

FACE Fuel #:	1	2	3	4	5	6	7	8	9
CPChem Designation:	FD-1-01	FD-2-01	FD-3-01	FD-4-01	FD-5-01	FD-6-01	FD-7-01	FD-8-01	FD-9-01
Design Variable Levels:									
Cetane Number	Low	Low	Low	Low	High	High	High	High	Center
Aromatic Content (Vol%)	Low	Low	High	High	Low	Low	High	High	Center
T90 (°F)	Low	High	Low	High	Low	High	Low	High	Center
Cetane Number by Engine Method-ASTM D613									
-CPChem C of A	29.93	28	32.02	28.44	54.2	53.3	44.3	50	44.95
-ORNL/SwRI	30.7	28.7	30.7	28.5	55	54.1	45.9	49	43.5
Distillation, T90 (F) - ASTM D86:									
-CPChem C of A	517	637	518	639	528	646	513	648	610
-ORNL/SwRI	532	648	525	640	526	642	512	647	607
Hydrocarbons by FIA - ASTM D1319:									
Aromatics, Volume % (Reproducibility = 1.4-1.6 vol.%)									
-CPChem C of A	22.2	19.4	45	46.6	19.5	21.3	42.3	43.3	32.5
-ORNL/SwRI (& repeat)	26.5	23.4	48	51.2 (49.1)	22.7	22.5	41.6	45.7 (44.0)	41.6 (39.6)
-NCUT (& repeat)	21.9	20.2	47.8	57.0 (60.0)	19.8	17.4	41	35.1 (39.7)	37 (40.4)
Olefins, Volume % (Reproducibility = 1.7 - 5.1 vol.%)									
-CPChem C of A	3.5	3.3	0.6	1.3	1.4	0.7	2.5	4.3	2.4
-ORNL/SwRI (& repeat)	1.2	2.8	3.2	12.4 (7.7)	1.1	4.8	1.2	1.5 (2.0)	8.9 (4.8)
-NCUT (& repeat)	3	3.5	0.6	3.6 (3.8)	1.2	4.1	0.5	1.3 (2.8)	0.7 (8.8)
Saturates, Volume % (Reproducibility = 5.6-4.8 vol.%)									
-CPChem C of A	74.3	77.3	54.4	52.1	79.1	78	55.2	52.4	65.1
-ORNL/SwRI (& repeat)	72.3	73.8	48.8	36.4 (43.2)	76.2	72.7	57.2	52.8 (54.0)	49.5 (55.6)
-NCUT (& repeat)	75.1	77.3	51.6	39.4 (36.2)	79	78.5	58.5	63.6 (57.5)	62.3 (50.8)
Aromatics by SFC - ASTM D5186 (Reproducibility = 1.5-1.8 mass%)									
Total Aromatics, Mass %									
-ORNL/SwRI	26.1	23.1	50	40.7	22.2	21.1	46.2	43.5	37
-NCUT	27	23.4	50.9	40.6	22.8	21.9	47.6	45.2	37.8
Mono Aromatics, Mass %									
-ORNL/SwRI	24.2	21.7	45.5	38.8	21.1	17	37.8	22.7	32.3
-NCUT	24.9	22.2	45.8	38.7	21.8	17.2	35.5	20.9	32.7
Polynuclear Aromatics, Mass %									
-ORNL/SwRI	1.9	1.3	4.5	2	1.1	4.1	8.4	20.8	4.6
-NCUT	2.1	1.2	5.1	1.9	1	4.7	12.1	24.3	5.1
Hydrocarbon Types by Mass Spectrometry, Volume % - ASTM D2425 (ORNL/SwRI)									
Paraffins (Reproducibility = 4.0%)	61.3	64.8	31.4	39.7	52.2	42.1	47.9	41.7	34
Monocycloparaffins (Reproducibility = 5.2%)	14.7	15.5	25.6	22.8	29.9	21.9	16.3	8.1	34
Dicycloparaffins (Reproducibility = 4.4%)	0	0	0	0	0	10.6	0	5.8	0
Tricycloparaffins (Reproducibility = 2.0%)	0	0	0	0	0	5.4	0	3.2	0
Total Napthenes	14.7	15.5	25.6	22.8	29.9	37.9	16.3	17.1	34
Total Saturates	76	80.3	57	62.5	82.1	80	64.2	58.8	68
Alkylbenzenes (Reproducibility = 1.4%)	21.5	17.7	28.4	35.2	13.8	8.2	33.3	9	18.2
Indans/Tetralins (Reproducibility = 0.5%)	0.8	0.7	7.5	0.6	2.9	6	0	4	6.9
Indenes (CnH2n-10)	0.1	0.1	1.3	0	0.1	1.3	0	4.7	1.3
Naphthalene (Reproducibility = 1.0%)	0.4	0.3	1	0.5	0.3	0.6	2.5	1.1	0.9
Alkylinaphthalenes	0.7	0.6	2.2	0.9	0.5	1.6	0	2.2	2.1
Acenaphthenes (CnH2n-14) (Reproducibility = 0.9%)	0.2	0.2	1.6	0.1	0.1	1.6	0	14.7	1.6
Acenaphylenes (CnH2n-16) (Reproducibility = 0.1%)	0.2	0.1	1	0.2	0.1	0.8	0	5.5	0.9
Tricyclic Aromatics (CnH2n-18) (Reproducibility = 0.1%)	0	0	0	0	0	0	0	0.1	0
Total PNAs	1.5	1.2	5.8	1.7	1	4.6	2.5	23.6	5.5
Total Aromatics	23.9	19.7	43	37.5	17.8	20.1	35.8	41.3	31.9
Net Heat of Combustion (BTU/lb) -ASTM D240 (Reproducibility = 0.40 MJ/kg = 172 Btu/lb)									
-ORNL/SwRI	18402	18553.1	18120	18269.4	18442.6	18399.4	18211.3	18140.9	18256.5
API Gravity - ASTM D4052:									
API*:									
-ORNL/SwRI	43.5	44.6	37	37.8	43.5	36.7	37.5	31.3	35.7
Specific Gravity (Reproducibility = 0.0005 g/ml)									
-CPChem C of A	0.8084	0.8037	0.8401	0.8355	0.8086	0.8411	0.8375	0.8682	0.8465
-ORNL/SwRI	0.8084	0.8037	0.84	0.8359	0.8086	0.8412	0.8375	0.8694	0.8464
-NCUT	0.8076	0.803	0.8393	0.8352	0.8078	0.8401	0.8366	0.8684	0.8457
Elemental Analysis - ASTM D5291:									
Carbon, wt% (Reproducibility = (Mean Value + 48.48)*0.018)									
-ORNL/SwRI	85.71	86.12	86.49	86.9	86.11	86.22	86.57	87.52	86.97
-NCUT	85.76	85.29	86.94	86.68	85.48	86.28	86.88	87.28	86.9
Hydrogen, wt% (Reproducibility = 0.2314* (Mean Value)*0.5)									
-ORNL/SwRI	13.56	13.64	12.56	12.77	13.85	13.66	12.59	12.33	13.1
-NCUT	14.08	14.23	12.76	13.23	14.11	13.55	12.93	12.48	13.04
Bromine Number (g Br/100g) -ASTM D1159-NCUT:									
	0.27	0.15	0.35	0.29	0.22	0.23	0.25	0.14	0.32
Cloud Point (°C) - ASTM D2500:									
-ORNL/SwRI	-27	-51	-35	-50	-29	-25	-21	-20	-30
-NCUT	-25	-59	-38	-59	-28	-28	-22	-19	-30
Kinematic Viscosity at 40°C (cSt) - ASTM D445 (Reproducibility = 0.8%)									
-CPChem C of A						3.09	1.55		
-ORNL/SwRI	1.741	1.96	1.32	1.785	1.795	3.097	1.759	3.278	2.107
-NCUT	1.56	1.652	1.317	1.781	1.587	3.099	1.581	3.158	2.104
Sulfur by UV Fluorescence (PPM) - ASTM D5453									
-CPChem C of A	1.7	0.3	2.8	0.1	1.2	13.6	2	1.7	3.4
-ORNL/SwRI	1.9	0.4	2.6	<1	1.2	2.8	1.4	1.6	2.5
Sulfur (PPM) -ASTM D5623 -NCUT:									
	1.2	<0.5	1.7	<0.5	<0.5	2	<0.5	0.9	1.9
Nitrogen (mg/L) - ASTM D4629 - NCUT:									
	0.8	1.68	2.1	0.87	1.35	2.3	0.9	0.81	2.2
Cetane Number by Engine Method -ASTM D613									
-CPChem C of A	29.9	28	32	28.4	54.2	53.3	44.3	50	45
-ORNL/SwRI	30.7	28.7	30.7	28.5	55	54.1	45.9	49	43.5
Cetane Index (calculated) - ASTM D976:									
-CPChem C of A							41.5		
-ORNL/SwRI	40.1	39	31.2	40.7	49.7	52.1	41.9	42.9	46.1
Flash Point by Closed Cup (°F) - ASTM D93:									
-CPChem C of A	140.4	134.4		130.4	138.1		150.3		
-ORNL/SwRI	135	128	141	139	131	166	149	158	140
Distillation (°F) - ASTM D86 (Reproducibility dependent on apparatus and setup used)									
-CPChem C of A									
IBP	174	307.4	315.3	331.7	327.6	364.3	354.7	433.9	320.5
5%	286.9	352.6	332	345.6	363.2	414.3	379.8	459.5	359.8
10%	313.5	362.8	341.2	350.1	369.1	440.6	385.5	475.5	372.9
15%									
20%	351.8	365.2	344.5	360.7	382.3	471.4	395.6	493	398.1
30%	365.5	366.6	356	376.7	395.8	494.1	409.3	503.6	429.8
40%	366.8	366.6	368.6	400.5	412.3	512.8	426.2	513.5	466.3
50%	373.8	371.1	384.4	437.5	430.2	530.2	446.2	524.8	494.6
60%	385	379.4	408.2	477.9	451.4	550.9	466	541.9	516.7
70%	400.8	390.2	438.8	518.4	473.7	575.2	481.3	567.1	538.3
80%	430.2	415.6	475.5	574.7	496.8	607.3	493.5	605.7	565.9
90%	516.7	637.3	518	639	527.5	645.8	512.8	647.8	610
95%	570.4	665.8	548.2	664	561.7	667.4	539.4	675.1	644.9
FBP	610.5	673	583.2	675.1	591.6	674.4	594	687.4	667.6
Recovered (mL)	98.5	97.9	98.3	98.5	98.5	97.6	98.3	99	98.5
Residue (mL)	1	1	1	1	1	0.8	1	1	1
Loss (mL)	0.5	1.1	0.7	0.5	0.5	1.6	0.7	0	0.5
-ORNL/SwRI									
IBP	344	345	317	324	341	369	357	435	315
5%	360	354	339	342	362	405	377	462	351
10%	363	358	343	348	367	433	380	478	363
15%	365	360	349	353	375	450	387	485	376
20%	368	363	353	359	381	466	392	493	390
30%	375	368	364	376	395	489	408	503	423
40%	382	374	378	400	411	508	425	512	460
50%	391	380	395	433	430	527	445	523	491
60%	403	388	418	474	451	547	465	539	517
70%	422	402	450	513	473	569	480	563	537
80%	467	454	485	571	495	601	492	602	564
90%	543	654	525	640	526	642	512	647	607
95%	584	672	553	664	557	663	538	669	640
FBP	616	679	582	674	591	673	583	687	661
Recovered (mL)	97.6	98.3	97.3	97.7	98	97.5	98.2	97.3	97.7
Residue (mL)	1.5	1.2	1.1	1.4	1.1	1.7	1.1	1	1.3
Loss (mL)	0.9	0.5	1.6	0.9	0.9	0.8	0.7	1.7	1
Simulated Distillation (°F) - mass % - ASTM D2887 - NCUT (Reproducibility - 1.4 F @ 10%; 2.2 F @ 95%; 5.8 F @ FBP)									
0.50%	283.3	284.7	245.5	283.3	271.0	253.8	284.7	359.6	257.4
5%	325.0	325.0	297.0	298.4	325.0	357.1	338.7	440.2	321.1
10%	338.7	337.3	326.1	338.7	338.7	402.1	344.8	487.8	331.2
15%	356.0	349.5	328.6	328.6	351.0	433.0	362.1	490.3	344.8
20%	363.2	362.1	338.7	338.7	364.6	456.1	366.8	492.4	369.3
30%	373.3	371.8	354.6	356.6	386.6	488.8	396.0	505.4	423.3
40%	380.5	378.0	374.4	397.0	411.4	516.2	434.1	514.8	471.9
50%	392.4	385.5	400.6	442.8	440.2	541.0	487.8	532.8	503.2
60%	408.9	396.0	430.5	475.5	480.6	565.2	492.4	560.8	532.8
70%	433.0	412.5	465.8	522.0	492.4	594.0	493.5	587.1	561.9
80%	500.7	491.4	506.8	584.6	520.9	643.3	519.8	639.7	592.9
90%	574.5	683.6	556.2	677.5	564.1	690.4	556.2	694.0	654.1
95%	622.8	705.6	590.4	703.4	601.9	710.2	584.6	714.9	694.0
99.50%	739.8	757.0	675.3	756.0	674.2	772.2	705.6	776.8	759.2