

**EXHIBIT D**  
**OCTANE LEVELS OF EPA<sup>ct</sup> STUDY TEST FUELS**  
**vs. MARKET FUEL**

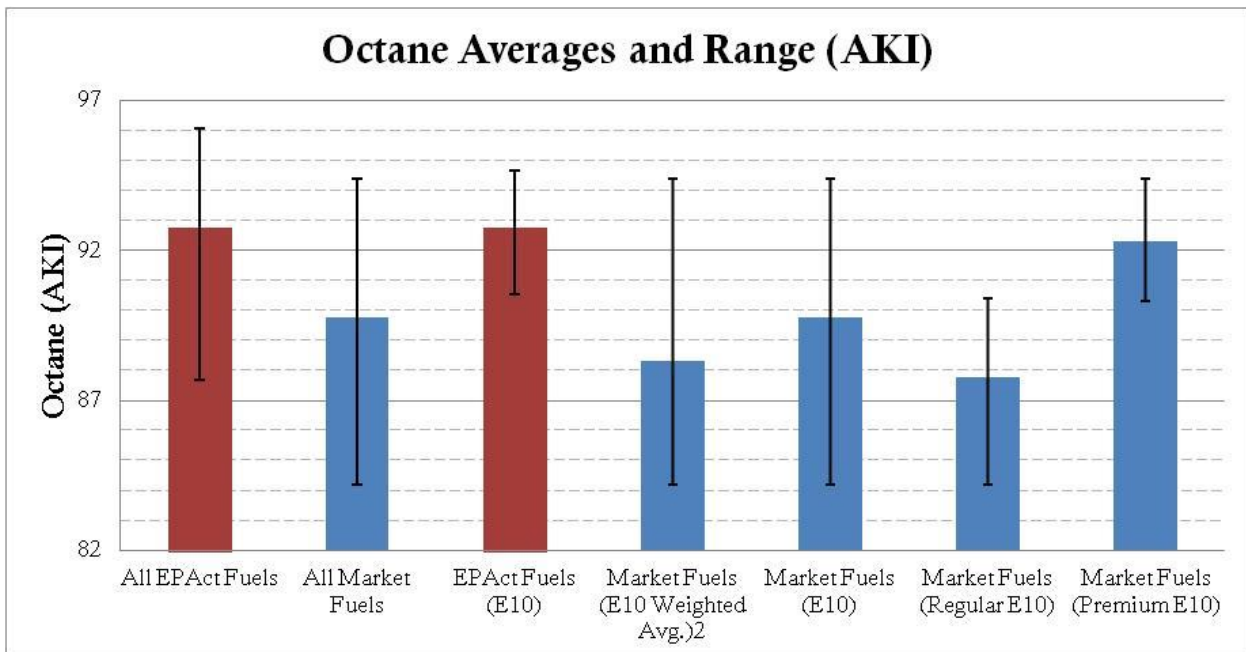
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## Octane Levels of EPAct Study Test Fuels vs. Market Fuel<sup>1</sup>

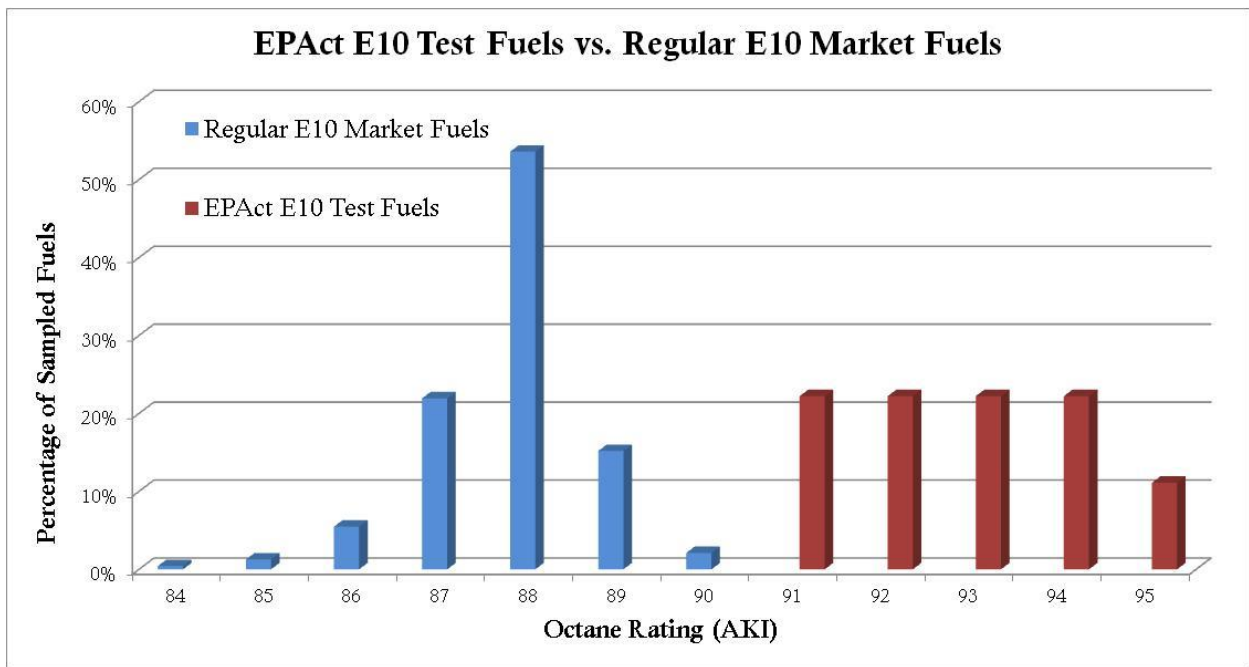
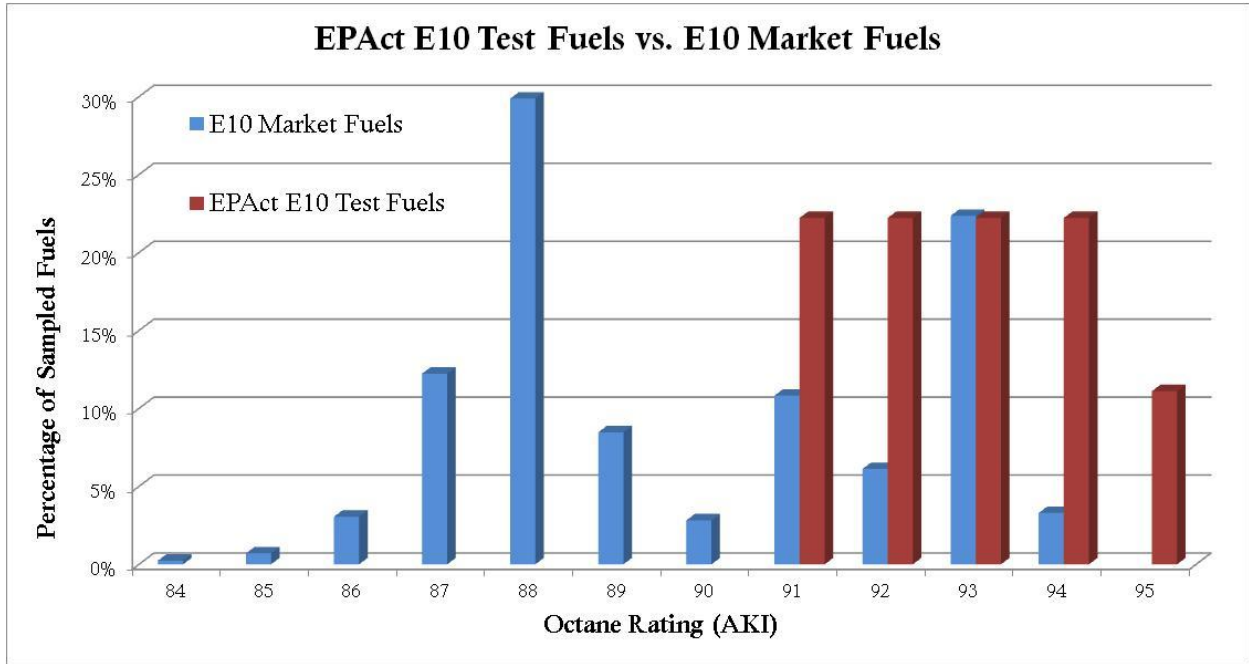
Octane (AKI)							
	All EPAct Fuels	All Market Fuels	EPAct Fuels (E10)	Market Fuels (E10 Weighted Avg.) <sup>2</sup>	Market Fuels (E10)	Market Fuels (Regular E10)	Market Fuels (Premium E10)
<b>Average</b>	92.79	89.79	92.76	88.34	89.78	87.77	92.32
<b>Median</b>	92.80	88.90	92.80	----	88.80	87.80	92.80
<b>Highest</b>	96.05	94.40	94.65	94.40	94.40	90.40	94.40
<b>Lowest</b>	87.70	84.20	90.55	84.20	84.20	84.20	90.30



<sup>1</sup> “EPAct Fuels” represent the test fuels used in the EPAct study. EPA, EPAct/V2/E-89: Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles Certified to Tier 2 Standards: Final Report on Program Design and Data Collection 31–32 (Apr. 2013) (hereinafter EPAct, Final Report on Program Design); *see infra* at D-4. “Market Fuels” represent U.S. fuels measured in the Alliance of Automobile Manufacturers Fuel Survey. Alliance of Automobile Manufacturers, North American Fuel Survey (Summer 2014).

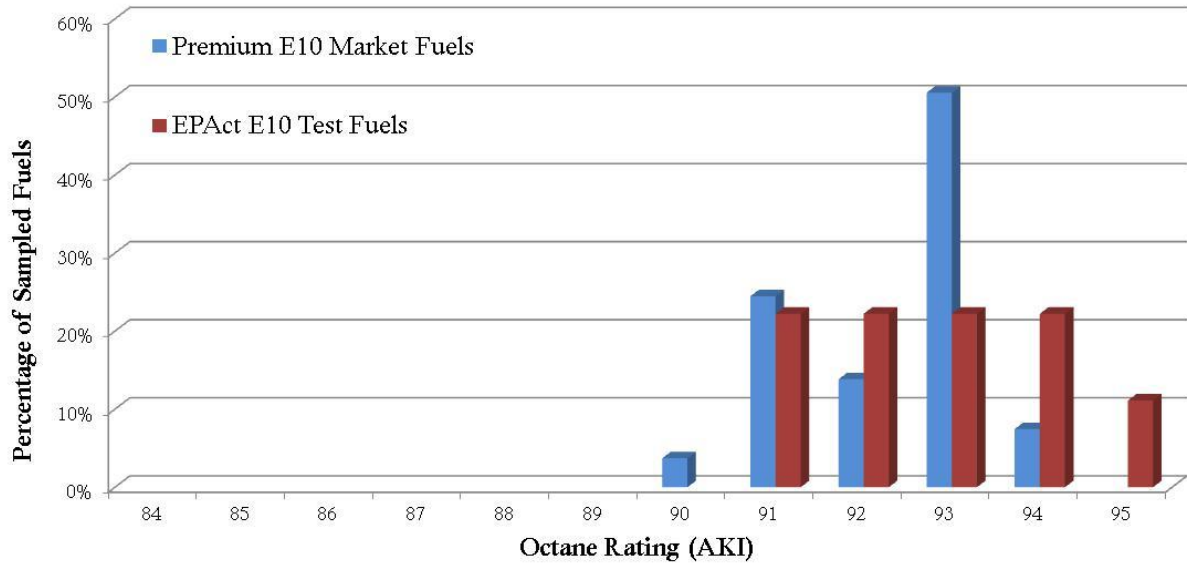
<sup>2</sup> The weighted average was calculated using the 2014 average sales of each fuel grade (Regular, Mid-grade, and Premium). Energy Information Administration, *U.S. Sales to End Users, Total Refiner Motor Gasoline Sales Volumes*, [http://www.eia.gov/dnav/pet/pet\\_cons\\_refmg\\_d\\_nus\\_vtr\\_mgalpd\\_m.htm](http://www.eia.gov/dnav/pet/pet_cons_refmg_d_nus_vtr_mgalpd_m.htm) (last visited on June 25, 2015). Of all gasoline sold in 2014, 84.29% was Regular, 6.30% was Mid-grade, and 9.41% was Premium. For calculation purposes, Mid-grade was divided into half Regular and half Premium. Thus, Regular was assigned a weight of 87.44%, and Premium was assigned a weight of 12.56%.

## Distribution of Octane Levels Across E Pact Study Test Fuels and Market Fuels<sup>3</sup>



<sup>3</sup> Raw octane values were rounded to the nearest whole octane value. “EPAct Fuels” represent the test fuels used in the EPAct study. *See* EPAct, Final Report on Program Design, *supra* note 1, at 31–32. “Market Fuels” represent U.S. fuels measured in the Alliance of Automobile Manufacturers Fuel Survey. *See* North American Fuel Survey, *supra* at D-1, note 1. These charts show the percent of EPAct Study test fuels surveyed and market fuels with a particular rounded octane value.

### EPAct E10 Test Fuels vs. Premium E10 Market Fuels



# EPAct Study Test Fuel Properties<sup>4</sup>

EPAct/V2/E-89 Fuels Round Robin

## Fuel Property Data

PROPERTY	UNIT	TEST METHOD	FUEL										FUEL										FUEL									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20	21	22	23	24	25	26	27	28	30	31			
Density, 60°F	g/cm <sup>3</sup>	D4052	0.7211	0.7220	0.7350	0.7346	0.7573	0.7342	0.7208	0.7191	0.7454	0.7644	0.7596	0.7517	0.7540	0.7223	0.7428	0.7636	0.7425	0.7754	0.7371	0.7476	0.7422	0.7702	0.7593	0.7434	0.7699	0.7508	0.7742			
API Gravity, 60°F	°API	D4052	64.6	64.3	60.8	60.9	55.2	61.1	64.6	65.1	58.2	53.4	54.6	56.5	56.0	64.2	58.8	53.6	58.9	50.8	60.3	57.6	58.9	52.0	54.6	58.6	52.1	56.8	51.1			
Ethanol	vol. %	D5599	10.03	<0.10	10.36	9.94	<0.10	10.56	<0.10	<0.10	<0.10	9.82	10.30	9.83	<0.10	<0.10	<0.10	10.76	20.31	20.14	20.51	20.32	20.51	20.03	15.24	14.91	14.98	9.81	20.11			
Total Content of Oxygenates Other Than Ethanol	vol. %	D5599	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10			
Distillation	IBP	D86 (OptiDist or equivalent for E10, E15 and E20 fuels)	92.9	83.5	106.4	89.9	94.1	106.7	100.1	83.7	85.3	104.7	92.0	91.3	96.6	100.4	84.7	104.5	107.9	106.3	89.8	109.0	89.7	89.0	88.7	104.8	103.9	90.9	105.8			
	5% evap		112.5	105.4	136.0	115.9	128.6	130.4	127.6	108.1	105.1	130.0	115.4	110.7	127.0	126.5	105.5	133.0	137.3	134.7	118.8	133.3	115.9	113.7	109.6	135.3	136.3	110.3	132.5			
	10% evap		117.3	121.7	141.7	126.3	145.4	135.9	137.0	123.4	115.1	136.3	124.4	116.9	139.8	135.5	115.6	139.2	142.6	141.3	129.6	138.9	126.9	125.5	117.1	142.3	144.2	116.7	139.1			
	20% evap		123.9	154.4	148.9	140.9	172.6	142.6	149.0	151.6	130.3	144.3	137.6	125.0	158.7	147.3	130.5	147.8	149.7	150.3	144.3	146.2	142.8	142.1	127.8	152.0	154.0	125.4	147.7			
	30% evap		131.2	190.6	155.0	151.7	199.4	148.3	161.7	185.1	147.2	151.0	148.1	133.8	178.2	160.0	146.6	155.1	155.3	157.1	153.7	152.3	153.2	153.3	138.6	158.0	160.2	133.9	155.1			
	40% evap		139.9	218.5	175.1	161.2	222.1	153.4	176.6	204.4	167.7	161.6	156.5	142.8	199.9	175.1	166.3	172.1	159.6	162.6	159.5	157.8	160.4	160.9	149.8	163.8	165.8	143.1	161.3			
	50% evap		148.9	236.7	217.5	221.9	237.0	188.5	193.1	221.1	192.8	217.1	189.3	152.2	222.5	192.8	189.7	218.8	162.7	167.6	163.2	162.5	165.1	166.9	160.3	221.5	216.6	152.9	167.3			
	60% evap		172.3	252.7	230.2	245.9	247.2	228.2	210.2	232.5	224.7	261.5	231.1	198.5	245.2	212.0	216.2	237.5	179.9	217.3	167.2	171.6	172.9	191.3	174.7	265.1	240.2	197.2	214.0			
	70% evap		224.1	271.7	243.6	270.0	258.5	267.7	228.6	246.4	260.3	290.4	251.4	275.1	269.8	237.3	243.0	251.9	234.8	255.2	233.9	270.9	266.1	281.6	277.0	274.9	251.6	267.3	271.6			
	80% evap		254.6	305.9	257.1	303.5	273.1	310.1	251.5	264.0	292.2	317.5	270.0	307.9	303.5	280.1	265.9	268.6	253.1	275.3	253.6	311.4	305.5	310.3	306.5	311.3	268.4	294.6	297.0			
	90% evap	300.2	340.1	295.9	337.5	300.0	340.4	298.4	303.1	341.8	340.2	298.6	339.8	337.9	338.5	299.4	300.6	298.7	305.0	297.3	338.2	338.1	337.9	338.7	340.3	298.8	323.8	325.2				
	95% evap	334.5	353.0	334.4	352.0	323.5	352.7	329.3	330.5	363.5	354.3	325.0	357.7	354.4	354.5	329.3	330.8	336.6	331.3	334.5	350.0	350.3	352.7	356.7	351.9	327.3	341.8	342.1				
	FBP	368.0	375.3	368.9	369.8	357.8	369.2	361.8	360.9	384.7	372.4	360.8	375.9	377.5	377.5	363.7	365.6	371.9	360.5	369.9	364.6	368.2	371.8	377.3	372.2	363.2	366.1	365.6				
DVPE (EPA equation)	psi	D5191	10.07	10.20	6.93	10.01	6.95	7.24	7.15	10.20	10.30	7.11	9.93	10.13	6.92	7.14	10.23	7.12	6.70	7.06	10.21	6.84	10.12	10.16	10.21	6.97	6.87	10.23	6.98			
Aromatics	vol. %	D1319	15.4	14.1	15.0	15.5	34.7	15.0	17.0	15.7	35.8	34.0	35.0	34.8	34.1	16.9	35.3	35.6	15.2	35.5	15.0	15.9	15.3	35.2	35.6	14.9	34.5	35.5	35.5			
Olefins	vol. %	D1319	7.6	6.8	7.6	6.8	6.9	8.8	7.5	6.4	6.2	6.1	6.9	6.9	6.3	8.5	7.2	6.8	7.4	7.1	6.9	7.5	7.3	6.6	6.5	7.4	7.0	6.5	6.8			
Saturates	vol. %	100 - D1319Aromatics - D1319Olefins - D5599Ethanol	67.0	79.1	67.0	67.8	58.4	65.6	75.5	78.0	58.0	50.1	47.8	48.5	59.6	74.6	57.4	46.9	57.1	37.3	57.6	56.4	56.9	38.1	42.7	62.9	43.5	48.2	37.6			
Benzene	vol. %	D3606	0.62	0.51	0.61	0.54	0.51	0.68	0.55	0.50	0.54	0.52	0.54	0.57	0.51	0.52	0.54	0.62	0.61	0.61	0.59	0.63	0.62	0.65	0.62	0.56	0.59	0.58	0.60			
S	mg/kg	D5453	30	23	22	21	24	23	23	23	25	24	19	23	24	24	23	22	22	21	21	21	26	23	26	24	23	25				
RON	-	D2699	94.8	96.0	98.0	97.1	96.7	96.3	91.2	95.5	94.5	98.5	97.8	100.4	95.8	91.5	95.0	101.0	101.9	101.4	101.8	97.4	100.8	102.2	101.7	100.8	102.7	100.5	101.7			
MON	-	D2700	86.3	88.6	87.6	87.6	86.3	86.6	84.2	87.8	84.8	87.2	85.6	88.0	85.8	84.6	84.9	88.3	89.3	87.5	89.3	86.8	88.6	88.3	88.5	89.2	89.4	88.1	88.2			
(RON+MON)/2	-	-	90.6	92.3	92.8	92.4	91.5	91.5	87.7	91.7	89.7	92.9	91.7	94.2	90.8	88.1	90.0	94.7	95.6	94.5	95.6	92.1	94.7	95.3	95.1	95.0	96.1	94.3	95.0			
C	mass %	D5291 mod.*	81.70	85.12	81.61	82.21	86.58	81.52	85.16	85.12	87.03	83.47	83.68	83.32	86.76	85.28	86.88	83.40	78.06	79.90	78.24	78.34	78.47	80.62	81.48	80.27	81.78	83.17	79.90			
H	mass %	D5291 mod.*	14.02	14.43	14.17	14.12	12.92	14.21	14.25	14.32	12.82	12.83	12.61	12.68	13.15	14.29	12.79	12.66	14.01	12.43	13.85	13.86	13.86	12.38	12.45	14.01	12.62	13.00	12.49			
O	mass %	D5599	3.9	<0.1	3.9	3.7	<0.1	4.0	<0.1	<0.1	<0.1	3.6	3.7	3.6	<0.1	<0.1	<0.1	3.9	7.6	7.1	7.7	7.5	7.6	7.2	5.6	5.5	5.4	3.6	7.2			
Net Heat of Combustion	MJ/kg	D4809	41.950	43.960	41.536	41.952	42.948	41.785	43.735	44.037	43.209	41.210	41.175	41.373	43.171	43.519	43.108	41.013	40.057	39.285	40.031	39.915	40.114	38.855	40.384	41.062	40.383	41.304	39.391			
Water	mass %	E-1064	0.071	0.010	0.059	0.077	0.014	0.073	0.019	0.020	0.009	0.067	0.066	0.066	0.066	0.014	0.015	0.012	0.066	0.138	0.128	0.113	0.112	0.108	0.117	0.088	0.090	0.091	0.086	0.143		
Lead	g/l	D3237	-	<0.001	-	-	<0.003	-	<0.001	0.001	<0.001	<0.003	-	<0.003	<0.001	<0.001	<0.001	-	<0.003	0.009	0.004	<0.003	0.005	0.001	<0.003	<0.003	<0.003	-	<0.003			
Copper Strip Corrosion	-	D130	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A			
Solvent Washed Gum Content	mg/100ml	D381	<0.5	<0.5	<0.5	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	1.5	<0.5	0.5	1	<0.5	0.5	<0.5	0.5	0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.5			
Oxidation Stability	min.	D525	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240	>240			

\* Method adapted by individual laboratories to testing of gasolines

<sup>4</sup> EPAct, Final Report on Program Design, *supra* note 1, at 31–32.