.039	0.037	129.506	54.170
18.831	563.480	--	unknown	0.001	0.002	0.002	32.000	0.000
19.104	566.710	N5	cyclopentane	0.340	0.336	0.427	120.650	49.250
19.291	568.880	I6	2,3-dimethylbutane	1.357	1.510	1.387	136.364	57.980
19.447	570.660	--	unknown	0.043	0.045	0.118	32.000	0.000
19.563	571.980	O6	2,3-dimethylbutene-1	0.016	0.017	0.017	132.098	55.610
19.706	573.580	I6	2-methylpentane	3.766	4.245	3.849	140.468	60.260
19.835	575.020	O6	4-methyl-t-pentene-2	0.069	0.075	0.072	137.480	58.600
20.390	581.030	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.811	585.430	I6	3-methylpentane	2.343	2.597	2.395	145.886	63.270
20.962	586.980	--	unknown	0.000	0.000	0.000	32.000	0.000
21.261	589.990	O6	2-methylpentene-1	0.113	0.122	0.119	143.780	62.100
21.351	590.880	O6	hexene-1	0.049	0.053	0.051	146.246	63.470
21.989	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.297	600.000	P6	n-hexane	1.891	2.112	1.933	155.714	68.730
22.521	602.680	O6	t-hexene-3	0.074	0.080	0.078	152.744	67.080
22.587	603.470	O6	c-hexene-3	0.024	0.026	0.026	151.592	66.440
22.739	605.260	O6	t-hexene-2	0.146	0.157	0.152	154.184	67.880
22.828	606.300	--	unknown	0.000	0.001	0.001	32.000	0.000
22.942	607.630	O6	2-methylpentene-2	0.185	0.197	0.194	153.140	67.300
23.021	608.550	O6	4-methylcyclopentene	0.050	0.048	0.054	148.820	64.900
23.184	610.410	O6	3-methyl-c-pentene-2	0.112	0.119	0.118	153.842	67.690
23.307	611.820	O6	3-methylcyclopentene	0.027	0.026	0.029	149.000	65.000
23.416	613.060	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.547	614.520	O6	c-hexene-2	0.079	0.084	0.083	155.984	68.880
23.783	617.160	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.112	620.750	O7	3,3-dimethylpentene-1	0.174	0.182	0.156	171.446	77.470
24.254	622.280	--	unknown	0.001	0.001	0.003	32.000	0.000
24.407	623.920	I7	2,2-dimethylpentane	0.104	0.114	0.092	174.542	79.190
24.625	626.230	N6	methylcyclopentane	2.450	2.409	2.564	161.240	71.800

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Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
25.036	630.520	I7	2,4-dimethylpentane	1.536	1.681	1.350	176.882	80.490
25.273	632.940	O7	cyclic diolefin or triolefin-[1]	0.003	0.003	0.003	32.000	0.000
25.455	634.790	I7	2,2,3-trimethylbutane	0.049	0.052	0.043	177.584	80.880
25.622	636.460	--	unknown	0.002	0.002	0.002	32.000	0.000
25.835	638.580	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007	32.000	0.000
26.172	641.870	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.284	642.950	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.655	646.510	O7	4,4-dimethyl-c-pentene-2	0.008	0.009	0.007	176.756	80.420
26.801	647.880	O7	2,4-dimethylpentene-1	0.008	0.009	0.007	178.880	81.600
26.903	648.840	O6	1-methylcyclopentene	0.188	0.177	0.201	167.864	75.480
27.103	650.700	A6	benzene	0.723	0.606	0.816	176.162	80.090
27.286	652.390	O7	2-methyl-c-hexene-3	0.004	0.005	0.004	186.800	86.000
27.500	654.350	I7	3,3-dimethylpentane	0.098	0.104	0.086	186.908	86.060
27.601	655.270	O7	5-methylhexene-1	0.010	0.011	0.009	185.558	85.310
27.793	657.000	--	unknown	0.004	0.004	0.003	32.000	0.000
27.928	658.200	N6	cyclohexane	0.828	0.783	0.867	177.296	80.720
28.222	660.810	O7	2-methyl-t-hexene-3	0.017	0.018	0.015	186.620	85.900
28.353	661.960	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.444	662.760	O7	2-ethyl-3-methylbutene-1	0.006	0.007	0.006	187.448	86.360
28.571	663.850	O7	4-methylhexene-1	0.014	0.015	0.013	188.114	86.730
28.887	666.570	O7	4-methyl-t/c-hexene-2	0.028	0.029	0.025	187.358	86.310
29.042	667.890	I7	2-methylhexane	2.012	2.182	1.768	194.090	90.050
29.205	669.270	I7	2,3-dimethylpentane	2.596	2.750	2.282	193.604	89.780
29.488	671.630	N7	1,1-dimethylcyclopentane	0.076	0.074	0.068	189.464	87.480
29.808	674.280	O7	5-methyl-t-hexene-2	0.024	0.025	0.021	190.598	88.110
30.024	676.040	I7	3-methylhexane	2.049	2.196	1.802	197.330	91.850
30.171	677.230	O7	1,6-heptadiene	0.000	0.000	0.000	205.106	96.170
30.451	679.480	O7	3,4-dimethyl-c-pentene-2	0.013	0.013	0.011	192.650	89.250
30.759	681.920	N7	1c,3-dimethylcyclopentane	0.698	0.690	0.626	195.386	90.770
31.112	684.680	N7	1t,3-dimethylcyclopentane	0.620	0.610	0.557	197.096	91.720
31.289	686.050	I7	3-ethylpentane	0.190	0.201	0.167	200.246	93.470

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Processed 651 Peaks
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Hold

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31.480	687.520	N7	1t,2-dimethylcyclopentane	0.607	0.595	0.545	197.366	91.870
31.662	688.900	I8	2,2,4-trimethylpentane	2.855	3.038	2.202	210.632	99.240
32.214	693.050	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.450	694.810	O7	3-methyl-c-hexene-3	0.022	0.022	0.020	203.720	95.400
32.700	696.640	--	unknown	0.000	0.000	0.000	32.000	0.000
32.986	698.710	O7	t-heptene-3	0.079	0.083	0.071	204.206	95.670
33.164	700.000	P7	n-heptane	1.387	1.493	1.219	209.156	98.420
33.461	701.940	O7	2-methyl-2-hexene	0.083	0.085	0.074	203.738	95.410
33.616	702.940	O7	3-methyl-t-hexene-3	0.031	0.033	0.028	200.372	93.540
33.861	704.520	O7	t-heptene-2	0.031	0.032	0.028	208.310	97.950
34.089	705.980	O7	3-ethylpentene-2	0.021	0.021	0.019	204.818	96.010
34.214	706.770	--	unknown	0.000	0.000	0.000	32.000	0.000
34.578	709.070	O7	c-heptene-2	0.078	0.081	0.070	209.138	98.410
34.766	710.240	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.096	712.280	O7	2,3-dimethylpentene-2	0.033	0.034	0.030	207.320	97.400
35.327	713.690	O7	3-ethylcyclopentene	0.004	0.004	0.003	207.986	97.770
35.420	714.260	--	unknown	0.001	0.001	0.000	32.000	0.000
35.720	716.070	O7	O7-[3]	0.006	0.007	0.006	32.000	0.000
35.991	717.700	N7	1c,2-dimethylcyclopentane	0.298	0.299	0.267	211.154	99.530
36.114	718.430	N7	methylcyclohexane	1.289	1.233	1.156	213.674	100.930
36.427	720.280	I8	2,2-dimethylhexane	0.046	0.049	0.036	224.312	106.840
36.538	720.930	N8	1,1,3-trimethylcyclopentane	0.174	0.171	0.136	220.802	104.890
36.870	722.860	O7	O7-[4]	0.005	0.005	0.004	32.000	0.000
36.954	723.340	O7	O7-[5]	0.002	0.002	0.002	32.000	0.000
37.145	724.450	O7	O7-[6]	0.005	0.005	0.004	32.000	0.000
37.289	725.270	--	unknown	0.001	0.001	0.001	32.000	0.000
37.505	726.490	O7	O7-[7]	0.006	0.006	0.005	32.000	0.000
37.621	727.150	--	unknown	0.001	0.001	0.001	32.000	0.000
38.005	729.310	N7	ethylcyclopentane	0.345	0.332	0.310	218.246	103.470
38.130	730.010	I8	2,5-dimethylhexane	0.583	0.619	0.449	228.398	109.110
38.319	731.050	I8	2,2,3-trimethylpentane	0.120	0.123	0.093	229.730	109.850

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Hold

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38.468	731.870	I8	2,4-dimethylhexane	0.664	0.698	0.512	228.974	109.430
38.593	732.560	--	unknown	0.012	0.013	0.009	32.000	0.000
38.811	733.750	--	unknown	0.001	0.002	0.001	32.000	0.000
38.925	734.370	O7	O7-[8]	0.002	0.002	0.002	32.000	0.000
39.161	735.650	O7	O7-[9]	0.002	0.002	0.001	32.000	0.000
39.475	737.320	N8	1c,2t,4-trimethylcyclopentane	0.294	0.283	0.231	242.132	116.740
39.691	738.480	I8	3,3-dimethylhexane	0.058	0.060	0.045	233.546	111.970
40.178	741.030	O7	O7-[10]	0.003	0.003	0.003	32.000	0.000
40.466	742.530	O7	O7-[11]	0.001	0.001	0.001	32.000	0.000
40.624	743.350	O7	O7-[12]	0.005	0.005	0.004	32.000	0.000
40.838	744.450	N8	1t,2c,3-trimethylcyclopentane	0.214	0.204	0.168	230.738	110.410
41.378	747.190	I8	2,3,4-trimethylpentane	1.257	1.288	0.970	236.246	113.470
41.596	748.280	I8	I8-[1]	0.077	0.079	0.060	236.246	113.470
41.893	749.770	O7	O7-[13]	0.021	0.021	0.016	32.000	0.000
42.200	751.290	I8	2,3,3-trimethylpentane	1.186	1.202	0.915	238.586	114.770
42.634	753.410	A7	toluene	4.743	4.028	4.534	231.134	110.630
42.762	754.030	O8	O8-[1]	0.004	0.004	0.003	32.000	0.000
42.935	754.870	O8	O8-[2]	0.001	0.001	0.001	32.000	0.000
43.086	755.590	O8	O8-[3]	0.006	0.006	0.005	32.000	0.000
43.195	756.120	--	unknown	0.001	0.001	0.001	32.000	0.000
43.613	758.110	I8	2,3-dimethylhexane	0.535	0.553	0.412	240.098	115.610
43.752	758.770	I8	2-methyl-3-ethylpentane	0.092	0.095	0.071	240.098	115.610
44.090	760.360	N8	1,1,2-trimethylcyclopentane	0.010	0.010	0.008	236.714	113.730
44.534	762.420	O8	O8-[4]	0.028	0.028	0.022	32.000	0.000
44.942	764.300	I8	2-methylheptane	0.935	0.986	0.721	243.770	117.650
45.254	765.720	I8	4-methylheptane	0.356	0.372	0.275	243.878	117.710
45.516	766.900	I8	3-methyl-3-ethylpentane	0.072	0.074	0.055	240.098	115.610
45.622	767.380	I8	3,4-dimethylhexane	0.090	0.092	0.069	243.914	117.730
46.243	770.150	N8	1c,3-dimethylcyclohexane	0.112	0.108	0.088	246.848	119.360
46.656	771.970	I8	3-methylheptane	0.893	0.931	0.689	246.074	118.930
46.927	773.150	--	unknown	0.186	0.196	0.143	32.000	0.000

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Hold

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47.010	773.510	N8	1c,2t,3-trimethylcyclopentane	0.422	0.403	0.331	243.500	117.500
47.177	774.240	I8	3-ethylhexane	0.111	0.115	0.086	245.372	118.540
47.452	775.420	N8	1t,4-dimethylcyclohexane	0.196	0.189	0.154	246.848	119.360
47.893	777.300	--	unknown	0.002	0.002	0.006	32.000	0.000
48.274	778.920	--	unknown	0.001	0.001	0.002	32.000	0.000
48.425	779.550	O8	O8-[5]	0.001	0.001	0.001	32.000	0.000
48.776	781.020	N8	1,1-dimethylcyclohexane	0.035	0.033	0.027	247.190	119.550
49.238	782.930	I9	2,2,5-trimethylhexane	0.635	0.661	0.436	255.362	124.090
49.663	784.670	N8	3c-ethylmethylcyclopentane	0.215	0.206	0.168	249.980	121.100
49.866	785.500	O9	2,6-dimethylheptene-1	0.003	0.003	0.002	32.000	0.000
50.209	786.880	N8	3t-ethylmethylcyclopentane	0.182	0.175	0.143	249.980	121.100
50.542	788.220	N8	2t-ethylmethylcyclopentane	0.166	0.159	0.130	250.160	121.200
50.986	789.980	O8	O8-[6]	0.006	0.006	0.005	32.000	0.000
51.124	790.530	N8	1,1-methylethylcyclopentane	0.023	0.021	0.018	250.754	121.530
51.820	793.250	N8	1t,2-dimethylcyclohexane	0.192	0.182	0.150	254.174	123.430
52.002	793.950	O8	t-octene-4	0.010	0.010	0.008	252.068	122.260
52.424	795.580	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.884	797.330	N8	1c,2c,3-trimethylcyclopentane	0.032	0.030	0.025	253.400	123.000
53.591	800.000	P8	n-octane	0.834	0.875	0.643	258.224	125.680
53.868	801.040	N8	1c,4-dimethylcyclohexane	0.270	0.254	0.212	255.794	124.330
54.738	804.260	O8	t-octene-2	0.008	0.009	0.007	32.000	0.000
54.959	805.070	--	unknown	0.005	0.005	0.014	32.000	0.000
55.333	806.440	I9	I9-[1]	0.038	0.039	0.026	32.000	0.000
55.432	806.790	--	unknown	0.017	0.018	0.012	32.000	0.000
55.827	808.220	N8	i-propylcyclopentane	0.085	0.081	0.067	259.574	126.430
56.490	810.590	--	unknown	0.004	0.004	0.003	32.000	0.000
56.764	811.560	O9	O9-[1]	0.001	0.001	0.001	32.000	0.000
57.027	812.480	--	unknown	0.009	0.009	0.006	32.000	0.000
57.151	812.920	O8	c-octene-2	0.004	0.004	0.003	32.000	0.000
57.393	813.770	--	unknown	0.001	0.001	0.001	32.000	0.000
57.698	814.830	N8	N8-[1]	0.014	0.013	0.011	32.000	0.000

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Hold

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58.063	816.090	O8	O8-[1]	0.002	0.002	0.002	32.000	0.000
58.448	817.400	I9	2,2,3,4-tetramethylpentane	0.127	0.126	0.087	271.454	133.030
59.089	819.580	I9	2,3,4-trimethylhexane	0.072	0.071	0.049	282.308	139.060
59.385	820.580	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.645	821.450	O9	O9-[1]	0.031	0.032	0.022	32.000	0.000
60.061	822.830	N8	N8-[3]	0.001	0.001	0.001	32.000	0.000
60.499	824.270	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.041	826.050	N8	1c,2-dimethylcyclohexane	0.191	0.177	0.150	265.532	129.740
61.242	826.700	--	unknown	0.022	0.023	0.018	32.000	0.000
61.629	827.950	I9	2,3,5-trimethylhexane	0.007	0.007	0.005	268.430	131.350
61.946	828.960	I9	2,2-dimethylheptane	0.013	0.014	0.009	270.860	132.700
62.835	831.790	N9	1,1,4-trimethylcyclohexane	0.341	0.325	0.238	275.000	135.000
63.401	833.560	I9	2,2,3-trimethylhexane	0.161	0.166	0.111	271.220	132.900
63.982	835.360	I9	2,4-dimethylheptane	0.034	0.035	0.024	271.220	132.900
64.717	837.620	I9	4,4-dimethylheptane	0.196	0.202	0.135	271.220	132.900
65.032	838.570	N8	ethylcyclohexane	0.001	0.001	0.001	269.222	131.790
65.641	840.410	N8	n-propylcyclopentane	0.036	0.034	0.028	267.728	130.960
65.842	841.010	I9	2,5-dimethylheptane	0.263	0.270	0.180	276.800	136.000
66.297	842.370	I9	3,3-&3,5-dimethylheptane	0.062	0.063	0.042	278.636	137.020
66.704	843.570	I9	3,5-dimethylheptane	0.042	0.043	0.029	276.800	136.000
67.179	844.970	I9	2,6-dimethylheptane	0.073	0.075	0.050	275.396	135.220
67.805	846.790	N9	1,1,3-trimethylcyclohexane	0.049	0.046	0.034	295.862	146.590
68.302	848.220	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
68.843	849.770	N8	N8-[4]	0.001	0.001	0.001	32.000	0.000
69.083	850.450	N8	N8-[5]	0.003	0.003	0.003	32.000	0.000
69.408	851.370	N9	1c,2t,4t-trimethylcyclohexane	0.020	0.019	0.014	32.000	0.000
70.265	853.770	A8	ethylbenzene	1.244	1.056	1.032	277.160	136.200
70.640	854.810	N9	1c,3c,5c-trimethylcyclohexane	0.130	0.123	0.091	32.000	0.000
71.467	857.080	O9	2-methyloctene-1	0.020	0.022	0.014	32.000	0.000
71.907	858.280	I9	I9-[2]	0.003	0.003	0.002	32.000	0.000
72.357	859.500	O9	2-methyloctene-2	0.029	0.031	0.020	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
72.761	860.580	N9	N9-[1]	0.000	0.000	0.000	32.000	0.000
74.118	864.180	A8	1,3-dimethylbenzene	3.353	2.857	2.782	282.416	139.120
74.449	865.050	A8	1,4-dimethylbenzene	1.354	1.158	1.123	281.048	138.360
75.059	866.630	I9	3,4-dimethylheptane	0.031	0.031	0.021	285.080	140.600
75.385	867.470	I9	3,4 -dimethylheptane	0.063	0.063	0.043	285.080	140.600
75.920	868.850	N9	N9-[2]	0.027	0.026	0.019	32.000	0.000
76.362	869.970	I9	I9-[3]	0.077	0.078	0.053	32.000	0.000
77.226	872.150	I9	4-ethylheptane	0.002	0.002	0.001	288.392	142.440
77.572	873.020	I9	4-methyloctane	0.276	0.282	0.190	288.392	142.440
77.966	874.000	I9	2-methyloctane	0.339	0.350	0.233	289.904	143.280
78.572	875.500	N9	N9-[3]	0.038	0.036	0.026	32.000	0.000
79.424	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.041	0.040	0.029	304.160	151.200
79.737	878.350	I9	3-ethylheptane	0.079	0.080	0.054	289.400	143.000
80.250	879.590	I9	3-methyloctane	0.436	0.446	0.300	291.614	144.230
80.572	880.360	I9	3,3-diethylpentane	0.022	0.021	0.015	270.842	132.690
81.011	881.410	--	unknown	0.067	0.070	0.046	32.000	0.000
81.299	882.090	N9	1c,2t,4c-trimethylcyclohexane	0.018	0.017	0.013	275.000	135.000
81.666	882.960	N9	1,1,2-trimethylcyclohexane	0.031	0.028	0.021	293.360	145.200
82.028	883.810	A8	1,2-dimethylbenzene	1.675	1.401	1.389	291.974	144.430
82.560	885.060	I9	I9-[4]	0.028	0.029	0.019	32.000	0.000
82.923	885.900	I9	I9-[5]	0.106	0.107	0.073	32.000	0.000
83.657	887.600	N9	N9-[4]	0.090	0.085	0.063	32.000	0.000
83.921	888.210	N9	N9-[5]	0.118	0.111	0.082	32.000	0.000
84.067	888.540	--	unknown	0.035	0.037	0.025	32.000	0.000
84.610	889.780	I9	I9-[6]	0.068	0.068	0.047	32.000	0.000
85.014	890.690	N9	N9-[6]	0.160	0.151	0.111	32.000	0.000
85.556	891.920	I9	I9-[7]	0.017	0.017	0.012	32.000	0.000
86.009	892.930	N9	i-butylcyclopentane	0.033	0.031	0.023	298.346	147.970
86.218	893.400	N9	N9-[7]	0.022	0.021	0.016	32.000	0.000
87.072	895.290	--	unknown	0.001	0.001	0.001	32.000	0.000
87.451	896.120	N9	N9-[8]	0.015	0.014	0.011	32.000	0.000

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Comments: Normalized to 100.000%

Hold

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87.738	896.750	N9	N9-[9]	0.009	0.008	0.006	32.000	0.000
88.032	897.390	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.251	897.870	O9	t-nonene-3	0.021	0.022	0.015	32.000	0.000
88.667	898.770	I9	I9-[8]	0.128	0.129	0.088	32.000	0.000
88.826	899.110	--	unknown	0.024	0.025	0.016	32.000	0.000
89.237	900.000	P9	n-nonane	0.392	0.402	0.269	303.476	150.820
89.598	901.740	N9	1,1-methylethylcyclohexane	0.094	0.086	0.066	305.924	152.180
90.171	904.510	N9	N9-[10]	0.010	0.009	0.007	32.000	0.000
90.421	905.710	N9	N9-[11]	0.027	0.025	0.019	32.000	0.000
90.703	907.060	O10	t-2,2,5,5-tetramethylhexene-3	0.005	0.005	0.003	32.000	0.000
90.812	907.580	--	unknown	0.002	0.002	0.001	32.000	0.000
91.178	909.320	--	unknown	0.000	0.000	0.000	32.000	0.000
91.585	911.250	N9	N9-[12]	0.006	0.006	0.004	32.000	0.000
92.008	913.250	A9	i-propylbenzene	0.066	0.056	0.048	306.338	152.410
92.372	914.960	O9	c-nonene-3	0.075	0.081	0.052	32.000	0.000
92.519	915.650	--	unknown	0.019	0.020	0.013	32.000	0.000
92.931	917.570	I10	I10-[1]	0.012	0.012	0.008	32.000	0.000
93.036	918.050	N9	i-propylcyclohexane	0.023	0.021	0.016	310.622	154.790
93.192	918.780	--	unknown	0.006	0.006	0.004	32.000	0.000
93.771	921.460	I10	I10-[2]	0.114	0.115	0.070	32.000	0.000
94.167	923.280	I10	2,2-dimethyloctane	0.037	0.037	0.023	314.420	156.900
94.442	924.540	I10	2,4-dimethyloctane	0.055	0.056	0.034	312.620	155.900
94.875	926.510	N9	N9-[13]	0.007	0.007	0.005	32.000	0.000
95.309	928.480	N9	N9-[14]	0.024	0.022	0.016	32.000	0.000
95.917	931.230	I10	2,6-dimethyloctane	0.092	0.093	0.057	320.738	160.410
96.276	932.840	I10	2,5-dimethyloctane	0.083	0.084	0.052	317.300	158.500
96.532	933.990	--	unknown	0.003	0.003	0.002	32.000	0.000
97.131	936.660	N9	n-butylcyclopentane	0.062	0.058	0.043	313.916	156.620
97.342	937.590	I10	I10-[3]	0.033	0.034	0.021	32.000	0.000
97.492	938.260	N10	N10-[1]	0.038	0.035	0.024	32.000	0.000
97.756	939.420	--	unknown	0.006	0.006	0.004	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

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98.004	940.510	I10	I10-[4]	0.022	0.023	0.014	32.000	0.000
98.461	942.520	I10	3,3-dimethyloctane	0.147	0.146	0.091	322.160	161.200
98.773	943.880	N10	N10-[2]	0.025	0.023	0.016	32.000	0.000
98.985	944.800	--	unknown	0.020	0.021	0.012	32.000	0.000
99.156	945.550	--	unknown	0.026	0.027	0.016	32.000	0.000
99.549	947.250	A9	n-propylbenzene	0.372	0.318	0.273	318.632	159.240
99.845	948.530	I10	3,6-dimethyloctane	0.028	0.028	0.017	321.440	160.800
100.101	949.630	I10	3-methyl-5-ethylheptane	0.048	0.049	0.030	316.760	158.200
100.244	950.240	--	unknown	0.007	0.007	0.004	32.000	0.000
100.566	951.630	N10	N10-[3]	0.029	0.027	0.018	32.000	0.000
101.193	954.300	--	unknown	0.026	0.028	0.017	32.000	0.000
101.502	955.610	A9	1,3-methylethylbenzene	1.316	1.121	0.965	322.394	161.330
101.890	957.250	A9	1,4-methylethylbenzene	0.564	0.482	0.414	323.618	162.010
102.197	958.540	N10	N10-[4]	0.032	0.029	0.020	32.000	0.000
102.377	959.300	--	unknown	0.003	0.003	0.002	32.000	0.000
102.746	960.840	--	unknown	0.002	0.002	0.001	32.000	0.000
102.944	961.670	--	unknown	0.011	0.012	0.031	32.000	0.000
103.233	962.870	A9	1,3,5-trimethylbenzene	0.702	0.597	0.514	328.532	164.740
103.497	963.970	I10	I10-[5]	0.044	0.044	0.027	32.000	0.000
103.765	965.080	N10	N10-[5]	0.019	0.018	0.012	32.000	0.000
103.955	965.870	--	unknown	0.006	0.007	0.004	32.000	0.000
104.194	966.850	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.510	968.150	I10	5-methylnonane	0.055	0.055	0.034	329.180	165.100
104.915	969.810	I10	4-methylnonane	0.449	0.447	0.278	32.000	0.000
105.258	971.210	A9	1,2-methylethylbenzene	0.419	0.350	0.307	329.324	165.180
105.444	971.970	I10	2-methylnonane	0.131	0.133	0.081	332.654	167.030
105.595	972.580	--	unknown	0.010	0.011	0.006	32.000	0.000
105.866	973.680	--	unknown	0.012	0.013	0.008	32.000	0.000
106.103	974.640	I10	3-ethyloctane	0.028	0.028	0.017	331.700	166.500
106.183	974.960	--	unknown	0.014	0.015	0.009	32.000	0.000
106.470	976.120	N10	N10-[6]	0.025	0.023	0.016	32.000	0.000

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Hold

Components Listed in Chromatographic Order

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106.803	977.460	I10	3-methylnonane	0.158	0.159	0.098	334.040	167.800
107.022	978.330	--	unknown	0.006	0.007	0.004	32.000	0.000
107.372	979.730	N10	N10-[7]	0.003	0.003	0.002	32.000	0.000
107.543	980.410	I10	I10-[7]	0.100	0.100	0.062	32.000	0.000
107.816	981.500	I10	I10-[8]	0.009	0.009	0.005	32.000	0.000
108.103	982.640	--	unknown	0.011	0.012	0.007	32.000	0.000
108.564	984.460	A9	1,2,4-trimethylbenzene	2.048	1.721	1.501	336.884	169.380
108.797	985.380	--	unknown	0.007	0.008	0.005	32.000	0.000
108.972	986.070	I10	I10-[9]	0.011	0.011	0.007	32.000	0.000
109.078	986.480	N10	i-butylcyclohexane	0.037	0.034	0.023	340.340	171.300
109.269	987.230	--	unknown	0.028	0.029	0.018	32.000	0.000
109.387	987.690	I10	I10-[10]	0.048	0.048	0.030	32.000	0.000
109.669	988.790	I10	I10-[11]	0.020	0.020	0.012	32.000	0.000
109.809	989.340	I10	I10-[12]	0.013	0.013	0.008	32.000	0.000
110.160	990.700	N10	N10-[8]	0.024	0.022	0.015	32.000	0.000
110.369	991.510	--	unknown	0.003	0.003	0.002	32.000	0.000
110.777	993.090	O10	decene-1	0.003	0.003	0.002	339.080	170.600
110.936	993.700	N10	1t-methyl-2-n-propylcyclohexane	0.012	0.011	0.008	339.800	171.000
111.055	994.160	O10	2,3-dimethyloctene-2	0.065	0.065	0.041	32.000	0.000
111.164	994.580	I10	I10-[13]	0.017	0.016	0.010	32.000	0.000
111.461	995.720	A10	i-butylbenzene	0.004	0.003	0.002	343.022	172.790
111.607	996.280	I10	I10-[14]	0.058	0.058	0.036	32.000	0.000
111.840	997.170	--	unknown	0.040	0.042	0.025	32.000	0.000
112.121	998.240	A10	sec-butylbenzene	0.038	0.033	0.025	344.012	173.340
112.368	999.180	--	unknown	0.009	0.010	0.006	32.000	0.000
112.581	1000.000	P10	n-decane	0.207	0.209	0.128	345.470	174.150
112.824	1001.530	I11	I11-[1]	0.029	0.029	0.017	32.000	0.000
113.180	1003.780	N10	N10-[9]	0.018	0.017	0.012	32.000	0.000
113.510	1005.850	--	unknown	0.004	0.004	0.003	32.000	0.000
113.826	1007.830	A9	1,2,3-trimethylbenzene	0.402	0.331	0.294	349.016	176.120
113.975	1008.760	--	unknown	0.010	0.010	0.007	32.000	0.000

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Hold

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114.271	1010.610	A10	1,3-methyl-i-propylbenzene	0.044	0.038	0.029	347.144	175.080
114.682	1013.170	--	unknown	0.009	0.009	0.024	32.000	0.000
114.832	1014.090	A10	1,4-methyl-i-propylbenzene	0.027	0.023	0.018	350.834	177.130
114.993	1015.090	--	unknown	0.003	0.003	0.002	32.000	0.000
115.300	1016.990	I11	I11-[2]	0.028	0.028	0.016	32.000	0.000
115.570	1018.650	I11	I11-[3]	0.013	0.013	0.007	32.000	0.000
115.864	1020.460	A10	2-3-dihydroindene	0.279	0.213	0.208	352.130	177.850
116.229	1022.700	--	unknown	0.020	0.021	0.015	32.000	0.000
116.478	1024.220	N10	sec-butylcyclohexane	0.043	0.039	0.027	354.812	179.340
116.706	1025.620	I11	I11-[4]	0.009	0.009	0.005	32.000	0.000
117.055	1027.740	A10	1,2-methyl-i-propylbenzene	0.075	0.063	0.049	352.724	178.180
117.226	1028.780	I11	3-ethylnonane	0.005	0.005	0.003	32.000	0.000
117.320	1029.340	--	unknown	0.004	0.004	0.002	32.000	0.000
117.628	1031.210	--	unknown	0.068	0.072	0.038	32.000	0.000
117.854	1032.570	N11	N11-[1]	0.026	0.024	0.015	32.000	0.000
117.905	1032.880	--	unknown	0.022	0.023	0.012	32.000	0.000
118.087	1033.980	I11	I11-[5]	0.017	0.017	0.009	32.000	0.000
118.232	1034.850	--	unknown	0.003	0.003	0.002	32.000	0.000
118.602	1037.070	I11	I11-[6]	0.032	0.029	0.018	32.000	0.000
118.769	1038.070	--	unknown	0.035	0.037	0.020	32.000	0.000
119.210	1040.700	A10	1,3-diethylbenzene	0.142	0.121	0.093	358.052	181.140
119.411	1041.900	--	unknown	0.065	0.069	0.043	32.000	0.000
119.662	1043.390	A10	1,3-methyl-n-propylbenzene	0.289	0.247	0.190	359.618	182.010
119.837	1044.430	I11	I11-[7]	0.024	0.024	0.014	32.000	0.000
120.122	1046.120	A10	1,4-diethylbenzene	0.013	0.011	0.009	362.822	183.790
120.295	1047.140	A10	1,4-methyl-n-propylbenzene	0.179	0.154	0.118	362.156	183.420
120.471	1048.180	A10	n-butylbenzene	0.087	0.074	0.057	361.940	183.300
120.880	1050.580	A10	1,3-dimethyl-5-ethylbenzene	0.303	0.254	0.199	362.516	183.620
121.203	1052.480	A10	1,2-diethylbenzene	0.032	0.027	0.021	362.228	183.460
121.345	1053.310	I11	I11-[8]	0.019	0.018	0.010	32.000	0.000
121.574	1054.640	N10	t-decahydronaphthalene	0.009	0.009	0.005	368.960	187.200

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Hold

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121.824	1056.100	N11	N11-[2]	0.017	0.016	0.010	32.000	0.000
122.111	1057.770	--	unknown	0.015	0.015	0.008	32.000	0.000
122.248	1058.570	A10	1,2-methyl-n-propylbenzene	0.098	0.083	0.064	364.946	184.970
122.649	1060.890	I11	I11-[9]	0.014	0.014	0.008	32.000	0.000
122.753	1061.490	I11	I11-[10]	0.071	0.070	0.040	32.000	0.000
122.963	1062.710	I11	I11-[11]	0.049	0.049	0.027	32.000	0.000
123.266	1064.450	--	unknown	0.003	0.003	0.002	32.000	0.000
123.473	1065.640	I11	I11-[12]	0.049	0.049	0.028	32.000	0.000
123.732	1067.120	--	unknown	0.010	0.010	0.005	32.000	0.000
124.019	1068.770	A10	1,4,dimethyl-2-ethylbenzene	0.220	0.185	0.144	368.366	186.870
124.290	1070.310	A10	1,3-dimethyl-4-ethylbenzene	0.276	0.236	0.181	370.832	188.240
124.564	1071.870	I11	I11-[13]	0.003	0.003	0.002	32.000	0.000
124.863	1073.570	--	unknown	0.009	0.009	0.005	32.000	0.000
125.122	1075.040	I11	I11-[14]	0.150	0.149	0.084	32.000	0.000
125.288	1075.980	A10	1,2-dimethyl-4-ethylbenzene	0.303	0.255	0.199	373.136	189.520
125.600	1077.740	--	unknown	0.009	0.010	0.006	32.000	0.000
125.883	1079.340	--	unknown	0.014	0.015	0.009	32.000	0.000
125.993	1079.950	I11	I11-[15]	0.004	0.004	0.002	32.000	0.000
126.263	1081.470	A10	1,3-dimethyl-2-ethylbenzene	0.051	0.042	0.034	374.090	190.050
126.416	1082.330	I11	I11-[16]	0.019	0.019	0.011	32.000	0.000
126.746	1084.170	--	unknown	0.018	0.019	0.010	32.000	0.000
126.946	1085.290	I11	I11-[17]	0.009	0.009	0.005	32.000	0.000
127.174	1086.560	--	unknown	0.016	0.017	0.009	32.000	0.000
127.516	1088.460	--	unknown	0.009	0.009	0.005	32.000	0.000
127.585	1088.850	--	unknown	0.012	0.013	0.007	32.000	0.000
127.857	1090.360	O11	undecene-1	0.022	0.021	0.012	378.860	192.700
128.194	1092.210	A11	1,4-methyl-t-butylbenzene	0.038	0.033	0.023	32.000	0.000
128.469	1093.730	A10	1,2-dimethyl-3-ethylbenzene	0.084	0.070	0.055	381.110	193.950
128.812	1095.620	--	unknown	0.007	0.008	0.005	32.000	0.000
129.079	1097.080	--	unknown	0.015	0.016	0.010	32.000	0.000
129.171	1097.580	A11	1,2-ethyl-i-propylbenzene	0.008	0.007	0.005	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
129.333	1098.470	--	unknown	0.007	0.007	0.004	32.000	0.000
129.612	1100.000	P11	n-undecane	0.111	0.110	0.063	384.620	195.900
129.808	1101.470	--	unknown	0.008	0.009	0.005	32.000	0.000
129.918	1102.290	A11	1,4-ethyl-i-propylbenzene	0.003	0.002	0.002	32.000	0.000
130.344	1105.480	A10	1,2,4,5-tetramethylbenzene	0.177	0.147	0.116	386.312	196.840
130.716	1108.250	A11	1,2-methyl-n-butylbenzene	0.007	0.006	0.004	390.200	199.000
130.885	1109.500	A10	1,2,3,5-tetramethylbenzene	0.236	0.195	0.155	388.472	198.040
131.033	1110.600	--	unknown	0.007	0.007	0.004	32.000	0.000
131.375	1113.140	--	unknown	0.013	0.013	0.008	32.000	0.000
131.569	1114.570	--	unknown	0.008	0.008	0.005	32.000	0.000
131.875	1116.830	--	unknown	0.023	0.024	0.015	32.000	0.000
132.319	1120.090	--	unknown	0.015	0.016	0.010	32.000	0.000
132.477	1121.250	--	unknown	0.016	0.017	0.010	32.000	0.000
132.953	1124.740	A11	1,2-methyl-t-butylbenzene	0.007	0.005	0.004	32.000	0.000
133.116	1125.930	--	unknown	0.013	0.013	0.008	32.000	0.000
133.429	1128.210	A10	5-methylindan	0.208	0.172	0.138	32.000	0.000
133.774	1130.720	I12	I12-[1]	0.051	0.050	0.026	421.340	216.300
134.179	1133.650	--	unknown	0.008	0.008	0.004	32.000	0.000
134.296	1134.500	A10	4-methylindan	0.052	0.043	0.034	32.000	0.000
134.562	1136.420	--	unknown	0.012	0.012	0.008	32.000	0.000
134.675	1137.240	A11	1,2-ethyl-n-propylbenzene	0.060	0.050	0.036	32.000	0.000
134.927	1139.050	A10	2-methylindan	0.199	0.162	0.132	368.600	187.000
135.138	1140.570	A11	1,3-methyl-n-butylbenzene	0.010	0.008	0.006	390.200	199.000
135.389	1142.370	--	unknown	0.006	0.006	0.004	32.000	0.000
135.546	1143.500	A12	1,3-di-i-propylbenzene	0.067	0.056	0.036	397.760	203.200
135.754	1144.980	A11	s-pentylbenzene	0.061	0.051	0.036	401.000	205.000
135.908	1146.080	--	unknown	0.002	0.003	0.001	32.000	0.000
136.341	1149.170	--	unknown	0.019	0.020	0.011	32.000	0.000
136.438	1149.860	A11	n-pentylbenzene	0.048	0.039	0.028	401.720	205.400
136.503	1150.320	--	unknown	0.027	0.028	0.016	32.000	0.000
136.798	1152.420	N12	1t-M-2-(4-MP)cyclopentane	0.005	0.004	0.002	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
136.995	1153.810	A12	1,2-di-i-propylbenzene	0.029	0.024	0.016	399.200	204.000
137.141	1154.840	--	unknown	0.028	0.030	0.015	32.000	0.000
137.626	1158.270	--	unknown	0.042	0.044	0.023	32.000	0.000
137.897	1160.180	A12	1,4-di-i-propylbenzene	0.052	0.043	0.028	410.540	210.300
138.175	1162.130	--	unknown	0.008	0.008	0.004	32.000	0.000
138.350	1163.360	A10	tetrahydronaphthalene	0.018	0.014	0.012	405.716	207.620
138.492	1164.350	--	unknown	0.009	0.010	0.006	32.000	0.000
138.725	1165.980	--	unknown	0.004	0.004	0.003	32.000	0.000
138.886	1167.110	I12	I12-[2]	0.056	0.055	0.029	421.340	216.300
139.182	1169.170	A10	naphthalene	0.172	0.123	0.118	424.382	217.990
139.508	1171.430	A12	1-t-butyl-3,5-dimethylbenzene	0.004	0.003	0.002	32.000	0.000
139.848	1173.800	A12	1,4-ethyl-t-butylbenzene	0.078	0.064	0.042	32.000	0.000
140.252	1176.590	--	unknown	0.028	0.029	0.015	32.000	0.000
140.543	1178.590	I12	I12-[3]	0.058	0.057	0.030	421.340	216.300
140.774	1180.190	I12	I12-[4]	0.033	0.032	0.017	421.340	216.300
141.123	1182.590	--	unknown	0.007	0.007	0.004	32.000	0.000
141.350	1184.150	I12	I12-[5]	0.034	0.034	0.018	421.340	216.300
141.603	1185.880	--	unknown	0.012	0.013	0.006	32.000	0.000
141.896	1187.880	I12	I12-[6]	0.035	0.035	0.018	421.340	216.300
142.096	1189.240	A12	1,3-di-n-propylbenzene	0.041	0.034	0.022	32.000	0.000
142.335	1190.870	A12	A12-[1]	0.025	0.021	0.014	32.000	0.000
142.553	1192.350	O12	dodecene-1	0.005	0.004	0.002	416.120	213.400
142.636	1192.910	--	unknown	0.002	0.002	0.001	32.000	0.000
142.913	1194.790	--	unknown	0.008	0.008	0.004	32.000	0.000
143.254	1197.100	--	unknown	0.005	0.005	0.003	32.000	0.000
143.557	1199.140	A12	A12-[2]	0.020	0.017	0.011	32.000	0.000
143.683	1200.000	P12	n-dodecane	0.048	0.047	0.025	421.340	216.300
143.945	1202.200	--	unknown	0.003	0.004	0.002	32.000	0.000
144.228	1204.580	--	unknown	0.018	0.019	0.009	32.000	0.000
144.763	1209.070	--	unknown	0.012	0.013	0.006	32.000	0.000
144.988	1210.940	--	unknown	0.006	0.007	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
145.186	1212.600	A12	1,3,5-triethylbenzene	0.003	0.003	0.002	420.800	216.000
145.373	1214.150	--	unknown	0.008	0.008	0.004	32.000	0.000
145.717	1217.020	--	unknown	0.023	0.024	0.012	32.000	0.000
145.890	1218.450	--	unknown	0.014	0.014	0.007	32.000	0.000
146.206	1221.080	--	unknown	0.003	0.003	0.002	32.000	0.000
146.497	1223.490	--	unknown	0.018	0.019	0.010	32.000	0.000
146.738	1225.470	--	unknown	0.019	0.020	0.010	32.000	0.000
146.829	1226.220	--	unknown	0.006	0.007	0.004	32.000	0.000
147.121	1228.630	--	unknown	0.005	0.005	0.003	32.000	0.000
147.201	1229.280	--	unknown	0.013	0.014	0.007	32.000	0.000
147.506	1231.790	A12	1,2,4-triethylbenzene	0.014	0.012	0.008	423.500	217.500
147.727	1233.600	--	unknown	0.004	0.005	0.002	32.000	0.000
147.833	1234.470	--	unknown	0.001	0.001	0.001	32.000	0.000
148.079	1236.480	--	unknown	0.004	0.004	0.002	32.000	0.000
148.191	1237.400	--	unknown	0.005	0.005	0.003	32.000	0.000
148.237	1237.770	--	unknown	0.008	0.008	0.004	32.000	0.000
148.466	1239.640	--	unknown	0.002	0.002	0.001	32.000	0.000
148.802	1242.380	A12	1,4-methyl-n-pentylbenzene	0.037	0.031	0.020	32.000	0.000
149.087	1244.690	--	unknown	0.010	0.010	0.005	32.000	0.000
149.242	1245.950	--	unknown	0.004	0.004	0.002	32.000	0.000
149.380	1247.060	--	unknown	0.003	0.004	0.002	32.000	0.000
149.669	1249.400	--	unknown	0.005	0.005	0.003	32.000	0.000
149.952	1251.690	--	unknown	0.007	0.007	0.004	32.000	0.000
150.150	1253.280	--	unknown	0.008	0.009	0.004	32.000	0.000
150.531	1256.350	A12	n-hexylbenzene	0.020	0.017	0.011	32.000	0.000
150.627	1257.120	--	unknown	0.021	0.022	0.012	32.000	0.000
150.997	1260.090	--	unknown	0.012	0.013	0.007	32.000	0.000
151.253	1262.130	--	unknown	0.005	0.005	0.003	32.000	0.000
151.500	1264.100	--	unknown	0.005	0.005	0.003	32.000	0.000
151.659	1265.370	--	unknown	0.004	0.004	0.002	32.000	0.000
151.844	1266.840	--	unknown	0.006	0.006	0.003	32.000	0.000

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:02:16 PM

RawFile: D:\1\DATA\D6730OCT3020\103F0301.D\103F0301.CDF Acquired: 10/31/20 02:46:24
Sample: ODDB:54926 Analyzed: 11/2/2020 8:59:33 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
151.920	1267.450	--	unknown	0.010	0.010	0.005	32.000	0.000
152.216	1269.800	--	unknown	0.009	0.010	0.005	32.000	0.000
152.363	1270.970	--	unknown	0.002	0.003	0.001	32.000	0.000
152.637	1273.140	I13	I13-[1]	0.009	0.008	0.004	455.720	235.400
152.827	1274.640	A11	1,2,3,4,5-pentamethylbenzene	0.024	0.018	0.014	449.600	232.000
153.056	1276.450	--	unknown	0.010	0.010	0.006	32.000	0.000
153.571	1280.510	--	unknown	0.007	0.007	0.004	32.000	0.000
153.924	1283.290	A11	2-methylnaphthalene	0.096	0.069	0.059	465.890	241.050
154.413	1287.120	--	unknown	0.011	0.011	0.006	32.000	0.000
154.565	1288.300	--	unknown	0.002	0.003	0.002	32.000	0.000
154.704	1289.390	--	unknown	0.003	0.003	0.002	32.000	0.000
154.903	1290.940	O13	tridecene-1	0.007	0.007	0.003	451.040	232.800
155.161	1292.950	--	unknown	0.001	0.001	0.000	32.000	0.000
155.342	1294.360	--	unknown	0.002	0.002	0.001	32.000	0.000
155.502	1295.610	--	unknown	0.004	0.004	0.002	32.000	0.000
155.593	1296.310	--	unknown	0.002	0.002	0.001	32.000	0.000
155.879	1298.530	A11	1-methylnaphthalene	0.038	0.028	0.024	472.352	244.640
156.069	1300.000	P13	n-tridecane	0.010	0.010	0.005	455.720	235.400
156.179	1300.990	+	C14+ (Summarized)	0.400	0.386	0.178	455.720	235.400

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 9:17:46 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF
Acquired: 10/31/20 06:07:04
Sample: ODDB:54927
Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.879	8.832	8.093
I-Paraffins:	39.619	43.084	35.942
Olefins:	4.191	4.509	4.543
Naphthenes:	12.190	11.763	10.841
Aromatics:	23.391	19.721	18.843
Total C14+:	0.390	0.376	0.173
Total Unknowns:	1.692	1.779	1.218

Oxygenates:

Total: 10.648(Mass%) 9.936(Vol%)

Total Oxygen Content: 3.698(Mass%)

Multisubstituted Aromatics: 14.827(Mass%) 12.534(Vol%)

Average Molecular Weight: 88.030

Relative Density: 0.736

Vapor Pressure :

Calculated Octane Number: 86.0

Motor Octane Number (Jenkins Calculation): 78.1

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	210.63	334.04	465.89
BP by Vol (Deg F)	31.10	173.30	210.63	334.04	465.89

Percent Carbon: 83.877
Percent Hydrogen: 12.425
Bromine Number (Calc): 7.851
Particulate Matter Index: 1.156

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF
Sample: ODDB:54927
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:

Acquired: 10/31/20 06:07:04
Analyzed: 11/2/2020 9:17:20 PM

Normalized to 100.000%

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	10.648	3.698	9.936

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF
Acquired: 10/31/20 06:07:04
Sample: ODDB:54927
Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.505	0.105	0.048	0.000	0.000	0.000	0.658
C5	2.490	7.000	1.810	0.341	0.000	0.001	11.641
C6	1.894	7.939	1.182	3.284	0.725	0.045	15.070
C7	1.389	8.651	0.763	3.940	4.747	0.008	19.497
C8	0.834	9.933	0.070	2.870	7.619	0.208	21.533
C9	0.391	3.395	0.207	1.393	5.870	0.187	11.443
C10	0.207	1.790	0.076	0.311	3.638	0.242	6.264
C11	0.110	0.534	0.021	0.047	0.407	0.385	1.504
C12	0.047	0.265	0.006	0.005	0.386	0.309	1.018
C13	0.009	0.008	0.007	0.000	0.000	0.306	0.331
Total:	7.879	39.619	4.191	12.190	23.391	1.692	87.270

Oxygenates	10.648	Total C14+:	0.390
Total Unknowns:	1.692	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.643	0.139	0.058	0.000	0.000	0.000	0.839
C5	2.928	8.317	2.022	0.336	0.000	0.001	13.604
C6	2.115	8.888	1.238	3.198	0.607	0.048	16.094
C7	1.496	9.297	0.792	3.839	4.031	0.008	19.464
C8	0.874	10.378	0.071	2.742	6.465	0.218	20.749
C9	0.401	3.476	0.219	1.314	4.961	0.197	10.566
C10	0.208	1.794	0.076	0.285	3.015	0.255	5.634
C11	0.109	0.528	0.021	0.044	0.322	0.405	1.429
C12	0.046	0.259	0.006	0.004	0.319	0.325	0.960
C13	0.009	0.008	0.007	0.000	0.000	0.322	0.346
Total:	8.832	43.084	4.509	11.763	19.721	1.779	87.908

Oxygenates	9.936	Total C14+:	0.376
Total Unknowns:	1.779	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF
Acquired: 10/31/20 06:07:04
Sample: ODDB:54927
Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.004
C4	0.765	0.159	0.075	0.000	0.000	0.001	1.000
C5	3.038	8.540	2.276	0.427	0.000	0.001	14.283
C6	1.935	8.110	1.243	3.435	0.817	0.121	15.660
C7	1.220	7.600	0.683	3.532	4.535	0.009	17.579
C8	0.643	7.655	0.054	2.251	6.317	0.166	17.086
C9	0.268	2.330	0.144	0.972	4.299	0.142	8.155
C10	0.128	1.108	0.048	0.194	2.421	0.177	4.076
C11	0.062	0.301	0.012	0.027	0.244	0.255	0.901
C12	0.024	0.137	0.003	0.002	0.209	0.181	0.557
C13	0.005	0.004	0.003	0.000	0.000	0.167	0.178
Total:	8.093	35.942	4.543	10.841	18.843	1.218	78.262

Oxygenates	20.347	Total C14+:	0.173	
Total Unknowns:	1.218	Grand Total:	100.000	

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
13.032	481.390	O5	1,4-pentadiene	0.001	0.001	0.001
14.849	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.009
16.187	527.950	O5	1t,3-pentadiene	0.008	0.008	0.010
16.886	538.200	O5	cyclopentadiene	0.005	0.006	0.007
20.387	580.980	O6	1,5-hexadiene	0.000	0.000	0.000
21.990	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.274	632.930	O7	cyclic diolefin or triolefin-[1]	0.002	0.003	0.003
25.836	638.570	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007
28.353	661.940	O6	diolefin (hexadiene)	0.003	0.003	0.003
36.538	720.920	N8	1,1,3-trimethylcyclopentane	0.180	0.177	0.141

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.436	100.000	P1	methane	0.000	0.000	0.000	-258.700	-161.500
6.621	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.115	293.470	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.177	300.000	P3	propane	0.002	0.002	0.003	-43.672	-42.040
8.192	366.110	I4	i-butane	0.105	0.139	0.159	10.904	-11.720
8.343	372.490	--	unknown	0.000	0.000	0.001	32.000	0.000
8.849	390.700	O4	butene-1	0.002	0.003	0.004	20.750	-6.250
8.880	391.700	O4	isobutylene	0.003	0.004	0.005	20.750	-6.250
9.155	400.000	P4	n-butane	0.505	0.643	0.765	31.100	-0.500
9.546	412.290	O4	t-butene-2	0.018	0.022	0.028	33.584	0.880
9.643	415.120	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.876	421.560	--	unknown	0.001	0.001	0.001	32.000	0.000
10.131	428.120	O4	c-butene-2	0.024	0.029	0.038	38.696	3.720
11.667	460.050	X2	ethanol	10.648	9.936	20.347	173.300	78.500
11.713	460.850	O5	3-methylbutene-1	0.071	0.084	0.090	68.090	20.050
12.774	477.720	I5	i-pentane	6.996	8.313	8.536	82.112	27.840
13.032	481.390	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.747	490.870	O5	pentene-1	0.123	0.142	0.155	85.928	29.960
14.223	496.680	O5	2-methylbutene-1	0.286	0.323	0.358	88.070	31.150
14.508	500.000	P5	n-pentane	2.490	2.928	3.038	96.908	36.060
14.849	506.110	O5	2-methylbutadiene-1,3	0.007	0.008	0.009	93.308	34.060
15.096	510.400	O5	t-pentene-2	0.372	0.423	0.467	97.412	36.340
15.467	516.600	O5	3,3-dimethylbutene-1	0.005	0.006	0.006	106.232	41.240
15.637	519.360	O5	c-pentene-2	0.207	0.232	0.260	98.474	36.930
15.796	521.900	--	unknown	0.000	0.000	0.001	32.000	0.000
15.974	524.690	O5	2-methylbutene-2	0.622	0.692	0.781	101.408	38.560
16.187	527.950	O5	1t,3-pentadiene	0.008	0.008	0.010	107.636	42.020
16.307	529.760	--	unknown	0.001	0.001	0.001	32.000	0.000
16.886	538.200	O5	cyclopentadiene	0.005	0.006	0.007	32.000	0.000
17.015	540.010	I6	2,2-dimethylbutane	0.446	0.506	0.456	121.514	49.730
18.313	557.150	O5	cyclopentene	0.102	0.097	0.131	111.614	44.230

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Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
18.680	561.650	O6	4-methylpentene-1	0.024	0.026	0.025	128.948	53.860
18.748	562.480	O6	3-methylpentene-1	0.035	0.039	0.037	129.506	54.170
18.831	563.470	--	unknown	0.002	0.002	0.002	32.000	0.000
19.105	566.710	N5	cyclopentane	0.341	0.336	0.427	120.650	49.250
19.292	568.880	I6	2,3-dimethylbutane	1.359	1.512	1.388	136.364	57.980
19.448	570.660	--	unknown	0.043	0.045	0.118	32.000	0.000
19.706	573.560	I6	2-methylpentane	3.788	4.270	3.869	140.468	60.260
19.836	575.010	O6	4-methyl-t-pentene-2	0.069	0.075	0.072	137.480	58.600
20.387	580.980	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.811	585.420	I6	3-methylpentane	2.346	2.600	2.397	145.886	63.270
21.262	589.990	O6	2-methylpentene-1	0.114	0.122	0.119	143.780	62.100
21.352	590.880	O6	hexene-1	0.049	0.053	0.051	146.246	63.470
21.990	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.298	600.000	P6	n-hexane	1.894	2.115	1.935	155.714	68.730
22.522	602.680	O6	t-hexene-3	0.074	0.080	0.078	152.744	67.080
22.588	603.470	O6	c-hexene-3	0.025	0.026	0.026	151.592	66.440
22.740	605.260	O6	t-hexene-2	0.146	0.157	0.152	154.184	67.880
22.821	606.210	--	unknown	0.001	0.001	0.001	32.000	0.000
22.943	607.630	O6	2-methylpentene-2	0.185	0.198	0.194	153.140	67.300
23.022	608.550	O6	4-methylcyclopentene	0.050	0.048	0.054	148.820	64.900
23.185	610.410	O6	3-methyl-c-pentene-2	0.113	0.119	0.118	153.842	67.690
23.308	611.820	O6	3-methylcyclopentene	0.027	0.026	0.029	149.000	65.000
23.416	613.040	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.548	614.520	O6	c-hexene-2	0.079	0.084	0.083	155.984	68.880
23.784	617.150	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.113	620.750	O7	3,3-dimethylpentene-1	0.174	0.183	0.156	171.446	77.470
24.253	622.260	--	unknown	0.001	0.001	0.003	32.000	0.000
24.307	622.840	O7	4,4-dimethyl-t-pentene-2	0.001	0.001	0.001	170.114	76.730
24.408	623.920	I7	2,2-dimethylpentane	0.104	0.113	0.091	174.542	79.190
24.626	626.230	N6	methylcyclopentane	2.454	2.413	2.567	161.240	71.800
25.037	630.510	I7	2,4-dimethylpentane	1.538	1.684	1.352	176.882	80.490

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
25.274	632.930	O7	cyclic diolefin or triolefin-[1]	0.002	0.003	0.003	32.000	0.000
25.457	634.780	I7	2,2,3-trimethylbutane	0.049	0.052	0.043	177.584	80.880
25.623	636.450	--	unknown	0.002	0.002	0.002	32.000	0.000
25.836	638.570	O7	cyclic diolefin or triolefin-[2]	0.007	0.007	0.007	32.000	0.000
26.173	641.870	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.285	642.950	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.656	646.500	O7	4,4-dimethyl-c-pentene-2	0.008	0.009	0.007	176.756	80.420
26.802	647.880	O7	2,4-dimethylpentene-1	0.008	0.009	0.007	178.880	81.600
26.905	648.840	O6	1-methylcyclopentene	0.188	0.178	0.202	167.864	75.480
27.104	650.700	A6	benzene	0.725	0.607	0.817	176.162	80.090
27.286	652.380	O7	2-methyl-c-hexene-3	0.004	0.005	0.004	186.800	86.000
27.501	654.350	I7	3,3-dimethylpentane	0.098	0.104	0.086	186.908	86.060
27.602	655.270	O7	5-methylhexene-1	0.010	0.011	0.009	185.558	85.310
27.794	656.990	--	unknown	0.004	0.004	0.003	32.000	0.000
27.928	658.200	N6	cyclohexane	0.830	0.785	0.868	177.296	80.720
28.224	660.810	O7	2-methyl-t-hexene-3	0.017	0.018	0.015	186.620	85.900
28.353	661.940	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.445	662.750	O7	2-ethyl-3-methylbutene-1	0.006	0.007	0.006	187.448	86.360
28.572	663.850	O7	4-methylhexene-1	0.014	0.015	0.013	188.114	86.730
28.878	666.480	O7	4-methyl-t/c-hexene-2	0.024	0.025	0.022	187.358	86.310
29.042	667.880	I7	2-methylhexane	2.018	2.189	1.772	194.090	90.050
29.206	669.260	I7	2,3-dimethylpentane	2.601	2.755	2.285	193.604	89.780
29.488	671.620	N7	1,1-dimethylcyclopentane	0.076	0.074	0.068	189.464	87.480
29.810	674.280	O7	5-methyl-t-hexene-2	0.023	0.024	0.021	190.598	88.110
30.024	676.030	I7	3-methylhexane	2.052	2.199	1.803	197.330	91.850
30.452	679.470	O7	3,4-dimethyl-c-pentene-2	0.013	0.013	0.011	192.650	89.250
30.760	681.910	N7	1c,3-dimethylcyclopentane	0.699	0.691	0.626	195.386	90.770
31.113	684.670	N7	1t,3-dimethylcyclopentane	0.621	0.611	0.557	197.096	91.720
31.291	686.050	I7	3-ethylpentane	0.191	0.201	0.168	200.246	93.470
31.480	687.510	N7	1t,2-dimethylcyclopentane	0.608	0.596	0.545	197.366	91.870
31.662	688.890	I8	2,2,4-trimethylpentane	2.863	3.047	2.206	210.632	99.240

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
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Processed 627 Peaks
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
32.212	693.030	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.451	694.800	O7	3-methyl-c-hexene-3	0.022	0.022	0.020	203.720	95.400
32.987	698.710	O7	t-heptene-3	0.079	0.083	0.071	204.206	95.670
33.166	700.000	P7	n-heptane	1.389	1.496	1.220	209.156	98.420
33.463	701.940	O7	2-methyl-2-hexene	0.083	0.085	0.074	203.738	95.410
33.617	702.940	O7	3-methyl-t-hexene-3	0.031	0.033	0.028	200.372	93.540
33.862	704.520	O7	t-heptene-2	0.031	0.032	0.028	208.310	97.950
34.091	705.990	O7	3-ethylpentene-2	0.021	0.021	0.019	204.818	96.010
34.579	709.070	O7	c-heptene-2	0.078	0.081	0.070	209.138	98.410
34.768	710.250	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.095	712.270	O7	2,3-dimethylpentene-2	0.033	0.034	0.030	207.320	97.400
35.326	713.680	O7	3-ethylcyclopentene	0.004	0.004	0.003	207.986	97.770
35.414	714.220	--	unknown	0.001	0.001	0.001	32.000	0.000
35.720	716.070	O7	O7-[3]	0.006	0.007	0.006	32.000	0.000
35.986	717.660	N7	1c,2-dimethylcyclopentane	0.292	0.294	0.262	211.154	99.530
36.114	718.420	N7	methylcyclohexane	1.296	1.240	1.161	213.674	100.930
36.429	720.280	I8	2,2-dimethylhexane	0.040	0.042	0.031	224.312	106.840
36.538	720.920	N8	1,1,3-trimethylcyclopentane	0.180	0.177	0.141	220.802	104.890
36.868	722.840	O7	O7-[4]	0.005	0.005	0.004	32.000	0.000
36.956	723.350	O7	O7-[5]	0.002	0.002	0.002	32.000	0.000
37.147	724.450	O7	O7-[6]	0.005	0.005	0.004	32.000	0.000
37.265	725.120	--	unknown	0.001	0.001	0.001	32.000	0.000
37.506	726.490	O7	O7-[7]	0.006	0.006	0.006	32.000	0.000
38.007	729.310	N7	ethylcyclopentane	0.348	0.334	0.312	218.246	103.470
38.131	730.000	I8	2,5-dimethylhexane	0.580	0.616	0.447	228.398	109.110
38.321	731.050	I8	2,2,3-trimethylpentane	0.114	0.118	0.088	229.730	109.850
38.470	731.880	I8	2,4-dimethylhexane	0.670	0.705	0.517	228.974	109.430
38.596	732.570	--	unknown	0.012	0.013	0.009	32.000	0.000
38.813	733.760	--	unknown	0.002	0.002	0.001	32.000	0.000
38.927	734.370	O7	O7-[8]	0.002	0.002	0.002	32.000	0.000
39.161	735.640	O7	O7-[9]	0.002	0.002	0.001	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
39.475	737.320	N8	1c,2t,4-trimethylcyclopentane	0.294	0.283	0.230	242.132	116.740
39.693	738.480	I8	3,3-dimethylhexane	0.058	0.060	0.045	233.546	111.970
40.179	741.040	O7	O7-[10]	0.003	0.003	0.003	32.000	0.000
40.481	742.600	O7	O7-[11]	0.002	0.002	0.002	32.000	0.000
40.634	743.400	O7	O7-[12]	0.005	0.005	0.004	32.000	0.000
40.839	744.450	N8	1t,2c,3-trimethylcyclopentane	0.213	0.204	0.167	230.738	110.410
41.380	747.200	I8	2,3,4-trimethylpentane	1.258	1.288	0.969	236.246	113.470
41.597	748.280	I8	I8-[1]	0.078	0.080	0.060	236.246	113.470
41.895	749.780	O7	O7-[13]	0.021	0.021	0.016	32.000	0.000
42.201	751.290	I8	2,3,3-trimethylpentane	1.186	1.203	0.914	238.586	114.770
42.632	753.400	A7	toluene	4.747	4.031	4.535	231.134	110.630
42.760	754.020	O8	O8-[1]	0.004	0.004	0.003	32.000	0.000
42.937	754.880	O8	O8-[2]	0.001	0.001	0.001	32.000	0.000
43.080	755.570	O8	O8-[3]	0.006	0.006	0.005	32.000	0.000
43.193	756.110	--	unknown	0.001	0.001	0.001	32.000	0.000
43.617	758.130	I8	2,3-dimethylhexane	0.556	0.575	0.428	240.098	115.610
43.791	758.950	I8	2-methyl-3-ethylpentane	0.071	0.073	0.055	240.098	115.610
44.088	760.350	N8	1,1,2-trimethylcyclopentane	0.010	0.010	0.008	236.714	113.730
44.533	762.420	O8	O8-[4]	0.028	0.028	0.022	32.000	0.000
44.944	764.310	I8	2-methylheptane	0.935	0.986	0.720	243.770	117.650
45.254	765.720	I8	4-methylheptane	0.356	0.372	0.275	243.878	117.710
45.512	766.890	I8	3-methyl-3-ethylpentane	0.072	0.075	0.056	240.098	115.610
45.624	767.390	I8	3,4-dimethylhexane	0.089	0.091	0.069	243.914	117.730
46.244	770.160	N8	1c,2c,4-trimethylcyclopentane	0.112	0.108	0.088	242.168	116.760
46.656	771.970	I8	3-methylheptane	0.892	0.931	0.688	246.074	118.930
46.928	773.160	--	unknown	0.189	0.199	0.146	32.000	0.000
47.010	773.510	N8	1c,2t,3-trimethylcyclopentane	0.417	0.398	0.327	243.500	117.500
47.179	774.250	I8	3-ethylhexane	0.114	0.117	0.087	245.372	118.540
47.452	775.430	N8	1t,4-dimethylcyclohexane	0.196	0.189	0.154	246.848	119.360
47.894	777.310	--	unknown	0.002	0.002	0.006	32.000	0.000
48.271	778.910	--	unknown	0.001	0.001	0.002	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
48.426	779.560	O8	O8-[5]	0.001	0.001	0.001	32.000	0.000
48.774	781.010	N8	1,1-dimethylcyclohexane	0.035	0.033	0.027	247.190	119.550
49.238	782.930	I9	2,2,5-trimethylhexane	0.635	0.661	0.436	255.362	124.090
49.661	784.660	N8	3c-ethylmethylcyclopentane	0.215	0.206	0.169	249.980	121.100
49.884	785.570	O9	2,6-dimethylheptene-1	0.003	0.003	0.002	32.000	0.000
50.211	786.900	N8	3t-ethylmethylcyclopentane	0.182	0.175	0.143	249.980	121.100
50.544	788.230	N8	2t-ethylmethylcyclopentane	0.166	0.159	0.130	250.160	121.200
51.006	790.070	O8	O8-[6]	0.007	0.007	0.006	32.000	0.000
51.122	790.520	N8	1,1-methylethylcyclopentane	0.022	0.020	0.017	250.754	121.530
51.817	793.240	N8	1t,2-dimethylcyclohexane	0.194	0.184	0.152	254.174	123.430
52.063	794.190	O8	t-octene-4	0.007	0.008	0.006	252.068	122.260
52.424	795.580	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.885	797.340	N8	1c,2c,3-trimethylcyclopentane	0.032	0.030	0.025	253.400	123.000
53.590	800.000	P8	n-octane	0.834	0.874	0.643	258.224	125.680
53.869	801.040	N8	1c,4-dimethylcyclohexane	0.270	0.254	0.212	255.794	124.330
54.739	804.270	O8	t-octene-2	0.008	0.009	0.007	32.000	0.000
54.963	805.090	--	unknown	0.005	0.005	0.014	32.000	0.000
55.331	806.440	I9	I9-[1]	0.037	0.038	0.026	32.000	0.000
55.423	806.770	--	unknown	0.019	0.020	0.013	32.000	0.000
55.829	808.240	N8	i-propylcyclopentane	0.085	0.081	0.067	259.574	126.430
56.491	810.600	--	unknown	0.004	0.004	0.003	32.000	0.000
56.760	811.550	O9	O9-[1]	0.001	0.001	0.001	32.000	0.000
57.033	812.510	--	unknown	0.008	0.009	0.006	32.000	0.000
57.132	812.860	O8	c-octene-2	0.004	0.004	0.003	32.000	0.000
57.398	813.790	--	unknown	0.001	0.001	0.001	32.000	0.000
57.700	814.840	N8	N8-[1]	0.014	0.014	0.011	32.000	0.000
58.065	816.100	O8	O8-[1]	0.002	0.002	0.002	32.000	0.000
58.448	817.410	I9	2,2,3,4-tetramethylpentane	0.127	0.126	0.087	271.454	133.030
59.087	819.580	I9	2,3,4-trimethylhexane	0.072	0.071	0.049	282.308	139.060
59.390	820.600	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.646	821.460	O9	O9-[1]	0.031	0.032	0.022	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
60.061	822.830	N8	N8-[3]	0.001	0.001	0.001	32.000	0.000
60.501	824.290	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.041	826.050	N8	1c,2-dimethylcyclohexane	0.191	0.176	0.150	265.532	129.740
61.241	826.700	--	unknown	0.022	0.024	0.018	32.000	0.000
61.629	827.950	I9	2,3,5-trimethylhexane	0.007	0.007	0.005	268.430	131.350
61.944	828.970	I9	2,2-dimethylheptane	0.013	0.014	0.009	270.860	132.700
62.456	830.590	--	unknown	0.001	0.001	0.001	32.000	0.000
62.829	831.770	N9	1,1,4-trimethylcyclohexane	0.340	0.324	0.237	275.000	135.000
63.398	833.560	I9	2,2,3-trimethylhexane	0.161	0.166	0.110	271.220	132.900
63.981	835.370	I9	2,4-dimethylheptane	0.034	0.035	0.023	271.220	132.900
64.727	837.650	I9	4,4-dimethylheptane	0.196	0.202	0.135	271.220	132.900
65.049	838.630	N8	ethylcyclohexane	0.001	0.001	0.001	269.222	131.790
65.629	840.380	N8	n-propylcyclopentane	0.032	0.030	0.025	267.728	130.960
65.837	841.000	I9	2,5-dimethylheptane	0.266	0.274	0.183	276.800	136.000
66.295	842.370	I9	3,3-&3,5-dimethylheptane	0.062	0.063	0.042	278.636	137.020
66.703	843.570	I9	3,5-dimethylheptane	0.042	0.043	0.029	276.800	136.000
67.182	844.980	I9	2,6-dimethylheptane	0.072	0.075	0.050	275.396	135.220
67.805	846.790	N9	1,1,3-trimethylcyclohexane	0.049	0.046	0.034	295.862	146.590
68.304	848.230	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
68.834	849.750	N8	N8-[4]	0.001	0.001	0.001	32.000	0.000
69.080	850.450	N8	N8-[5]	0.003	0.003	0.003	32.000	0.000
69.406	851.370	N9	1c,2t,4t-trimethylcyclohexane	0.020	0.019	0.014	32.000	0.000
70.260	853.760	A8	ethylbenzene	1.243	1.056	1.031	277.160	136.200
70.639	854.810	N9	1c,3c,5c-trimethylcyclohexane	0.130	0.123	0.091	32.000	0.000
71.486	857.140	O9	2-methyloctene-1	0.021	0.022	0.014	32.000	0.000
71.892	858.240	I9	I9-[2]	0.004	0.004	0.003	32.000	0.000
72.361	859.510	O9	2-methyloctene-2	0.030	0.033	0.021	32.000	0.000
72.773	860.620	N9	N9-[1]	0.002	0.002	0.001	32.000	0.000
73.172	861.680	N9	N9-[2]	0.001	0.001	0.001	32.000	0.000
74.115	864.180	A8	1,3-dimethylbenzene	3.345	2.850	2.773	282.416	139.120
74.446	865.040	A8	1,4-dimethylbenzene	1.358	1.161	1.126	281.048	138.360

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Hold

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75.058	866.630	I9	3,4-dimethylheptane	0.031	0.031	0.021	285.080	140.600
75.383	867.470	I9	3,4 -dimethylheptane	0.063	0.063	0.043	285.080	140.600
75.919	868.850	N9	N9-[3]	0.027	0.026	0.019	32.000	0.000
76.359	869.970	I9	I9-[3]	0.078	0.078	0.053	32.000	0.000
77.241	872.200	I9	4-ethylheptane	0.002	0.002	0.002	288.392	142.440
77.571	873.020	I9	4-methyloctane	0.276	0.282	0.189	288.392	142.440
77.963	874.000	I9	2-methyloctane	0.339	0.349	0.232	289.904	143.280
78.569	875.500	N9	N9-[4]	0.038	0.036	0.026	32.000	0.000
79.143	876.900	--	unknown	0.001	0.001	0.000	32.000	0.000
79.422	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.041	0.039	0.028	304.160	151.200
79.737	878.350	I9	3-ethylheptane	0.079	0.080	0.054	289.400	143.000
80.250	879.590	I9	3-methyloctane	0.436	0.445	0.299	291.614	144.230
80.573	880.360	I9	3,3-diethylpentane	0.021	0.021	0.015	270.842	132.690
81.011	881.410	--	unknown	0.066	0.070	0.046	32.000	0.000
81.299	882.100	N9	1c,2t,4c-trimethylcyclohexane	0.018	0.017	0.013	275.000	135.000
81.666	882.960	N9	1,1,2-trimethylcyclohexane	0.030	0.028	0.021	293.360	145.200
82.030	883.820	A8	1,2-dimethylbenzene	1.673	1.399	1.387	291.974	144.430
82.560	885.060	I9	I9-[4]	0.028	0.029	0.019	32.000	0.000
82.922	885.910	I9	I9-[5]	0.106	0.107	0.073	32.000	0.000
83.656	887.600	N9	N9-[5]	0.090	0.085	0.063	32.000	0.000
83.922	888.210	N9	N9-[6]	0.116	0.110	0.081	32.000	0.000
84.062	888.530	--	unknown	0.036	0.038	0.025	32.000	0.000
84.438	889.390	O9	nonene-1	0.007	0.006	0.005	274.100	134.500
84.609	889.780	I9	I9-[6]	0.061	0.061	0.042	32.000	0.000
85.014	890.700	N9	N9-[7]	0.159	0.151	0.111	32.000	0.000
85.554	891.910	I9	I9-[7]	0.017	0.017	0.011	32.000	0.000
86.008	892.930	N9	i-butylcyclopentane	0.033	0.031	0.023	298.346	147.970
86.220	893.400	N9	N9-[8]	0.023	0.021	0.016	32.000	0.000
87.064	895.270	--	unknown	0.001	0.001	0.001	32.000	0.000
87.439	896.100	N9	N9-[9]	0.015	0.014	0.011	32.000	0.000
87.738	896.750	N9	N9-[10]	0.009	0.008	0.006	32.000	0.000

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Processed 627 Peaks
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

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88.032	897.390	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.251	897.870	O9	t-nonene-3	0.021	0.022	0.015	32.000	0.000
88.663	898.760	I9	I9-[8]	0.130	0.131	0.089	32.000	0.000
88.835	899.130	--	unknown	0.022	0.024	0.015	32.000	0.000
89.236	900.000	P9	n-nonane	0.391	0.401	0.268	303.476	150.820
89.596	901.740	N9	1,1-methylethylcyclohexane	0.094	0.086	0.065	305.924	152.180
90.170	904.510	N9	N9-[11]	0.010	0.009	0.007	32.000	0.000
90.421	905.720	N9	N9-[12]	0.027	0.025	0.019	32.000	0.000
90.709	907.090	O10	t-2,2,5,5-tetramethylhexene-3	0.005	0.005	0.003	32.000	0.000
90.811	907.580	--	unknown	0.002	0.002	0.001	32.000	0.000
91.172	909.300	--	unknown	0.000	0.000	0.000	32.000	0.000
91.585	911.260	N9	N9-[13]	0.006	0.006	0.004	32.000	0.000
92.010	913.260	A9	i-propylbenzene	0.066	0.056	0.048	306.338	152.410
92.371	914.960	O9	c-nonene-3	0.076	0.082	0.053	32.000	0.000
92.531	915.700	--	unknown	0.018	0.019	0.012	32.000	0.000
92.931	917.570	I10	I10-[1]	0.012	0.012	0.008	32.000	0.000
93.029	918.030	N9	i-propylcyclohexane	0.023	0.022	0.016	310.622	154.790
93.198	918.810	--	unknown	0.005	0.006	0.004	32.000	0.000
93.772	921.470	I10	I10-[2]	0.114	0.115	0.070	32.000	0.000
94.169	923.290	I10	2,2-dimethyloctane	0.036	0.037	0.023	314.420	156.900
94.443	924.550	I10	2,4-dimethyloctane	0.055	0.055	0.034	312.620	155.900
94.876	926.520	N9	N9-[14]	0.007	0.007	0.005	32.000	0.000
95.310	928.500	N9	N9-[15]	0.023	0.022	0.016	32.000	0.000
95.916	931.230	I10	2,6-dimethyloctane	0.092	0.093	0.057	320.738	160.410
96.272	932.830	I10	2,5-dimethyloctane	0.083	0.084	0.051	317.300	158.500
96.531	933.990	--	unknown	0.003	0.003	0.002	32.000	0.000
97.129	936.650	N9	n-butylcyclopentane	0.062	0.058	0.043	313.916	156.620
97.343	937.600	I10	I10-[3]	0.033	0.034	0.021	32.000	0.000
97.493	938.260	N10	N10-[1]	0.038	0.035	0.024	32.000	0.000
97.758	939.430	--	unknown	0.006	0.006	0.004	32.000	0.000
98.008	940.530	I10	I10-[4]	0.022	0.023	0.014	32.000	0.000

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Hold

Components Listed in Chromatographic Order

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98.462	942.520	I10	3,3-dimethyloctane	0.146	0.146	0.091	322.160	161.200
98.774	943.890	N10	N10-[2]	0.025	0.023	0.016	32.000	0.000
98.985	944.810	--	unknown	0.020	0.021	0.012	32.000	0.000
99.158	945.560	--	unknown	0.026	0.027	0.016	32.000	0.000
99.549	947.250	A9	n-propylbenzene	0.371	0.317	0.272	318.632	159.240
99.845	948.530	I10	3,6-dimethyloctane	0.028	0.028	0.017	321.440	160.800
100.102	949.640	I10	3-methyl-5-ethylheptane	0.048	0.049	0.030	316.760	158.200
100.238	950.220	--	unknown	0.007	0.008	0.005	32.000	0.000
100.568	951.630	N10	N10-[3]	0.029	0.027	0.018	32.000	0.000
101.239	954.490	--	unknown	0.027	0.028	0.017	32.000	0.000
101.505	955.620	A9	1,3-methylethylbenzene	1.312	1.117	0.961	322.394	161.330
101.888	957.240	A9	1,4-methylethylbenzene	0.563	0.481	0.412	323.618	162.010
102.197	958.540	N10	N10-[4]	0.031	0.029	0.020	32.000	0.000
102.356	959.210	--	unknown	0.003	0.004	0.002	32.000	0.000
102.761	960.910	--	unknown	0.002	0.002	0.001	32.000	0.000
102.945	961.670	--	unknown	0.011	0.012	0.030	32.000	0.000
103.232	962.870	A9	1,3,5-trimethylbenzene	0.700	0.595	0.512	328.532	164.740
103.497	963.970	I10	I10-[5]	0.044	0.043	0.027	32.000	0.000
103.764	965.080	N10	N10-[5]	0.019	0.018	0.012	32.000	0.000
103.956	965.870	--	unknown	0.006	0.007	0.004	32.000	0.000
104.194	966.850	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.510	968.150	I10	5-methylnonane	0.054	0.055	0.034	329.180	165.100
104.915	969.810	I10	4-methylnonane	0.448	0.445	0.277	32.000	0.000
105.259	971.210	A9	1,2-methylethylbenzene	0.417	0.349	0.306	329.324	165.180
105.445	971.970	I10	2-methylnonane	0.129	0.131	0.080	332.654	167.030
105.582	972.530	--	unknown	0.012	0.012	0.007	32.000	0.000
105.867	973.680	--	unknown	0.012	0.013	0.007	32.000	0.000
106.098	974.620	I10	3-ethyloctane	0.029	0.028	0.018	331.700	166.500
106.188	974.980	--	unknown	0.014	0.014	0.008	32.000	0.000
106.470	976.120	N10	N10-[6]	0.025	0.023	0.015	32.000	0.000
106.801	977.450	I10	3-methylnonane	0.158	0.158	0.097	334.040	167.800

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Hold

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107.023	978.340	--	unknown	0.006	0.007	0.004	32.000	0.000
107.366	979.710	N10	N10-[7]	0.003	0.003	0.002	32.000	0.000
107.544	980.420	I10	I10-[7]	0.100	0.100	0.062	32.000	0.000
107.816	981.500	I10	I10-[8]	0.009	0.008	0.005	32.000	0.000
108.102	982.630	--	unknown	0.011	0.012	0.007	32.000	0.000
108.563	984.450	A9	1,2,4-trimethylbenzene	2.041	1.716	1.495	336.884	169.380
108.797	985.370	--	unknown	0.007	0.008	0.005	32.000	0.000
108.981	986.100	I10	I10-[9]	0.012	0.012	0.008	32.000	0.000
109.080	986.480	N10	i-butylcyclohexane	0.036	0.033	0.022	340.340	171.300
109.268	987.220	--	unknown	0.027	0.029	0.017	32.000	0.000
109.385	987.680	I10	I10-[10]	0.049	0.048	0.030	32.000	0.000
109.669	988.790	I10	I10-[11]	0.020	0.020	0.012	32.000	0.000
109.809	989.340	I10	I10-[12]	0.013	0.013	0.008	32.000	0.000
110.163	990.710	N10	N10-[8]	0.024	0.022	0.015	32.000	0.000
110.409	991.670	--	unknown	0.003	0.003	0.002	32.000	0.000
110.794	993.150	O10	decene-1	0.003	0.003	0.002	339.080	170.600
110.923	993.650	N10	1t-methyl-2-n-propylcyclohexane	0.010	0.009	0.006	339.800	171.000
111.051	994.140	O10	2,3-dimethyloctene-2	0.069	0.068	0.043	32.000	0.000
111.178	994.630	I10	I10-[13]	0.015	0.014	0.009	32.000	0.000
111.468	995.740	--	unknown	0.004	0.004	0.002	32.000	0.000
111.603	996.260	A10	i-butylbenzene	0.054	0.047	0.036	343.022	172.790
111.842	997.180	I10	I10-[14]	0.040	0.040	0.025	32.000	0.000
112.120	998.240	A10	sec-butylbenzene	0.038	0.032	0.025	344.012	173.340
112.367	999.180	--	unknown	0.009	0.009	0.006	32.000	0.000
112.583	1000.000	P10	n-decane	0.207	0.208	0.128	345.470	174.150
112.824	1001.530	I11	I11-[1]	0.029	0.029	0.016	32.000	0.000
113.176	1003.740	N10	N10-[9]	0.018	0.017	0.011	32.000	0.000
113.588	1006.330	--	unknown	0.006	0.006	0.004	32.000	0.000
113.827	1007.830	A9	1,2,3-trimethylbenzene	0.400	0.329	0.293	349.016	176.120
113.987	1008.830	--	unknown	0.008	0.009	0.006	32.000	0.000
114.272	1010.610	A10	1,3-methyl-i-propylbenzene	0.044	0.038	0.029	347.144	175.080

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Hold

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114.709	1013.330	--	unknown	0.010	0.010	0.027	32.000	0.000
114.831	1014.090	A10	1,4-methyl-i-propylbenzene	0.026	0.022	0.017	350.834	177.130
114.992	1015.080	--	unknown	0.003	0.003	0.002	32.000	0.000
115.302	1017.000	I11	I11-[2]	0.028	0.028	0.016	32.000	0.000
115.570	1018.650	I11	I11-[3]	0.013	0.013	0.007	32.000	0.000
115.864	1020.460	A10	2-3-dihydroindene	0.278	0.213	0.207	352.130	177.850
116.229	1022.700	--	unknown	0.020	0.021	0.015	32.000	0.000
116.475	1024.200	N10	sec-butylcyclohexane	0.043	0.039	0.027	354.812	179.340
116.709	1025.630	I11	I11-[4]	0.009	0.009	0.005	32.000	0.000
117.057	1027.750	A10	1,2-methyl-i-propylbenzene	0.075	0.063	0.049	352.724	178.180
117.202	1028.630	I11	3-ethylnonane	0.005	0.005	0.003	32.000	0.000
117.317	1029.320	--	unknown	0.004	0.004	0.002	32.000	0.000
117.629	1031.210	--	unknown	0.068	0.071	0.038	32.000	0.000
117.853	1032.560	N11	N11-[1]	0.030	0.028	0.017	32.000	0.000
117.931	1033.040	--	unknown	0.017	0.018	0.010	32.000	0.000
118.090	1033.990	I11	I11-[5]	0.016	0.016	0.009	32.000	0.000
118.227	1034.820	--	unknown	0.003	0.003	0.002	32.000	0.000
118.603	1037.070	I11	I11-[6]	0.032	0.029	0.018	32.000	0.000
118.769	1038.070	--	unknown	0.035	0.036	0.020	32.000	0.000
119.210	1040.700	A10	1,3-diethylbenzene	0.141	0.120	0.093	358.052	181.140
119.411	1041.900	--	unknown	0.065	0.068	0.043	32.000	0.000
119.659	1043.370	A10	1,3-methyl-n-propylbenzene	0.286	0.244	0.188	359.618	182.010
119.832	1044.400	I11	I11-[7]	0.026	0.026	0.015	32.000	0.000
120.116	1046.080	A10	1,4-diethylbenzene	0.012	0.010	0.008	362.822	183.790
120.297	1047.150	A10	1,4-methyl-n-propylbenzene	0.179	0.154	0.118	362.156	183.420
120.471	1048.170	A10	n-butylbenzene	0.086	0.074	0.057	361.940	183.300
120.880	1050.580	A10	1,3-dimethyl-5-ethylbenzene	0.302	0.253	0.198	362.516	183.620
121.204	1052.480	A10	1,2-diethylbenzene	0.032	0.027	0.021	362.228	183.460
121.347	1053.320	I11	I11-[8]	0.018	0.018	0.010	32.000	0.000
121.574	1054.650	N10	t-decahydronaphthalene	0.009	0.009	0.005	368.960	187.200
121.823	1056.100	N11	N11-[2]	0.017	0.016	0.010	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
122.084	1057.620	--	unknown	0.012	0.012	0.007	32.000	0.000
122.246	1058.560	A10	1,2-methyl-n-propylbenzene	0.100	0.085	0.066	364.946	184.970
122.623	1060.740	I11	I11-[9]	0.011	0.011	0.006	32.000	0.000
122.753	1061.490	I11	I11-[10]	0.073	0.073	0.041	32.000	0.000
122.965	1062.710	I11	I11-[11]	0.039	0.038	0.022	32.000	0.000
123.049	1063.200	--	unknown	0.010	0.010	0.006	32.000	0.000
123.269	1064.470	--	unknown	0.003	0.003	0.002	32.000	0.000
123.471	1065.630	I11	I11-[12]	0.049	0.048	0.027	32.000	0.000
123.730	1067.110	--	unknown	0.009	0.010	0.005	32.000	0.000
124.019	1068.770	A10	1,4,dimethyl-2-ethylbenzene	0.219	0.184	0.144	368.366	186.870
124.290	1070.320	A10	1,3-dimethyl-4-ethylbenzene	0.274	0.235	0.180	370.832	188.240
124.555	1071.820	I11	I11-[13]	0.004	0.004	0.002	32.000	0.000
124.862	1073.570	--	unknown	0.008	0.009	0.005	32.000	0.000
125.122	1075.040	I11	I11-[14]	0.150	0.149	0.084	32.000	0.000
125.289	1075.990	A10	1,2-dimethyl-4-ethylbenzene	0.301	0.254	0.198	373.136	189.520
125.600	1077.740	--	unknown	0.009	0.010	0.006	32.000	0.000
125.886	1079.360	--	unknown	0.012	0.013	0.008	32.000	0.000
125.959	1079.770	I11	I11-[15]	0.005	0.005	0.003	32.000	0.000
126.262	1081.470	A10	1,3-dimethyl-2-ethylbenzene	0.051	0.042	0.033	374.090	190.050
126.417	1082.340	I11	I11-[16]	0.018	0.018	0.010	32.000	0.000
126.745	1084.170	--	unknown	0.018	0.019	0.010	32.000	0.000
126.946	1085.290	I11	I11-[17]	0.009	0.009	0.005	32.000	0.000
127.176	1086.580	--	unknown	0.016	0.017	0.009	32.000	0.000
127.489	1088.320	--	unknown	0.007	0.008	0.004	32.000	0.000
127.585	1088.850	--	unknown	0.013	0.014	0.007	32.000	0.000
127.857	1090.360	O11	undecene-1	0.021	0.021	0.012	378.860	192.700
128.195	1092.220	A11	1,4-methyl-t-butylbenzene	0.038	0.033	0.022	32.000	0.000
128.469	1093.740	A10	1,2-dimethyl-3-ethylbenzene	0.084	0.069	0.055	381.110	193.950
128.811	1095.620	--	unknown	0.007	0.007	0.005	32.000	0.000
129.088	1097.140	--	unknown	0.014	0.015	0.009	32.000	0.000
129.165	1097.560	A11	1,2-ethyl-i-propylbenzene	0.009	0.007	0.005	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
129.334	1098.480	--	unknown	0.007	0.007	0.004	32.000	0.000
129.611	1100.000	P11	n-undecane	0.110	0.109	0.062	384.620	195.900
129.808	1101.470	--	unknown	0.009	0.009	0.005	32.000	0.000
129.918	1102.300	A11	1,4-ethyl-i-propylbenzene	0.003	0.002	0.002	32.000	0.000
130.345	1105.490	A10	1,2,4,5-tetramethylbenzene	0.174	0.144	0.114	386.312	196.840
130.521	1106.800	A11	1,2-methyl-n-butylbenzene	0.003	0.002	0.002	390.200	199.000
130.716	1108.250	--	unknown	0.007	0.007	0.004	32.000	0.000
130.886	1109.520	A10	1,2,3,5-tetramethylbenzene	0.235	0.195	0.154	388.472	198.040
131.043	1110.680	--	unknown	0.006	0.006	0.004	32.000	0.000
131.375	1113.140	--	unknown	0.012	0.013	0.008	32.000	0.000
131.569	1114.570	--	unknown	0.008	0.008	0.005	32.000	0.000
131.876	1116.840	--	unknown	0.022	0.023	0.015	32.000	0.000
132.319	1120.100	--	unknown	0.015	0.016	0.010	32.000	0.000
132.477	1121.260	--	unknown	0.016	0.016	0.010	32.000	0.000
133.021	1125.240	A11	1,2-methyl-t-butylbenzene	0.007	0.006	0.004	32.000	0.000
133.117	1125.940	--	unknown	0.012	0.013	0.007	32.000	0.000
133.428	1128.210	A10	5-methylindan	0.206	0.171	0.137	32.000	0.000
133.774	1130.720	I12	I12-[1]	0.050	0.049	0.026	421.340	216.300
134.166	1133.560	--	unknown	0.007	0.007	0.004	32.000	0.000
134.297	1134.510	A10	4-methylindan	0.052	0.043	0.035	32.000	0.000
134.675	1137.240	A11	1,2-ethyl-n-propylbenzene	0.070	0.058	0.042	32.000	0.000
134.927	1139.050	A10	2-methylindan	0.198	0.161	0.132	368.600	187.000
135.138	1140.570	A11	1,3-methyl-n-butylbenzene	0.009	0.008	0.006	390.200	199.000
135.394	1142.410	--	unknown	0.006	0.007	0.004	32.000	0.000
135.541	1143.460	A12	1,3-di-i-propylbenzene	0.066	0.055	0.036	397.760	203.200
135.753	1144.980	A11	s-pentylbenzene	0.063	0.052	0.038	401.000	205.000
136.181	1148.030	--	unknown	0.003	0.003	0.002	32.000	0.000
136.328	1149.070	--	unknown	0.015	0.015	0.009	32.000	0.000
136.438	1149.860	A11	n-pentylbenzene	0.050	0.041	0.030	401.720	205.400
136.510	1150.370	--	unknown	0.025	0.026	0.015	32.000	0.000
136.798	1152.420	N12	1t-M-2-(4-MP)cyclopentane	0.005	0.004	0.002	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
136.996	1153.810	A12	1,2-di-i-propylbenzene	0.029	0.024	0.016	399.200	204.000
137.141	1154.850	--	unknown	0.028	0.029	0.015	32.000	0.000
137.625	1158.260	--	unknown	0.041	0.043	0.022	32.000	0.000
137.887	1160.100	A12	1,4-di-i-propylbenzene	0.051	0.042	0.028	410.540	210.300
138.172	1162.110	--	unknown	0.007	0.008	0.004	32.000	0.000
138.348	1163.340	A10	tetrahydronaphthalene	0.019	0.014	0.013	405.716	207.620
138.493	1164.360	--	unknown	0.008	0.008	0.005	32.000	0.000
138.711	1165.880	--	unknown	0.004	0.004	0.003	32.000	0.000
138.885	1167.100	I12	I12-[2]	0.056	0.054	0.029	421.340	216.300
139.182	1169.170	A10	naphthalene	0.170	0.122	0.117	424.382	217.990
139.506	1171.420	A12	1-t-butyl-3,5-dimethylbenzene	0.004	0.003	0.002	32.000	0.000
139.848	1173.790	A12	1,4-ethyl-t-butylbenzene	0.077	0.064	0.042	32.000	0.000
140.252	1176.590	--	unknown	0.027	0.029	0.015	32.000	0.000
140.542	1178.590	I12	I12-[3]	0.057	0.056	0.030	421.340	216.300
140.774	1180.180	I12	I12-[4]	0.033	0.032	0.017	421.340	216.300
141.110	1182.500	--	unknown	0.007	0.007	0.004	32.000	0.000
141.357	1184.190	I12	I12-[5]	0.034	0.033	0.017	421.340	216.300
141.603	1185.870	--	unknown	0.012	0.012	0.006	32.000	0.000
141.896	1187.880	I12	I12-[6]	0.035	0.034	0.018	421.340	216.300
142.096	1189.230	A12	1,3-di-n-propylbenzene	0.041	0.034	0.022	32.000	0.000
142.336	1190.870	A12	A12-[1]	0.025	0.021	0.014	32.000	0.000
142.553	1192.350	O12	dodecene-1	0.006	0.006	0.003	416.120	213.400
142.913	1194.790	--	unknown	0.007	0.008	0.004	32.000	0.000
143.255	1197.100	--	unknown	0.005	0.005	0.002	32.000	0.000
143.558	1199.140	A12	A12-[2]	0.020	0.016	0.011	32.000	0.000
143.684	1200.000	P12	n-dodecane	0.047	0.046	0.024	421.340	216.300
143.947	1202.210	--	unknown	0.003	0.003	0.002	32.000	0.000
144.227	1204.560	--	unknown	0.013	0.013	0.007	32.000	0.000
144.313	1205.290	--	unknown	0.005	0.005	0.002	32.000	0.000
144.763	1209.060	--	unknown	0.012	0.013	0.006	32.000	0.000
144.987	1210.930	--	unknown	0.006	0.006	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
145.186	1212.590	A12	1,3,5-triethylbenzene	0.003	0.003	0.002	420.800	216.000
145.372	1214.140	--	unknown	0.007	0.008	0.004	32.000	0.000
145.716	1217.010	--	unknown	0.022	0.023	0.012	32.000	0.000
145.890	1218.450	--	unknown	0.013	0.014	0.007	32.000	0.000
146.207	1221.080	--	unknown	0.003	0.003	0.002	32.000	0.000
146.498	1223.480	--	unknown	0.018	0.019	0.010	32.000	0.000
146.736	1225.450	--	unknown	0.017	0.018	0.009	32.000	0.000
146.808	1226.050	--	unknown	0.008	0.008	0.004	32.000	0.000
147.108	1228.510	--	unknown	0.004	0.005	0.002	32.000	0.000
147.205	1229.310	--	unknown	0.013	0.014	0.007	32.000	0.000
147.507	1231.790	A12	1,2,4-triethylbenzene	0.014	0.011	0.007	423.500	217.500
147.728	1233.610	--	unknown	0.005	0.005	0.003	32.000	0.000
148.088	1236.540	--	unknown	0.004	0.004	0.002	32.000	0.000
148.189	1237.370	--	unknown	0.005	0.005	0.002	32.000	0.000
148.231	1237.720	--	unknown	0.008	0.008	0.004	32.000	0.000
148.467	1239.640	--	unknown	0.001	0.002	0.001	32.000	0.000
148.803	1242.370	A12	1,4-methyl-n-pentylbenzene	0.036	0.030	0.020	32.000	0.000
149.087	1244.680	--	unknown	0.009	0.010	0.005	32.000	0.000
149.242	1245.940	--	unknown	0.004	0.004	0.002	32.000	0.000
149.379	1247.050	--	unknown	0.003	0.003	0.002	32.000	0.000
149.669	1249.390	--	unknown	0.004	0.005	0.002	32.000	0.000
149.951	1251.670	--	unknown	0.006	0.006	0.003	32.000	0.000
150.150	1253.270	--	unknown	0.008	0.008	0.004	32.000	0.000
150.534	1256.360	A12	n-hexylbenzene	0.020	0.017	0.011	32.000	0.000
150.626	1257.100	--	unknown	0.020	0.021	0.011	32.000	0.000
150.997	1260.070	--	unknown	0.011	0.012	0.006	32.000	0.000
151.255	1262.140	--	unknown	0.005	0.005	0.003	32.000	0.000
151.501	1264.100	--	unknown	0.005	0.005	0.003	32.000	0.000
151.660	1265.370	--	unknown	0.003	0.003	0.002	32.000	0.000
151.849	1266.870	--	unknown	0.006	0.006	0.003	32.000	0.000
151.917	1267.420	--	unknown	0.009	0.009	0.005	32.000	0.000

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:18:01 PM

RawFile: D:\1\DATA\D6730OCT3020\104F0401.D\104F0401.CDF Acquired: 10/31/20 06:07:04
Sample: ODDB:54927 Analyzed: 11/2/2020 9:17:20 PM
Processed 627 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
152.209	1269.740	--	unknown	0.011	0.011	0.006	32.000	0.000
152.638	1273.140	I13	I13-[1]	0.008	0.008	0.004	455.720	235.400
152.827	1274.640	A11	1,2,3,4,5-pentamethylbenzene	0.024	0.017	0.014	449.600	232.000
153.057	1276.450	--	unknown	0.009	0.009	0.005	32.000	0.000
153.571	1280.500	--	unknown	0.006	0.006	0.003	32.000	0.000
153.924	1283.270	A11	2-methylnaphthalene	0.095	0.068	0.058	465.890	241.050
154.413	1287.110	--	unknown	0.010	0.010	0.006	32.000	0.000
154.562	1288.270	--	unknown	0.002	0.002	0.001	32.000	0.000
154.704	1289.380	--	unknown	0.003	0.003	0.002	32.000	0.000
154.909	1290.970	O13	tridecene-1	0.007	0.007	0.003	451.040	232.800
155.340	1294.330	--	unknown	0.001	0.002	0.001	32.000	0.000
155.505	1295.610	--	unknown	0.003	0.003	0.001	32.000	0.000
155.576	1296.170	--	unknown	0.002	0.002	0.001	32.000	0.000
155.877	1298.500	A11	1-methylnaphthalene	0.037	0.027	0.023	472.352	244.640
156.070	1300.000	P13	n-tridecane	0.009	0.009	0.005	455.720	235.400
156.182	1301.000	+	C14+ (Summarized)	0.390	0.376	0.173	455.720	235.400

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 9:31:33 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF
Acquired: 10/31/20 09:28:00
Sample: ODDB:54928
Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.424	8.357	7.222
I-Paraffins:	37.199	40.616	31.946
Olefins:	3.891	4.198	3.984
Naphthenes:	11.435	11.078	9.630
Aromatics:	21.894	18.533	16.710
Total C14+:	0.355	0.344	0.149
Total Unknowns:	1.645	1.738	1.142

Oxygenates:

Total: 16.156(Mass%) 15.136(Vol%)

Total Oxygen Content: 5.611(Mass%)

Multisubstituted Aromatics: 13.900(Mass%) 11.798(Vol%)

Average Molecular Weight: 83.316

Relative Density: 0.739

Vapor Pressure :

Calculated Octane Number: 86.8

Motor Octane Number (Jenkins Calculation): 78.7

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	197.33	329.32	465.89
BP by Vol (Deg F)	31.10	173.30	197.33	329.32	449.60

Percent Carbon: 82.918 Percent Hydrogen: 11.471

Bromine Number (Calc): 7.285 Particulate Matter Index: 1.074

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:32:01 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF
Sample: ODDB:54928
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:

Acquired: 10/31/20 09:28:00
Analyzed: 11/2/2020 9:31:07 PM

Normalized to 100.000%

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	16.156	5.611	15.136

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:32:01 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF
Acquired: 10/31/20 09:28:00
Sample: ODDB:54928
Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.472	0.097	0.045	0.000	0.000	0.001	0.615
C5	2.364	6.598	1.633	0.323	0.000	0.001	10.919
C6	1.781	7.437	1.133	3.087	0.681	0.041	14.160
C7	1.303	8.108	0.727	3.698	4.466	0.006	18.309
C8	0.787	9.331	0.068	2.685	7.182	0.211	20.264
C9	0.368	3.193	0.186	1.306	5.506	0.192	10.752
C10	0.193	1.696	0.067	0.293	3.332	0.264	5.844
C11	0.102	0.488	0.019	0.039	0.369	0.356	1.374
C12	0.043	0.244	0.005	0.004	0.358	0.288	0.941
C13	0.009	0.008	0.007	0.000	0.000	0.285	0.309
Total:	7.424	37.199	3.891	11.435	21.894	1.645	81.844

Oxygenates	16.156	Total C14+:	0.355
Total Unknowns:	1.645	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.603	0.129	0.054	0.000	0.000	0.001	0.787
C5	2.791	7.872	1.828	0.320	0.000	0.001	12.812
C6	1.997	8.359	1.192	3.018	0.573	0.044	15.182
C7	1.409	8.749	0.759	3.617	3.808	0.007	18.348
C8	0.828	9.788	0.069	2.576	6.119	0.223	19.602
C9	0.379	3.282	0.198	1.236	4.673	0.203	9.971
C10	0.195	1.706	0.067	0.270	2.771	0.278	5.287
C11	0.102	0.485	0.019	0.036	0.293	0.376	1.311
C12	0.042	0.239	0.005	0.004	0.297	0.304	0.891
C13	0.009	0.007	0.007	0.000	0.000	0.301	0.324
Total:	8.357	40.616	4.198	11.078	18.533	1.738	82.783

Oxygenates	15.136	Total C14+:	0.344
Total Unknowns:	1.738	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:32:01 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF
Acquired: 10/31/20 09:28:00
Sample: ODDB:54928
Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Normalized to 100.000%

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.677	0.140	0.067	0.000	0.000	0.001	0.884
C5	2.730	7.619	1.944	0.384	0.000	0.001	12.678
C6	1.722	7.190	1.128	3.056	0.726	0.106	13.928
C7	1.084	6.742	0.616	3.138	4.038	0.006	15.624
C8	0.574	6.806	0.050	1.994	5.636	0.159	15.218
C9	0.239	2.074	0.123	0.862	3.817	0.160	7.275
C10	0.113	0.993	0.040	0.174	2.099	0.179	3.597
C11	0.055	0.260	0.010	0.021	0.210	0.222	0.779
C12	0.021	0.119	0.003	0.002	0.184	0.160	0.488
C13	0.004	0.003	0.003	0.000	0.000	0.147	0.158
Total:	7.222	31.946	3.984	9.630	16.710	1.142	69.491

Oxygenates	29.218	Total C14+:	0.149	
Total Unknowns:	1.142	Grand Total:	100.000	

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 9:32:01 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
8.989	395.150	O4	1,3-butadiene	0.000	0.000	0.000
13.018	481.230	O5	1,4-pentadiene	0.001	0.001	0.001
14.847	506.130	O5	2-methylbutadiene-1,3	0.007	0.007	0.008
16.185	527.960	O5	1t,3-pentadiene	0.007	0.008	0.009
16.884	538.210	O5	cyclopentadiene	0.005	0.006	0.006
20.389	581.030	O6	1,5-hexadiene	0.000	0.000	0.000
21.988	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.273	632.950	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002
25.835	638.590	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007
28.352	661.960	O6	diolefin (hexadiene)	0.003	0.003	0.003
36.536	720.930	N8	1,1,3-trimethylcyclopentane	0.162	0.160	0.120

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.434	100.000	P1	methane	0.000	0.000	0.001	-258.700	-161.500
6.620	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.114	293.500	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.175	300.000	P3	propane	0.002	0.002	0.003	-43.672	-42.040
8.190	366.110	I4	i-butane	0.097	0.129	0.140	10.904	-11.720
8.341	372.460	--	unknown	0.000	0.000	0.001	32.000	0.000
8.700	385.850	--	unknown	0.000	0.000	0.000	32.000	0.000
8.827	390.070	O4	butene-1	0.002	0.003	0.003	20.750	-6.250
8.878	391.710	O4	isobutylene	0.003	0.004	0.004	20.750	-6.250
8.989	395.150	O4	1,3-butadiene	0.000	0.000	0.000	24.062	-4.410
9.153	400.000	P4	n-butane	0.472	0.603	0.677	31.100	-0.500
9.544	412.290	O4	t-butene-2	0.017	0.021	0.025	33.584	0.880
9.641	415.130	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.863	421.260	--	unknown	0.001	0.001	0.001	32.000	0.000
10.129	428.120	O4	c-butene-2	0.023	0.027	0.034	38.696	3.720
11.757	461.660	X2	ethanol	16.156	15.136	29.218	173.300	78.500
12.772	477.720	I5	i-pentane	6.595	7.868	7.616	82.112	27.840
13.018	481.230	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.745	490.880	O5	pentene-1	0.116	0.134	0.138	85.928	29.960
14.221	496.690	O5	2-methylbutene-1	0.268	0.305	0.319	88.070	31.150
14.505	500.000	P5	n-pentane	2.364	2.791	2.730	96.908	36.060
14.847	506.130	O5	2-methylbutadiene-1,3	0.007	0.007	0.008	93.308	34.060
15.094	510.410	O5	t-pentene-2	0.350	0.399	0.416	97.412	36.340
15.465	516.610	O5	3,3-dimethylbutene-1	0.005	0.005	0.006	106.232	41.240
15.635	519.360	O5	c-pentene-2	0.194	0.219	0.231	98.474	36.930
15.794	521.910	--	unknown	0.000	0.000	0.001	32.000	0.000
15.972	524.700	O5	2-methylbutene-2	0.585	0.652	0.694	101.408	38.560
16.185	527.960	O5	1t,3-pentadiene	0.007	0.008	0.009	107.636	42.020
16.305	529.780	--	unknown	0.001	0.001	0.001	32.000	0.000
16.884	538.210	O5	cyclopentadiene	0.005	0.006	0.006	32.000	0.000
17.013	540.020	I6	2,2-dimethylbutane	0.419	0.477	0.405	121.514	49.730

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
18.312	557.160	O5	cyclopentene	0.095	0.091	0.117	111.614	44.230
18.678	561.660	O6	4-methylpentene-1	0.022	0.025	0.022	128.948	53.860
18.747	562.490	O6	3-methylpentene-1	0.037	0.041	0.036	129.506	54.170
19.103	566.710	N5	cyclopentane	0.323	0.320	0.384	120.650	49.250
19.290	568.880	I6	2,3-dimethylbutane	1.275	1.425	1.233	136.364	57.980
19.446	570.670	--	unknown	0.040	0.043	0.105	32.000	0.000
19.566	572.030	O6	2,3-dimethylbutene-1	0.019	0.021	0.019	132.098	55.610
19.703	573.570	I6	2-methylpentane	3.538	4.005	3.421	140.468	60.260
19.834	575.020	O6	4-methyl-t-pentene-2	0.065	0.071	0.064	137.480	58.600
20.389	581.030	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.808	585.420	I6	3-methylpentane	2.204	2.452	2.131	145.886	63.270
21.260	590.000	O6	2-methylpentene-1	0.107	0.115	0.106	143.780	62.100
21.350	590.900	O6	hexene-1	0.046	0.050	0.045	146.246	63.470
21.988	597.090	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.295	600.000	P6	n-hexane	1.781	1.997	1.722	155.714	68.730
22.520	602.700	O6	t-hexene-3	0.070	0.076	0.069	152.744	67.080
22.587	603.480	O6	c-hexene-3	0.023	0.025	0.023	151.592	66.440
22.739	605.280	O6	t-hexene-2	0.137	0.149	0.136	154.184	67.880
22.942	607.650	O6	2-methylpentene-2	0.174	0.187	0.173	153.140	67.300
23.021	608.570	O6	4-methylcyclopentene	0.047	0.045	0.048	148.820	64.900
23.183	610.430	O6	3-methyl-c-pentene-2	0.106	0.112	0.105	153.842	67.690
23.306	611.830	O6	3-methylcyclopentene	0.025	0.024	0.026	149.000	65.000
23.415	613.070	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.546	614.540	O6	c-hexene-2	0.074	0.079	0.074	155.984	68.880
23.783	617.170	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.112	620.760	O7	3,3-dimethylpentene-1	0.163	0.172	0.139	171.446	77.470
24.244	622.190	--	unknown	0.001	0.001	0.002	32.000	0.000
24.304	622.840	O7	4,4-dimethyl-t-pentene-2	0.002	0.002	0.002	170.114	76.730
24.407	623.940	I7	2,2-dimethylpentane	0.098	0.107	0.081	174.542	79.190
24.623	626.230	N6	methylcyclopentane	2.307	2.278	2.284	161.240	71.800
25.034	630.510	I7	2,4-dimethylpentane	1.442	1.585	1.199	176.882	80.490

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
25.273	632.950	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002	32.000	0.000
25.455	634.800	I7	2,2,3-trimethylbutane	0.046	0.049	0.038	177.584	80.880
25.622	636.470	--	unknown	0.002	0.002	0.002	32.000	0.000
25.835	638.590	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007	32.000	0.000
26.173	641.890	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.283	642.960	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.655	646.520	O7	4,4-dimethyl-c-pentene-2	0.008	0.008	0.007	176.756	80.420
26.801	647.900	O7	2,4-dimethylpentene-1	0.008	0.008	0.007	178.880	81.600
26.903	648.850	O6	1-methylcyclopentene	0.177	0.167	0.179	167.864	75.480
27.103	650.710	A6	benzene	0.681	0.573	0.726	176.162	80.090
27.285	652.400	O7	2-methyl-c-hexene-3	0.004	0.004	0.003	186.800	86.000
27.500	654.360	I7	3,3-dimethylpentane	0.092	0.098	0.076	186.908	86.060
27.600	655.270	O7	5-methylhexene-1	0.009	0.010	0.008	185.558	85.310
27.793	657.010	--	unknown	0.003	0.004	0.003	32.000	0.000
27.927	658.210	N6	cyclohexane	0.780	0.740	0.772	177.296	80.720
28.222	660.820	O7	2-methyl-t-hexene-3	0.016	0.017	0.014	186.620	85.900
28.352	661.960	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.444	662.760	O7	2-ethyl-3-methylbutene-1	0.006	0.006	0.005	187.448	86.360
28.571	663.870	O7	4-methylhexene-1	0.013	0.014	0.011	188.114	86.730
28.884	666.550	O7	4-methyl-t/c-hexene-2	0.027	0.028	0.023	187.358	86.310
29.040	667.880	I7	2-methylhexane	1.883	2.051	1.566	194.090	90.050
29.203	669.260	I7	2,3-dimethylpentane	2.443	2.598	2.031	193.604	89.780
29.486	671.630	N7	1,1-dimethylcyclopentane	0.072	0.070	0.061	189.464	87.480
29.808	674.290	O7	5-methyl-t-hexene-2	0.022	0.023	0.018	190.598	88.110
30.021	676.020	I7	3-methylhexane	1.925	2.071	1.600	197.330	91.850
30.450	679.480	O7	3,4-dimethyl-c-pentene-2	0.012	0.012	0.010	192.650	89.250
30.758	681.920	N7	1c,3-dimethylcyclopentane	0.656	0.651	0.557	195.386	90.770
31.111	684.690	N7	1t,3-dimethylcyclopentane	0.583	0.576	0.495	197.096	91.720
31.287	686.050	I7	3-ethylpentane	0.179	0.190	0.149	200.246	93.470
31.477	687.510	N7	1t,2-dimethylcyclopentane	0.571	0.562	0.485	197.366	91.870
31.659	688.890	I8	2,2,4-trimethylpentane	2.672	2.855	1.949	210.632	99.240

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
31.751	689.590	O7	2-ethylpentene-1	0.008	0.008	0.007	200.552	93.640
32.211	693.040	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.450	694.810	O7	3-methyl-c-hexene-3	0.020	0.021	0.017	203.720	95.400
32.987	698.720	O7	t-heptene-3	0.074	0.078	0.063	204.206	95.670
33.163	700.000	P7	n-heptane	1.303	1.409	1.084	209.156	98.420
33.461	701.950	O7	2-methyl-2-hexene	0.078	0.081	0.066	203.738	95.410
33.616	702.950	O7	3-methyl-t-hexene-3	0.029	0.031	0.025	200.372	93.540
33.860	704.530	O7	t-heptene-2	0.029	0.030	0.025	208.310	97.950
34.089	705.990	O7	3-ethylpentene-2	0.020	0.020	0.017	204.818	96.010
34.574	709.050	O7	c-heptene-2	0.074	0.076	0.062	209.138	98.410
34.767	710.260	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.095	712.280	O7	2,3-dimethylpentene-2	0.031	0.032	0.027	207.320	97.400
35.326	713.700	O7	3-ethylcyclopentene	0.004	0.003	0.003	207.986	97.770
35.420	714.270	--	unknown	0.000	0.001	0.000	32.000	0.000
35.719	716.080	O7	O7-[3]	0.006	0.006	0.005	32.000	0.000
35.981	717.650	N7	1c,2-dimethylcyclopentane	0.257	0.259	0.218	211.154	99.530
36.112	718.420	N7	methylcyclohexane	1.235	1.187	1.048	213.674	100.930
36.424	720.270	I8	2,2-dimethylhexane	0.045	0.048	0.033	224.312	106.840
36.536	720.930	N8	1,1,3-trimethylcyclopentane	0.162	0.160	0.120	220.802	104.890
36.847	722.740	--	unknown	0.009	0.009	0.006	32.000	0.000
36.948	723.320	O7	O7-[4]	0.003	0.003	0.002	32.000	0.000
37.145	724.450	O7	O7-[5]	0.004	0.005	0.004	32.000	0.000
37.287	725.260	--	unknown	0.001	0.001	0.001	32.000	0.000
37.503	726.490	O7	O7-[6]	0.007	0.007	0.006	32.000	0.000
38.005	729.320	N7	ethylcyclopentane	0.324	0.313	0.275	218.246	103.470
38.129	730.010	I8	2,5-dimethylhexane	0.548	0.584	0.400	228.398	109.110
38.317	731.050	I8	2,2,3-trimethylpentane	0.105	0.109	0.077	229.730	109.850
38.466	731.870	I8	2,4-dimethylhexane	0.633	0.669	0.462	228.974	109.430
38.603	732.620	--	unknown	0.010	0.010	0.007	32.000	0.000
38.816	733.790	--	unknown	0.002	0.002	0.001	32.000	0.000
38.922	734.360	O7	O7-[7]	0.002	0.002	0.001	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
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Processed 631 Peaks
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
39.161	735.650	O7	O7-[8]	0.002	0.002	0.001	32.000	0.000
39.474	737.330	N8	1c,2t,4-trimethylcyclopentane	0.276	0.268	0.205	242.132	116.740
39.691	738.480	I8	3,3-dimethylhexane	0.054	0.057	0.040	233.546	111.970
40.177	741.040	O7	O7-[9]	0.003	0.003	0.003	32.000	0.000
40.480	742.610	O7	O7-[10]	0.002	0.002	0.001	32.000	0.000
40.654	743.510	O7	O7-[11]	0.006	0.006	0.005	32.000	0.000
40.837	744.450	N8	1t,2c,3-trimethylcyclopentane	0.200	0.192	0.148	230.738	110.410
41.376	747.190	I8	2,3,4-trimethylpentane	1.183	1.216	0.863	236.246	113.470
41.594	748.290	I8	I8-[1]	0.073	0.075	0.053	236.246	113.470
41.892	749.770	O7	O7-[12]	0.019	0.020	0.014	32.000	0.000
42.198	751.280	I8	2,3,3-trimethylpentane	1.116	1.135	0.814	238.586	114.770
42.628	753.390	A7	toluene	4.466	3.808	4.038	231.134	110.630
42.749	753.980	O8	O8-[1]	0.004	0.004	0.003	32.000	0.000
42.938	754.890	O8	O8-[2]	0.001	0.001	0.001	32.000	0.000
43.079	755.570	O8	O8-[3]	0.005	0.006	0.004	32.000	0.000
43.191	756.110	--	unknown	0.001	0.001	0.001	32.000	0.000
43.610	758.100	I8	2,3-dimethylhexane	0.509	0.528	0.371	240.098	115.610
43.760	758.810	I8	2-methyl-3-ethylpentane	0.081	0.084	0.059	240.098	115.610
44.088	760.360	N8	1,1,2-trimethylcyclopentane	0.010	0.009	0.007	236.714	113.730
44.532	762.420	O8	O8-[4]	0.026	0.027	0.020	32.000	0.000
44.937	764.290	I8	2-methylheptane	0.880	0.932	0.642	243.770	117.650
45.253	765.720	I8	4-methylheptane	0.335	0.352	0.245	243.878	117.710
45.514	766.910	I8	3-methyl-3-ethylpentane	0.067	0.069	0.049	240.098	115.610
45.619	767.380	I8	3,4-dimethylhexane	0.085	0.087	0.062	243.914	117.730
46.239	770.140	N8	1c,2c,4-trimethylcyclopentane	0.105	0.102	0.078	242.168	116.760
46.653	771.970	I8	3-methylheptane	0.841	0.881	0.613	246.074	118.930
46.932	773.190	--	unknown	0.187	0.197	0.136	32.000	0.000
47.013	773.540	N8	1c,2t,3-trimethylcyclopentane	0.386	0.371	0.287	243.500	117.500
47.175	774.240	I8	3-ethylhexane	0.104	0.108	0.076	245.372	118.540
47.449	775.420	N8	1t,4-dimethylcyclohexane	0.185	0.179	0.137	246.848	119.360
47.893	777.320	--	unknown	0.002	0.002	0.005	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
48.280	778.960	--	unknown	0.001	0.001	0.002	32.000	0.000
48.428	779.580	O8	O8-[5]	0.001	0.001	0.001	32.000	0.000
48.774	781.020	N8	1,1-dimethylcyclohexane	0.033	0.031	0.024	247.190	119.550
49.235	782.930	I9	2,2,5-trimethylhexane	0.598	0.625	0.389	255.362	124.090
49.664	784.690	N8	3c-ethylmethylcyclopentane	0.202	0.194	0.150	249.980	121.100
49.848	785.430	O9	2,6-dimethylheptene-1	0.004	0.004	0.002	32.000	0.000
50.210	786.900	N8	3t-ethylmethylcyclopentane	0.172	0.166	0.128	249.980	121.100
50.543	788.230	N8	2t-ethylmethylcyclopentane	0.157	0.151	0.116	250.160	121.200
51.019	790.120	O8	O8-[6]	0.007	0.007	0.005	32.000	0.000
51.125	790.540	N8	1,1-methylethylcyclopentane	0.020	0.019	0.015	250.754	121.530
51.816	793.250	N8	1t,2-dimethylcyclohexane	0.181	0.173	0.135	254.174	123.430
52.014	794.010	O8	t-octene-4	0.008	0.009	0.006	252.068	122.260
52.422	795.590	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.884	797.340	N8	1c,2c,3-trimethylcyclopentane	0.030	0.029	0.023	253.400	123.000
53.588	800.000	P8	n-octane	0.787	0.828	0.574	258.224	125.680
53.867	801.040	N8	1c,4-dimethylcyclohexane	0.255	0.240	0.189	255.794	124.330
54.738	804.280	O8	t-octene-2	0.008	0.008	0.006	32.000	0.000
54.961	805.090	--	unknown	0.005	0.005	0.012	32.000	0.000
55.335	806.460	I9	I9-[1]	0.035	0.036	0.023	32.000	0.000
55.422	806.770	--	unknown	0.018	0.019	0.011	32.000	0.000
55.829	808.240	N8	i-propylcyclopentane	0.080	0.077	0.060	259.574	126.430
56.490	810.600	--	unknown	0.003	0.004	0.009	32.000	0.000
57.026	812.490	--	unknown	0.008	0.009	0.022	32.000	0.000
57.120	812.820	O8	c-octene-2	0.004	0.004	0.003	32.000	0.000
57.323	813.530	--	unknown	0.001	0.001	0.001	32.000	0.000
57.698	814.840	N8	N8-[1]	0.013	0.013	0.010	32.000	0.000
58.061	816.090	O8	O8-[7]	0.002	0.002	0.002	32.000	0.000
58.446	817.410	I9	2,2,3,4-tetramethylpentane	0.120	0.120	0.078	271.454	133.030
59.088	819.590	I9	2,3,4-trimethylhexane	0.067	0.067	0.044	282.308	139.060
59.384	820.580	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.646	821.460	O9	O9-[1]	0.029	0.030	0.019	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
60.073	822.880	N8	N8-[3]	0.001	0.001	0.001	32.000	0.000
60.499	824.290	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.040	826.050	N8	1c,2-dimethylcyclohexane	0.178	0.165	0.132	265.532	129.740
61.226	826.660	--	unknown	0.023	0.025	0.017	32.000	0.000
61.630	827.960	I9	2,3,5-trimethylhexane	0.006	0.006	0.004	268.430	131.350
61.943	828.970	I9	2,2-dimethylheptane	0.013	0.013	0.008	270.860	132.700
62.837	831.800	N9	1,1,4-trimethylcyclohexane	0.321	0.307	0.212	275.000	135.000
63.396	833.560	I9	2,2,3-trimethylhexane	0.152	0.157	0.099	271.220	132.900
63.984	835.380	I9	2,4-dimethylheptane	0.032	0.033	0.021	271.220	132.900
64.724	837.650	I9	4,4-dimethylheptane	0.185	0.192	0.120	271.220	132.900
65.059	838.670	N8	ethylcyclohexane	0.001	0.001	0.001	269.222	131.790
65.634	840.400	N8	n-propylcyclopentane	0.031	0.030	0.023	267.728	130.960
65.833	841.000	I9	2,5-dimethylheptane	0.250	0.258	0.163	276.800	136.000
66.292	842.360	I9	3,3-&3,5-dimethylheptane	0.058	0.059	0.038	278.636	137.020
66.705	843.580	I9	3,5-dimethylheptane	0.040	0.041	0.026	276.800	136.000
67.186	845.000	I9	2,6-dimethylheptane	0.057	0.060	0.037	275.396	135.220
67.338	845.440	--	unknown	0.011	0.012	0.007	32.000	0.000
67.808	846.810	N9	1,1,3-trimethylcyclohexane	0.046	0.043	0.030	295.862	146.590
68.310	848.250	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
68.834	849.750	N8	N8-[4]	0.001	0.001	0.001	32.000	0.000
69.094	850.490	N8	N8-[5]	0.003	0.003	0.002	32.000	0.000
69.410	851.380	N9	1c,2t,4t-trimethylcyclohexane	0.019	0.018	0.012	32.000	0.000
70.260	853.760	A8	ethylbenzene	1.172	0.999	0.920	277.160	136.200
70.637	854.810	N9	1c,3c,5c-trimethylcyclohexane	0.123	0.116	0.081	32.000	0.000
71.467	857.090	O9	2-methyloctene-1	0.019	0.021	0.013	32.000	0.000
71.902	858.280	I9	I9-[2]	0.003	0.003	0.002	32.000	0.000
72.359	859.510	O9	2-methyloctene-2	0.028	0.030	0.018	32.000	0.000
74.105	864.150	A8	1,3-dimethylbenzene	3.147	2.692	2.470	282.416	139.120
74.436	865.020	A8	1,4-dimethylbenzene	1.286	1.104	1.010	281.048	138.360
75.054	866.630	I9	3,4-dimethylheptane	0.029	0.030	0.019	285.080	140.600
75.382	867.470	I9	3,4 -dimethylheptane	0.059	0.059	0.038	285.080	140.600

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Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
75.917	868.850	N9	N9-[1]	0.026	0.024	0.017	32.000	0.000
76.356	869.970	I9	I9-[3]	0.073	0.074	0.047	32.000	0.000
77.252	872.230	I9	4-ethylheptane	0.002	0.002	0.001	288.392	142.440
77.562	873.000	I9	4-methyloctane	0.260	0.267	0.169	288.392	142.440
77.960	873.990	I9	2-methyloctane	0.319	0.331	0.207	289.904	143.280
78.567	875.490	N9	N9-[2]	0.035	0.034	0.023	32.000	0.000
79.422	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.039	0.038	0.026	304.160	151.200
79.736	878.350	I9	3-ethylheptane	0.074	0.076	0.048	289.400	143.000
80.248	879.590	I9	3-methyloctane	0.411	0.421	0.267	291.614	144.230
80.571	880.360	I9	3,3-diethylpentane	0.020	0.020	0.013	270.842	132.690
81.010	881.410	--	unknown	0.063	0.066	0.041	32.000	0.000
81.297	882.090	N9	1c,2t,4c-trimethylcyclohexane	0.017	0.016	0.011	275.000	135.000
81.665	882.960	N9	1,1,2-trimethylcyclohexane	0.028	0.026	0.019	293.360	145.200
82.022	883.810	A8	1,2-dimethylbenzene	1.577	1.324	1.237	291.974	144.430
82.558	885.060	I9	I9-[4]	0.027	0.027	0.017	32.000	0.000
82.922	885.910	I9	I9-[5]	0.100	0.101	0.065	32.000	0.000
83.654	887.600	N9	N9-[3]	0.085	0.081	0.056	32.000	0.000
83.922	888.210	N9	N9-[4]	0.106	0.100	0.070	32.000	0.000
84.048	888.500	--	unknown	0.038	0.040	0.025	32.000	0.000
84.607	889.780	I9	I9-[6]	0.064	0.065	0.041	32.000	0.000
85.012	890.700	N9	N9-[5]	0.150	0.142	0.099	32.000	0.000
85.552	891.910	I9	I9-[7]	0.016	0.016	0.010	32.000	0.000
86.005	892.930	N9	i-butylcyclopentane	0.031	0.030	0.021	298.346	147.970
86.217	893.400	N9	N9-[6]	0.021	0.020	0.014	32.000	0.000
87.053	895.250	--	unknown	0.001	0.001	0.001	32.000	0.000
87.443	896.110	N9	N9-[7]	0.014	0.014	0.010	32.000	0.000
87.736	896.750	N9	N9-[8]	0.008	0.008	0.005	32.000	0.000
88.031	897.390	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.250	897.870	O9	t-nonene-3	0.020	0.020	0.013	32.000	0.000
88.666	898.770	I9	I9-[8]	0.122	0.124	0.079	32.000	0.000
88.834	899.130	--	unknown	0.021	0.022	0.014	32.000	0.000

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Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
89.235	900.000	P9	n-nonane	0.368	0.379	0.239	303.476	150.820
89.596	901.740	N9	1,1-methylethylcyclohexane	0.088	0.081	0.058	305.924	152.180
90.170	904.510	N9	N9-[9]	0.009	0.009	0.006	32.000	0.000
90.420	905.720	N9	N9-[10]	0.026	0.024	0.017	32.000	0.000
90.704	907.070	O10	t-2,2,5,5-tetramethylhexene-3	0.004	0.005	0.003	32.000	0.000
90.815	907.610	--	unknown	0.002	0.002	0.001	32.000	0.000
91.153	909.210	--	unknown	0.000	0.000	0.000	32.000	0.000
91.584	911.260	N9	N9-[11]	0.006	0.006	0.004	32.000	0.000
92.007	913.250	A9	i-propylbenzene	0.062	0.053	0.043	306.338	152.410
92.375	914.980	O9	c-nonene-3	0.071	0.077	0.047	32.000	0.000
92.520	915.660	--	unknown	0.018	0.019	0.012	32.000	0.000
92.950	917.670	I10	I10-[1]	0.014	0.014	0.008	32.000	0.000
93.034	918.050	N9	i-propylcyclohexane	0.019	0.018	0.013	310.622	154.790
93.174	918.710	--	unknown	0.006	0.006	0.004	32.000	0.000
93.770	921.460	I10	I10-[2]	0.107	0.108	0.063	32.000	0.000
94.167	923.290	I10	2,2-dimethyloctane	0.034	0.035	0.020	314.420	156.900
94.442	924.550	I10	2,4-dimethyloctane	0.051	0.052	0.030	312.620	155.900
94.875	926.530	N9	N9-[12]	0.007	0.006	0.004	32.000	0.000
95.307	928.490	N9	N9-[13]	0.022	0.021	0.015	32.000	0.000
95.915	931.230	I10	2,6-dimethyloctane	0.086	0.088	0.050	320.738	160.410
96.272	932.840	I10	2,5-dimethyloctane	0.078	0.079	0.046	317.300	158.500
96.535	934.010	--	unknown	0.003	0.003	0.002	32.000	0.000
97.128	936.650	N9	n-butylcyclopentane	0.058	0.055	0.038	313.916	156.620
97.341	937.600	I10	I10-[3]	0.031	0.031	0.018	32.000	0.000
97.490	938.260	N10	N10-[1]	0.036	0.033	0.021	32.000	0.000
97.755	939.430	--	unknown	0.005	0.006	0.003	32.000	0.000
98.001	940.510	I10	I10-[4]	0.021	0.021	0.012	32.000	0.000
98.459	942.520	I10	3,3-dimethyloctane	0.138	0.138	0.081	322.160	161.200
98.772	943.890	N10	N10-[2]	0.023	0.022	0.014	32.000	0.000
98.984	944.810	--	unknown	0.019	0.020	0.011	32.000	0.000
99.154	945.550	--	unknown	0.024	0.026	0.014	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
99.548	947.250	A9	n-propylbenzene	0.349	0.299	0.242	318.632	159.240
99.844	948.530	I10	3,6-dimethyloctane	0.026	0.026	0.015	321.440	160.800
100.098	949.630	I10	3-methyl-5-ethylheptane	0.047	0.047	0.027	316.760	158.200
100.261	950.330	--	unknown	0.005	0.006	0.003	32.000	0.000
100.566	951.630	N10	N10-[3]	0.028	0.025	0.016	32.000	0.000
101.192	954.300	--	unknown	0.024	0.025	0.014	32.000	0.000
101.493	955.580	A9	1,3-methylethylbenzene	1.234	1.055	0.855	322.394	161.330
101.885	957.240	A9	1,4-methylethylbenzene	0.529	0.454	0.367	323.618	162.010
102.195	958.540	N10	N10-[4]	0.030	0.027	0.018	32.000	0.000
102.358	959.230	--	unknown	0.003	0.003	0.002	32.000	0.000
102.765	960.930	--	unknown	0.002	0.002	0.001	32.000	0.000
102.947	961.690	--	unknown	0.010	0.011	0.027	32.000	0.000
103.229	962.870	A9	1,3,5-trimethylbenzene	0.657	0.561	0.455	328.532	164.740
103.494	963.970	I10	I10-[5]	0.041	0.041	0.024	32.000	0.000
103.763	965.080	N10	N10-[5]	0.018	0.017	0.011	32.000	0.000
103.954	965.870	--	unknown	0.006	0.006	0.003	32.000	0.000
104.191	966.850	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.507	968.150	I10	5-methylnonane	0.051	0.052	0.030	329.180	165.100
104.912	969.810	I10	4-methylnonane	0.420	0.420	0.246	32.000	0.000
105.256	971.210	A9	1,2-methylethylbenzene	0.392	0.329	0.271	329.324	165.180
105.442	971.970	I10	2-methylnonane	0.120	0.122	0.070	332.654	167.030
105.569	972.480	--	unknown	0.013	0.013	0.007	32.000	0.000
105.864	973.680	--	unknown	0.011	0.012	0.007	32.000	0.000
106.096	974.620	I10	3-ethyloctane	0.026	0.025	0.015	331.700	166.500
106.175	974.940	--	unknown	0.014	0.015	0.008	32.000	0.000
106.467	976.120	N10	N10-[6]	0.023	0.021	0.014	32.000	0.000
106.799	977.450	I10	3-methylnonane	0.146	0.147	0.085	334.040	167.800
106.975	978.160	--	unknown	0.008	0.009	0.005	32.000	0.000
107.357	979.680	N10	N10-[7]	0.003	0.002	0.002	32.000	0.000
107.540	980.410	I10	I10-[7]	0.094	0.094	0.055	32.000	0.000
107.814	981.500	I10	I10-[8]	0.008	0.008	0.005	32.000	0.000

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Hold

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Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
108.101	982.640	--	unknown	0.010	0.011	0.006	32.000	0.000
108.556	984.440	A9	1,2,4-trimethylbenzene	1.912	1.614	1.326	336.884	169.380
108.794	985.380	--	unknown	0.007	0.007	0.005	32.000	0.000
108.962	986.040	I10	I10-[9]	0.010	0.010	0.006	32.000	0.000
109.077	986.490	N10	i-butylcyclohexane	0.035	0.032	0.021	340.340	171.300
109.270	987.240	--	unknown	0.025	0.026	0.015	32.000	0.000
109.385	987.700	I10	I10-[10]	0.046	0.046	0.027	32.000	0.000
109.665	988.790	I10	I10-[11]	0.018	0.018	0.011	32.000	0.000
109.806	989.340	I10	I10-[12]	0.012	0.012	0.007	32.000	0.000
110.154	990.690	N10	N10-[8]	0.022	0.020	0.013	32.000	0.000
110.289	991.210	--	unknown	0.003	0.003	0.002	32.000	0.000
110.777	993.100	O10	decene-1	0.002	0.002	0.001	339.080	170.600
110.930	993.690	N10	1t-methyl-2-n-propylcyclohexane	0.012	0.011	0.007	339.800	171.000
111.054	994.170	O10	2,3-dimethyloctene-2	0.060	0.060	0.036	32.000	0.000
111.162	994.580	I10	I10-[13]	0.015	0.015	0.009	32.000	0.000
111.464	995.740	A10	i-butylbenzene	0.003	0.003	0.002	343.022	172.790
111.604	996.280	I10	I10-[14]	0.054	0.054	0.031	32.000	0.000
111.839	997.180	--	unknown	0.037	0.039	0.022	32.000	0.000
112.118	998.240	A10	sec-butylbenzene	0.035	0.030	0.022	344.012	173.340
112.366	999.190	--	unknown	0.008	0.009	0.005	32.000	0.000
112.579	1000.000	P10	n-decane	0.193	0.195	0.113	345.470	174.150
112.821	1001.530	I11	I11-[1]	0.027	0.027	0.014	32.000	0.000
113.178	1003.780	N10	N10-[9]	0.016	0.015	0.010	32.000	0.000
113.619	1006.550	--	unknown	0.006	0.006	0.004	32.000	0.000
113.822	1007.820	A9	1,2,3-trimethylbenzene	0.371	0.307	0.257	349.016	176.120
113.976	1008.780	--	unknown	0.009	0.009	0.006	32.000	0.000
114.269	1010.610	A10	1,3-methyl-i-propylbenzene	0.041	0.035	0.025	347.144	175.080
114.700	1013.290	--	unknown	0.009	0.009	0.023	32.000	0.000
114.830	1014.100	A10	1,4-methyl-i-propylbenzene	0.024	0.021	0.015	350.834	177.130
114.982	1015.040	--	unknown	0.003	0.003	0.002	32.000	0.000
115.298	1016.990	I11	I11-[2]	0.025	0.025	0.014	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
115.567	1018.650	I11	I11-[3]	0.012	0.012	0.006	32.000	0.000
115.861	1020.460	A10	2-3-dihydroindene	0.259	0.199	0.183	352.130	177.850
116.228	1022.710	--	unknown	0.018	0.019	0.013	32.000	0.000
116.472	1024.200	N10	sec-butylcyclohexane	0.040	0.036	0.024	354.812	179.340
116.706	1025.630	I11	I11-[4]	0.008	0.008	0.004	32.000	0.000
117.055	1027.750	A10	1,2-methyl-i-propylbenzene	0.068	0.058	0.042	352.724	178.180
117.181	1028.520	I11	3-ethylnonane	0.006	0.006	0.003	32.000	0.000
117.322	1029.370	--	unknown	0.003	0.003	0.002	32.000	0.000
117.624	1031.200	--	unknown	0.063	0.066	0.034	32.000	0.000
117.850	1032.560	N11	N11-[1]	0.024	0.022	0.013	32.000	0.000
117.904	1032.890	--	unknown	0.020	0.021	0.011	32.000	0.000
118.089	1034.000	I11	I11-[5]	0.016	0.016	0.008	32.000	0.000
118.244	1034.930	--	unknown	0.002	0.002	0.001	32.000	0.000
118.599	1037.070	I11	I11-[6]	0.029	0.027	0.016	32.000	0.000
118.767	1038.070	--	unknown	0.032	0.034	0.017	32.000	0.000
119.208	1040.700	A10	1,3-diethylbenzene	0.131	0.112	0.081	358.052	181.140
119.409	1041.900	--	unknown	0.060	0.064	0.038	32.000	0.000
119.657	1043.370	A10	1,3-methyl-n-propylbenzene	0.270	0.232	0.167	359.618	182.010
119.830	1044.400	I11	I11-[7]	0.020	0.020	0.011	32.000	0.000
120.120	1046.120	A10	1,4-diethylbenzene	0.011	0.010	0.007	362.822	183.790
120.294	1047.140	A10	1,4-methyl-n-propylbenzene	0.166	0.143	0.103	362.156	183.420
120.468	1048.170	A10	n-butylbenzene	0.080	0.069	0.050	361.940	183.300
120.878	1050.580	A10	1,3-dimethyl-5-ethylbenzene	0.281	0.236	0.174	362.516	183.620
121.201	1052.480	A10	1,2-diethylbenzene	0.030	0.025	0.018	362.228	183.460
121.344	1053.310	I11	I11-[8]	0.017	0.017	0.009	32.000	0.000
121.572	1054.640	N10	t-decahydronaphthalene	0.008	0.008	0.004	368.960	187.200
121.823	1056.110	N11	N11-[2]	0.016	0.014	0.008	32.000	0.000
122.074	1057.570	--	unknown	0.011	0.012	0.006	32.000	0.000
122.246	1058.560	A10	1,2-methyl-n-propylbenzene	0.092	0.078	0.057	364.946	184.970
122.634	1060.810	I11	I11-[9]	0.011	0.011	0.006	32.000	0.000
122.750	1061.480	I11	I11-[10]	0.067	0.067	0.036	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
122.959	1062.690	I11	I11-[11]	0.036	0.036	0.019	32.000	0.000
123.051	1063.220	--	unknown	0.008	0.009	0.004	32.000	0.000
123.251	1064.370	--	unknown	0.003	0.003	0.002	32.000	0.000
123.473	1065.650	I11	I11-[12]	0.044	0.044	0.024	32.000	0.000
123.726	1067.100	--	unknown	0.008	0.009	0.004	32.000	0.000
124.016	1068.760	A10	1,4,dimethyl-2-ethylbenzene	0.204	0.171	0.126	368.366	186.870
124.288	1070.310	A10	1,3-dimethyl-4-ethylbenzene	0.255	0.219	0.158	370.832	188.240
124.558	1071.850	I11	I11-[13]	0.003	0.003	0.002	32.000	0.000
124.861	1073.570	--	unknown	0.007	0.008	0.004	32.000	0.000
125.119	1075.030	I11	I11-[14]	0.138	0.138	0.074	32.000	0.000
125.286	1075.980	A10	1,2-dimethyl-4-ethylbenzene	0.281	0.237	0.174	373.136	189.520
125.599	1077.750	--	unknown	0.008	0.008	0.005	32.000	0.000
125.886	1079.360	--	unknown	0.012	0.012	0.007	32.000	0.000
125.978	1079.880	I11	I11-[15]	0.004	0.004	0.002	32.000	0.000
126.261	1081.470	A10	1,3-dimethyl-2-ethylbenzene	0.046	0.039	0.029	374.090	190.050
126.413	1082.320	I11	I11-[16]	0.017	0.017	0.009	32.000	0.000
126.744	1084.170	--	unknown	0.016	0.017	0.009	32.000	0.000
126.943	1085.280	I11	I11-[17]	0.008	0.008	0.004	32.000	0.000
127.173	1086.560	--	unknown	0.014	0.015	0.008	32.000	0.000
127.515	1088.470	--	unknown	0.008	0.008	0.004	32.000	0.000
127.583	1088.840	--	unknown	0.011	0.011	0.006	32.000	0.000
127.856	1090.360	O11	undecene-1	0.019	0.019	0.010	378.860	192.700
128.192	1092.210	A11	1,4-methyl-t-butylbenzene	0.035	0.030	0.020	32.000	0.000
128.467	1093.720	A10	1,2-dimethyl-3-ethylbenzene	0.077	0.064	0.048	381.110	193.950
128.811	1095.620	--	unknown	0.006	0.007	0.004	32.000	0.000
129.087	1097.130	--	unknown	0.013	0.013	0.008	32.000	0.000
129.164	1097.550	A11	1,2-ethyl-i-propylbenzene	0.008	0.007	0.005	32.000	0.000
129.332	1098.480	--	unknown	0.006	0.006	0.003	32.000	0.000
129.611	1100.000	P11	n-undecane	0.102	0.102	0.055	384.620	195.900
129.808	1101.470	--	unknown	0.007	0.007	0.004	32.000	0.000
129.922	1102.330	A11	1,4-ethyl-i-propylbenzene	0.002	0.002	0.001	32.000	0.000

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Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
130.342	1105.470	A10	1,2,4,5-tetramethylbenzene	0.162	0.135	0.100	386.312	196.840
130.705	1108.170	A11	1,2-methyl-n-butylbenzene	0.007	0.006	0.004	390.200	199.000
130.882	1109.490	A10	1,2,3,5-tetramethylbenzene	0.219	0.181	0.136	388.472	198.040
131.030	1110.590	--	unknown	0.006	0.006	0.004	32.000	0.000
131.374	1113.140	--	unknown	0.011	0.012	0.007	32.000	0.000
131.568	1114.570	--	unknown	0.007	0.007	0.004	32.000	0.000
131.876	1116.850	--	unknown	0.020	0.021	0.012	32.000	0.000
132.318	1120.090	--	unknown	0.013	0.014	0.008	32.000	0.000
132.475	1121.250	--	unknown	0.014	0.015	0.009	32.000	0.000
132.957	1124.780	A11	1,2-methyl-t-butylbenzene	0.005	0.004	0.003	32.000	0.000
133.115	1125.930	--	unknown	0.012	0.012	0.007	32.000	0.000
133.427	1128.210	A10	5-methylindan	0.192	0.159	0.121	32.000	0.000
133.772	1130.710	I12	I12-[1]	0.046	0.045	0.023	421.340	216.300
134.177	1133.650	--	unknown	0.007	0.007	0.003	32.000	0.000
134.295	1134.500	A10	4-methylindan	0.047	0.039	0.030	32.000	0.000
134.567	1136.470	--	unknown	0.012	0.012	0.007	32.000	0.000
134.673	1137.230	A11	1,2-ethyl-n-propylbenzene	0.054	0.045	0.030	32.000	0.000
134.925	1139.040	A10	2-methylindan	0.184	0.150	0.116	368.600	187.000
135.135	1140.560	A11	1,3-methyl-n-butylbenzene	0.009	0.007	0.005	390.200	199.000
135.392	1142.400	--	unknown	0.006	0.006	0.003	32.000	0.000
135.542	1143.470	A12	1,3-di-i-propylbenzene	0.062	0.051	0.032	397.760	203.200
135.752	1144.980	A11	s-pentylbenzene	0.058	0.048	0.033	401.000	205.000
136.342	1149.190	--	unknown	0.018	0.019	0.010	32.000	0.000
136.439	1149.870	A11	n-pentylbenzene	0.046	0.038	0.026	401.720	205.400
136.518	1150.440	--	unknown	0.021	0.022	0.012	32.000	0.000
136.795	1152.410	N12	1t-M-2-(4-MP)cyclopentane	0.004	0.004	0.002	32.000	0.000
136.994	1153.820	A12	1,2-di-i-propylbenzene	0.027	0.022	0.014	399.200	204.000
137.141	1154.860	--	unknown	0.026	0.027	0.013	32.000	0.000
137.625	1158.270	--	unknown	0.038	0.040	0.020	32.000	0.000
137.899	1160.200	A12	1,4-di-i-propylbenzene	0.047	0.039	0.024	410.540	210.300
138.176	1162.150	--	unknown	0.007	0.007	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
Processed 631 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
138.347	1163.350	A10	tetrahydronaphthalene	0.017	0.013	0.011	405.716	207.620
138.492	1164.360	--	unknown	0.007	0.007	0.004	32.000	0.000
138.740	1166.100	--	unknown	0.004	0.004	0.003	32.000	0.000
138.886	1167.110	I12	I12-[2]	0.051	0.050	0.025	421.340	216.300
139.180	1169.170	A10	naphthalene	0.158	0.114	0.103	424.382	217.990
139.505	1171.430	A12	1-t-butyl-3,5-dimethylbenzene	0.003	0.003	0.002	32.000	0.000
139.846	1173.800	A12	1,4-ethyl-t-butylbenzene	0.071	0.059	0.037	32.000	0.000
140.250	1176.590	--	unknown	0.025	0.027	0.013	32.000	0.000
140.541	1178.600	I12	I12-[3]	0.053	0.052	0.026	421.340	216.300
140.773	1180.190	I12	I12-[4]	0.030	0.030	0.015	421.340	216.300
141.121	1182.590	--	unknown	0.006	0.006	0.003	32.000	0.000
141.349	1184.150	I12	I12-[5]	0.031	0.030	0.015	421.340	216.300
141.602	1185.880	--	unknown	0.011	0.011	0.005	32.000	0.000
141.895	1187.890	I12	I12-[6]	0.032	0.032	0.016	421.340	216.300
142.094	1189.240	A12	1,3-di-n-propylbenzene	0.038	0.031	0.019	32.000	0.000
142.333	1190.870	A12	A12-[1]	0.023	0.019	0.012	32.000	0.000
142.552	1192.360	O12	dodecene-1	0.005	0.005	0.003	416.120	213.400
142.912	1194.800	--	unknown	0.006	0.007	0.003	32.000	0.000
143.253	1197.110	--	unknown	0.004	0.004	0.002	32.000	0.000
143.553	1199.140	A12	A12-[2]	0.019	0.016	0.010	32.000	0.000
143.681	1200.000	P12	n-dodecane	0.043	0.042	0.021	421.340	216.300
143.945	1202.220	--	unknown	0.003	0.003	0.001	32.000	0.000
144.227	1204.590	--	unknown	0.011	0.012	0.005	32.000	0.000
144.303	1205.230	--	unknown	0.004	0.005	0.002	32.000	0.000
144.762	1209.070	--	unknown	0.011	0.011	0.005	32.000	0.000
144.986	1210.950	--	unknown	0.005	0.006	0.003	32.000	0.000
145.185	1212.610	A12	1,3,5-triethylbenzene	0.003	0.002	0.002	420.800	216.000
145.373	1214.170	--	unknown	0.007	0.007	0.003	32.000	0.000
145.715	1217.020	--	unknown	0.021	0.022	0.011	32.000	0.000
145.888	1218.450	--	unknown	0.012	0.013	0.006	32.000	0.000
146.206	1221.090	--	unknown	0.003	0.003	0.001	32.000	0.000

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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
146.496	1223.490	--	unknown	0.017	0.018	0.009	32.000	0.000
146.738	1225.490	--	unknown	0.016	0.017	0.008	32.000	0.000
146.814	1226.120	--	unknown	0.007	0.007	0.003	32.000	0.000
147.120	1228.630	--	unknown	0.004	0.005	0.002	32.000	0.000
147.195	1229.250	--	unknown	0.012	0.012	0.006	32.000	0.000
147.506	1231.800	A12	1,2,4-triethylbenzene	0.013	0.011	0.006	423.500	217.500
147.727	1233.620	--	unknown	0.005	0.005	0.002	32.000	0.000
148.079	1236.490	--	unknown	0.003	0.003	0.002	32.000	0.000
148.235	1237.770	--	unknown	0.011	0.012	0.006	32.000	0.000
148.464	1239.640	--	unknown	0.001	0.001	0.001	32.000	0.000
148.801	1242.370	A12	1,4-methyl-n-pentylbenzene	0.034	0.028	0.017	32.000	0.000
149.085	1244.690	--	unknown	0.009	0.009	0.004	32.000	0.000
149.239	1245.930	--	unknown	0.003	0.004	0.002	32.000	0.000
149.378	1247.060	--	unknown	0.003	0.003	0.001	32.000	0.000
149.666	1249.390	--	unknown	0.004	0.004	0.002	32.000	0.000
149.950	1251.680	--	unknown	0.006	0.006	0.003	32.000	0.000
150.147	1253.270	--	unknown	0.007	0.008	0.004	32.000	0.000
150.532	1256.360	A12	n-hexylbenzene	0.019	0.015	0.010	32.000	0.000
150.622	1257.080	--	unknown	0.019	0.020	0.010	32.000	0.000
150.995	1260.070	--	unknown	0.011	0.011	0.005	32.000	0.000
151.253	1262.140	--	unknown	0.004	0.005	0.002	32.000	0.000
151.499	1264.100	--	unknown	0.004	0.005	0.002	32.000	0.000
151.658	1265.370	--	unknown	0.003	0.003	0.002	32.000	0.000
151.875	1267.100	--	unknown	0.006	0.006	0.003	32.000	0.000
151.917	1267.430	--	unknown	0.008	0.008	0.004	32.000	0.000
152.207	1269.730	--	unknown	0.010	0.011	0.005	32.000	0.000
152.636	1273.140	I13	I13-[1]	0.008	0.007	0.003	455.720	235.400
152.825	1274.630	A11	1,2,3,4,5-pentamethylbenzene	0.022	0.016	0.012	449.600	232.000
153.056	1276.450	--	unknown	0.008	0.009	0.005	32.000	0.000
153.570	1280.500	--	unknown	0.006	0.006	0.003	32.000	0.000
153.923	1283.270	A11	2-methylnaphthalene	0.088	0.064	0.051	465.890	241.050

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 9:32:01 PM

RawFile: D:\1\DATA\D6730OCT3020\105F0501.D\105F0501.CDF Acquired: 10/31/20 09:28:00
Sample: ODDB:54928 Analyzed: 11/2/2020 9:31:07 PM
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Comments: Normalized to 100.000%

Hold

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
154.411	1287.100	--	unknown	0.009	0.010	0.005	32.000	0.000
154.561	1288.270	--	unknown	0.002	0.002	0.001	32.000	0.000
154.701	1289.360	--	unknown	0.003	0.003	0.001	32.000	0.000
154.905	1290.960	O13	tridecene-1	0.007	0.007	0.003	451.040	232.800
155.340	1294.340	--	unknown	0.001	0.002	0.001	32.000	0.000
155.502	1295.590	--	unknown	0.003	0.003	0.001	32.000	0.000
155.590	1296.280	--	unknown	0.001	0.001	0.001	32.000	0.000
155.874	1298.480	A11	1-methylnaphthalene	0.035	0.025	0.020	472.352	244.640
156.070	1300.000	P13	n-tridecane	0.009	0.009	0.004	455.720	235.400
156.188	1301.060	+	C14+ (Summarized)	0.355	0.344	0.149	455.720	235.400

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 9:50:28 PM

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF
Acquired: 10/31/20 12:48:52
Sample: ODDB:54929
Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.413	8.344	7.211
I-Paraffins:	37.157	40.572	31.921
Olefins:	3.894	4.201	3.985
Naphthenes:	11.454	11.097	9.648
Aromatics:	21.911	18.549	16.725
Total C14+:	0.365	0.354	0.153
Total Unknowns:	1.671	1.765	1.154

Oxygenates:

Total: 16.136(Mass%) 15.119(Vol%)

Total Oxygen Content: 5.604(Mass%)

Multisubstituted Aromatics: 13.921(Mass%) 11.817(Vol%)

Average Molecular Weight: 83.376

Relative Density: 0.739

Vapor Pressure :

Calculated Octane Number: 86.7

Motor Octane Number (Jenkins Calculation): 78.7

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	197.33	329.32	465.89
BP by Vol (Deg F)	31.10	173.30	197.33	329.32	449.60

Percent Carbon: 82.922
Percent Hydrogen: 11.474

Bromine Number (Calc): 7.275
Particulate Matter Index: 1.113

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:50:37 PM

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF
Sample: ODDB:54929
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha

Acquired: 10/31/20 12:48:52
Analyzed: 11/2/2020 9:49:30 PM

Comments:

Normalized to xxx%
Int Std: NONE
Int Std Amt: 0.000
Sample Wt: 1.000 Sample Den: 1.000

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	16.136	5.604	15.119

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:50:37 PM

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF
Acquired: 10/31/20 12:48:52
Sample: ODDB:54929
Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.0000
Sample Wt: 1.0000 Sample Den: 1.000

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.001	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.468	0.096	0.044	0.000	0.000	0.001	0.610
C5	2.357	6.569	1.628	0.322	0.000	0.001	10.877
C6	1.781	7.433	1.132	3.087	0.681	0.041	14.155
C7	1.303	8.110	0.732	3.696	4.455	0.007	18.303
C8	0.783	9.310	0.068	2.696	7.154	0.191	20.201
C9	0.367	3.187	0.192	1.305	5.517	0.182	10.750
C10	0.194	1.697	0.066	0.300	3.374	0.262	5.894
C11	0.104	0.498	0.020	0.043	0.365	0.371	1.401
C12	0.045	0.249	0.006	0.004	0.365	0.315	0.984
C13	0.009	0.008	0.006	0.000	0.000	0.300	0.323
Total:	7.413	37.157	3.894	11.454	21.911	1.671	81.828

Oxygenates	16.136	Total C14+:	0.365
Total Unknowns:	1.671	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.598	0.128	0.054	0.000	0.000	0.001	0.780
C5	2.782	7.838	1.822	0.320	0.000	0.001	12.763
C6	1.997	8.357	1.190	3.019	0.573	0.044	15.179
C7	1.409	8.752	0.763	3.616	3.799	0.007	18.346
C8	0.824	9.767	0.069	2.586	6.096	0.202	19.544
C9	0.378	3.276	0.204	1.236	4.682	0.193	9.968
C10	0.197	1.707	0.067	0.277	2.806	0.277	5.331
C11	0.103	0.495	0.020	0.040	0.289	0.392	1.339
C12	0.044	0.244	0.006	0.004	0.303	0.332	0.934
C13	0.009	0.008	0.006	0.000	0.000	0.316	0.339
Total:	8.344	40.572	4.201	11.097	18.549	1.765	82.762

Oxygenates	15.119	Total C14+:	0.354
Total Unknowns:	1.765	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 9:50:37 PM

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF
Acquired: 10/31/20 12:48:52
Sample: ODDB:54929
Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.0000
Sample Wt: 1.0000 Sample Den: 1.000

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.671	0.138	0.066	0.000	0.000	0.001	0.877
C5	2.723	7.591	1.939	0.383	0.000	0.001	12.638
C6	1.723	7.192	1.127	3.058	0.727	0.107	13.933
C7	1.084	6.748	0.620	3.139	4.031	0.007	15.629
C8	0.571	6.795	0.050	2.003	5.618	0.144	15.182
C9	0.239	2.072	0.127	0.862	3.827	0.154	7.279
C10	0.114	0.994	0.040	0.178	2.127	0.179	3.632
C11	0.055	0.266	0.011	0.023	0.208	0.232	0.795
C12	0.022	0.122	0.003	0.002	0.188	0.176	0.512
C13	0.004	0.004	0.003	0.000	0.000	0.154	0.165
Total:	7.211	31.921	3.985	9.648	16.725	1.154	69.491

Oxygenates	29.202	Total C14+:	0.153	
Total Unknowns:	1.154	Grand Total:	100.000	

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 9:50:37 PM

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
8.985	394.970	O4	1,3-butadiene	0.000	0.000	0.000
13.021	481.250	O5	1,4-pentadiene	0.001	0.001	0.001
14.850	506.140	O5	2-methylbutadiene-1,3	0.007	0.007	0.008
16.188	527.980	O5	1t,3-pentadiene	0.007	0.008	0.009
16.887	538.230	O5	cyclopentadiene	0.005	0.006	0.006
20.389	581.020	O6	1,5-hexadiene	0.000	0.000	0.000
21.990	597.110	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.276	632.970	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002
25.838	638.610	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007
28.355	661.980	O6	diolefin (hexadiene)	0.003	0.003	0.003
30.175	677.270	O7	1,6-heptadiene	0.000	0.000	0.000
36.539	720.940	N8	1,1,3-trimethylcyclopentane	0.169	0.167	0.126

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.436	100.000	P1	methane	0.000	0.000	0.000	-258.700	-161.500
6.550	180.040	O2	ethylene	0.000	0.000	0.000	-154.624	-103.680
6.622	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.116	293.470	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.178	300.000	P3	propane	0.001	0.002	0.003	-43.672	-42.040
8.193	366.110	I4	i-butane	0.096	0.128	0.138	10.904	-11.720
8.344	372.510	--	unknown	0.000	0.000	0.001	32.000	0.000
8.710	386.090	--	unknown	0.000	0.000	0.000	32.000	0.000
8.828	390.030	O4	butene-1	0.002	0.002	0.003	20.750	-6.250
8.880	391.700	O4	isobutylene	0.003	0.004	0.005	20.750	-6.250
8.985	394.970	O4	1,3-butadiene	0.000	0.000	0.000	24.062	-4.410
9.155	400.000	P4	n-butane	0.468	0.598	0.671	31.100	-0.500
9.546	412.300	O4	t-butene-2	0.017	0.021	0.025	33.584	0.880
9.643	415.120	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.863	421.210	--	unknown	0.001	0.001	0.001	32.000	0.000
10.132	428.130	O4	c-butene-2	0.023	0.027	0.034	38.696	3.720
11.744	461.400	X2	ethanol	16.136	15.119	29.202	173.300	78.500
12.772	477.700	I5	i-pentane	6.566	7.834	7.587	82.112	27.840
13.021	481.250	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.748	490.890	O5	pentene-1	0.115	0.133	0.137	85.928	29.960
14.223	496.700	O5	2-methylbutene-1	0.267	0.304	0.318	88.070	31.150
14.507	500.000	P5	n-pentane	2.357	2.782	2.723	96.908	36.060
14.850	506.140	O5	2-methylbutadiene-1,3	0.007	0.007	0.008	93.308	34.060
15.097	510.430	O5	t-pentene-2	0.349	0.398	0.414	97.412	36.340
15.468	516.630	O5	3,3-dimethylbutene-1	0.005	0.005	0.006	106.232	41.240
15.637	519.380	O5	c-pentene-2	0.194	0.218	0.230	98.474	36.930
15.795	521.900	--	unknown	0.000	0.000	0.001	32.000	0.000
15.975	524.710	O5	2-methylbutene-2	0.583	0.651	0.693	101.408	38.560
16.188	527.980	O5	1t,3-pentadiene	0.007	0.008	0.009	107.636	42.020
16.308	529.790	--	unknown	0.001	0.001	0.001	32.000	0.000
16.887	538.230	O5	cyclopentadiene	0.005	0.006	0.006	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
17.015	540.040	I6	2,2-dimethylbutane	0.418	0.477	0.405	121.514	49.730
18.314	557.180	O5	cyclopentene	0.095	0.091	0.117	111.614	44.230
18.681	561.680	O6	4-methylpentene-1	0.022	0.025	0.022	128.948	53.860
18.749	562.500	O6	3-methylpentene-1	0.037	0.041	0.036	129.506	54.170
19.106	566.730	N5	cyclopentane	0.322	0.320	0.383	120.650	49.250
19.292	568.890	I6	2,3-dimethylbutane	1.274	1.424	1.233	136.364	57.980
19.448	570.680	--	unknown	0.040	0.043	0.105	32.000	0.000
19.567	572.030	O6	2,3-dimethylbutene-1	0.018	0.020	0.018	132.098	55.610
19.704	573.560	I6	2-methylpentane	3.537	4.004	3.422	140.468	60.260
19.837	575.040	O6	4-methyl-t-pentene-2	0.064	0.071	0.064	137.480	58.600
19.915	575.900	--	unknown	0.000	0.000	0.000	32.000	0.000
20.389	581.020	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.810	585.410	I6	3-methylpentane	2.204	2.452	2.132	145.886	63.270
21.263	590.010	O6	2-methylpentene-1	0.107	0.116	0.106	143.780	62.100
21.353	590.910	O6	hexene-1	0.046	0.050	0.045	146.246	63.470
21.990	597.110	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.297	600.000	P6	n-hexane	1.781	1.997	1.723	155.714	68.730
22.523	602.710	O6	t-hexene-3	0.070	0.076	0.069	152.744	67.080
22.589	603.500	O6	c-hexene-3	0.023	0.025	0.023	151.592	66.440
22.741	605.290	O6	t-hexene-2	0.137	0.148	0.135	154.184	67.880
22.826	606.280	--	unknown	0.001	0.001	0.001	32.000	0.000
22.945	607.660	O6	2-methylpentene-2	0.174	0.186	0.173	153.140	67.300
23.024	608.580	O6	4-methylcyclopentene	0.047	0.046	0.048	148.820	64.900
23.186	610.440	O6	3-methyl-c-pentene-2	0.106	0.112	0.105	153.842	67.690
23.309	611.850	O6	3-methylcyclopentene	0.025	0.025	0.026	149.000	65.000
23.418	613.080	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.549	614.550	O6	c-hexene-2	0.074	0.079	0.074	155.984	68.880
23.786	617.180	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.114	620.780	O7	3,3-dimethylpentene-1	0.163	0.172	0.139	171.446	77.470
24.247	622.210	--	unknown	0.001	0.001	0.002	32.000	0.000
24.310	622.880	O7	4,4-dimethyl-t-pentene-2	0.002	0.002	0.002	170.114	76.730

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
24.409	623.950	I7	2,2-dimethylpentane	0.097	0.107	0.081	174.542	79.190
24.624	626.230	N6	methylcyclopentane	2.307	2.278	2.285	161.240	71.800
25.036	630.510	I7	2,4-dimethylpentane	1.443	1.586	1.201	176.882	80.490
25.276	632.970	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002	32.000	0.000
25.458	634.810	I7	2,2,3-trimethylbutane	0.046	0.049	0.038	177.584	80.880
25.625	636.490	--	unknown	0.002	0.002	0.002	32.000	0.000
25.838	638.610	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007	32.000	0.000
26.175	641.910	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.287	642.990	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.659	646.540	O7	4,4-dimethyl-c-pentene-2	0.008	0.008	0.007	176.756	80.420
26.804	647.920	O7	2,4-dimethylpentene-1	0.008	0.008	0.007	178.880	81.600
26.906	648.870	O6	1-methylcyclopentene	0.177	0.167	0.179	167.864	75.480
27.105	650.730	A6	benzene	0.681	0.573	0.727	176.162	80.090
27.288	652.420	O7	2-methyl-c-hexene-3	0.004	0.004	0.003	186.800	86.000
27.503	654.390	I7	3,3-dimethylpentane	0.092	0.098	0.076	186.908	86.060
27.604	655.300	O7	5-methylhexene-1	0.010	0.010	0.008	185.558	85.310
27.796	657.030	--	unknown	0.004	0.004	0.003	32.000	0.000
27.930	658.220	N6	cyclohexane	0.780	0.741	0.773	177.296	80.720
28.225	660.840	O7	2-methyl-t-hexene-3	0.016	0.017	0.014	186.620	85.900
28.355	661.980	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.447	662.780	O7	2-ethyl-3-methylbutene-1	0.006	0.006	0.005	187.448	86.360
28.573	663.880	O7	4-methylhexene-1	0.013	0.014	0.011	188.114	86.730
28.887	666.570	O7	4-methyl-t/c-hexene-2	0.027	0.029	0.023	187.358	86.310
29.038	667.860	I7	2-methylhexane	1.879	2.047	1.563	194.090	90.050
29.202	669.250	I7	2,3-dimethylpentane	2.449	2.604	2.037	193.604	89.780
29.487	671.630	N7	1,1-dimethylcyclopentane	0.072	0.070	0.061	189.464	87.480
29.811	674.300	O7	5-methyl-t-hexene-2	0.022	0.023	0.019	190.598	88.110
30.022	676.030	I7	3-methylhexane	1.926	2.072	1.602	197.330	91.850
30.175	677.270	O7	1,6-heptadiene	0.000	0.000	0.000	205.106	96.170
30.454	679.500	O7	3,4-dimethyl-c-pentene-2	0.012	0.012	0.010	192.650	89.250
30.760	681.930	N7	1c,3-dimethylcyclopentane	0.656	0.651	0.557	195.386	90.770

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
31.113	684.700	N7	1t,3-dimethylcyclopentane	0.583	0.576	0.495	197.096	91.720
31.288	686.050	I7	3-ethylpentane	0.179	0.190	0.149	200.246	93.470
31.478	687.510	N7	1t,2-dimethylcyclopentane	0.570	0.561	0.484	197.366	91.870
31.658	688.880	I8	2,2,4-trimethylpentane	2.672	2.855	1.950	210.632	99.240
31.758	689.640	O7	2-ethylpentene-1	0.007	0.007	0.006	200.552	93.640
32.215	693.070	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.453	694.830	O7	3-methyl-c-hexene-3	0.021	0.021	0.017	203.720	95.400
32.989	698.740	O7	t-heptene-3	0.074	0.078	0.063	204.206	95.670
33.164	700.000	P7	n-heptane	1.303	1.409	1.084	209.156	98.420
33.349	701.210	O7	c-heptene-3	0.015	0.016	0.013	204.350	95.750
33.465	701.970	O7	2-methyl-2-hexene	0.063	0.065	0.053	203.738	95.410
33.619	702.970	O7	3-methyl-t-hexene-3	0.029	0.031	0.025	200.372	93.540
33.863	704.550	O7	t-heptene-2	0.029	0.030	0.025	208.310	97.950
34.093	706.010	O7	3-ethylpentene-2	0.020	0.020	0.017	204.818	96.010
34.582	709.100	O7	c-heptene-2	0.073	0.076	0.062	209.138	98.410
34.769	710.270	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.095	712.280	O7	2,3-dimethylpentene-2	0.031	0.031	0.026	207.320	97.400
35.329	713.710	O7	3-ethylcyclopentene	0.004	0.003	0.003	207.986	97.770
35.422	714.280	--	unknown	0.000	0.000	0.000	32.000	0.000
35.721	716.090	O7	O7-[3]	0.006	0.006	0.005	32.000	0.000
35.982	717.650	N7	1c,2-dimethylcyclopentane	0.254	0.256	0.215	211.154	99.530
36.112	718.420	N7	methylcyclohexane	1.237	1.188	1.050	213.674	100.930
36.431	720.310	I8	2,2-dimethylhexane	0.037	0.040	0.027	224.312	106.840
36.539	720.940	N8	1,1,3-trimethylcyclopentane	0.169	0.167	0.126	220.802	104.890
36.852	722.760	O7	O7-[4]	0.009	0.009	0.007	32.000	0.000
36.965	723.420	--	unknown	0.002	0.002	0.002	32.000	0.000
37.148	724.460	O7	O7-[5]	0.004	0.004	0.004	32.000	0.000
37.252	725.060	--	unknown	0.001	0.001	0.001	32.000	0.000
37.505	726.500	O7	O7-[6]	0.006	0.006	0.005	32.000	0.000
37.624	727.170	--	unknown	0.001	0.001	0.001	32.000	0.000
38.007	729.320	N7	ethylcyclopentane	0.324	0.313	0.276	218.246	103.470

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
38.131	730.020	I8	2,5-dimethylhexane	0.546	0.582	0.399	228.398	109.110
38.321	731.070	I8	2,2,3-trimethylpentane	0.105	0.109	0.077	229.730	109.850
38.468	731.880	I8	2,4-dimethylhexane	0.630	0.665	0.460	228.974	109.430
38.594	732.570	--	unknown	0.012	0.012	0.009	32.000	0.000
38.819	733.800	--	unknown	0.001	0.002	0.001	32.000	0.000
38.928	734.390	O7	O7-[7]	0.002	0.002	0.002	32.000	0.000
39.166	735.680	O7	O7-[8]	0.002	0.002	0.001	32.000	0.000
39.477	737.340	N8	1c,2t,4-trimethylcyclopentane	0.276	0.267	0.205	242.132	116.740
39.694	738.500	I8	3,3-dimethylhexane	0.054	0.057	0.040	233.546	111.970
40.180	741.050	O7	O7-[9]	0.003	0.003	0.003	32.000	0.000
40.488	742.650	O7	O7-[10]	0.002	0.002	0.001	32.000	0.000
40.623	743.350	O7	O7-[11]	0.004	0.004	0.003	32.000	0.000
40.842	744.470	N8	1t,2c,3-trimethylcyclopentane	0.201	0.193	0.149	230.738	110.410
41.378	747.190	I8	2,3,4-trimethylpentane	1.180	1.213	0.861	236.246	113.470
41.598	748.300	I8	I8-[1]	0.073	0.075	0.053	236.246	113.470
41.895	749.780	O7	O7-[12]	0.019	0.020	0.014	32.000	0.000
42.199	751.290	I8	2,3,3-trimethylpentane	1.113	1.133	0.812	238.586	114.770
42.624	753.370	A7	toluene	4.455	3.799	4.031	231.134	110.630
42.746	753.960	O8	O8-[1]	0.004	0.004	0.003	32.000	0.000
43.082	755.580	O8	O8-[2]	0.008	0.008	0.006	32.000	0.000
43.613	758.120	I8	2,3-dimethylhexane	0.497	0.516	0.363	240.098	115.610
43.742	758.730	I8	2-methyl-3-ethylpentane	0.091	0.095	0.066	240.098	115.610
44.092	760.370	N8	1,1,2-trimethylcyclopentane	0.010	0.009	0.007	236.714	113.730
44.535	762.430	O8	O8-[3]	0.026	0.027	0.020	32.000	0.000
44.938	764.290	I8	2-methylheptane	0.877	0.929	0.640	243.770	117.650
45.254	765.730	I8	4-methylheptane	0.334	0.351	0.244	243.878	117.710
45.515	766.910	I8	3-methyl-3-ethylpentane	0.068	0.070	0.049	240.098	115.610
45.624	767.400	I8	3,4-dimethylhexane	0.084	0.086	0.061	243.914	117.730
46.254	770.200	N8	1c,2c,4-trimethylcyclopentane	0.105	0.102	0.078	242.168	116.760
46.655	771.970	I8	3-methylheptane	0.838	0.878	0.612	246.074	118.930
46.927	773.160	--	unknown	0.172	0.181	0.125	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
47.012	773.530	N8	1c,2t,3-trimethylcyclopentane	0.394	0.378	0.293	243.500	117.500
47.179	774.250	I8	3-ethylhexane	0.109	0.113	0.080	245.372	118.540
47.450	775.420	N8	1t,4-dimethylcyclohexane	0.184	0.178	0.137	246.848	119.360
47.893	777.310	--	unknown	0.002	0.002	0.005	32.000	0.000
48.270	778.910	--	unknown	0.001	0.001	0.002	32.000	0.000
48.431	779.590	O8	O8-[4]	0.001	0.001	0.000	32.000	0.000
48.779	781.040	N8	1,1-dimethylcyclohexane	0.033	0.031	0.024	247.190	119.550
49.237	782.930	I9	2,2,5-trimethylhexane	0.596	0.623	0.387	255.362	124.090
49.666	784.690	N8	3c-ethylmethylcyclopentane	0.202	0.195	0.150	249.980	121.100
49.894	785.620	O9	2,6-dimethylheptene-1	0.002	0.002	0.002	32.000	0.000
50.214	786.910	N8	3t-ethylmethylcyclopentane	0.171	0.165	0.127	249.980	121.100
50.545	788.240	N8	2t-ethylmethylcyclopentane	0.156	0.150	0.116	250.160	121.200
50.997	790.030	O8	O8-[5]	0.006	0.006	0.005	32.000	0.000
51.130	790.560	N8	1,1-methylethylcyclopentane	0.021	0.020	0.015	250.754	121.530
51.819	793.250	N8	1t,2-dimethylcyclohexane	0.182	0.173	0.135	254.174	123.430
52.039	794.110	O8	t-octene-4	0.007	0.007	0.005	252.068	122.260
52.428	795.600	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.887	797.350	N8	1c,2c,3-trimethylcyclopentane	0.030	0.029	0.022	253.400	123.000
53.589	800.000	P8	n-octane	0.783	0.824	0.571	258.224	125.680
53.870	801.050	N8	1c,4-dimethylcyclohexane	0.254	0.240	0.188	255.794	124.330
54.742	804.280	O8	t-octene-2	0.008	0.008	0.006	32.000	0.000
54.965	805.100	--	unknown	0.005	0.005	0.012	32.000	0.000
55.341	806.470	I9	I9-[1]	0.037	0.037	0.024	32.000	0.000
55.439	806.830	--	unknown	0.016	0.017	0.010	32.000	0.000
55.831	808.240	N8	i-propylcyclopentane	0.080	0.076	0.060	259.574	126.430
56.495	810.620	--	unknown	0.003	0.004	0.009	32.000	0.000
57.029	812.500	--	unknown	0.008	0.009	0.022	32.000	0.000
57.130	812.850	O8	c-octene-2	0.005	0.005	0.003	32.000	0.000
57.705	814.850	N8	N8-[1]	0.013	0.013	0.010	32.000	0.000
58.071	816.120	O8	O8-[6]	0.002	0.002	0.002	32.000	0.000
58.453	817.430	I9	2,2,3,4-tetramethylpentane	0.119	0.119	0.077	271.454	133.030

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
59.093	819.600	I9	2,3,4-trimethylhexane	0.067	0.067	0.044	282.308	139.060
59.393	820.610	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.650	821.470	O9	O9-[1]	0.029	0.030	0.019	32.000	0.000
60.061	822.840	N8	N8-[3]	0.001	0.001	0.000	32.000	0.000
60.506	824.300	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.043	826.060	N8	1c,2-dimethylcyclohexane	0.178	0.165	0.132	265.532	129.740
61.238	826.690	--	unknown	0.022	0.024	0.017	32.000	0.000
61.637	827.980	I9	2,3,5-trimethylhexane	0.006	0.007	0.004	268.430	131.350
61.950	828.980	I9	2,2-dimethylheptane	0.013	0.013	0.008	270.860	132.700
62.840	831.810	N9	1,1,4-trimethylcyclohexane	0.320	0.306	0.211	275.000	135.000
63.404	833.570	I9	2,2,3-trimethylhexane	0.151	0.156	0.098	271.220	132.900
63.988	835.390	I9	2,4-dimethylheptane	0.032	0.033	0.021	271.220	132.900
64.729	837.660	I9	4,4-dimethylheptane	0.186	0.192	0.121	271.220	132.900
65.630	840.380	N8	n-propylcyclopentane	0.029	0.027	0.021	267.728	130.960
65.839	841.010	I9	2,5-dimethylheptane	0.251	0.259	0.163	276.800	136.000
66.302	842.390	I9	3,3-&3,5-dimethylheptane	0.058	0.059	0.038	278.636	137.020
66.710	843.590	I9	3,5-dimethylheptane	0.040	0.041	0.026	276.800	136.000
67.183	844.980	I9	2,6-dimethylheptane	0.068	0.071	0.044	275.396	135.220
67.814	846.820	N9	1,1,3-trimethylcyclohexane	0.046	0.043	0.030	295.862	146.590
68.311	848.250	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
69.088	850.460	N8	N8-[4]	0.004	0.004	0.003	32.000	0.000
69.416	851.390	N9	1c,2t,4t-trimethylcyclohexane	0.019	0.018	0.012	32.000	0.000
70.259	853.750	A8	ethylbenzene	1.167	0.995	0.916	277.160	136.200
70.644	854.820	N9	1c,3c,5c-trimethylcyclohexane	0.123	0.116	0.081	32.000	0.000
71.474	857.100	O9	2-methyloctene-1	0.019	0.021	0.013	32.000	0.000
71.914	858.300	I9	I9-[2]	0.003	0.003	0.002	32.000	0.000
72.366	859.520	O9	2-methyloctene-2	0.027	0.030	0.018	32.000	0.000
74.096	864.120	A8	1,3-dimethylbenzene	3.126	2.674	2.455	282.416	139.120
74.430	865.000	A8	1,4-dimethylbenzene	1.290	1.108	1.013	281.048	138.360
75.057	866.630	I9	3,4-dimethylheptane	0.029	0.030	0.019	285.080	140.600
75.385	867.480	I9	3,4 -dimethylheptane	0.059	0.059	0.038	285.080	140.600

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
75.922	868.850	N9	N9-[1]	0.026	0.024	0.017	32.000	0.000
76.359	869.970	I9	I9-[3]	0.073	0.074	0.047	32.000	0.000
77.238	872.190	I9	4-ethylheptane	0.002	0.002	0.001	288.392	142.440
77.563	873.000	I9	4-methyloctane	0.259	0.266	0.168	288.392	142.440
77.960	873.990	I9	2-methyloctane	0.318	0.330	0.207	289.904	143.280
78.570	875.490	N9	N9-[2]	0.035	0.034	0.023	32.000	0.000
79.425	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.039	0.038	0.026	304.160	151.200
79.740	878.350	I9	3-ethylheptane	0.074	0.075	0.048	289.400	143.000
80.254	879.590	I9	3-methyloctane	0.410	0.420	0.266	291.614	144.230
80.575	880.360	I9	3,3-diethylpentane	0.020	0.020	0.013	270.842	132.690
81.013	881.410	--	unknown	0.062	0.066	0.041	32.000	0.000
81.302	882.100	N9	1c,2t,4c-trimethylcyclohexane	0.017	0.016	0.011	275.000	135.000
81.677	882.980	N9	1,1,2-trimethylcyclohexane	0.029	0.027	0.019	293.360	145.200
82.020	883.790	A8	1,2-dimethylbenzene	1.571	1.319	1.234	291.974	144.430
82.563	885.060	I9	I9-[4]	0.027	0.027	0.017	32.000	0.000
82.925	885.910	I9	I9-[5]	0.099	0.101	0.065	32.000	0.000
83.660	887.600	N9	N9-[3]	0.085	0.080	0.056	32.000	0.000
83.926	888.220	N9	N9-[4]	0.105	0.100	0.070	32.000	0.000
84.052	888.500	--	unknown	0.038	0.040	0.025	32.000	0.000
84.435	889.380	O9	nonene-1	0.006	0.006	0.004	274.100	134.500
84.610	889.780	I9	I9-[6]	0.058	0.059	0.038	32.000	0.000
85.016	890.700	N9	N9-[5]	0.150	0.142	0.099	32.000	0.000
85.558	891.920	I9	I9-[7]	0.016	0.016	0.010	32.000	0.000
86.011	892.930	N9	i-butylcyclopentane	0.031	0.030	0.021	298.346	147.970
86.223	893.400	N9	N9-[6]	0.021	0.020	0.014	32.000	0.000
87.061	895.260	--	unknown	0.001	0.001	0.001	32.000	0.000
87.443	896.100	N9	N9-[7]	0.014	0.014	0.009	32.000	0.000
87.743	896.760	N9	N9-[8]	0.008	0.008	0.005	32.000	0.000
88.036	897.400	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.255	897.870	O9	t-nonene-3	0.020	0.020	0.013	32.000	0.000
88.670	898.770	I9	I9-[8]	0.117	0.118	0.076	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
88.810	899.070	--	unknown	0.026	0.028	0.017	32.000	0.000
89.239	900.000	P9	n-nonane	0.367	0.378	0.239	303.476	150.820
89.601	901.750	N9	1,1-methylethylcyclohexane	0.088	0.081	0.058	305.924	152.180
90.176	904.530	N9	N9-[9]	0.009	0.009	0.006	32.000	0.000
90.428	905.730	N9	N9-[10]	0.026	0.024	0.017	32.000	0.000
90.712	907.090	O10	t-2,2,5,5-tetramethylhexene-3	0.007	0.007	0.004	32.000	0.000
91.590	911.260	N9	N9-[11]	0.006	0.006	0.004	32.000	0.000
92.015	913.270	A9	i-propylbenzene	0.062	0.053	0.043	306.338	152.410
92.378	914.970	O9	c-nonene-3	0.073	0.079	0.048	32.000	0.000
92.544	915.750	--	unknown	0.016	0.017	0.010	32.000	0.000
92.943	917.610	I10	I10-[1]	0.012	0.012	0.007	32.000	0.000
93.038	918.050	N9	i-propylcyclohexane	0.021	0.019	0.014	310.622	154.790
93.196	918.790	--	unknown	0.005	0.006	0.004	32.000	0.000
93.777	921.470	I10	I10-[2]	0.107	0.108	0.063	32.000	0.000
94.174	923.300	I10	2,2-dimethyloctane	0.034	0.035	0.020	314.420	156.900
94.449	924.560	I10	2,4-dimethyloctane	0.051	0.052	0.030	312.620	155.900
94.881	926.530	N9	N9-[12]	0.007	0.006	0.004	32.000	0.000
95.316	928.510	N9	N9-[13]	0.022	0.021	0.015	32.000	0.000
95.922	931.240	I10	2,6-dimethyloctane	0.086	0.087	0.050	320.738	160.410
96.279	932.850	I10	2,5-dimethyloctane	0.078	0.079	0.046	317.300	158.500
96.546	934.040	--	unknown	0.002	0.003	0.001	32.000	0.000
97.135	936.660	N9	n-butylcyclopentane	0.058	0.055	0.038	313.916	156.620
97.347	937.600	I10	I10-[3]	0.031	0.032	0.018	32.000	0.000
97.498	938.270	N10	N10-[1]	0.036	0.033	0.021	32.000	0.000
97.762	939.430	--	unknown	0.005	0.006	0.003	32.000	0.000
98.010	940.530	I10	I10-[4]	0.021	0.021	0.012	32.000	0.000
98.465	942.520	I10	3,3-dimethyloctane	0.138	0.138	0.081	322.160	161.200
98.778	943.890	N10	N10-[2]	0.023	0.022	0.014	32.000	0.000
98.992	944.820	--	unknown	0.019	0.020	0.011	32.000	0.000
99.161	945.560	--	unknown	0.024	0.026	0.014	32.000	0.000
99.554	947.260	A9	n-propylbenzene	0.349	0.299	0.242	318.632	159.240

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
99.850	948.540	I10	3,6-dimethyloctane	0.026	0.026	0.015	321.440	160.800
100.107	949.640	I10	3-methyl-5-ethylheptane	0.046	0.047	0.027	316.760	158.200
100.259	950.290	--	unknown	0.006	0.006	0.003	32.000	0.000
100.572	951.640	N10	N10-[3]	0.028	0.025	0.016	32.000	0.000
101.243	954.500	--	unknown	0.025	0.026	0.015	32.000	0.000
101.501	955.590	A9	1,3-methylethylbenzene	1.233	1.054	0.855	322.394	161.330
101.888	957.230	A9	1,4-methylethylbenzene	0.529	0.454	0.367	323.618	162.010
102.202	958.550	N10	N10-[4]	0.030	0.028	0.018	32.000	0.000
102.379	959.290	--	unknown	0.003	0.003	0.002	32.000	0.000
102.738	960.800	--	unknown	0.002	0.002	0.001	32.000	0.000
102.947	961.670	--	unknown	0.011	0.011	0.028	32.000	0.000
103.233	962.860	A9	1,3,5-trimethylbenzene	0.658	0.562	0.456	328.532	164.740
103.499	963.970	I10	I10-[5]	0.041	0.041	0.024	32.000	0.000
103.769	965.080	N10	N10-[5]	0.018	0.017	0.011	32.000	0.000
103.960	965.870	--	unknown	0.006	0.006	0.004	32.000	0.000
104.196	966.850	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.512	968.140	I10	5-methylnonane	0.051	0.052	0.030	329.180	165.100
104.917	969.800	I10	4-methylnonane	0.421	0.420	0.246	32.000	0.000
105.261	971.210	A9	1,2-methylethylbenzene	0.392	0.329	0.272	329.324	165.180
105.451	971.980	I10	2-methylnonane	0.120	0.122	0.070	332.654	167.030
105.571	972.470	--	unknown	0.013	0.014	0.008	32.000	0.000
105.871	973.690	--	unknown	0.011	0.012	0.007	32.000	0.000
106.106	974.630	I10	3-ethyloctane	0.025	0.025	0.015	331.700	166.500
106.179	974.930	--	unknown	0.014	0.015	0.008	32.000	0.000
106.475	976.120	N10	N10-[6]	0.023	0.021	0.014	32.000	0.000
106.805	977.450	I10	3-methylnonane	0.148	0.149	0.087	334.040	167.800
107.020	978.310	--	unknown	0.006	0.007	0.004	32.000	0.000
107.372	979.710	N10	N10-[7]	0.003	0.003	0.002	32.000	0.000
107.549	980.420	I10	I10-[7]	0.094	0.094	0.055	32.000	0.000
107.822	981.510	I10	I10-[8]	0.008	0.008	0.005	32.000	0.000
108.105	982.630	--	unknown	0.011	0.011	0.006	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
108.558	984.420	A9	1,2,4-trimethylbenzene	1.918	1.619	1.330	336.884	169.380
108.802	985.380	--	unknown	0.007	0.007	0.005	32.000	0.000
108.963	986.010	I10	I10-[9]	0.010	0.010	0.006	32.000	0.000
109.084	986.490	N10	i-butylcyclohexane	0.035	0.033	0.021	340.340	171.300
109.280	987.250	--	unknown	0.027	0.028	0.016	32.000	0.000
109.390	987.690	I10	I10-[10]	0.045	0.045	0.026	32.000	0.000
109.673	988.790	I10	I10-[11]	0.019	0.019	0.011	32.000	0.000
109.814	989.340	I10	I10-[12]	0.012	0.012	0.007	32.000	0.000
110.163	990.700	N10	N10-[8]	0.023	0.021	0.013	32.000	0.000
110.392	991.580	--	unknown	0.003	0.003	0.002	32.000	0.000
110.797	993.150	O10	decene-1	0.003	0.003	0.002	339.080	170.600
110.957	993.770	N10	1t-methyl-2-n-propylcyclohexane	0.015	0.014	0.009	339.800	171.000
111.057	994.150	O10	2,3-dimethyloctene-2	0.057	0.057	0.034	32.000	0.000
111.167	994.570	I10	I10-[13]	0.016	0.016	0.009	32.000	0.000
111.472	995.740	A10	i-butylbenzene	0.004	0.003	0.002	343.022	172.790
111.612	996.280	I10	I10-[14]	0.054	0.054	0.032	32.000	0.000
111.845	997.170	--	unknown	0.038	0.040	0.022	32.000	0.000
112.127	998.250	A10	sec-butylbenzene	0.036	0.031	0.022	344.012	173.340
112.373	999.190	--	unknown	0.008	0.009	0.005	32.000	0.000
112.586	1000.000	P10	n-decane	0.194	0.197	0.114	345.470	174.150
112.829	1001.530	I11	I11-[1]	0.028	0.028	0.015	32.000	0.000
113.185	1003.780	N10	N10-[9]	0.017	0.016	0.010	32.000	0.000
113.519	1005.880	--	unknown	0.004	0.004	0.002	32.000	0.000
113.832	1007.840	A9	1,2,3-trimethylbenzene	0.376	0.311	0.261	349.016	176.120
113.982	1008.770	--	unknown	0.009	0.010	0.006	32.000	0.000
114.277	1010.610	A10	1,3-methyl-i-propylbenzene	0.041	0.036	0.026	347.144	175.080
114.702	1013.260	--	unknown	0.009	0.009	0.023	32.000	0.000
114.838	1014.100	A10	1,4-methyl-i-propylbenzene	0.025	0.022	0.016	350.834	177.130
115.003	1015.120	--	unknown	0.003	0.003	0.002	32.000	0.000
115.306	1017.000	I11	I11-[2]	0.026	0.026	0.014	32.000	0.000
115.575	1018.660	I11	I11-[3]	0.012	0.012	0.006	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
115.869	1020.470	A10	2-3-dihydroindene	0.262	0.201	0.185	352.130	177.850
116.235	1022.710	--	unknown	0.019	0.020	0.013	32.000	0.000
116.482	1024.220	N10	sec-butylcyclohexane	0.041	0.037	0.024	354.812	179.340
116.716	1025.640	I11	I11-[4]	0.008	0.008	0.004	32.000	0.000
117.063	1027.760	A10	1,2-methyl-i-propylbenzene	0.070	0.059	0.044	352.724	178.180
117.207	1028.630	--	unknown	0.005	0.006	0.003	32.000	0.000
117.328	1029.370	I11	3-ethylnonane	0.004	0.004	0.002	32.000	0.000
117.633	1031.210	--	unknown	0.064	0.068	0.034	32.000	0.000
117.855	1032.550	N11	N11-[1]	0.027	0.025	0.014	32.000	0.000
117.926	1032.980	--	unknown	0.018	0.019	0.010	32.000	0.000
118.095	1034.000	I11	I11-[5]	0.016	0.015	0.008	32.000	0.000
118.233	1034.830	--	unknown	0.003	0.003	0.002	32.000	0.000
118.609	1037.090	I11	I11-[6]	0.030	0.028	0.016	32.000	0.000
118.774	1038.080	--	unknown	0.033	0.035	0.018	32.000	0.000
119.216	1040.710	A10	1,3-diethylbenzene	0.133	0.114	0.083	358.052	181.140
119.417	1041.910	--	unknown	0.061	0.065	0.038	32.000	0.000
119.665	1043.390	A10	1,3-methyl-n-propylbenzene	0.270	0.232	0.168	359.618	182.010
119.841	1044.430	I11	I11-[7]	0.023	0.023	0.012	32.000	0.000
120.117	1046.060	A10	1,4-diethylbenzene	0.011	0.009	0.007	362.822	183.790
120.299	1047.140	A10	1,4-methyl-n-propylbenzene	0.169	0.145	0.105	362.156	183.420
120.477	1048.190	A10	n-butylbenzene	0.081	0.070	0.051	361.940	183.300
120.885	1050.580	A10	1,3-dimethyl-5-ethylbenzene	0.284	0.239	0.176	362.516	183.620
121.209	1052.480	A10	1,2-diethylbenzene	0.030	0.025	0.019	362.228	183.460
121.352	1053.320	I11	I11-[8]	0.017	0.017	0.009	32.000	0.000
121.580	1054.650	N10	t-decahydronaphthalene	0.009	0.008	0.005	368.960	187.200
121.830	1056.110	N11	N11-[2]	0.016	0.015	0.009	32.000	0.000
122.110	1057.740	--	unknown	0.013	0.014	0.007	32.000	0.000
122.253	1058.570	A10	1,2-methyl-n-propylbenzene	0.093	0.078	0.057	364.946	184.970
122.657	1060.910	I11	I11-[9]	0.013	0.013	0.007	32.000	0.000
122.758	1061.500	I11	I11-[10]	0.066	0.066	0.035	32.000	0.000
122.966	1062.700	I11	I11-[11]	0.036	0.036	0.019	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
123.053	1063.200	--	unknown	0.010	0.010	0.005	32.000	0.000
123.318	1064.730	--	unknown	0.003	0.004	0.002	32.000	0.000
123.478	1065.640	I11	I11-[12]	0.045	0.045	0.024	32.000	0.000
123.735	1067.120	--	unknown	0.009	0.009	0.005	32.000	0.000
124.024	1068.770	A10	1,4,dimethyl-2-ethylbenzene	0.206	0.174	0.128	368.366	186.870
124.296	1070.320	A10	1,3-dimethyl-4-ethylbenzene	0.258	0.222	0.160	370.832	188.240
124.575	1071.910	I11	I11-[13]	0.003	0.003	0.002	32.000	0.000
124.869	1073.580	--	unknown	0.008	0.008	0.004	32.000	0.000
125.127	1075.050	I11	I11-[14]	0.141	0.141	0.075	32.000	0.000
125.294	1075.990	A10	1,2-dimethyl-4-ethylbenzene	0.283	0.240	0.176	373.136	189.520
125.608	1077.770	--	unknown	0.009	0.009	0.005	32.000	0.000
125.891	1079.360	--	unknown	0.013	0.013	0.008	32.000	0.000
125.981	1079.870	I11	I11-[15]	0.004	0.004	0.002	32.000	0.000
126.269	1081.480	A10	1,3-dimethyl-2-ethylbenzene	0.048	0.040	0.030	374.090	190.050
126.422	1082.340	I11	I11-[16]	0.017	0.017	0.009	32.000	0.000
126.753	1084.190	--	unknown	0.017	0.018	0.009	32.000	0.000
126.952	1085.300	I11	I11-[17]	0.008	0.008	0.004	32.000	0.000
127.183	1086.590	--	unknown	0.015	0.016	0.008	32.000	0.000
127.517	1088.440	--	unknown	0.008	0.009	0.004	32.000	0.000
127.595	1088.880	--	unknown	0.011	0.012	0.006	32.000	0.000
127.863	1090.360	O11	undecene-1	0.020	0.020	0.011	378.860	192.700
128.200	1092.230	A11	1,4-methyl-t-butylbenzene	0.036	0.031	0.020	32.000	0.000
128.476	1093.750	A10	1,2-dimethyl-3-ethylbenzene	0.079	0.065	0.049	381.110	193.950
128.819	1095.630	--	unknown	0.007	0.007	0.004	32.000	0.000
129.096	1097.150	--	unknown	0.014	0.015	0.009	32.000	0.000
129.166	1097.540	A11	1,2-ethyl-i-propylbenzene	0.008	0.007	0.005	32.000	0.000
129.341	1098.490	--	unknown	0.006	0.007	0.004	32.000	0.000
129.616	1100.000	P11	n-undecane	0.104	0.103	0.055	384.620	195.900
129.816	1101.500	--	unknown	0.008	0.008	0.004	32.000	0.000
129.937	1102.400	A11	1,4-ethyl-i-propylbenzene	0.002	0.002	0.001	32.000	0.000
130.350	1105.490	A10	1,2,4,5-tetramethylbenzene	0.164	0.137	0.102	386.312	196.840

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
130.592	1107.290	A11	1,2-methyl-n-butylbenzene	0.003	0.002	0.002	390.200	199.000
130.682	1107.960	--	unknown	0.006	0.006	0.003	32.000	0.000
130.890	1109.510	A10	1,2,3,5-tetramethylbenzene	0.220	0.183	0.137	388.472	198.040
131.033	1110.570	--	unknown	0.007	0.007	0.004	32.000	0.000
131.382	1113.160	--	unknown	0.012	0.012	0.007	32.000	0.000
131.577	1114.600	--	unknown	0.008	0.008	0.005	32.000	0.000
131.724	1115.680	--	unknown	0.003	0.004	0.002	32.000	0.000
131.884	1116.860	--	unknown	0.018	0.018	0.011	32.000	0.000
132.325	1120.110	--	unknown	0.014	0.015	0.009	32.000	0.000
132.483	1121.260	--	unknown	0.015	0.016	0.009	32.000	0.000
132.965	1124.790	A11	1,2-methyl-t-butylbenzene	0.006	0.005	0.003	32.000	0.000
133.121	1125.930	--	unknown	0.012	0.013	0.007	32.000	0.000
133.435	1128.220	A10	5-methylindan	0.194	0.161	0.123	32.000	0.000
133.781	1130.730	I12	I12-[1]	0.047	0.047	0.023	421.340	216.300
134.185	1133.660	--	unknown	0.007	0.008	0.003	32.000	0.000
134.303	1134.510	A10	4-methylindan	0.048	0.040	0.031	32.000	0.000
134.582	1136.530	--	unknown	0.014	0.014	0.009	32.000	0.000
134.682	1137.250	A11	1,2-ethyl-n-propylbenzene	0.054	0.044	0.030	32.000	0.000
134.933	1139.060	A10	2-methylindan	0.186	0.152	0.117	368.600	187.000
135.145	1140.580	A11	1,3-methyl-n-butylbenzene	0.009	0.007	0.005	390.200	199.000
135.403	1142.430	--	unknown	0.006	0.006	0.003	32.000	0.000
135.550	1143.490	A12	1,3-di-i-propylbenzene	0.063	0.052	0.032	397.760	203.200
135.763	1145.010	A11	s-pentylbenzene	0.057	0.048	0.032	401.000	205.000
135.916	1146.100	--	unknown	0.002	0.002	0.001	32.000	0.000
136.202	1148.140	--	unknown	0.004	0.004	0.002	32.000	0.000
136.348	1149.180	--	unknown	0.015	0.016	0.009	32.000	0.000
136.442	1149.850	A11	n-pentylbenzene	0.043	0.036	0.024	401.720	205.400
136.509	1150.320	--	unknown	0.026	0.027	0.014	32.000	0.000
136.806	1152.430	N12	1t-M-2-(4-MP)cyclopentane	0.004	0.004	0.002	32.000	0.000
137.003	1153.830	A12	1,2-di-i-propylbenzene	0.027	0.023	0.014	399.200	204.000
137.149	1154.860	--	unknown	0.026	0.028	0.014	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
137.633	1158.280	--	unknown	0.039	0.041	0.020	32.000	0.000
137.900	1160.150	A12	1,4-di-i-propylbenzene	0.048	0.040	0.025	410.540	210.300
138.182	1162.140	--	unknown	0.007	0.007	0.004	32.000	0.000
138.355	1163.350	A10	tetrahydronaphthalene	0.018	0.014	0.011	405.716	207.620
138.501	1164.370	--	unknown	0.008	0.008	0.005	32.000	0.000
138.755	1166.150	--	unknown	0.004	0.005	0.003	32.000	0.000
138.892	1167.100	I12	I12-[2]	0.052	0.051	0.025	421.340	216.300
139.187	1169.160	A10	naphthalene	0.160	0.116	0.104	424.382	217.990
139.513	1171.430	A12	1-t-butyl-3,5-dimethylbenzene	0.004	0.003	0.002	32.000	0.000
139.854	1173.790	A12	1,4-ethyl-t-butylbenzene	0.073	0.060	0.037	32.000	0.000
140.259	1176.590	--	unknown	0.026	0.027	0.013	32.000	0.000
140.551	1178.610	I12	I12-[3]	0.054	0.053	0.026	421.340	216.300
140.780	1180.190	I12	I12-[4]	0.031	0.030	0.015	421.340	216.300
141.121	1182.530	--	unknown	0.007	0.007	0.003	32.000	0.000
141.359	1184.160	I12	I12-[5]	0.032	0.031	0.016	421.340	216.300
141.610	1185.880	--	unknown	0.011	0.012	0.005	32.000	0.000
141.904	1187.890	I12	I12-[6]	0.033	0.032	0.016	421.340	216.300
142.103	1189.240	A12	1,3-di-n-propylbenzene	0.038	0.032	0.020	32.000	0.000
142.344	1190.880	A12	A12-[1]	0.024	0.020	0.012	32.000	0.000
142.563	1192.370	O12	dodecene-1	0.006	0.006	0.003	416.120	213.400
142.919	1194.790	--	unknown	0.007	0.007	0.003	32.000	0.000
143.261	1197.100	--	unknown	0.005	0.005	0.002	32.000	0.000
143.564	1199.150	A12	A12-[2]	0.019	0.016	0.010	32.000	0.000
143.690	1200.000	P12	n-dodecane	0.045	0.044	0.022	421.340	216.300
143.954	1202.220	--	unknown	0.003	0.003	0.002	32.000	0.000
144.232	1204.550	--	unknown	0.012	0.013	0.006	32.000	0.000
144.323	1205.320	--	unknown	0.004	0.004	0.002	32.000	0.000
144.771	1209.070	--	unknown	0.011	0.012	0.006	32.000	0.000
144.995	1210.950	--	unknown	0.006	0.006	0.003	32.000	0.000
145.195	1212.610	A12	1,3,5-triethylbenzene	0.003	0.003	0.002	420.800	216.000
145.382	1214.170	--	unknown	0.007	0.008	0.004	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
145.724	1217.020	--	unknown	0.021	0.022	0.011	32.000	0.000
145.898	1218.470	--	unknown	0.011	0.012	0.006	32.000	0.000
146.057	1219.780	--	unknown	0.001	0.001	0.001	32.000	0.000
146.215	1221.090	--	unknown	0.003	0.003	0.001	32.000	0.000
146.506	1223.500	--	unknown	0.017	0.018	0.009	32.000	0.000
146.747	1225.490	--	unknown	0.017	0.018	0.009	32.000	0.000
146.831	1226.190	--	unknown	0.006	0.007	0.003	32.000	0.000
147.128	1228.630	--	unknown	0.005	0.005	0.002	32.000	0.000
147.209	1229.290	--	unknown	0.012	0.013	0.006	32.000	0.000
147.512	1231.780	A12	1,2,4-triethylbenzene	0.013	0.011	0.007	423.500	217.500
147.735	1233.610	--	unknown	0.005	0.005	0.003	32.000	0.000
148.062	1236.280	--	unknown	0.003	0.003	0.001	32.000	0.000
148.188	1237.320	--	unknown	0.005	0.005	0.003	32.000	0.000
148.238	1237.730	--	unknown	0.008	0.008	0.004	32.000	0.000
148.473	1239.640	--	unknown	0.001	0.002	0.001	32.000	0.000
148.811	1242.390	A12	1,4-methyl-n-pentylbenzene	0.035	0.029	0.018	32.000	0.000
149.096	1244.710	--	unknown	0.009	0.010	0.005	32.000	0.000
149.249	1245.950	--	unknown	0.004	0.004	0.002	32.000	0.000
149.389	1247.080	--	unknown	0.003	0.003	0.002	32.000	0.000
149.676	1249.400	--	unknown	0.005	0.005	0.002	32.000	0.000
149.959	1251.690	--	unknown	0.006	0.006	0.003	32.000	0.000
150.156	1253.280	--	unknown	0.008	0.008	0.004	32.000	0.000
150.544	1256.400	A12	n-hexylbenzene	0.019	0.016	0.010	32.000	0.000
150.632	1257.110	--	unknown	0.020	0.021	0.010	32.000	0.000
151.004	1260.090	--	unknown	0.011	0.012	0.006	32.000	0.000
151.261	1262.140	--	unknown	0.005	0.005	0.002	32.000	0.000
151.508	1264.110	--	unknown	0.005	0.005	0.002	32.000	0.000
151.669	1265.390	--	unknown	0.003	0.004	0.002	32.000	0.000
151.872	1267.010	--	unknown	0.006	0.006	0.003	32.000	0.000
151.922	1267.410	--	unknown	0.009	0.009	0.004	32.000	0.000
152.218	1269.770	--	unknown	0.006	0.006	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\106F0601.D\106F0601.CDF Acquired: 10/31/20 12:48:52
Sample: ODDB:54929 Analyzed: 11/2/2020 9:49:30 PM
Processed 637 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
152.274	1270.210	--	unknown	0.005	0.005	0.003	32.000	0.000
152.645	1273.150	I13	I13-[1]	0.008	0.008	0.004	455.720	235.400
152.835	1274.650	A11	1,2,3,4,5-pentamethylbenzene	0.023	0.017	0.013	449.600	232.000
153.066	1276.480	--	unknown	0.006	0.006	0.003	32.000	0.000
153.117	1276.880	--	unknown	0.003	0.003	0.002	32.000	0.000
153.580	1280.530	--	unknown	0.006	0.006	0.003	32.000	0.000
153.932	1283.290	A11	2-methylnaphthalene	0.090	0.065	0.052	465.890	241.050
154.421	1287.120	--	unknown	0.010	0.010	0.006	32.000	0.000
154.571	1288.300	--	unknown	0.002	0.002	0.001	32.000	0.000
154.712	1289.400	--	unknown	0.003	0.003	0.002	32.000	0.000
154.918	1291.010	O13	tridecene-1	0.006	0.006	0.003	451.040	232.800
155.160	1292.890	--	unknown	0.001	0.001	0.000	32.000	0.000
155.349	1294.360	--	unknown	0.002	0.002	0.001	32.000	0.000
155.512	1295.630	--	unknown	0.003	0.003	0.001	32.000	0.000
155.582	1296.170	--	unknown	0.002	0.002	0.001	32.000	0.000
155.885	1298.520	A11	1-methylnaphthalene	0.035	0.026	0.021	472.352	244.640
156.076	1300.000	P13	n-tridecane	0.009	0.009	0.004	455.720	235.400
156.191	1301.040	+	C14+ (Summarized)	0.365	0.354	0.153	455.720	235.400

Detailed Hydrocarbon Analysis Summary Report -

Report Date: 11/2/2020 10:38:17 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Acquired: 10/31/20 16:09:43
Sample: ODDB:54930
Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Location: GC 12 D6730
Normalized to 100.000%

SUMMARY REPORT

Group Type	Total(Mass%)	Total(Vol%)	Total(Mol%)
Paraffins:	7.411	8.343	7.211
I-Paraffins:	37.151	40.567	31.918
Olefins:	3.897	4.203	3.986
Naphthenes:	11.428	11.071	9.623
Aromatics:	21.877	18.518	16.692
Total C14+:	0.356	0.345	0.150
Total Unknowns:	1.713	1.808	1.182

Oxygenates:

Total: 16.167(Mass%) 15.146(Vol%)

Total Oxygen Content: 5.615(Mass%)

Multisubstituted Aromatics: 13.848(Mass%) 11.754(Vol%)

Average Molecular Weight: 83.311

Relative Density: 0.739

Vapor Pressure :

Calculated Octane Number: 86.7

Motor Octane Number (Jenkins Calculation): 78.7

	IBP	T10	T50	T90	FBP
BP by Mass (Deg F)	31.10	173.30	197.33	329.32	465.89
BP by Vol (Deg F)	31.10	173.30	197.33	329.32	449.60

Percent Carbon: 82.916
Percent Hydrogen: 11.470
Bromine Number (Calc): 7.284
Particulate Matter Index: 1.102

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 10:38:28 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Sample: ODDB:54930
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha

Acquired: 10/31/20 16:09:43
Analyzed: 11/2/2020 10:37:26 PM

Comments:

Normalized to xxx%
Int Std: NONE
Int Std Amt: 0.000
Sample Wt: 1.000 Sample Den: 1.000

Oxygenates

Compound	Mass%	Mass% Oxygen	Vol%
ethanol : X2	16.167	5.615	15.146

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 10:38:28 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Acquired: 10/31/20 16:09:43
Sample: ODDB:54930
Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.0000
Sample Wt: 1.0000 Sample Den: 1.000

Totals by Group Type & Carbon Number (in Mass Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.472	0.097	0.045	0.000	0.000	0.001	0.615
C5	2.365	6.599	1.633	0.323	0.000	0.001	10.921
C6	1.782	7.446	1.130	3.088	0.681	0.042	14.170
C7	1.302	8.110	0.732	3.693	4.450	0.009	18.297
C8	0.770	9.310	0.066	2.687	7.143	0.201	20.176
C9	0.366	3.188	0.191	1.295	5.504	0.179	10.723
C10	0.194	1.677	0.069	0.295	3.413	0.229	5.876
C11	0.104	0.496	0.020	0.042	0.373	0.370	1.404
C12	0.044	0.221	0.004	0.004	0.312	0.385	0.971
C13	0.009	0.008	0.006	0.000	0.000	0.298	0.321
Total:	7.411	37.151	3.897	11.428	21.877	1.713	81.764

Oxygenates	16.167	Total C14+:	0.356
Total Unknowns:	1.713	Grand Total:	100.000

Totals by Group Type & Carbon Number (in Volume Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	0.002	0.000	0.000	0.000	0.000	0.000	0.002
C4	0.603	0.129	0.054	0.000	0.000	0.001	0.787
C5	2.792	7.872	1.828	0.320	0.000	0.001	12.813
C6	1.998	8.369	1.188	3.020	0.573	0.044	15.192
C7	1.408	8.750	0.763	3.613	3.794	0.009	18.338
C8	0.810	9.765	0.067	2.577	6.086	0.212	19.517
C9	0.377	3.276	0.202	1.226	4.670	0.189	9.942
C10	0.196	1.687	0.070	0.272	2.840	0.241	5.306
C11	0.103	0.493	0.020	0.039	0.296	0.390	1.340
C12	0.044	0.217	0.004	0.004	0.259	0.406	0.934
C13	0.009	0.008	0.006	0.000	0.000	0.315	0.337
Total:	8.343	40.567	4.203	11.071	18.518	1.808	82.701

Oxygenates	15.146	Total C14+:	0.345
Total Unknowns:	1.808	Grand Total:	100.000

Detailed Hydrocarbon Analysis Detail Report -

Report Date: 11/2/2020 10:38:28 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Acquired: 10/31/20 16:09:43
Sample: ODDB:54930
Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.0000
Sample Wt: 1.0000 Sample Den: 1.000

Totals by Group Type & Carbon Number (in Mol Percent)

	Paraffins	I-Paraffins	Olefins	Naphthenes	Aromatics	Unknowns	Total
C1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.001	0.000	0.000	0.000	0.000	0.000	0.001
C3	0.003	0.000	0.000	0.000	0.000	0.000	0.003
C4	0.677	0.140	0.067	0.000	0.000	0.001	0.884
C5	2.731	7.619	1.944	0.384	0.000	0.001	12.679
C6	1.723	7.199	1.124	3.057	0.727	0.107	13.936
C7	1.083	6.743	0.620	3.134	4.024	0.012	15.615
C8	0.562	6.790	0.048	1.995	5.605	0.152	15.151
C9	0.238	2.071	0.126	0.855	3.815	0.151	7.256
C10	0.114	0.982	0.041	0.175	2.149	0.159	3.620
C11	0.055	0.264	0.011	0.023	0.212	0.232	0.797
C12	0.022	0.108	0.002	0.002	0.160	0.214	0.508
C13	0.004	0.004	0.003	0.000	0.000	0.154	0.164
Total:	7.211	31.918	3.986	9.623	16.692	1.182	69.432

Oxygenates	29.236	Total C14+:	0.150
Total Unknowns:	1.182	Grand Total:	100.000

Detailed Hydrocarbon Analysis - Dienes (Di-Olefins) Detail Report - Report Date: 11/2/2020 10:38:29 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Diene Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %
8.987	395.090	O4	1,3-butadiene	0.000	0.000	0.000
13.019	481.240	O5	1,4-pentadiene	0.001	0.001	0.001
14.848	506.130	O5	2-methylbutadiene-1,3	0.007	0.007	0.008
16.186	527.970	O5	1t,3-pentadiene	0.007	0.008	0.009
16.886	538.220	O5	cyclopentadiene	0.005	0.006	0.006
20.391	581.040	O6	1,5-hexadiene	0.000	0.000	0.000
21.990	597.110	O6	1c/t,4-hexadiene	0.000	0.000	0.000
25.274	632.960	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002
25.837	638.600	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007
28.354	661.970	O6	diolefin (hexadiene)	0.003	0.003	0.003
30.187	677.370	O7	1,6-heptadiene	0.000	0.000	0.000
36.537	720.930	N8	1,1,3-trimethylcyclopentane	0.160	0.158	0.119

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Acquired: 10/31/20 16:09:43
Sample: ODDB:54930
Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold
Sample Wt: 1.000
Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
6.434	100.000	P1	methane	0.000	0.000	0.000	-258.700	-161.500
6.620	200.000	P2	ethane	0.000	0.000	0.001	-127.480	-88.600
7.114	293.490	O3	propylene	0.000	0.000	0.000	-53.896	-47.720
7.176	300.000	P3	propane	0.002	0.002	0.003	-43.672	-42.040
8.191	366.110	I4	i-butane	0.097	0.129	0.140	10.904	-11.720
8.342	372.500	--	unknown	0.000	0.000	0.000	32.000	0.000
8.705	386.000	--	unknown	0.000	0.000	0.000	32.000	0.000
8.826	390.030	O4	butene-1	0.002	0.003	0.003	20.750	-6.250
8.879	391.710	O4	isobutylene	0.003	0.004	0.004	20.750	-6.250
8.987	395.090	O4	1,3-butadiene	0.000	0.000	0.000	24.062	-4.410
9.154	400.000	P4	n-butane	0.472	0.603	0.677	31.100	-0.500
9.545	412.300	O4	t-butene-2	0.017	0.021	0.025	33.584	0.880
9.642	415.130	I5	2,2-dimethylpropane	0.003	0.004	0.004	49.100	9.500
9.867	421.360	--	unknown	0.001	0.001	0.001	32.000	0.000
10.130	428.130	O4	c-butene-2	0.023	0.027	0.034	38.696	3.720
11.754	461.600	X2	ethanol	16.167	15.146	29.236	173.300	78.500
12.772	477.720	I5	i-pentane	6.596	7.868	7.616	82.112	27.840
13.019	481.240	O5	1,4-pentadiene	0.001	0.001	0.001	78.728	25.960
13.746	490.880	O5	pentene-1	0.116	0.134	0.138	85.928	29.960
14.222	496.690	O5	2-methylbutene-1	0.268	0.305	0.319	88.070	31.150
14.506	500.000	P5	n-pentane	2.365	2.792	2.731	96.908	36.060
14.848	506.130	O5	2-methylbutadiene-1,3	0.007	0.007	0.008	93.308	34.060
15.095	510.410	O5	t-pentene-2	0.350	0.399	0.416	97.412	36.340
15.466	516.610	O5	3,3-dimethylbutene-1	0.005	0.005	0.006	106.232	41.240
15.636	519.370	O5	c-pentene-2	0.194	0.219	0.231	98.474	36.930
15.795	521.910	--	unknown	0.000	0.000	0.001	32.000	0.000
15.974	524.700	O5	2-methylbutene-2	0.585	0.653	0.695	101.408	38.560
16.186	527.970	O5	1t,3-pentadiene	0.007	0.008	0.009	107.636	42.020
16.307	529.790	--	unknown	0.001	0.001	0.001	32.000	0.000
16.886	538.220	O5	cyclopentadiene	0.005	0.006	0.006	32.000	0.000
17.014	540.030	I6	2,2-dimethylbutane	0.419	0.477	0.405	121.514	49.730

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF
Acquired: 10/31/20 16:09:43
Sample: ODDB:54930
Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments:
Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold
Sample Wt: 1.000
Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
18.313	557.170	O5	cyclopentene	0.095	0.091	0.117	111.614	44.230
18.680	561.670	O6	4-methylpentene-1	0.022	0.025	0.022	128.948	53.860
18.748	562.490	O6	3-methylpentene-1	0.037	0.041	0.036	129.506	54.170
19.105	566.720	N5	cyclopentane	0.323	0.320	0.384	120.650	49.250
19.291	568.880	I6	2,3-dimethylbutane	1.276	1.426	1.234	136.364	57.980
19.447	570.670	--	unknown	0.040	0.043	0.105	32.000	0.000
19.564	572.000	O6	2,3-dimethylbutene-1	0.016	0.017	0.016	132.098	55.610
19.704	573.570	I6	2-methylpentane	3.545	4.012	3.427	140.468	60.260
19.836	575.030	O6	4-methyl-t-pentene-2	0.064	0.071	0.064	137.480	58.600
19.909	575.840	--	unknown	0.000	0.000	0.000	32.000	0.000
20.391	581.040	O6	1,5-hexadiene	0.000	0.000	0.000	139.010	59.450
20.810	585.420	I6	3-methylpentane	2.206	2.454	2.133	145.886	63.270
21.262	590.010	O6	2-methylpentene-1	0.107	0.115	0.106	143.780	62.100
21.352	590.900	O6	hexene-1	0.046	0.050	0.045	146.246	63.470
21.990	597.110	O6	1c/t,4-hexadiene	0.000	0.000	0.000	149.000	65.000
22.296	600.000	P6	n-hexane	1.782	1.998	1.723	155.714	68.730
22.522	602.700	O6	t-hexene-3	0.070	0.076	0.069	152.744	67.080
22.589	603.490	O6	c-hexene-3	0.023	0.025	0.023	151.592	66.440
22.740	605.280	O6	t-hexene-2	0.137	0.148	0.135	154.184	67.880
22.828	606.320	--	unknown	0.000	0.000	0.000	32.000	0.000
22.943	607.660	O6	2-methylpentene-2	0.174	0.187	0.173	153.140	67.300
23.023	608.570	O6	4-methylcyclopentene	0.047	0.046	0.048	148.820	64.900
23.185	610.440	O6	3-methyl-c-pentene-2	0.106	0.112	0.105	153.842	67.690
23.308	611.840	O6	3-methylcyclopentene	0.025	0.025	0.026	149.000	65.000
23.417	613.080	O6	O6-[1]	0.000	0.000	0.000	32.000	0.000
23.548	614.550	O6	c-hexene-2	0.074	0.079	0.074	155.984	68.880
23.786	617.190	O6	O6-[2]	0.001	0.001	0.001	32.000	0.000
24.113	620.770	O7	3,3-dimethylpentene-1	0.163	0.172	0.139	171.446	77.470
24.245	622.200	--	unknown	0.001	0.001	0.002	32.000	0.000
24.299	622.780	--	unknown	0.002	0.002	0.005	32.000	0.000
24.408	623.940	I7	2,2-dimethylpentane	0.098	0.107	0.081	174.542	79.190

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
24.624	626.230	N6	methylcyclopentane	2.308	2.279	2.285	161.240	71.800
25.036	630.520	I7	2,4-dimethylpentane	1.443	1.586	1.200	176.882	80.490
25.274	632.960	O7	cyclic diolefin or triolefin-[1]	0.002	0.002	0.002	32.000	0.000
25.457	634.800	I7	2,2,3-trimethylbutane	0.046	0.049	0.038	177.584	80.880
25.624	636.480	--	unknown	0.002	0.002	0.002	32.000	0.000
25.837	638.600	O7	cyclic diolefin or triolefin-[2]	0.006	0.007	0.007	32.000	0.000
26.174	641.900	O7	O7-[1]	0.002	0.002	0.002	32.000	0.000
26.286	642.980	O7	3,4-dimethylpentene-1	0.006	0.006	0.005	177.422	80.790
26.657	646.530	O7	4,4-dimethyl-c-pentene-2	0.008	0.008	0.007	176.756	80.420
26.803	647.910	O7	2,4-dimethylpentene-1	0.008	0.008	0.007	178.880	81.600
26.905	648.860	O6	1-methylcyclopentene	0.177	0.167	0.179	167.864	75.480
27.104	650.720	A6	benzene	0.681	0.573	0.727	176.162	80.090
27.287	652.400	O7	2-methyl-c-hexene-3	0.004	0.004	0.003	186.800	86.000
27.502	654.370	I7	3,3-dimethylpentane	0.090	0.096	0.075	186.908	86.060
27.606	655.320	O7	5-methylhexene-1	0.011	0.012	0.009	185.558	85.310
27.795	657.020	--	unknown	0.004	0.004	0.003	32.000	0.000
27.928	658.210	N6	cyclohexane	0.780	0.741	0.772	177.296	80.720
28.224	660.830	O7	2-methyl-t-hexene-3	0.016	0.017	0.014	186.620	85.900
28.354	661.970	O6	diolefin (hexadiene)	0.003	0.003	0.003	158.000	70.000
28.445	662.770	O7	2-ethyl-3-methylbutene-1	0.006	0.006	0.005	187.448	86.360
28.573	663.880	O7	4-methylhexene-1	0.013	0.014	0.011	188.114	86.730
28.886	666.570	O7	4-methyl-t/c-hexene-2	0.025	0.027	0.021	187.358	86.310
29.039	667.870	I7	2-methylhexane	1.883	2.051	1.566	194.090	90.050
29.202	669.250	I7	2,3-dimethylpentane	2.445	2.600	2.033	193.604	89.780
29.487	671.630	N7	1,1-dimethylcyclopentane	0.072	0.070	0.061	189.464	87.480
29.810	674.300	O7	5-methyl-t-hexene-2	0.022	0.023	0.019	190.598	88.110
30.022	676.030	I7	3-methylhexane	1.925	2.071	1.601	197.330	91.850
30.187	677.370	O7	1,6-heptadiene	0.000	0.000	0.000	205.106	96.170
30.452	679.490	O7	3,4-dimethyl-c-pentene-2	0.012	0.012	0.010	192.650	89.250
30.759	681.930	N7	1c,3-dimethylcyclopentane	0.656	0.651	0.557	195.386	90.770
31.112	684.690	N7	1t,3-dimethylcyclopentane	0.583	0.576	0.495	197.096	91.720

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
31.289	686.050	I7	3-ethylpentane	0.179	0.189	0.149	200.246	93.470
31.479	687.510	N7	1t,2-dimethylcyclopentane	0.571	0.561	0.484	197.366	91.870
31.659	688.890	I8	2,2,4-trimethylpentane	2.672	2.854	1.948	210.632	99.240
31.752	689.590	O7	2-ethylpentene-1	0.008	0.008	0.007	200.552	93.640
32.213	693.050	O7	O7-[2]	0.001	0.001	0.001	32.000	0.000
32.452	694.820	O7	3-methyl-c-hexene-3	0.021	0.021	0.017	203.720	95.400
32.987	698.720	O7	t-heptene-3	0.074	0.078	0.063	204.206	95.670
33.164	700.000	P7	n-heptane	1.302	1.408	1.083	209.156	98.420
33.463	701.960	O7	2-methyl-2-hexene	0.078	0.080	0.066	203.738	95.410
33.617	702.960	O7	3-methyl-t-hexene-3	0.029	0.031	0.025	200.372	93.540
33.862	704.540	O7	t-heptene-2	0.029	0.030	0.025	208.310	97.950
34.091	706.000	O7	3-ethylpentene-2	0.019	0.020	0.016	204.818	96.010
34.224	706.850	--	unknown	0.000	0.000	0.000	32.000	0.000
34.575	709.060	O7	c-heptene-2	0.073	0.076	0.062	209.138	98.410
34.767	710.260	O7	3-methyl-t-hexene-2	0.001	0.001	0.001	203.324	95.180
35.096	712.290	O7	2,3-dimethylpentene-2	0.031	0.032	0.027	207.320	97.400
35.327	713.700	O7	3-ethylcyclopentene	0.004	0.003	0.003	207.986	97.770
35.433	714.350	--	unknown	0.000	0.000	0.000	32.000	0.000
35.720	716.080	O7	O7-[3]	0.006	0.006	0.005	32.000	0.000
35.981	717.650	N7	1c,2-dimethylcyclopentane	0.271	0.274	0.230	211.154	99.530
36.113	718.430	N7	methylcyclohexane	1.218	1.170	1.034	213.674	100.930
36.462	720.490	I8	2,2-dimethylhexane	0.046	0.049	0.034	224.312	106.840
36.537	720.930	N8	1,1,3-trimethylcyclopentane	0.160	0.158	0.119	220.802	104.890
36.849	722.750	O7	O7-[4]	0.009	0.009	0.007	32.000	0.000
36.960	723.380	O7	O7-[5]	0.002	0.002	0.002	32.000	0.000
37.148	724.460	O7	O7-[6]	0.005	0.005	0.004	32.000	0.000
37.296	725.310	--	unknown	0.001	0.001	0.001	32.000	0.000
37.504	726.490	O7	O7-[7]	0.006	0.006	0.005	32.000	0.000
37.621	727.160	--	unknown	0.001	0.001	0.001	32.000	0.000
38.007	729.320	N7	ethylcyclopentane	0.322	0.311	0.273	218.246	103.470
38.130	730.010	I8	2,5-dimethylhexane	0.548	0.584	0.400	228.398	109.110

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
38.322	731.070	I8	2,2,3-trimethylpentane	0.103	0.106	0.075	229.730	109.850
38.468	731.880	I8	2,4-dimethylhexane	0.633	0.669	0.462	228.974	109.430
38.603	732.620	--	unknown	0.010	0.011	0.007	32.000	0.000
38.819	733.800	--	unknown	0.002	0.002	0.001	32.000	0.000
38.931	734.400	O7	O7-[8]	0.002	0.002	0.001	32.000	0.000
39.163	735.660	O7	O7-[9]	0.002	0.002	0.001	32.000	0.000
39.475	737.330	N8	1c,2t,4-trimethylcyclopentane	0.276	0.267	0.205	242.132	116.740
39.692	738.480	I8	3,3-dimethylhexane	0.054	0.056	0.040	233.546	111.970
40.178	741.040	O7	O7-[10]	0.003	0.003	0.003	32.000	0.000
40.482	742.620	O7	O7-[11]	0.002	0.002	0.001	32.000	0.000
40.624	743.350	O7	O7-[12]	0.004	0.004	0.004	32.000	0.000
40.839	744.450	N8	1t,2c,3-trimethylcyclopentane	0.200	0.192	0.149	230.738	110.410
41.377	747.190	I8	2,3,4-trimethylpentane	1.179	1.212	0.860	236.246	113.470
41.596	748.290	I8	I8-[1]	0.073	0.075	0.053	236.246	113.470
41.894	749.770	O7	O7-[13]	0.019	0.019	0.014	32.000	0.000
42.199	751.280	I8	2,3,3-trimethylpentane	1.112	1.132	0.811	238.586	114.770
42.627	753.380	A7	toluene	4.450	3.794	4.024	231.134	110.630
42.754	753.990	O8	O8-[1]	0.004	0.004	0.003	32.000	0.000
42.937	754.880	O8	O8-[2]	0.001	0.001	0.001	32.000	0.000
43.082	755.580	O8	O8-[3]	0.006	0.006	0.004	32.000	0.000
43.190	756.100	--	unknown	0.001	0.001	0.001	32.000	0.000
43.611	758.100	I8	2,3-dimethylhexane	0.517	0.536	0.377	240.098	115.610
43.781	758.910	I8	2-methyl-3-ethylpentane	0.071	0.074	0.052	240.098	115.610
44.085	760.340	--	unknown	0.006	0.006	0.004	32.000	0.000
44.135	760.570	N8	1,1,2-trimethylcyclopentane	0.004	0.004	0.003	236.714	113.730
44.534	762.420	O8	O8-[4]	0.026	0.027	0.020	32.000	0.000
44.938	764.280	I8	2-methylheptane	0.876	0.928	0.639	243.770	117.650
45.254	765.720	I8	4-methylheptane	0.334	0.350	0.244	243.878	117.710
45.513	766.890	I8	3-methyl-3-ethylpentane	0.067	0.070	0.049	240.098	115.610
45.621	767.380	I8	3,4-dimethylhexane	0.084	0.086	0.061	243.914	117.730
46.245	770.160	N8	1c,2c,4-trimethylcyclopentane	0.105	0.102	0.078	242.168	116.760

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
46.653	771.960	I8	3-methylheptane	0.837	0.877	0.610	246.074	118.930
46.927	773.160	--	unknown	0.179	0.188	0.130	32.000	0.000
47.012	773.520	N8	1c,2t,3-trimethylcyclopentane	0.391	0.375	0.291	243.500	117.500
47.178	774.240	I8	3-ethylhexane	0.104	0.108	0.076	245.372	118.540
47.451	775.420	N8	1t,4-dimethylcyclohexane	0.184	0.178	0.136	246.848	119.360
47.894	777.310	--	unknown	0.002	0.002	0.005	32.000	0.000
48.275	778.920	--	unknown	0.001	0.001	0.002	32.000	0.000
48.427	779.560	O8	O8-[5]	0.001	0.001	0.000	32.000	0.000
48.775	781.020	N8	1,1-dimethylcyclohexane	0.033	0.031	0.024	247.190	119.550
49.237	782.930	I9	2,2,5-trimethylhexane	0.595	0.622	0.387	255.362	124.090
49.668	784.690	N8	3c-ethylmethylcyclopentane	0.202	0.194	0.150	249.980	121.100
49.877	785.540	O9	2,6-dimethylheptene-1	0.003	0.003	0.002	32.000	0.000
50.212	786.890	N8	3t-ethylmethylcyclopentane	0.171	0.165	0.127	249.980	121.100
50.544	788.220	N8	2t-ethylmethylcyclopentane	0.156	0.150	0.116	250.160	121.200
50.996	790.020	O8	O8-[6]	0.006	0.006	0.004	32.000	0.000
51.118	790.500	N8	1,1-methylethylcyclopentane	0.021	0.020	0.016	250.754	121.530
51.821	793.250	N8	1t,2-dimethylcyclohexane	0.181	0.173	0.135	254.174	123.430
52.033	794.080	O8	t-octene-4	0.007	0.008	0.005	252.068	122.260
52.422	795.570	O9	3,5,5-trimethylhexene-1	0.001	0.001	0.001	32.000	0.000
52.883	797.330	N8	1c,2c,3-trimethylcyclopentane	0.030	0.029	0.022	253.400	123.000
53.346	799.080	N8	1t,3-dimethylcyclohexane	0.012	0.012	0.009	254.174	123.430
53.591	800.000	P8	n-octane	0.770	0.810	0.562	258.224	125.680
53.869	801.040	N8	1c,4-dimethylcyclohexane	0.253	0.239	0.188	255.794	124.330
54.740	804.270	O8	t-octene-2	0.008	0.008	0.006	32.000	0.000
54.963	805.090	--	unknown	0.005	0.005	0.012	32.000	0.000
55.339	806.460	I9	I9-[1]	0.037	0.038	0.024	32.000	0.000
55.442	806.830	--	unknown	0.015	0.016	0.010	32.000	0.000
55.829	808.230	N8	i-propylcyclopentane	0.080	0.076	0.059	259.574	126.430
56.496	810.610	--	unknown	0.004	0.004	0.009	32.000	0.000
57.029	812.490	--	unknown	0.008	0.009	0.022	32.000	0.000
57.128	812.840	O8	c-octene-2	0.004	0.004	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
57.402	813.800	--	unknown	0.001	0.001	0.001	32.000	0.000
57.701	814.840	N8	N8-[1]	0.013	0.013	0.010	32.000	0.000
58.060	816.080	O8	O8-[7]	0.002	0.002	0.002	32.000	0.000
58.451	817.420	I9	2,2,3,4-tetramethylpentane	0.119	0.119	0.077	271.454	133.030
59.091	819.590	I9	2,3,4-trimethylhexane	0.067	0.067	0.044	282.308	139.060
59.392	820.600	N8	N8-[2]	0.003	0.003	0.002	32.000	0.000
59.647	821.450	O9	O9-[1]	0.029	0.030	0.019	32.000	0.000
60.056	822.810	N8	N8-[3]	0.001	0.001	0.001	32.000	0.000
60.503	824.290	O9	O9-[2]	0.006	0.006	0.004	32.000	0.000
61.039	826.040	N8	1c,2-dimethylcyclohexane	0.180	0.167	0.134	265.532	129.740
61.253	826.740	--	unknown	0.020	0.021	0.015	32.000	0.000
61.636	827.970	I9	2,3,5-trimethylhexane	0.006	0.006	0.004	268.430	131.350
61.946	828.970	I9	2,2-dimethylheptane	0.012	0.013	0.008	270.860	132.700
62.837	831.790	N9	1,1,4-trimethylcyclohexane	0.319	0.306	0.211	275.000	135.000
63.401	833.560	I9	2,2,3-trimethylhexane	0.151	0.156	0.098	271.220	132.900
63.985	835.370	I9	2,4-dimethylheptane	0.032	0.033	0.021	271.220	132.900
64.729	837.660	I9	4,4-dimethylheptane	0.184	0.190	0.119	271.220	132.900
65.026	838.560	N8	ethylcyclohexane	0.001	0.001	0.001	269.222	131.790
65.611	840.320	N8	n-propylcyclopentane	0.025	0.024	0.019	267.728	130.960
65.838	841.000	I9	2,5-dimethylheptane	0.255	0.263	0.165	276.800	136.000
66.297	842.370	I9	3,3-&3,5-dimethylheptane	0.058	0.059	0.038	278.636	137.020
66.708	843.590	I9	3,5-dimethylheptane	0.040	0.040	0.026	276.800	136.000
67.185	844.980	I9	2,6-dimethylheptane	0.068	0.071	0.044	275.396	135.220
67.811	846.800	N9	1,1,3-trimethylcyclohexane	0.046	0.043	0.030	295.862	146.590
68.307	848.240	O9	2,4-dimethylheptene-1	0.002	0.002	0.001	32.000	0.000
68.882	849.880	--	unknown	0.002	0.002	0.001	32.000	0.000
69.088	850.460	N8	N8-[4]	0.003	0.003	0.002	32.000	0.000
69.413	851.380	N9	1c,2t,4t-trimethylcyclohexane	0.019	0.018	0.012	32.000	0.000
70.264	853.770	A8	ethylbenzene	1.165	0.993	0.914	277.160	136.200
70.641	854.810	N9	1c,3c,5c-trimethylcyclohexane	0.122	0.116	0.081	32.000	0.000
71.473	857.100	O9	2-methyloctene-1	0.019	0.021	0.013	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
71.908	858.280	I9	I9-[2]	0.003	0.003	0.002	32.000	0.000
72.363	859.510	O9	2-methyloctene-2	0.027	0.030	0.018	32.000	0.000
74.102	864.140	A8	1,3-dimethylbenzene	3.126	2.673	2.453	282.416	139.120
74.437	865.020	A8	1,4-dimethylbenzene	1.282	1.101	1.006	281.048	138.360
75.057	866.630	I9	3,4-dimethylheptane	0.029	0.030	0.019	285.080	140.600
75.385	867.470	I9	3,4 -dimethylheptane	0.059	0.059	0.038	285.080	140.600
75.920	868.850	N9	N9-[1]	0.026	0.024	0.017	32.000	0.000
76.357	869.960	I9	I9-[3]	0.073	0.074	0.047	32.000	0.000
77.201	872.090	I9	4-ethylheptane	0.002	0.002	0.001	288.392	142.440
77.565	873.000	I9	4-methyloctane	0.259	0.266	0.168	288.392	142.440
77.962	873.990	I9	2-methyloctane	0.317	0.329	0.206	289.904	143.280
78.571	875.500	N9	N9-[2]	0.035	0.034	0.023	32.000	0.000
79.425	877.590	N9	1c,2t,3c-trimethylcyclohexane	0.038	0.037	0.025	304.160	151.200
79.737	878.350	I9	3-ethylheptane	0.074	0.075	0.048	289.400	143.000
80.248	879.580	I9	3-methyloctane	0.409	0.419	0.265	291.614	144.230
80.574	880.370	I9	3,3-diethylpentane	0.020	0.020	0.013	270.842	132.690
81.012	881.410	--	unknown	0.062	0.066	0.041	32.000	0.000
81.300	882.100	N9	1c,2t,4c-trimethylcyclohexane	0.017	0.016	0.011	275.000	135.000
81.647	882.920	N9	1,1,2-trimethylcyclohexane	0.025	0.023	0.017	293.360	145.200
82.025	883.810	A8	1,2-dimethylbenzene	1.571	1.319	1.233	291.974	144.430
82.561	885.060	I9	I9-[4]	0.027	0.027	0.017	32.000	0.000
82.924	885.910	I9	I9-[5]	0.099	0.100	0.064	32.000	0.000
83.656	887.600	N9	N9-[3]	0.085	0.080	0.056	32.000	0.000
83.923	888.210	N9	N9-[4]	0.105	0.100	0.069	32.000	0.000
84.050	888.500	--	unknown	0.038	0.040	0.025	32.000	0.000
84.419	889.350	O9	nonene-1	0.005	0.005	0.003	274.100	134.500
84.612	889.790	I9	I9-[6]	0.058	0.059	0.038	32.000	0.000
85.014	890.700	N9	N9-[5]	0.150	0.142	0.099	32.000	0.000
85.557	891.920	I9	I9-[7]	0.016	0.016	0.010	32.000	0.000
86.008	892.930	N9	i-butylcyclopentane	0.031	0.029	0.021	298.346	147.970
86.220	893.400	N9	N9-[6]	0.021	0.020	0.014	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
87.085	895.320	--	unknown	0.001	0.001	0.001	32.000	0.000
87.447	896.110	N9	N9-[7]	0.014	0.014	0.009	32.000	0.000
87.739	896.750	N9	N9-[8]	0.008	0.008	0.005	32.000	0.000
88.032	897.390	O9	t-nonene-2	0.007	0.008	0.005	32.000	0.000
88.253	897.870	O9	t-nonene-3	0.020	0.020	0.013	32.000	0.000
88.667	898.770	I9	I9-[8]	0.119	0.120	0.077	32.000	0.000
88.821	899.100	--	unknown	0.024	0.025	0.015	32.000	0.000
89.236	900.000	P9	n-nonane	0.366	0.377	0.238	303.476	150.820
89.599	901.750	N9	1,1-methylethylcyclohexane	0.088	0.081	0.058	305.924	152.180
90.172	904.520	N9	N9-[9]	0.009	0.009	0.006	32.000	0.000
90.423	905.720	N9	N9-[10]	0.025	0.024	0.017	32.000	0.000
90.704	907.070	O10	t-2,2,5,5-tetramethylhexene-3	0.004	0.005	0.003	32.000	0.000
90.819	907.620	--	unknown	0.002	0.002	0.001	32.000	0.000
91.587	911.270	N9	N9-[11]	0.006	0.005	0.004	32.000	0.000
92.011	913.270	A9	i-propylbenzene	0.062	0.053	0.043	306.338	152.410
92.375	914.970	O9	c-nonene-3	0.072	0.077	0.047	32.000	0.000
92.533	915.710	--	unknown	0.017	0.018	0.011	32.000	0.000
92.941	917.620	I10	I10-[1]	0.012	0.012	0.007	32.000	0.000
93.038	918.070	N9	i-propylcyclohexane	0.021	0.019	0.014	310.622	154.790
93.182	918.740	--	unknown	0.006	0.006	0.004	32.000	0.000
93.773	921.470	I10	I10-[2]	0.106	0.108	0.062	32.000	0.000
94.171	923.300	I10	2,2-dimethyloctane	0.034	0.035	0.020	314.420	156.900
94.445	924.560	I10	2,4-dimethyloctane	0.051	0.052	0.030	312.620	155.900
94.879	926.540	N9	N9-[12]	0.007	0.006	0.004	32.000	0.000
95.312	928.500	N9	N9-[13]	0.022	0.021	0.014	32.000	0.000
95.918	931.240	I10	2,6-dimethyloctane	0.086	0.087	0.050	320.738	160.410
96.277	932.850	I10	2,5-dimethyloctane	0.078	0.079	0.045	317.300	158.500
96.526	933.960	--	unknown	0.003	0.003	0.002	32.000	0.000
96.951	935.860	--	unknown	0.002	0.002	0.001	32.000	0.000
97.131	936.660	N9	n-butylcyclopentane	0.056	0.053	0.037	313.916	156.620
97.344	937.600	I10	I10-[3]	0.031	0.032	0.018	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
97.494	938.270	N10	N10-[1]	0.035	0.033	0.021	32.000	0.000
97.758	939.430	--	unknown	0.005	0.006	0.003	32.000	0.000
98.007	940.530	I10	I10-[4]	0.021	0.021	0.012	32.000	0.000
98.461	942.520	I10	3,3-dimethyloctane	0.137	0.137	0.080	322.160	161.200
98.775	943.890	N10	N10-[2]	0.023	0.021	0.014	32.000	0.000
98.987	944.810	--	unknown	0.019	0.020	0.011	32.000	0.000
99.159	945.560	--	unknown	0.024	0.026	0.014	32.000	0.000
99.551	947.260	A9	n-propylbenzene	0.348	0.298	0.241	318.632	159.240
99.847	948.540	I10	3,6-dimethyloctane	0.026	0.026	0.015	321.440	160.800
100.103	949.640	I10	3-methyl-5-ethylheptane	0.045	0.046	0.027	316.760	158.200
100.247	950.260	--	unknown	0.006	0.007	0.004	32.000	0.000
100.568	951.630	N10	N10-[3]	0.027	0.025	0.016	32.000	0.000
101.193	954.300	--	unknown	0.023	0.024	0.014	32.000	0.000
101.500	955.600	A9	1,3-methylethylbenzene	1.232	1.053	0.854	322.394	161.330
101.886	957.230	A9	1,4-methylethylbenzene	0.528	0.453	0.366	323.618	162.010
102.198	958.550	N10	N10-[4]	0.029	0.027	0.018	32.000	0.000
102.359	959.220	--	unknown	0.003	0.003	0.002	32.000	0.000
102.731	960.780	--	unknown	0.002	0.002	0.001	32.000	0.000
102.940	961.650	--	unknown	0.011	0.011	0.028	32.000	0.000
103.230	962.860	A9	1,3,5-trimethylbenzene	0.656	0.561	0.455	328.532	164.740
103.496	963.970	I10	I10-[5]	0.041	0.041	0.024	32.000	0.000
103.763	965.070	N10	N10-[5]	0.018	0.017	0.011	32.000	0.000
103.959	965.880	--	unknown	0.006	0.006	0.003	32.000	0.000
104.192	966.840	I10	I10-[6]	0.003	0.003	0.002	32.000	0.000
104.511	968.150	I10	5-methylnonane	0.051	0.051	0.030	329.180	165.100
104.914	969.800	I10	4-methylnonane	0.420	0.419	0.246	32.000	0.000
105.259	971.210	A9	1,2-methylethylbenzene	0.391	0.328	0.271	329.324	165.180
105.445	971.970	I10	2-methylnonane	0.124	0.126	0.072	332.654	167.030
105.596	972.580	--	unknown	0.009	0.010	0.006	32.000	0.000
105.867	973.680	--	unknown	0.011	0.012	0.007	32.000	0.000
106.099	974.620	I10	3-ethyloctane	0.026	0.026	0.015	331.700	166.500

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
106.183	974.960	--	unknown	0.013	0.014	0.008	32.000	0.000
106.471	976.120	N10	N10-[6]	0.023	0.021	0.014	32.000	0.000
106.803	977.450	I10	3-methylnonane	0.147	0.148	0.086	334.040	167.800
107.008	978.280	--	unknown	0.007	0.007	0.004	32.000	0.000
107.374	979.740	N10	N10-[7]	0.003	0.003	0.002	32.000	0.000
107.545	980.420	I10	I10-[7]	0.094	0.094	0.055	32.000	0.000
107.817	981.500	I10	I10-[8]	0.008	0.008	0.005	32.000	0.000
108.102	982.630	--	unknown	0.011	0.011	0.006	32.000	0.000
108.558	984.430	A9	1,2,4-trimethylbenzene	1.914	1.615	1.326	336.884	169.380
108.799	985.380	--	unknown	0.007	0.007	0.005	32.000	0.000
108.972	986.060	I10	I10-[9]	0.011	0.011	0.006	32.000	0.000
109.077	986.480	N10	i-butylcyclohexane	0.034	0.032	0.020	340.340	171.300
109.267	987.220	--	unknown	0.027	0.029	0.016	32.000	0.000
109.386	987.690	I10	I10-[10]	0.044	0.044	0.026	32.000	0.000
109.669	988.790	I10	I10-[11]	0.019	0.019	0.011	32.000	0.000
109.812	989.350	I10	I10-[12]	0.012	0.012	0.007	32.000	0.000
110.161	990.700	N10	N10-[8]	0.022	0.021	0.013	32.000	0.000
110.302	991.250	--	unknown	0.003	0.003	0.002	32.000	0.000
110.777	993.090	O10	decene-1	0.003	0.003	0.002	339.080	170.600
110.934	993.690	N10	1t-methyl-2-n-propylcyclohexane	0.012	0.011	0.007	339.800	171.000
111.054	994.160	O10	2,3-dimethyloctene-2	0.063	0.063	0.037	32.000	0.000
111.180	994.640	I10	I10-[13]	0.013	0.013	0.008	32.000	0.000
111.462	995.720	--	unknown	0.004	0.004	0.002	32.000	0.000
111.606	996.270	A10	i-butylbenzene	0.051	0.044	0.032	343.022	172.790
111.842	997.180	I10	I10-[14]	0.037	0.037	0.022	32.000	0.000
112.122	998.240	A10	sec-butylbenzene	0.035	0.030	0.022	344.012	173.340
112.369	999.180	--	unknown	0.008	0.009	0.005	32.000	0.000
112.583	1000.000	P10	n-decane	0.194	0.196	0.114	345.470	174.150
112.825	1001.530	I11	I11-[1]	0.027	0.027	0.015	32.000	0.000
113.184	1003.790	N10	N10-[9]	0.017	0.016	0.010	32.000	0.000
113.582	1006.290	--	unknown	0.005	0.005	0.003	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
113.827	1007.820	A9	1,2,3-trimethylbenzene	0.374	0.309	0.259	349.016	176.120
113.973	1008.740	--	unknown	0.009	0.010	0.007	32.000	0.000
114.273	1010.620	A10	1,3-methyl-i-propylbenzene	0.041	0.035	0.026	347.144	175.080
114.711	1013.330	--	unknown	0.010	0.010	0.025	32.000	0.000
114.833	1014.090	A10	1,4-methyl-i-propylbenzene	0.024	0.021	0.015	350.834	177.130
114.982	1015.020	--	unknown	0.003	0.003	0.002	32.000	0.000
115.302	1017.000	I11	I11-[2]	0.026	0.026	0.014	32.000	0.000
115.571	1018.650	I11	I11-[3]	0.012	0.012	0.006	32.000	0.000
115.865	1020.460	A10	2-3-dihydroindene	0.261	0.200	0.184	352.130	177.850
116.230	1022.700	--	unknown	0.018	0.020	0.013	32.000	0.000
116.476	1024.200	N10	sec-butylcyclohexane	0.041	0.037	0.024	354.812	179.340
116.709	1025.630	I11	I11-[4]	0.008	0.008	0.004	32.000	0.000
117.060	1027.760	A10	1,2-methyl-i-propylbenzene	0.070	0.059	0.044	352.724	178.180
117.238	1028.840	I11	3-ethylnonane	0.005	0.005	0.002	32.000	0.000
117.316	1029.320	--	unknown	0.004	0.004	0.002	32.000	0.000
117.629	1031.210	--	unknown	0.064	0.067	0.034	32.000	0.000
117.852	1032.550	N11	N11-[1]	0.026	0.024	0.014	32.000	0.000
117.916	1032.940	--	unknown	0.019	0.020	0.010	32.000	0.000
118.094	1034.010	I11	I11-[5]	0.016	0.016	0.008	32.000	0.000
118.228	1034.820	--	unknown	0.003	0.003	0.002	32.000	0.000
118.604	1037.080	I11	I11-[6]	0.030	0.028	0.016	32.000	0.000
118.770	1038.070	--	unknown	0.033	0.034	0.018	32.000	0.000
119.212	1040.710	A10	1,3-diethylbenzene	0.132	0.113	0.082	358.052	181.140
119.412	1041.900	--	unknown	0.061	0.065	0.038	32.000	0.000
119.661	1043.380	A10	1,3-methyl-n-propylbenzene	0.271	0.233	0.168	359.618	182.010
119.834	1044.400	I11	I11-[7]	0.021	0.021	0.011	32.000	0.000
120.111	1046.040	A10	1,4-diethylbenzene	0.011	0.009	0.007	362.822	183.790
120.297	1047.150	A10	1,4-methyl-n-propylbenzene	0.169	0.145	0.105	362.156	183.420
120.472	1048.180	A10	n-butylbenzene	0.081	0.070	0.050	361.940	183.300
120.880	1050.580	A10	1,3-dimethyl-5-ethylbenzene	0.283	0.238	0.176	362.516	183.620
121.204	1052.480	A10	1,2-diethylbenzene	0.030	0.025	0.019	362.228	183.460

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
121.347	1053.320	I11	I11-[8]	0.017	0.017	0.009	32.000	0.000
121.575	1054.640	N10	t-decahydronaphthalene	0.009	0.008	0.005	368.960	187.200
121.824	1056.100	N11	N11-[2]	0.016	0.015	0.009	32.000	0.000
122.092	1057.660	--	unknown	0.012	0.012	0.006	32.000	0.000
122.248	1058.560	A10	1,2-methyl-n-propylbenzene	0.093	0.079	0.058	364.946	184.970
122.617	1060.700	I11	I11-[9]	0.009	0.009	0.005	32.000	0.000
122.752	1061.480	I11	I11-[10]	0.069	0.069	0.037	32.000	0.000
122.964	1062.710	I11	I11-[11]	0.034	0.034	0.018	32.000	0.000
123.037	1063.130	--	unknown	0.011	0.012	0.006	32.000	0.000
123.319	1064.750	--	unknown	0.004	0.004	0.002	32.000	0.000
123.471	1065.630	I11	I11-[12]	0.045	0.045	0.024	32.000	0.000
123.731	1067.120	--	unknown	0.009	0.009	0.005	32.000	0.000
124.020	1068.770	A10	1,4,dimethyl-2-ethylbenzene	0.205	0.173	0.128	368.366	186.870
124.291	1070.310	A10	1,3-dimethyl-4-ethylbenzene	0.257	0.221	0.160	370.832	188.240
124.540	1071.730	I11	I11-[13]	0.004	0.004	0.002	32.000	0.000
124.865	1073.580	--	unknown	0.008	0.008	0.004	32.000	0.000
125.123	1075.040	I11	I11-[14]	0.141	0.140	0.075	32.000	0.000
125.290	1075.990	A10	1,2-dimethyl-4-ethylbenzene	0.283	0.239	0.175	373.136	189.520
125.602	1077.750	--	unknown	0.009	0.009	0.005	32.000	0.000
125.889	1079.370	--	unknown	0.012	0.013	0.007	32.000	0.000
125.965	1079.790	I11	I11-[15]	0.005	0.005	0.003	32.000	0.000
126.267	1081.490	A10	1,3-dimethyl-2-ethylbenzene	0.047	0.039	0.029	374.090	190.050
126.416	1082.330	I11	I11-[16]	0.018	0.018	0.010	32.000	0.000
126.747	1084.180	--	unknown	0.016	0.017	0.009	32.000	0.000
126.947	1085.300	I11	I11-[17]	0.008	0.008	0.004	32.000	0.000
127.178	1086.580	--	unknown	0.015	0.016	0.008	32.000	0.000
127.517	1088.470	--	unknown	0.008	0.009	0.004	32.000	0.000
127.589	1088.870	--	unknown	0.011	0.012	0.006	32.000	0.000
127.859	1090.360	O11	undecene-1	0.020	0.020	0.011	378.860	192.700
128.195	1092.220	A11	1,4-methyl-t-butylbenzene	0.036	0.031	0.020	32.000	0.000
128.471	1093.740	A10	1,2-dimethyl-3-ethylbenzene	0.079	0.065	0.049	381.110	193.950

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
128.814	1095.630	--	unknown	0.007	0.007	0.004	32.000	0.000
129.087	1097.120	--	unknown	0.013	0.014	0.008	32.000	0.000
129.172	1097.590	A11	1,2-ethyl-i-propylbenzene	0.008	0.007	0.005	32.000	0.000
129.335	1098.490	--	unknown	0.006	0.007	0.004	32.000	0.000
129.612	1100.000	P11	n-undecane	0.104	0.103	0.055	384.620	195.900
129.812	1101.490	--	unknown	0.007	0.008	0.004	32.000	0.000
129.920	1102.310	A11	1,4-ethyl-i-propylbenzene	0.002	0.002	0.001	32.000	0.000
130.345	1105.480	A10	1,2,4,5-tetramethylbenzene	0.164	0.136	0.102	386.312	196.840
130.731	1108.350	A11	1,2-methyl-n-butylbenzene	0.009	0.008	0.005	390.200	199.000
130.885	1109.500	A10	1,2,3,5-tetramethylbenzene	0.219	0.182	0.136	388.472	198.040
131.039	1110.640	--	unknown	0.006	0.006	0.004	32.000	0.000
131.377	1113.150	--	unknown	0.012	0.012	0.007	32.000	0.000
131.572	1114.590	--	unknown	0.007	0.008	0.005	32.000	0.000
131.876	1116.830	--	unknown	0.021	0.022	0.013	32.000	0.000
132.321	1120.110	--	unknown	0.014	0.015	0.009	32.000	0.000
132.478	1121.260	--	unknown	0.015	0.015	0.009	32.000	0.000
132.958	1124.770	A11	1,2-methyl-t-butylbenzene	0.006	0.005	0.003	32.000	0.000
133.117	1125.930	--	unknown	0.012	0.013	0.007	32.000	0.000
133.430	1128.210	A10	5-methylindan	0.194	0.161	0.122	32.000	0.000
133.772	1130.700	--	unknown	0.028	0.030	0.018	32.000	0.000
133.823	1131.070	I12	I12-[1]	0.019	0.019	0.009	421.340	216.300
134.181	1133.660	--	unknown	0.007	0.008	0.003	32.000	0.000
134.296	1134.500	A10	4-methylindan	0.048	0.040	0.030	32.000	0.000
134.584	1136.580	--	unknown	0.015	0.015	0.009	32.000	0.000
134.678	1137.260	A11	1,2-ethyl-n-propylbenzene	0.052	0.044	0.029	32.000	0.000
134.928	1139.060	A10	2-methylindan	0.186	0.152	0.117	368.600	187.000
135.139	1140.570	A11	1,3-methyl-n-butylbenzene	0.009	0.007	0.005	390.200	199.000
135.411	1142.520	--	unknown	0.006	0.007	0.004	32.000	0.000
135.545	1143.480	A12	1,3-di-i-propylbenzene	0.062	0.051	0.032	397.760	203.200
135.756	1144.990	A11	s-pentylbenzene	0.057	0.048	0.032	401.000	205.000
135.913	1146.110	--	unknown	0.002	0.002	0.001	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
136.342	1149.170	--	unknown	0.018	0.019	0.010	32.000	0.000
136.439	1149.860	A11	n-pentylbenzene	0.048	0.040	0.027	401.720	205.400
136.519	1150.430	--	unknown	0.022	0.023	0.012	32.000	0.000
136.799	1152.420	N12	1t-M-2-(4-MP)cyclopentane	0.004	0.004	0.002	32.000	0.000
136.998	1153.830	A12	1,2-di-i-propylbenzene	0.027	0.023	0.014	399.200	204.000
137.143	1154.860	--	unknown	0.026	0.028	0.013	32.000	0.000
137.628	1158.280	--	unknown	0.039	0.041	0.020	32.000	0.000
137.901	1160.200	A12	1,4-di-i-propylbenzene	0.048	0.040	0.025	410.540	210.300
138.178	1162.140	--	unknown	0.007	0.007	0.004	32.000	0.000
138.351	1163.350	A10	tetrahydronaphthalene	0.018	0.014	0.011	405.716	207.620
138.495	1164.370	--	unknown	0.007	0.008	0.005	32.000	0.000
138.737	1166.060	--	unknown	0.004	0.004	0.003	32.000	0.000
138.887	1167.100	I12	I12-[2]	0.052	0.051	0.025	421.340	216.300
139.184	1169.170	A10	naphthalene	0.160	0.115	0.104	424.382	217.990
139.510	1171.440	A12	1-t-butyl-3,5-dimethylbenzene	0.004	0.003	0.002	32.000	0.000
139.850	1173.800	--	unknown	0.054	0.057	0.028	32.000	0.000
139.906	1174.190	A12	1,4-ethyl-t-butylbenzene	0.022	0.018	0.011	32.000	0.000
140.253	1176.590	--	unknown	0.026	0.027	0.013	32.000	0.000
140.545	1178.600	I12	I12-[3]	0.054	0.053	0.026	421.340	216.300
140.775	1180.190	I12	I12-[4]	0.031	0.030	0.015	421.340	216.300
141.114	1182.520	--	unknown	0.006	0.007	0.003	32.000	0.000
141.354	1184.170	I12	I12-[5]	0.032	0.031	0.016	421.340	216.300
141.605	1185.890	--	unknown	0.011	0.012	0.005	32.000	0.000
141.898	1187.880	I12	I12-[6]	0.033	0.032	0.016	421.340	216.300
142.097	1189.240	A12	1,3-di-n-propylbenzene	0.038	0.032	0.020	32.000	0.000
142.336	1190.870	A12	A12-[1]	0.023	0.019	0.012	32.000	0.000
142.555	1192.350	O12	dodecene-1	0.004	0.004	0.002	416.120	213.400
142.651	1193.010	--	unknown	0.001	0.002	0.001	32.000	0.000
142.914	1194.790	--	unknown	0.007	0.007	0.003	32.000	0.000
143.255	1197.100	--	unknown	0.004	0.005	0.002	32.000	0.000
143.559	1199.150	A12	A12-[2]	0.019	0.016	0.010	32.000	0.000

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
143.684	1200.000	P12	n-dodecane	0.044	0.044	0.022	421.340	216.300
143.948	1202.220	--	unknown	0.003	0.003	0.002	32.000	0.000
144.230	1204.590	--	unknown	0.013	0.013	0.006	32.000	0.000
144.332	1205.440	--	unknown	0.004	0.004	0.002	32.000	0.000
144.764	1209.060	--	unknown	0.011	0.012	0.006	32.000	0.000
144.990	1210.950	--	unknown	0.006	0.006	0.003	32.000	0.000
145.189	1212.610	A12	1,3,5-triethylbenzene	0.003	0.003	0.002	420.800	216.000
145.375	1214.160	--	unknown	0.007	0.007	0.004	32.000	0.000
145.718	1217.010	--	unknown	0.021	0.022	0.011	32.000	0.000
145.896	1218.500	--	unknown	0.011	0.012	0.006	32.000	0.000
146.022	1219.540	--	unknown	0.002	0.002	0.001	32.000	0.000
146.209	1221.090	--	unknown	0.003	0.003	0.001	32.000	0.000
146.499	1223.490	--	unknown	0.017	0.018	0.009	32.000	0.000
146.739	1225.470	--	unknown	0.016	0.017	0.008	32.000	0.000
146.812	1226.070	--	unknown	0.007	0.008	0.004	32.000	0.000
147.116	1228.570	--	unknown	0.004	0.005	0.002	32.000	0.000
147.203	1229.290	--	unknown	0.012	0.013	0.006	32.000	0.000
147.508	1231.800	A12	1,2,4-triethylbenzene	0.013	0.011	0.007	423.500	217.500
147.732	1233.630	--	unknown	0.004	0.004	0.002	32.000	0.000
147.841	1234.520	--	unknown	0.001	0.001	0.001	32.000	0.000
148.094	1236.590	--	unknown	0.004	0.004	0.002	32.000	0.000
148.146	1237.020	--	unknown	0.004	0.005	0.002	32.000	0.000
148.234	1237.740	--	unknown	0.007	0.007	0.004	32.000	0.000
148.466	1239.630	--	unknown	0.001	0.002	0.001	32.000	0.000
148.804	1242.380	A12	1,4-methyl-n-pentylbenzene	0.034	0.029	0.018	32.000	0.000
149.090	1244.700	--	unknown	0.009	0.009	0.005	32.000	0.000
149.243	1245.940	--	unknown	0.003	0.004	0.002	32.000	0.000
149.382	1247.070	--	unknown	0.003	0.003	0.002	32.000	0.000
149.671	1249.400	--	unknown	0.004	0.005	0.002	32.000	0.000
149.954	1251.690	--	unknown	0.006	0.006	0.003	32.000	0.000
150.150	1253.270	--	unknown	0.007	0.008	0.004	32.000	0.000

Detailed Hydrocarbon Analysis Detail Report - Report Date: 11/2/2020 10:38:29 PM

RawFile: D:\1\DATA\D6730OCT3020\107F0701.D\107F0701.CDF Acquired: 10/31/20 16:09:43
Sample: ODDB:54930 Analyzed: 11/2/2020 10:37:26 PM
Processed 651 Peaks
Reference File: C:\Dragon Software\Dragon DHA\References\PONAVI_SwRI_07182018_1108.dha
Comments: Yield: 100.000%
Int Std: NONE
Int Std Amt: 0.000
Hold Sample Wt: 1.000 Sample Den: 1.000

Components Listed in Chromatographic Order

Minutes	Index	Group	Component	Mass %	Volume %	Mol %	BP(F)	BP(C)
150.535	1256.370	A12	n-hexylbenzene	0.019	0.016	0.010	32.000	0.000
150.627	1257.100	--	unknown	0.020	0.021	0.010	32.000	0.000
150.998	1260.080	--	unknown	0.011	0.012	0.006	32.000	0.000
151.255	1262.130	--	unknown	0.005	0.005	0.002	32.000	0.000
151.501	1264.090	--	unknown	0.005	0.005	0.002	32.000	0.000
151.660	1265.360	--	unknown	0.003	0.003	0.002	32.000	0.000
151.846	1266.850	--	unknown	0.005	0.005	0.003	32.000	0.000
151.922	1267.450	--	unknown	0.009	0.010	0.005	32.000	0.000
152.208	1269.720	--	unknown	0.008	0.009	0.004	32.000	0.000
152.370	1271.010	--	unknown	0.002	0.002	0.001	32.000	0.000
152.638	1273.140	I13	I13-[1]	0.008	0.008	0.004	455.720	235.400
152.829	1274.640	A11	1,2,3,4,5-pentamethylbenzene	0.022	0.017	0.013	449.600	232.000
153.056	1276.440	--	unknown	0.009	0.009	0.005	32.000	0.000
153.572	1280.500	--	unknown	0.006	0.006	0.003	32.000	0.000
153.928	1283.300	A11	2-methylnaphthalene	0.087	0.063	0.051	465.890	241.050
154.078	1284.470	--	unknown	0.002	0.002	0.001	32.000	0.000
154.414	1287.100	--	unknown	0.010	0.010	0.006	32.000	0.000
154.564	1288.280	--	unknown	0.002	0.002	0.001	32.000	0.000
154.705	1289.380	--	unknown	0.003	0.003	0.002	32.000	0.000
154.908	1290.960	O13	tridecene-1	0.006	0.006	0.003	451.040	232.800
155.142	1292.780	--	unknown	0.001	0.001	0.000	32.000	0.000
155.344	1294.350	--	unknown	0.002	0.002	0.001	32.000	0.000
155.504	1295.600	--	unknown	0.003	0.003	0.001	32.000	0.000
155.582	1296.200	--	unknown	0.002	0.002	0.001	32.000	0.000
155.878	1298.500	A11	1-methylnaphthalene	0.035	0.025	0.020	472.352	244.640
156.071	1300.000	P13	n-tridecane	0.009	0.009	0.004	455.720	235.400
156.182	1300.990	+	C14+ (Summarized)	0.356	0.345	0.150	455.720	235.400